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AMERESCO

**HILLINGDON
SPORTS &
LEISURE
COMPLEX**


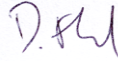
**PLANT NOISE
ASSESSMENT**

**19 SEPTEMBER
2023**

1952-AF-00001-01

**AMERESCO
HILLINGDON SPORTS & LEISURE COMPLEX
PLANT NOISE ASSESSMENT**

DOCUMENT REFERENCE: 1952-AF-00001-01

REVIEW AND AUTHORISATION			
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1. INTRODUCTION

- 1.1.1 Ameresco has commissioned AF Acoustics Ltd. to undertake a plant noise assessment for the proposed installation of a split system ASHP consisting of one compressor and five fan units to be installed at Hillingdon Sports & Leisure Complex.

1.2 Brief and Scope

- 1.2.1 The brief is to undertake a plant noise assessment for the proposed plant to be installed at Hillingdon Sports & Leisure Complex and to calculate the level of noise impact at the nearest residential receptor. If the proposed plant creates an adverse impact, or the noise levels at the nearest residential receptor do not meet the local authority guidance then recommendations will be given to reduce the noise from the plant, so that the plant produces a low impact in accordance with BS 4142:2014 and meets local authority guidance.

2. SITE DESCRIPTION

2.1 Location

- 2.1.1 The proposed plant is to be located at the Hillingdon Sports & Leisure Complex. The proposed plant is to be located in the south of the grounds and the proposed location is shown in Figure 2.1.
- 2.1.2 Hillingdon Sports & Leisure Complex is located in a mainly residential area. To the southeast of the centre are the nearest residential properties to the plant. To the north of the plant location is Hillingdon Sports & Leisure Complex itself, with Hillingdon Athletics Stadium further north. To the east is open fields and to the west is located Uxbridge College.
- 2.1.3 The noise profile at the measurement location at Hillingdon Sports & Leisure Complex consisted mainly of noise from the complex's plant room.

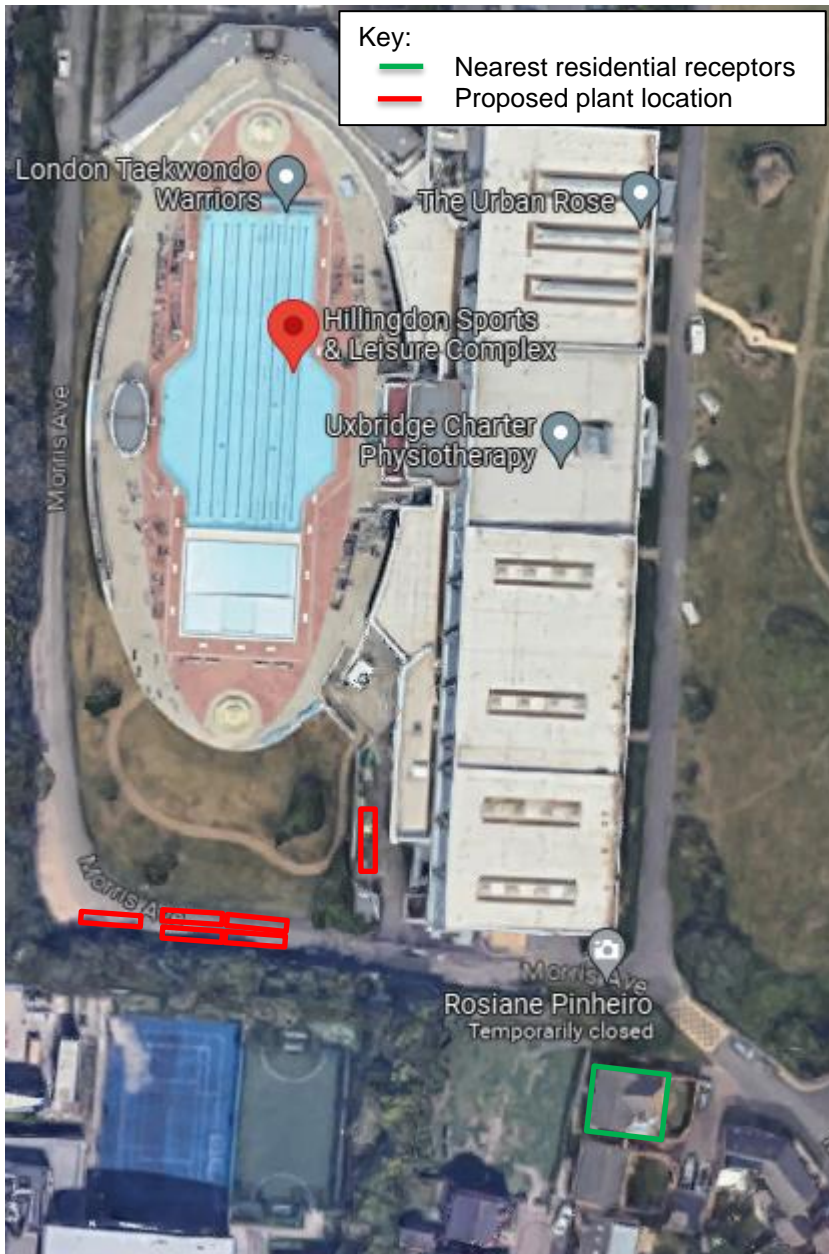


FIGURE 2.1: LOCATION MAP

3. GUIDANCE

3.1 British Standard 4142:2014

3.1.1 BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' describes methods for rating and assessing sound from "fixed installations which comprise mechanical and electrical plant and equipment", amongst other sources of noise.

3.1.2 The methodology contained within BS 4142:2014 uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

3.1.3 A summary of the approach set out within BS 4142:2014 is set out below:

- establish the specific sound level of the source(s);
- measure the representative background sound level, typically by measurement close to the receptor location;
- rate the specific sound level to account for any distinguishing characteristics;
- estimate the impact by subtracting the background sound level from the rating level; and
- consider the initial estimate of impact, in the context of the noise and its environment.

3.1.4 An initial estimate of the impact of the specific sound is obtained by subtracting the background sound level from the rating level. Using this approach, BS 4142 states:

*"Typically, the greater this difference, the greater the magnitude of impact
A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context*

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

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

3.1.5 Certain acoustic features can increase the significance of the impact over that expected from a basic comparison between specific sound level and the background sound level. These features include tonality and impulsivity, as well as additional characteristics and intermittency of the sound.

3.1.6 If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor.

3.1.7 The specific sound level is rated to account for distinguishing characteristics by using the penalties below:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible

3.1.8 Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor.

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible

3.1.9 For noise which is equally both impulsive and tonal, then both features can be taken into account by linearly summing the corrections for both characteristics.

3.1.10 If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

3.1.11 If a subjective assessment is not appropriate then an objective assessment can be made. A noise source is deemed to be tonal if the time averaged sound pressure level in a one-third octave band exceeds the level in adjacent one-third octave bands by the level differences given below:

- 15 dB in the low frequency one-third octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency one-third octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency one-third octave bands (500 Hz to 10000 Hz)

3.1.12 If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

3.2 Local authority Guidance – Hillingdon

3.2.1 The London Borough of Hillingdon's guidance on plant noise states, 'The rating level of noise emitted from the plant and/or machinery hereby approved shall be at least 5dB below the existing background noise level. The noise levels shall be determined at the nearest residential property. The measurements and assessment shall be made in accordance with British Standard 4142.'

4. NOISE SURVEY AND MEASUREMENTS

4.1 Unattended Noise Survey

- 4.1.1 An unattended noise survey was undertaken by Adrian Finn of AF Acoustics with the sound level meter located in the southeast corner of the site adjacent to the boundary of the site with the microphone located at a height of 1.5m. The measurement position is considered representative of the noise levels affecting the nearest noise sensitive receptor.
- 4.1.2 The duration of the survey was between 10:30 on 8 August and 10:30 on 9 August 2023. This measurement location is labelled in Figure 4.1. The measured noise levels are considered free field noise levels. The microphone was protected with a windshield during the noise survey. Measurements were carried out in accordance with the requirements of BS 7445-2:1991 and ISO 1996-2:1987.



FIGURE 4.1: MEASUREMENT LOCATION

- 4.1.3 The sound level meter had calibration checks before and after the measurement surveys to generate a calibration level of 114 dB at 1 kHz. The equipment calibration was verified before and after the survey and no calibration drift was observed. The microphone was fitted with a windshield.
- 4.1.4 The noise profile at the measurement location at Hillingdon Sports & Leisure Complex consisted mainly of noise from the centre plant room.
- 4.1.5 The equipment used is shown in Table 4.1.

Name	Serial Number	Last Calibrated
Norsonic 118 Class 1 Sound Level Meter	31382	February 2022
Norsonic 1206 Pre-amplifier	30416	February 2022
Gras 40AF Microphone	150690	February 2023
Norsonic 1251 Calibrator	30900	July 2023

TABLE 4.1: MEASUREMENT EQUIPMENT

4.2 Measurement Weather Conditions

- 4.2.1 The weather during the measurements was mainly dry and clear. The temperature ranged from 12 to 26°C. Average wind speeds remained below 3 ms⁻¹. The weather is deemed to have caused no significant effect during the measurement period.

4.3 Results

- 4.3.1 The results of the continuous noise monitoring survey are presented in graphical form in Figure A1 of Appendix A and summarised in Table 4.2.
- 4.3.2 The L_{A90} background noise level has been derived considering the most commonly occurring 1 hour period during the day and 15 minute period at night, whilst the L_{Amax,F} maximum noise level is the 90th percentile of the measured maximum noise levels.

Time period	Measured Noise Levels (dB re 2.0 x 10 ⁻⁵ Pa)		
	L _{Amax,F}	L _{Aeq,T}	Typical L _{A90,T}
Daytime (07:00 – 23:00)	65	55	54
Night time (23:00 – 07:00)	70	51	50

TABLE 4.2: SUMMARY OF UNATTENDED NOISE MEASUREMENTS, LT1

5. PLANT NOISE ASSESSMENT

5.1 Noise Rating Limit

5.1.1 The table below presents the maximum noise rating level which must not be exceeded at the noise sensitive receptor.

Measurement Period	Assessed Background Noise Level dB L_{A90}	Noise Rating Level Design Criteria	Plant Noise Rating Level Limit dB $L_{Ar,Tr}$
24 hour	50	5dB below the background noise level	45

TABLE 5.1: TARGET BACKGROUND NOISE LEVEL

5.2 Plant Noise Levels

5.2.1 It is proposed to install 5 fan units and a compressor (AWB252). The compressor has a sound pressure level of 57.1dB at 10m. The fan units have the following sound power level.

Plant	Parameter	Sound Level (dB) at Octave Band Centre Frequency						
		125	250	500	1000	2000	4000	8000
Fans	L_w	49	55	61	63	52	55	46

TABLE 5.2: PLANT NOISE LEVEL

5.3 Calculated Noise Levels

5.3.1 Table 5.3 provides a summary of the calculated plant noise at the nearest receptor, 18 Morris Ave. This receptor is located at a distance of approximately 70m from the fan units and 45m from the compressor. The compressor is shielded from the nearest residential receptor by the southern part of the sports complex, and as such a 10dB reduction in noise levels has been accounted for in the noise calculations. The calculation sheets are presented in Appendix B.

Property	Assessment Period	Target Plant Noise Rating Level dB $L_{Ar,Tr}$	Plant Specific Sound Level dB $L_{Aeq,Tr}$	Actual Noise Rating Level dB $L_{Ar,Tr}$
18 Morris Ave	24 hour	45	35	35

TABLE 5.3: PREDICTED NOISE AT NEAREST RESIDENTIAL RECEPTORS

5.3.2 No correction factors have been added in accordance with BS4142:2014. There are no tones or other acoustic characteristics present from the proposed plant.

5.3.3 As per the semantics of BS4142:2014, the assessment indicates little likelihood of adverse impact. The proposed plant meets the London Borough of Hillingdon's requirement that the plant is 5 dB below the background noise level at the nearest residential receptor.

6. CONCLUSION

- 6.1.1 Ameresco has commissioned AF Acoustics Ltd. to undertake a plant noise assessment for the proposed installation of a split system ASHP consisting of one compressor and five fan units to be installed at Hillingdon Sports & Leisure Complex.
- 6.1.2 A noise survey was undertaken adjacent to the nearest residential receptor. The representative noise levels measured at this location was used to establish the prevailing environmental noise climate.
- 6.1.3 Plant noise emission criteria have been set at the nearest receptor based on the results of the noise survey and in conjunction with the national guidance.
- 6.1.4 Noise calculations based on the plant data was undertaken to the nearest noise sensitive receptor.
- 6.1.5 As per the semantics of BS4142:2014, the assessment indicates little likelihood of adverse impact. The proposed plant meets the London Borough of Hillingdon's requirement that the plant is 5dB below the background noise level at the nearest residential receptors.

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APPENDIX A: FIGURES

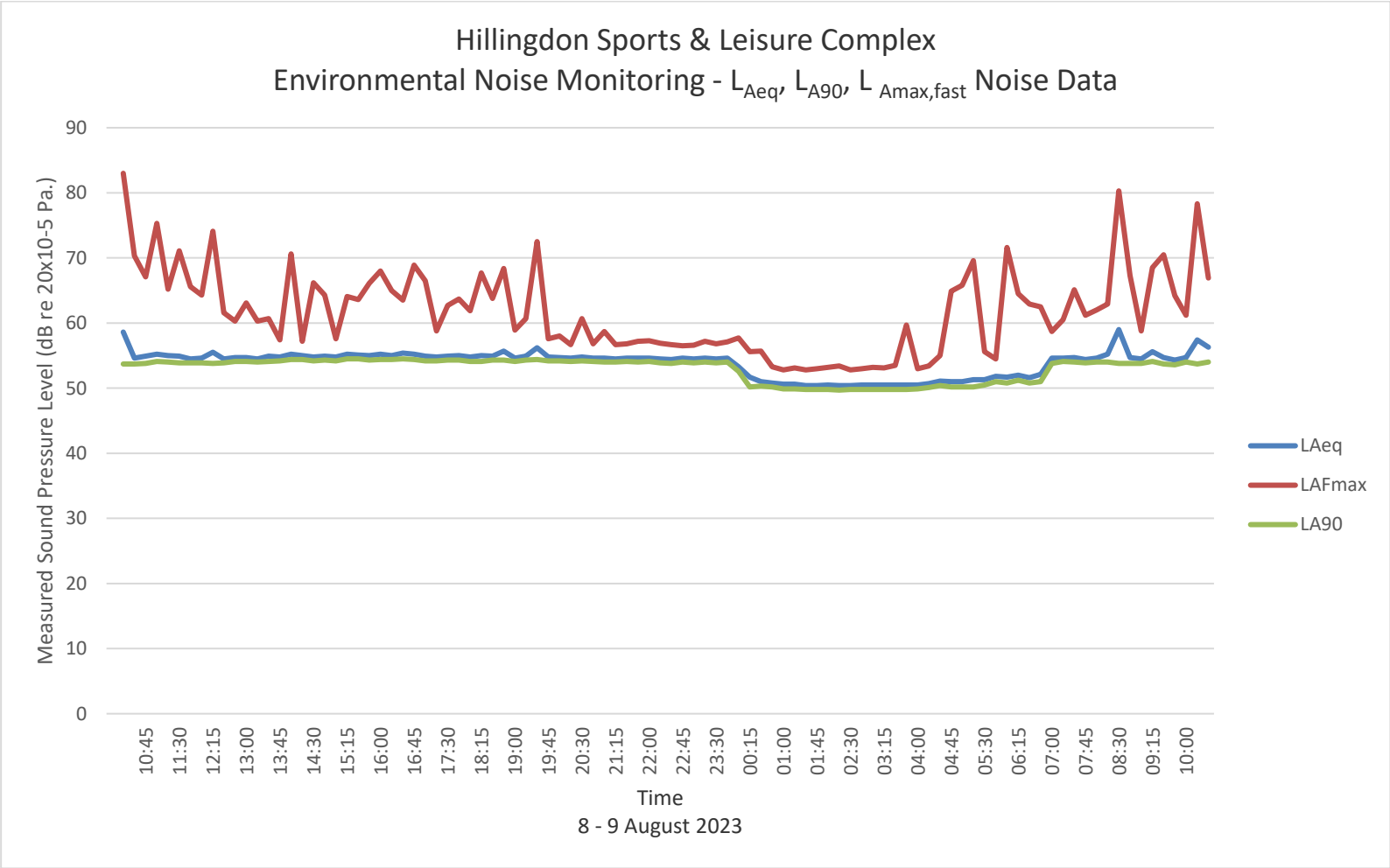


FIGURE A1: NOISE MEASUREMENT RESULTS AT HILLINGDON SPORTS & LEISURE COMPLEX

APPENDIX B: TABLES



Job No.	1952	Job Title	Hillingdon Sports & Leisure Complex
Date Created	07 Aug 2023	By	AF
Date Revised	18 Sep 2023	Rev	15
Date Reviewed	18/09/2023	By	AF
Review Type	Self Check	Review Status	No Comments

Plant Noise Calculation - Hillingdon Sports & Leisure Complex

Item / Description		Rating/Broadband/Input			Octave Band Centre Frequency, Hz								
		Rating	dB	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Fans	Lw						49.0	55.0	61.0	63.0	52.0	55.0	46.0
Number of Sources Correction		5 x		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
‡ Point Source Propagation Loss		70.0 m	3.0 dB		-44.9	-44.9	-44.9	-44.9	-44.9	-44.9	-44.9	-44.9	-44.9
‡ Total from fans at receptor				27.3 (A)	-37.9	11.1	17.1	23.1	25.1	14.1	17.1	8.1	
AWB 252	@10m			57.1 (A)									
Ratio of Distances - Point Source		10.0 m	45.0 m	-13.1									
No line of sight				-10.0									
Total from compresor at receptor				34.0									
= Total noise level at the nearest receptor				35									

TABLE B1: CALCULATIONS TO CLOSEST RECEPTOR

APPENDIX C: TERMINOLOGY RELATING TO NOISE

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of $20\mu\text{Pa}$ (20×10^{-6} Pascals) on a decibel scale.
Sound Power Level (L_w)	is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).
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 $20\mu\text{Pa}$.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
L_{Aeq,T}	Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound
L_{90,T}	L ₉₀ is the noise level exceeded for 90% of the period T (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
L_{max,T}	A noise level index defined as the maximum noise level during the 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.
Specific Noise	The noise source under investigation for assessing the likelihood of complaints.
Rating Level	The specific noise level plus any adjustment for the characteristic features of the noise.
Free field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
Façade	At a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX D: LIMITATIONS TO THE REPORT

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