



Sutherland Hospital

Operational Noise Compliance Testing

Hindmarsh Construction

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PREPARED BY:

Pulse White Noise Acoustics Pty Ltd
 ABN 95 642 886 306
 Level 5, 73 Walker Street, North Sydney, 2060
 1800 4 PULSE

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1 INTRODUCTION

Pulse White Noise Acoustics has been engaged to undertake the acoustic noise testing of the operational noise resulting from the Sutherland Hospital project.

Noise level measurement were conducted in conjunction with the projects *Conditions of Consent* including Item D8 of the SSD-11099584 which includes reference to the project trigger levels included in the *Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)* prepared by JHA Consulting Engineers and dated 10 August 2021.

Acoustic testing of the operational Sutherland Hospital has been undertaken as part of the compliance assessment.

A glossary of terminology used in this report is provided in Appendix A.

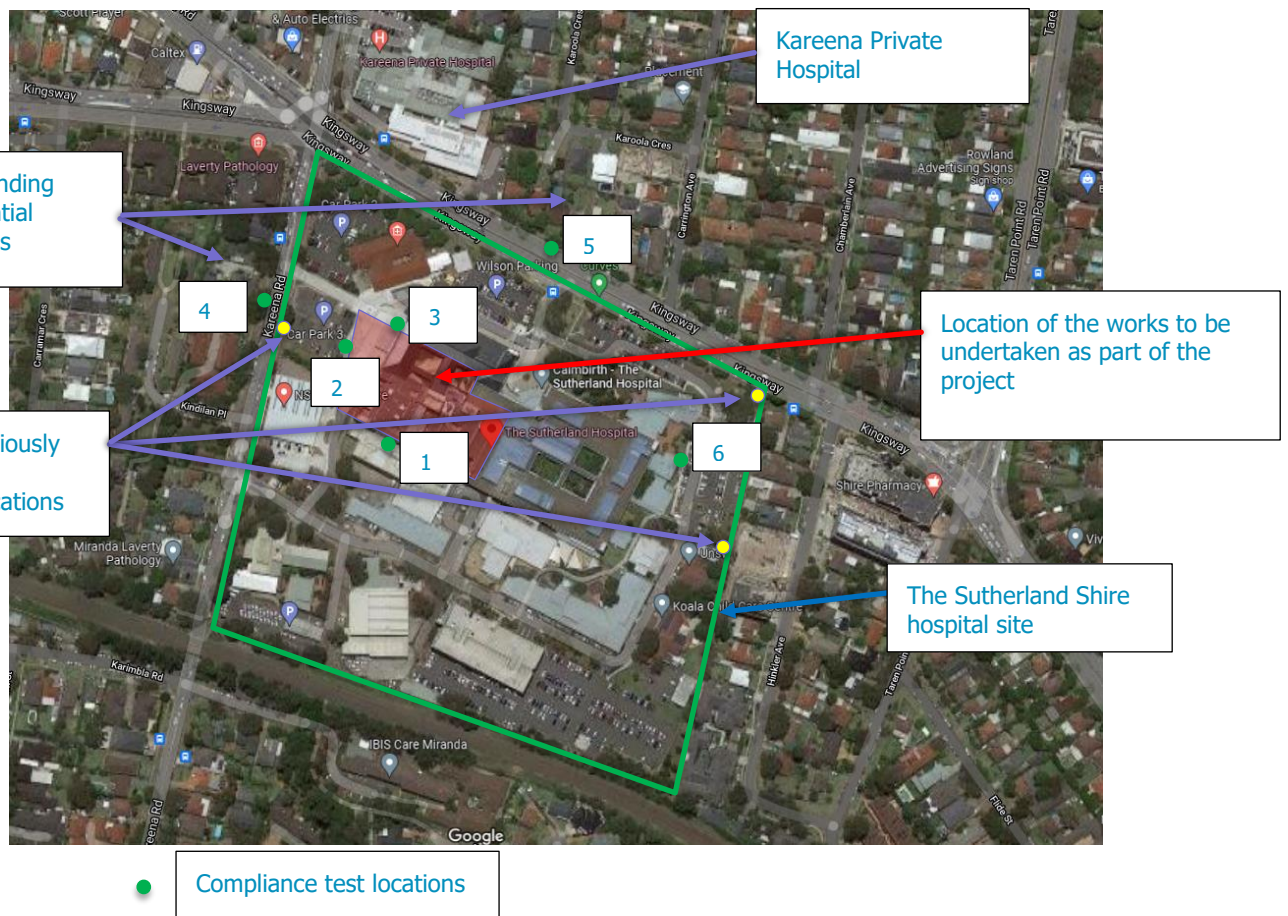
2 PROJECT DESCRIPTION

The development includes the construction of the a refurb on at Tthe Sutherland Hospital site which is located to the south of Kareena Road and the west of The Kingsway, the works to be conducted as part of the constructions include an extension and a refurbishment.

The surrounding receivers to the site include residential receivers within proximity to the site.

The site location, in relation to surrounding buildings, is shown in Figure 1 below, which include locations within proximity of the building services associated with the project including external condenser equipment, supply and exhaust fans.

Figure 1 Site Map, Measurement Locations and Surrounding Receivers



3 PROJECT NOISE LEVEL CRITERIA

Noise levels testing conducted as part of the assessment includes the required levels detailed in Item D8 including the SSD-11099584 which includes reference to the project trigger levels included in the 'Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)' prepared by JHA Consulting Engineers and dated 10 August 2021.

Details of condition D8 are included below:

Operational Noise – Design of Mechanical Plant and Equipment

- D8. Prior to the commencement of operation, the Applicant must submit evidence to the Certifier that the noise mitigation recommendations in the assessment undertaken under condition B22 have been incorporated into the design of mechanical plant and equipment to ensure the development will not exceed the project noise trigger levels identified in the 'Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)' prepared by JHA Consulting Engineers and dated 10 August 2021.

Section 4.4.1.3 (*Project Noise Trigger Levels*) of the *Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)* prepared by JHA Consulting Engineers and dated 10 August 2021 includes the project required noise emissions criteria as project noise trigger levels for the operation of building services, including the following:

4.4.1.3 Project Noise Trigger Levels

The PNTL's are shown in Table 8 and have been obtained in accordance with the requirements of the NSW NPI. These shall be assessed to the most affected point on or within the noise sensitive receiver boundary.

Indicative Noise Amenity Area	Period	Intrusiveness Criterion	Amenity Criterion
Low Density / Medium Density Residential (R2)	Day	53	53
	Evening	50	43
	Night	45	38
High Density Residential (R4)	Day	52	58
	Evening	50	48
	Night	44	43
Hospital (SP1)	Noisest 1 hour	---	50

Table 8: Determination of PNTL's (light grey highlight) for noise sensitive receivers.

Where location R2 includes the representative location for the residential receivers to the west of the site and location R4 includes the representative location for the residence to the north and east of the Sutherland Hospital site and as detailed in the *Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)* prepared by JHA Consulting Engineers and dated 10 August 2021.

4 OPERATIONAL NOISE LEVEL MEASUREMENTS

Attended noise level measurements of the operation of the Sutherland Hospital project has been conducted at a number of locations around the site including those within the hospital as well as at the surrounding residential receivers. The location of the testing is included in Figure 1 above.

Testing was conducted on the 14th November 2022 during a period when all building services were operational including the mechanical services equipment of the project.

Testing undertaken as part of the operational compliance testing of the hospital for compliance with condition D8 of the SSD approval.

The noise level survey was performed using a Brüel & Kjær Hand-held Analyser Type 2236C type meter. Calibration of the sound level meter was checked with a Brüel & Kjær Type 4231 acoustical calibrator (serial number 3009148) prior to and following the measurements. Drift in calibration did not exceed ± 0.5 dBA. All equipment carried current NATA calibration certificates.

Attended measurements took place between 3.30pm and 5:30pm on and 9.30pm and 10.30pm on the 13th November 2022.

Prior to all the noise measurements being undertaken all mechanical building services were operational including normal conditions.

The noise level testing undertaken as part of the compliance testing was undertaken in accordance with the requirements of the EPA's *Noise Policy for Industry* and the relevant Australian Standards including AS1055:2018 'Acoustics – Description and Measurement of Environmental Noise.

The attended and unattended noise locations were selected to obtain suitable noise levels for the normal operation of the mechanical services equipment and the projects noise level criteria as detailed in the SSD and the projects *Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)* prepared by JHA Consulting Engineers and dated 10 August 2021, including the noise emission requirements detailed in the section above.

Noise levels at the Hospital was undertaken in accordance with the requirements of the EPA and the testing methodologies of AS1055. Details of the testing are included in this Section of the report.

The project noise level criteria is based on the *Conditions of Consent* including Item D8 of the SSD-11099584 which includes reference to the *Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)* prepared by JHA Consulting Engineers and dated 10 August 2021 as detailed above.

The period of the testing undertaken at as part of the Operational Noise Compliance Testing included 15 min periods.

The period of testing was undertaken as this was identified as a representative period when Sutherland Hospital was operational including the normal operation of all building services, including the mechanical services equipment.

The noise level test location includes that which are representable of the potentially worst affected receivers, including other areas of the hospital as well as surrounding residential receivers.

The testing was undertaken during the period when the equipment was operational at maximum capacity. Details of the operation of the plant provided to this office has indicated that the major plant is not operational at maximum capacities during all hours.

The results of measured external noise levels during a period when the building services operating under normal conditions are detailed in the table below.

Table 1 Measured External Noise Levels – Afternoon

Measurement Location	Time of Measurement	Measured Noise Contribution $L_{Aeq (15 min)}$ dB(A)	Project Noise Level Trigger $L_{Aeq (15 min)}$ dB(A)	Comments
1 – Internal Hospital location	Period when the all building services operational under normal maximum conditions	Noise level from the operation of the hospital was inaudible	When in operation – 50	Noise level generated from the operation of the building services complaint with relevant day and evening criteria. The building services will not be required to run at maximum capacities during night time periods including the external condenser equipment.
2 – Internal Hospital location		Noise level from the operation of the hospital was inaudible	When in operation – 50	
3 – Internal Hospital location		Noise level from the operation of the hospital was inaudible	When in operation – 50	
4 – Residence to the west		Noise level from the operation of the hospital was inaudible	Day – 53 Evening – 43 Night - 38	
5 – Residence to the north		Noise level from the operation of the hospital was inaudible	Day – 52 Evening – 48 Night - 43	
6 – Residence to the east		Noise level from the operation of the hospital was inaudible	Day – 52 Evening – 48 Night - 43	

Table 2 Measured External Noise Levels – Night time

Measurement Location	Time of Measurement	Measured Noise Contribution $L_{Aeq} (15 \text{ min})$ dB(A)	Project Noise Level Trigger $L_{Aeq} (15 \text{ min})$ dB(A)	Comments
1 – Internal Hospital location	Period when the all building services operational under normal maximum conditions	Noise level from the operation of the hospital was inaudible	When in operation – 50	Noise level generated from the operation of the building services complaint with relevant day and evening criteria. The building services will not be required to run at maximum capacities during night time periods including the external condenser equipment.
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Based on the results of testing the noise emissions from the operation of the Sutherland Hospital project have been found to be compliant with the projects *Conditions of Consent* including Item D8 of the SSD-11099584 which and the *'Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)'* prepared by JHA Consulting Engineers and dated 10 August 2021.

As exceedances have not been identified no additional noise mitigations are required.

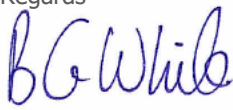
5 CONCLUSION

This report details the results of noise level testing conducted on the operational noise levels resulting from the Sutherland Hospital project, including the operational noise levels of the completed project.

Based on the results of acoustic testing noise levels resulting from the operation of the project, including the buildings mechanical services equipment, compliance with the projects *Conditions of Consent* including Item D8 the SSD-11099584 which includes reference to the *Noise & Vibration Impact Assessment for SSDA (SSD-11099584) (Revision G)* prepared by JHA Consulting Engineers and dated 10 August 2021.

In the event you require any additional information or clarification regarding this report please contact the author below.

Regards

A handwritten signature in blue ink that reads 'Ben White'.

Ben White
Director

Pulse White Noise Acoustics

6 APPENDIX A – GLOSSARY OF TERMS

<i>Ambient Sound</i>	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.																				
<i>Audible Range</i>	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.																				
<i>Character, acoustic</i>	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.																				
<i>Decibel [dB]</i>	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; <table border="0" style="margin-left: 40px;"> <tr><td>0dB</td><td>the faintest sound we can hear</td></tr> <tr><td>30dB</td><td>a quiet library or in a quiet location in the country</td></tr> <tr><td>45dB</td><td>typical office space. Ambience in the city at night</td></tr> <tr><td>60dB</td><td>Martin Place at lunch time</td></tr> <tr><td>70dB</td><td>the sound of a car passing on the street</td></tr> <tr><td>80dB</td><td>loud music played at home</td></tr> <tr><td>90dB</td><td>the sound of a truck passing on the street</td></tr> <tr><td>100dB</td><td>the sound of a rock band</td></tr> <tr><td>115dB</td><td>limit of sound permitted in industry</td></tr> <tr><td>120dB</td><td>deafening</td></tr> </table>	0dB	the faintest sound we can hear	30dB	a quiet library or in a quiet location in the country	45dB	typical office space. Ambience in the city at night	60dB	Martin Place at lunch time	70dB	the sound of a car passing on the street	80dB	loud music played at home	90dB	the sound of a truck passing on the street	100dB	the sound of a rock band	115dB	limit of sound permitted in industry	120dB	deafening
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<i>dB(A)</i>	<i>A-weighted decibels</i> The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.																				
<i>Frequency</i>	Frequency is synonymous to <i>pitch</i> . Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.																				
<i>Loudness</i>	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on																				
<i>L_{Max}</i>	The maximum sound pressure level measured over a given period.																				
<i>L_{Min}</i>	The minimum sound pressure level measured over a given period.																				
<i>L₁</i>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.																				
<i>L₁₀</i>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.																				
<i>L₉₀</i>	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L ₉₀ noise level expressed in units of dB(A).																				
<i>Leq</i>	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.																				
<i>Background Sound Low</i>	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the L _{A90} value																				



<i>Ctr</i>	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
<i>dB (A)</i>	'A' Weighted overall sound pressure level
<i>Noise Reduction</i>	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
<i>NR Noise Rating</i>	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the "A" weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
<i>R_w</i>	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for <i>R_w</i> are defined in ISO 140-2:1991 "Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data".
<i>R'_w</i>	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
<i>Sound Isolation</i>	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term "sound isolation" does not specify any grade or performance quality and requires the units to be specified for any contractual condition
<i>Sound Pressure Level, L_p dB</i>	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
<i>Sound Power Level, L_w dB</i>	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
<i>Speech Privacy</i>	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
<i>Transmission Loss</i>	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.