

**TALLAWARRA B – OPERATIONAL NOISE REVIEW
FOR
ENERGY AUSTRALIA**

Prepared for: EnergyAustralia

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EXECUTIVE SUMMARY

Benbow Environmental (BE) has been engaged by EnergyAustralia to undertake ongoing operational noise monitoring of the Tallawarra Power Station. The site is located at Lot 109, DP 1050302 Yallah Bay Road, Yallah NSW 2530. The objective of the monitoring program is to evaluate the site's compliance with the noise limits set in Environment Protection Licence (EPL) 555 and to satisfy Condition E4 of that licence.

The scope of this report is limited to the following:

- Undertake noise monitoring at nearest sensitive receptors and future Tallawarra lands receptors during normal operating conditions during the day and evening;
- Evaluate status of compliance against operational noise levels at the locations defined in Table 1 and 2 of the Project Approval;
- Assessment of annoying characteristics in accordance with the Noise Policy for Industry (NPfI); and
- Details of meteorological conditions prevailing during the monitoring.

The assessment utilised attended noise monitoring equipment to determine compliance with the noise criteria. The attended noise measurements were carried out by three consultants simultaneously using 2x SVANTEK SVAN957 Type 1 Precision Sound Level Meter, and 1x HBK 2255 Sound Level Meter (which is an advanced, single-channel, class 1 sound level meter).

Attended noise monitoring was undertaken during the day and evening period with one measurement taken at each location on the 26th June 2025. This was coordinated to be undertaken during peak energy demand when both units would be running simultaneously. Conducting monitoring at other times was not practical, as operating both gas-fired units outside peak energy demand would be financially unviable.

The site was inaudible/barely audible at existing residences. The site was inaudible at the Tallawarra Lands Central Precinct. Clear contributions were difficult to obtain at the Tallawarra Lands Central Precinct, a site contribution of <34 dB(A) was estimated. The site contribution at Tallawarra Lands Northern Precinct was observed to be 34-38 dB(A); an assessment of annoying characteristics was undertaken, and a low frequency penalty of 2dB applied to these Northern Precinct locations. With the penalty, the measured site contributions comply with the $L_{Aeq(15min)}$ project approval criteria of 40 dB(A). Noise enhancing weather conditions (a feature of the area for some of the Northern Precinct receptors) was occurring during the time of monitoring.

Based on the results of the attended monitoring, Tallawarra A&B Power Station complied with Table 1 and Table 2 of the Project Approval (07_0124) and with Condition L6 of Environment Protection Licence (EPL) 555 at all locations. Therefore, the site also complies with Table 3 and Table 4 of the Project Approval criteria at all locations.

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1. INTRODUCTION

Benbow Environmental (BE) has been engaged by EnergyAustralia to undertake an ongoing operational noise monitoring of Tallawarra power station when both units (Tallawarra A and Tallawarra B) are running. The site is located at Lot 109, DP 1050302 Yallah Bay Road, Yallah NSW 2530. This monitoring has been undertaken as OEMP.

The relevant condition has been repeated in Section 3.

In 2010, the Department of Planning's Major Projects approved 2 or 3 'E Class Gas Turbines' (Tallawarra B). The site has modified this application in 2016 and 2020, which now applies to 1 'F Class Gas Turbine' which is to operate at 300 to 400 MW. BE completed the testing of the power station when both Tallawarra A and B were in operation during peak energy demand during the day and evening on Thursday 26/6/2025.

1.1 OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN REQUIREMENTS

The following requirements from the operational noise monitoring plan are provided below.

Table 1-1: Operational Noise Management Plan Requirements

Potential Impact	Location	Parameters	Frequency	Methodology	Reporting	Responsibility	CoA and OEMP Reference
Ongoing Operational Noise Monitoring	T2 (A) Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, in Koonawarra. T4 (B) Any residence in Wyndarra Way and Malonga Place in Koonawarra. ML#9 (C) Any residence on The Boulevard, Park Crescent, Horsley Road and Newton Crescent in Oak Flats. ML#10 (D) Any residence on Reddall Parade and Henricks Parade in Mt Warrigal.	• L_{aeq} • LA_{10} • LA_{90}; and • LA_{Max} Noise levels shall not exceed criterion stipulated in Table 5-12 and Table 5-13 attended noise monitoring will be undertaken for 15 minutes per location. Monitoring is undertaken at each of the locations for day, evening and night periods.	• Annual basis throughout the life of the project, and • On following an exceedance of noise limits in Table 5-12 and Table 5-13; and • Or in response to a noise complaint.	Noise monitoring will: • Be undertaken in accordance with the <i>Noise Policy for Industry</i> (NSW EPA, 2017); • Be undertaken via attended noise monitoring at the locations identified in Table 5-12 and Table 5-13 and as illustrated within Figure 5-4. • Attended noise monitoring will be undertaken for 15 minutes per locations. • Monitoring is undertaken at each of the locations for day, evening and night periods • Include monitoring of operations that have the potential to cause offensive noise including, but not limited to, safety valve operation, blowdown operation and the operation of circuit	Reports will be submitted to the Secretary and EPA within 28 days of completing the noise event. Reports will be required • Annually • In the event of an exceedance during the ongoing noise review; • In response to a noise complaint; and / or • Additional monitoring as deemed necessary by the Secretary.	Specialist acoustic consultant on behalf of EnergyAustralia	4.5 4.6



Potential Impact	Location	Parameters	Frequency	Methodology	Reporting	Responsibility	CoA and OEMP Reference
	ML#11 (E) Any residence in Haywards Bay. (North) Most affected residence – proposed northern residential area. (Central) Most affected residence – proposed central residential area. (South) Most affected residence – proposed south-western residential area.			breakers during the day evening and night time periods; • Include monitoring of the effectiveness of any noise mitigation measures implemented under condition 3.6 of the Project Approval; and • In instances where Modification Factors for Low Frequency Noise apply, noise monitoring is to include an assessment of modifying factors in accordance with Fact Sheet C of the Noise Policy for Industry 2017. This is where noise is assessed for annoying characteristics such as tonal, low frequency or intermittent noise and a penalty of 5 dB will be added.			

NOTE:

Monitoring not undertaken at proposed south-west residential area — no longer planned for development.

Monitoring conducted 4:50 pm–8:00 pm only — deemed reasonable to capture worst-case scenario with both units operating.



1.2 SCOPE OF WORKS

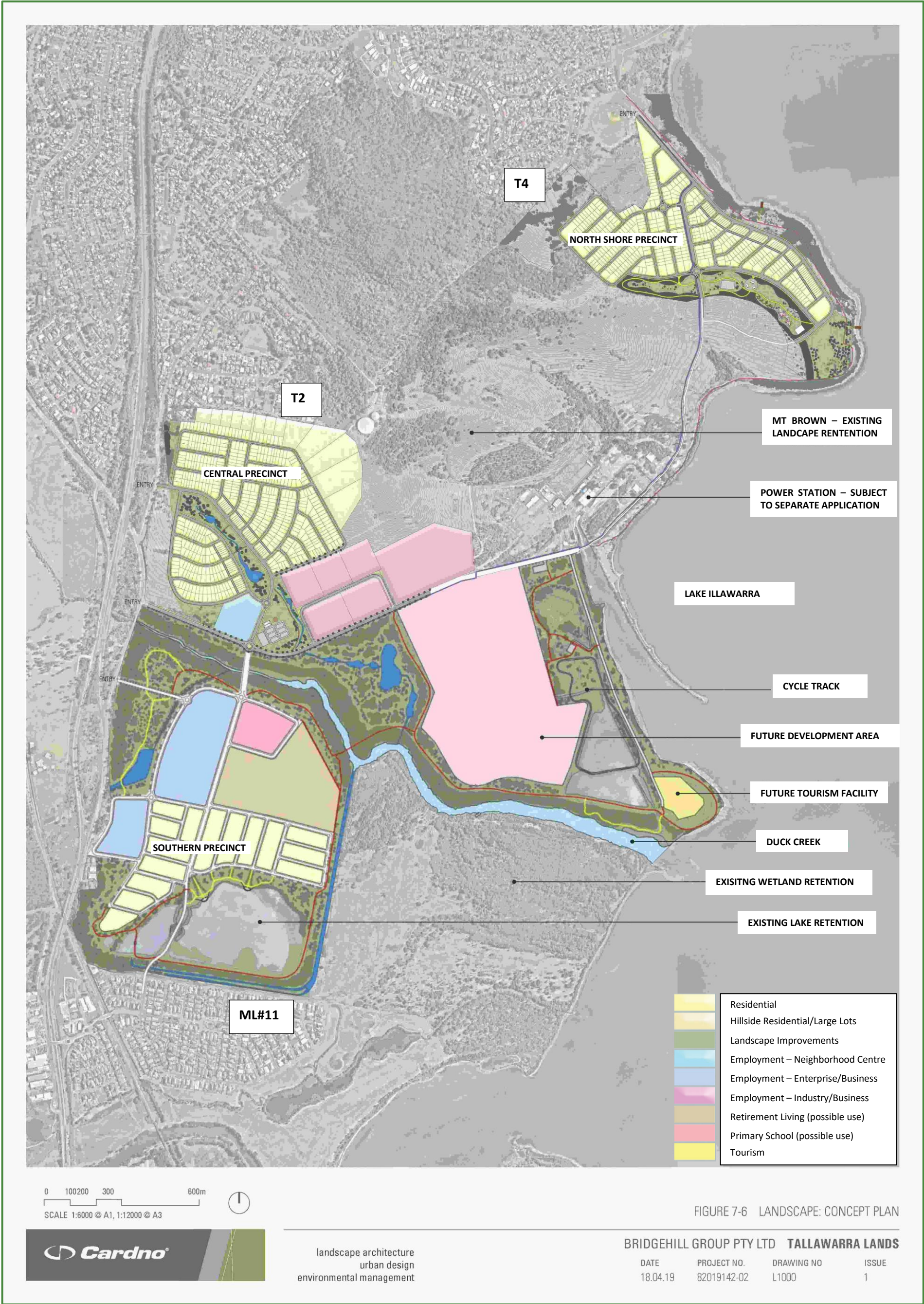
The scope of this report is limited to the following:

- Undertake noise monitoring at nearest sensitive receptors and future Tallawarra lands receptors during normal operating conditions during the day and evening;
- Evaluate status of compliance against operation noise levels at the locations defined in Table 1 and 2 of the Project Approval;
- Assessment of annoying characteristics in accordance with the Noise Policy for Industry (NPfI); and
- Details of meteorological conditions prevailing during the monitoring.

2. NEAREST SENSITIVE RECEPTORS

Table 2-1 lists the representative locations of potentially affected existing and future receivers that are considered in this assessment. The locations are shown in the following figures.

Figure 2-1: Future Use Concept Plan



Source: Cardno Landscape Concept Plan 2019



Table 2-1: Nearest Receivers

Receiver ID	Project Approval ID	Address	Direction from Site	Lot and DP	Approximate distance to site (m)	Easting	Northing	Type of receiver
R1	T2	54 Carlyle Close Dapto	NW	Lot 819 DP876973	1,150	297722.26	6177950.65	Residential
R2	T2	44 Coronet Place Dapto	NW	Lot 11 DP703747	1,120	297790.30	6178228.53	Residential
R3	T4	17 Malonga Place Koonawarra	N	Lot 169 DP262210	1,060	298541.81	6178767.46	Residential
R4	T4	83 Wyndarra Way Koonawarra	N	Lot 239 DP262630	1,240	298723.14	6178982.11	Residential
R5	-	68 Gilba Road Koonawarra	N	Lot 220 DP242860	1,450	298875.86	6179230.15	Residential
R6	ML#9	57 The Boulevard Oak Flats	S	Lot 200 DP13638	3,500	299687.96	6174255.44	Residential
R7	ML#9	23 Park Crescent Oak Flats	S	Lot 421 DP15987	3,800	298913.91	6173834.90	Residential
R8	ML#10	295 Reddall Parade Mount Warrigal	SE	Lot 261DP223828	3,650	301667.93	6175420.38	Residential
R9	ML#11	82 Haywards Bay Drive Haywards Bay	SW	Lot 523 DP1194029	2,370	297736.81	6175681.13	Residential
R10	ML#11	116 Haywards Bay Drive Haywards Bay	SW	Lot 226 DP1112514	2,470	297360.16	6175753.86	Residential
R11	ML#11	142a Haywards Bay Drive Haywards Bay	SW	Lot 381 DP1137139	2,720	297094.94	6175789.77	Residential
Tallawarra Lands Future Receivers								
R12	Most affected residence –	Southern Precinct	SW	Lot 2 DP792664	1,840	297772.00	6176344.10	Residential



Table 2-1: Nearest Receivers

Receiver ID	Project Approval ID	Address	Direction from Site	Lot and DP	Approximate distance to site (m)	Easting	Northing	Type of receiver
R13	proposed south-western residential area	Southern Precinct	SW	Lot 151 DP628980	1,960	297504.86	6176416.91	Residential
R14	Most affected residence – proposed central residential area	Central Precinct	W	Lot 15 DP DP1050255	1,100	297828.31	6177479.52	Residential
R15		Central Precinct	W	Lot 15 DP DP1050255	1,000	297885.37	6177673.22	Residential
R16		Central Precinct	W	Lot 1 DP551658	1,000	297884.38	6177776.82	Residential
R17		Central Precinct	NW	Lot 102 DP716727	1,010	297874.24	6177843.85	Residential
R18	Most affected residence – proposed northern residential area	Northern Precinct	N	Lot 30 DP1175058	870	298713.53	6178645.77	Residential
R19		Northern Precinct	N	Lot 30 DP1175058	820	298767.19	6178592.09	Residential
R20		Northern Precinct	N	Lot 30 DP1175058	750	298820.85	6178537.22	Residential
R21		Northern Precinct	N	Lot 30 DP1175058	710	298875.70	6178497.85	Residential
R22		Northern Precinct	NE	Lot 30 DP1175058	750	299024.79	6178521.67	Residential
R23		Northern Precinct	NE	Lot 30 DP1175058	800	299146.45	6178534.76	Residential
R24		Northern Precinct	NE	Lot 30 DP1175058	890	299302.70	6178559.77	Residential
R25		Northern Precinct	NE	Lot 30 DP1175058	850	299444.62	6178533.50	Residential

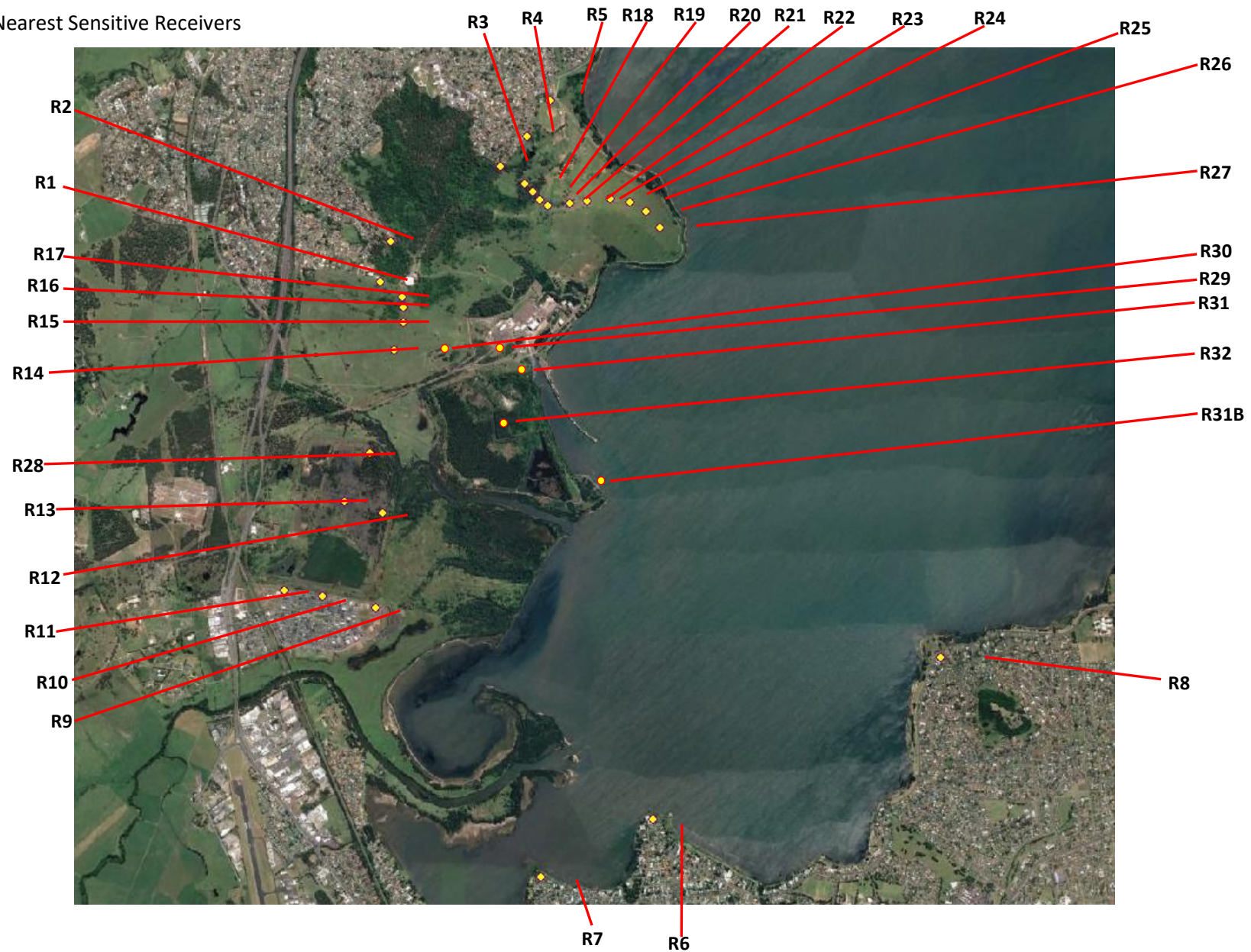


Table 2-1: Nearest Receivers

Receiver ID	Project Approval ID	Address	Direction from Site	Lot and DP	Approximate distance to site (m)	Easting	Northing	Type of receiver
R26		Northern Precinct	NE	Lot 30 DP1175058	990	299556.72	6178471.46	Residential
R27		Northern Precinct	NE	Lot 30 DP1175058	990	299655.69	6178362.90	Residential
R28	Most affected residence – proposed south-western residential area	Southern Precinct	SW	Lot 11 DP552933	1,580	297668.70	6176757.99	Aged Care (residential)
R29	-	Central Precinct	W	Lot 31 DP1175058	600	298323.28	6177514.00	Commercial
R30	-	Central Precinct	W	Lot 15 DP DP1050255	1,000	297930.88	6177478.31	Commercial
R31 R31B	-	Future Development Area (Potential Primary School)	SW	Lot 31 DP1175058	580 970	298492.60 298385.18	6177360.11 6176960.58	School
R32	-	Future Tourism Facility	S	Lot 31 DP1175058	1,250	299082.31	6176563.39	Commercial (Potential Holiday Accommodation)

Source: Benbow Environmental, SixMaps, Tallawarra Master Plan 2020

Figure 2-2: Nearest Sensitive Receivers



An aerial photograph of a residential development area, specifically the R20-R27 zone. The map shows a curved residential area with yellow star markers indicating specific locations. Red leader lines connect these markers to labels R18 through R27. The area is bordered by a body of water on the right and a road or boundary on the left. The text 'MILITARY' is visible in the upper left portion of the map.



3. PROJECT APPROVAL CRITERIA

This section has been extracted directly from Schedule 1 Application No: 07_0124.

Condition	Requirement																																			
Noise Impacts – Operational Noise																																				
3.5	The Proponent shall design, construct, operate and maintain the project to ensure that the total cumulative noise contribution from the combined operation of the Tallawarra Stage A and Tallawarra Stage B power stations to the background acoustic environment does not exceed the noise limits specified in Table 1 and Table 2 Table 1 – Maximum Allowable Noise Limits Outside the Tallawarra Lands <table><tr><th>Location</th><th>Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays</th><th>Evening 6:00 pm to 10:00 pm on any day</th><th colspan="2">Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays</th></tr><tr><th></th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th><th>L_{Amax}</th></tr><tr><td>Locality T2 Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, in Koonawarra</td><td>35 dB(A)</td><td>35 dB(A)</td><td>35 dB(A)</td><td>45 dB(A)</td></tr><tr><td>Locality T4 Any residence on Wyndarra Way and Malonga Place in Koonawarra</td><td>35 dB(A)</td><td>35 dB(A)</td><td>35 dB(A)</td><td>45 dB(A)</td></tr><tr><td>Locality ML#9 Any residence on The Boulevard, Park Crescent, Horsley Road and Newton Crescent in Oak Flats</td><td>38 dB(A)</td><td>38 dB(A)</td><td>38 dB(A)</td><td>45 dB(A)</td></tr><tr><td>Locality ML#10 Any residence on Reddall Parade and Henricks Parade in Mt Warrigal</td><td>38 dB(A)</td><td>38 dB(A)</td><td>38 dB(A)</td><td>45 dB(A)</td></tr><tr><td>Locality ML#11 Any residence in Haywards Bay</td><td>35 dB(A)</td><td>35 dB(A)</td><td>35 dB(A)</td><td>45 dB(A)</td></tr></table>	Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays			L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Amax}	Locality T2 Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, in Koonawarra	35 dB(A)	35 dB(A)	35 dB(A)	45 dB(A)	Locality T4 Any residence on Wyndarra Way and Malonga Place in Koonawarra	35 dB(A)	35 dB(A)	35 dB(A)	45 dB(A)	Locality ML#9 Any residence on The Boulevard, Park Crescent, Horsley Road and Newton Crescent in Oak Flats	38 dB(A)	38 dB(A)	38 dB(A)	45 dB(A)	Locality ML#10 Any residence on Reddall Parade and Henricks Parade in Mt Warrigal	38 dB(A)	38 dB(A)	38 dB(A)	45 dB(A)	Locality ML#11 Any residence in Haywards Bay	35 dB(A)	35 dB(A)	35 dB(A)	45 dB(A)
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Condition	Requirement																									
	The localities set out in Table 1 are those described in Appendix E of the document listed in condition 1.1c). For the purpose of Table 1, “residence” is defined as any residential dwelling existing at the date of this approval and any residential dwelling, once constructed, on land zoned R2 - Low Density Residential under the Wollongong Local Environmental Plan 2009 at the identified locality. Table 2 - Noise Limits for Tallawarra Lands Residential Areas <table><tr><th>Location</th><th>Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays</th><th>Evening 6:00 pm to 10:00 pm on any day</th><th colspan="2">Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays</th></tr><tr><th></th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th><th>L_{Amax}</th></tr><tr><td>Most affected residence - proposed northern residential area</td><td>If the <i>Noise Policy for Industry</i> (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)</td><td>If the <i>Noise Policy for Industry</i> (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)</td><td>If the <i>Noise Policy for Industry</i> (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)</td><td>50 dB(A)</td></tr><tr><td>Most affected residence - proposed central residential area</td><td>40 dB(A)</td><td>40 dB(A)</td><td>40 dB(A)</td><td>50 dB(A)</td></tr><tr><td>Most affected residence - proposed south-western residential area</td><td>41 dB(A)</td><td>41 dB(A)</td><td>41 dB(A)</td><td>51 dB(A)</td></tr></table> The proposed residential areas set out in Table 2 are those illustrated in Appendix A of the Tallawarra Concept Plan Application – Preliminary Assessment Report prepared by Don Fox Planning and dated June 2009. For the purpose of Table 2, “residence” is defined as any residential dwelling once constructed, either prior to or post the construction and operation of the power station, on land zoned R2 - Low Density Residential or R5 - Large Lot Residential under the Wollongong Local Environmental Plan 2009 within the proposed residential areas. If noise from an activity is substantially tonal, intermittent or impulsive in nature and contains major components within the low frequency range (as described in Noise Policy for Industry, (NSW EPA, 2017)), 5 dB(A) must be added to the measured noise level when comparing the measured noise with the limits specified in Tables 1 and 2, in accordance with the requirements of the Industrial Noise Policy.	Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays			L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Amax}	Most affected residence - proposed northern residential area	If the <i>Noise Policy for Industry</i> (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)	If the <i>Noise Policy for Industry</i> (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)	If the <i>Noise Policy for Industry</i> (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)	50 dB(A)	Most affected residence - proposed central residential area	40 dB(A)	40 dB(A)	40 dB(A)	50 dB(A)	Most affected residence - proposed south-western residential area	41 dB(A)	41 dB(A)	41 dB(A)	51 dB(A)
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Condition	Requirement
3.6	The noise limits set out in Table 1 and Table 2 do not apply under: wind speeds greater than 3 metres per second (measured at 10 metres above ground level); or under stability category G temperature inversion conditions; or under stability category F temperature inversion conditions and wind speeds greater than 2 metres per second at 10 metres above the ground. Stability category temperature inversion conditions are to be determined by the sigma-theta method referred to in the Noise Policy for Industry, (NSW EPA, 2017). The data to be used for determining meteorological conditions is that recorded by the meteorological weather station located at the Tallawarra Stage A power station. Where operational noise monitoring (as required by either conditions 4.1 or 4.5 of this approval) identifies any non-compliance with the operational noise limits specified under condition 3.5 of this approval, the Proponent shall prepare and submit to the Secretary for approval a report including, but not limited to: a) an assessment of all reasonable and feasible physical and other mitigation measures for reducing noise at the source; b) identification of the preferred measure(s) for reducing noise at the source; c) evidence that the EPA is satisfied that the proposed noise mitigation measures are acceptable; and d) location, type, timing and responsibility for implementation of the noise mitigation measure(s). The report is to be submitted to the Secretary within 90 days of undertaking the noise monitoring which has identified exceedances of the operational noise criteria specified under condition 3.5, unless otherwise agreed to by the Secretary. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Secretary.
Noise Impacts – Additional Noise Mitigation Measures	
3.7	If, after the implementation of all reasonable and feasible source controls, as identified in the report required by condition 3.6, the noise generated by the combined operation of the Tallawarra Stage A and Tallawarra Stage B power stations exceeds the noise limits stipulated in Table 3 and Table 4 at the specified localities, upon receiving a written request from an affected landowner (unless that landowner has acquisition rights under condition 3.13 of this approval and has requested acquisition) the Proponent shall investigate and implement reasonable and feasible at-receiver noise mitigation measures such as double glazing, insulation, air conditioning and or other building acoustic treatments at any residence on the land, in consultation with the landowner, to ensure that the noise limits specified in condition 3.5 of this approval are not exceeded.



Condition	Requirement			
	Table 3 – Additional Noise Mitigation Criteria Outside the Tallawarra Lands			
	Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays
		L_{Aeq}(15 minute)	L_{Aeq}(15 minute)	L_{Aeq}(15 minute)
	Locality T2 Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, Koonawarra	40 dB(A)	40 dB(A)	40 dB(A)
	Locality T4 Any residence on Wyndarra Way and Malonga Place in Koonawarra	41 dB(A)	41 dB(A)	41 dB(A)
	Locality ML#9 Any residence on The Boulevarde, Park Crescent, Horsley Road and Newton Crescent in Oak Flats	41 dB(A)	41 dB(A)	41 dB(A)
	Locality ML#10 Any residence on Reddall Parade and Henricks Parade in Mt Warrigal	40 dB(A)	40 dB(A)	40 dB(A)
	Locality ML#11 Any residence in Haywards Bay	47 dB(A)	47 dB(A)	47 dB(A)

Condition	Requirement																				
	Table 4 - Additional Noise Mitigation Criteria for Tallawarra Lands Residential Areas <table><tr><th>Location</th><th>Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays</th><th>Evening 6:00 pm to 10:00 pm on any day</th><th>Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays</th></tr><tr><th></th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th></tr><tr><td>Most affected residence - proposed northern residential area</td><td>43 dB(A)</td><td>43 dB(A)</td><td>43 dB(A)</td></tr><tr><td>Most affected residence - proposed central residential area</td><td>43 dB(A)</td><td>43 dB(A)</td><td>43 dB(A)</td></tr><tr><td>Most affected residence - proposed south-western residential area</td><td>44 dB(A)</td><td>44 dB(A)</td><td>44 dB(A)</td></tr></table> If noise from an activity is substantially tonal, intermittent or impulsive in nature and contains major components within the low frequency range (as described in <i>Noise Policy for Industry</i>, (NSW EPA, 2017)), 5 dB(A) must be added to the measured noise level when comparing the measured noise with the limits specified in Tables 3 and 4, in accordance with the requirements of the <i>Noise Policy for Industry</i>, (NSW EPA, 2017).	Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays		L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	Most affected residence - proposed northern residential area	43 dB(A)	43 dB(A)	43 dB(A)	Most affected residence - proposed central residential area	43 dB(A)	43 dB(A)	43 dB(A)	Most affected residence - proposed south-western residential area	44 dB(A)	44 dB(A)	44 dB(A)
Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays																		
	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)																		
Most affected residence - proposed northern residential area	43 dB(A)	43 dB(A)	43 dB(A)																		
Most affected residence - proposed central residential area	43 dB(A)	43 dB(A)	43 dB(A)																		
Most affected residence - proposed south-western residential area	44 dB(A)	44 dB(A)	44 dB(A)																		
3.8	The Proponent shall bear the costs of any additional at-receiver mitigation measures implemented at an affected property or land.																				
3.9	The Proponent shall make a binding written offer to the landowner regarding the mitigation options that can be implemented at the property. If within three months of receiving this request from the landowner the Proponent and landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution, whose decision shall be final. If the landowner refuses to accept the Proponent’s offer within six months of the date of offer, the Proponent's obligations to provide additional mitigation measures at the property or land shall cease, unless otherwise agreed by the Secretary.																				
3.10	If a landowner has agreed to, or a property has been the subject of the application of, at-source noise mitigation measures under condition 3.7, the Proponent's obligations to re-consider the land or property under the requirements of condition 3.7 shall cease, unless otherwise agreed by the Secretary.																				
3.11	The requirements of conditions 3.7 to 3.10 do not apply if a negotiated agreement consistent with the requirements <i>Noise Policy for Industry</i> , (NSW EPA, 2017) exists between the Proponent and the landowner.																				



Condition	Requirement
3.12	The Proponent shall provide written notice to all landowners that are entitled to rights under condition 3.7 within 21 days of determining the landholdings to which these rights apply. This condition only applies where operational noise levels have been confirmed. For the purpose of this condition and condition 3.18, confirmation of operational noise levels means: a) completion of the operational noise review required under condition 4.1 of this approval; and b) implementation of any source controls, as required under condition 3.6 of this approval, should the operational noise review indicate noise levels in excess of the operational noise limits specified in condition 3.5; and c) monitoring of operational noise levels, as per the requirements under condition 4.5 of this approval, following the implementation of any source controls.



Condition	Requirement																												
3.13	If, after the implementation of all reasonable and feasible source controls, as identified in the report required by condition 3.6, the noise generated by the combined operation of the Tallawarra Stage A and Tallawarra Stage B power stations exceeds the noise limits specified in Table 5 and Table 6 at the specified localities, the Proponent shall, upon receiving a written request for acquisition from the landowner, within two years of the date of that landowner being notified of his/her acquisition rights, acquire the land in accordance with the procedures in conditions 3.14 to 3.16 of this approval. Any landowner that has agreed to, or property that has been the subject of, the application of additional noise mitigation measures under condition 3.7 of this approval waives the right to land acquisition. Table 5 - Land Acquisition Criteria for Residential Receivers Outside the Tallawarra Lands <table><tr><th>Location</th><th>Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays</th><th>Evening 6:00 pm to 10:00 pm on any day</th><th>Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays</th></tr><tr><th></th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th></tr><tr><td>Locality T2 Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, Koonawarra</td><td>43 dB(A)</td><td>43 dB(A)</td><td>43 dB(A)</td></tr><tr><td>Locality T4 Any residence on Wyndarra Way and Malonga Place in Koonawarra</td><td>44 dB(A)</td><td>44 dB(A)</td><td>44 dB(A)</td></tr><tr><td>Locality ML#9 Any residence on The Boulevard, Park Crescent, Horsley Road and Newton Crescent in Oak Flats</td><td>44 dB(A)</td><td>44 dB(A)</td><td>44 dB(A)</td></tr><tr><td>Locality ML#10 Any residence on Reddall Parade and Henricks Parade in Mt Warrigal</td><td>43 dB(A)</td><td>43 dB(A)</td><td>43 dB(A)</td></tr><tr><td>Locality ML#11 Any residence in Haywards Bay</td><td>50 dB(A)</td><td>50 dB(A)</td><td>50 dB(A)</td></tr></table>	Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays		L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	Locality T2 Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, Koonawarra	43 dB(A)	43 dB(A)	43 dB(A)	Locality T4 Any residence on Wyndarra Way and Malonga Place in Koonawarra	44 dB(A)	44 dB(A)	44 dB(A)	Locality ML#9 Any residence on The Boulevard, Park Crescent, Horsley Road and Newton Crescent in Oak Flats	44 dB(A)	44 dB(A)	44 dB(A)	Locality ML#10 Any residence on Reddall Parade and Henricks Parade in Mt Warrigal	43 dB(A)	43 dB(A)	43 dB(A)	Locality ML#11 Any residence in Haywards Bay	50 dB(A)	50 dB(A)	50 dB(A)
Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays																										
	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)																										
Locality T2 Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, Koonawarra	43 dB(A)	43 dB(A)	43 dB(A)																										
Locality T4 Any residence on Wyndarra Way and Malonga Place in Koonawarra	44 dB(A)	44 dB(A)	44 dB(A)																										
Locality ML#9 Any residence on The Boulevard, Park Crescent, Horsley Road and Newton Crescent in Oak Flats	44 dB(A)	44 dB(A)	44 dB(A)																										
Locality ML#10 Any residence on Reddall Parade and Henricks Parade in Mt Warrigal	43 dB(A)	43 dB(A)	43 dB(A)																										
Locality ML#11 Any residence in Haywards Bay	50 dB(A)	50 dB(A)	50 dB(A)																										



Condition	Requirement																				
	Table 6 - Land Acquisition Criteria for Tallawarra Lands Residential Areas <table><tr><th>Location</th><th>Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays</th><th>Evening 6:00 pm to 10:00 pm on any day</th><th>Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays</th></tr><tr><th></th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th><th>L_{Aeq}(15 minute)</th></tr><tr><td>Most affected residence - proposed northern residential area</td><td>46dB(A)</td><td>46dB(A)</td><td>46dB(A)</td></tr><tr><td>Most affected residence - proposed central residential area</td><td>46 dB(A)</td><td>46 dB(A)</td><td>46 dB(A)</td></tr><tr><td>Most affected residence - proposed south-western residential area</td><td>47 dB(A)</td><td>47 dB(A)</td><td>47 dB(A)</td></tr></table> If noise from an activity is substantially tonal, intermittent or impulsive in nature and contains major components within the low frequency range (as described in <i>Noise Policy for Industry</i>, (NSW EPA, 2017)). 5 dB(A) must be added to the measured noise level when comparing the measured noise with the limits specified in Tables 5 and 6, in accordance with the requirements of the <i>Noise Policy for Industry</i>, (NSW EPA, 2017)..	Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays		L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	Most affected residence - proposed northern residential area	46dB(A)	46dB(A)	46dB(A)	Most affected residence - proposed central residential area	46 dB(A)	46 dB(A)	46 dB(A)	Most affected residence - proposed south-western residential area	47 dB(A)	47 dB(A)	47 dB(A)
Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays																		
	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)																		
Most affected residence - proposed northern residential area	46dB(A)	46dB(A)	46dB(A)																		
Most affected residence - proposed central residential area	46 dB(A)	46 dB(A)	46 dB(A)																		
Most affected residence - proposed south-western residential area	47 dB(A)	47 dB(A)	47 dB(A)																		
3.14	Within three months of receiving a written request from a landowner with acquisition rights under condition 3.13 of this approval, the Proponent shall make a binding written offer to the landowner based on: (a) the current market value of the landowner’s interest in the property at the date of this written request, as if the property was unaffected by the project which is the subject of the project application, having regard to the - i) existing and permissible use of the land, in accordance with the applicable planning instruments at the date of the written request, and ii) presence of improvements on the property and/or any approved building or structure which has been physically commenced at the date of the landowner’s written request, and is due to be completed subsequent to that date; (b) the reasonable costs associated with - i) relocating within the Wollongong or Shellharbour local government areas, ii) obtaining legal advice and expert advice for determining the acquisition price of the land, and the terms upon which it is required; and (c) reasonable compensation for any disturbance caused by the land acquisition process. However, if at the end of this period, the Proponent and landowner cannot agree on the acquisition price of the land, and/or the terms upon which the land is to be acquired, then either party may refer the matter to the Secretary for resolution.																				



Condition	Requirement
	Upon receiving such a request, the Secretary shall request the President of the NSW Division of the Australian Property Institute to appoint a qualified independent valuer or Fellow of the Institute, to consider submissions from both parties, and determine a fair and reasonable acquisition price for the land, and/or terms upon which the land is to be acquired. Within 14 days of receiving the independent valuer's determination, the Proponent shall make a written offer to purchase the land at a price not less than the independent valuer's determination. If the landowner refuses to accept this offer within six months of the date of the Proponent's offer, the Proponent's obligations to acquire the land shall cease, unless otherwise agreed by the Secretary.
3.15	The Proponent shall bear the costs of any valuation or survey assessment requested by the independent valuer or the Secretary and the costs of determination referred to above.
3.16	If a landowner has already agreed to an offer of acquisition under the requirements of condition 3.13, or an offer of acquisition has been made under the requirements of condition 3.13 and refused by the landowner, the Proponent's obligations to re-consider the landowner's request or property under the requirements of condition 3.13 shall cease, unless otherwise agreed by the Secretary.
3.17	The requirements of conditions 3.13 to 3.16 do not apply if a negotiated agreement consistent with the requirements of <i>Noise Policy for Industry</i> , (NSW EPA, 2017) exists between the Proponent and the relevant landowner.
3.18	The Proponent shall provide written notice to all landowners that are entitled to rights under condition 3.13 within 21 days of determining the landholdings to which land acquisition rights apply. This condition only applies where operational noise levels have been confirmed in accordance with the definition in condition 3.12.

4. ENVIRONMENT PROTECTION LICENCE

This section presents the noise limits (L6) and monitoring requirements (E4) for the site in accordance with the site's Environment Protection Licence 555. These are consistent with the OEMP and Project Approval.

L6 Noise limits

L6.1 *The Licensee shall operate and maintain the project to ensure that the total cumulative noise contribution from the combined operation of the Unit Stack 1 and Unit Stack 2 power stations to the background acoustic environment does not exceed the noise limits specified in Table 1 and Table 2.*

The localities set out in the Table 1 are those described in Appendix E of the Project Approval No. 07_0124.

Definitions - For the purpose of Table 1:

"residence" is defined as any residential dwelling existing at the date of this approval and any residential dwelling, once constructed, on land zoned R2 - Low Density Residential under the Wollongong Local Environmental Plan 2009 at the identified locality.

"Day" is defined as 7:00 am to 6:00 pm Mondays to Saturdays and 8:00 am to 6:00 pm Sundays and public holidays.

"Evening" is defined as 6:00 pm to 10:00 pm on any day.

"Night" 10:00 pm to 7:00 am Mondays to Saturdays and 10:00 pm to 8:00 am Sundays and public holidays.

Table 1 - Maximum Allowable Noise Limits Outside the Tallawarra Lands

Location	Day	Evening	Night	Night
	<i>LAeq (15 minute)</i>	<i>LAeq (15 minute)</i>	<i>LAeq (15 minute)</i>	<i>LAmx</i>
<i>Locality T2 Any residence on Carlyle Close, Wollin Place, Coronet Place, and Crompton Street, in Koonawarra</i>	<i>35 dB(A)</i>	<i>35 dB(A)</i>	<i>35 dB(A)</i>	<i>45 dB(A)</i>
<i>Locality T4 Any residence on Wyndarra Way and Malonga Place in Koonawarra</i>	<i>35 dB(A)</i>	<i>35 dB(A)</i>	<i>35 dB(A)</i>	<i>45 dB(A)</i>



Locality ML#9 Any residence on The Boulevarde, Park Crescent, Horsley Road and Newton Crescent in Oak Flats	38 dB(A)	38 dB(A)	38 dB(A)	45 dB(A)
Locality ML#10 Any residence on Reddall Parade and Henricks Parade in Mt Warrigal	38 dB(A)	38 dB(A)	38 dB(A)	45 dB(A)
Locality ML#11 Any residence in Haywards Bay	35 dB(A)	35 dB(A)	35 dB(A)	45 dB(A)

L6.2 The proposed residential areas set out in Table 2 are those illustrated in EPA DOC23/735713-2, 'Revised with Koonawarra Location.pdf', dated 28/08/2023. For the purpose of Table 2, "residence" is defined as any residential dwelling once constructed, either prior to or post the construction and operation of the power station, on land zoned R2 - Low Density Residential or R5 - Large Lot Residential under the Wollongong Local Environmental Plan 2009 within the proposed residential areas.

If noise from an activity is substantially tonal, intermittent or impulsive in nature and contains major components within the low frequency range (as described in Noise Policy for Industry (NSW EPA, 2017)), 5dB(A) must be added to the measured noise level when comparing the measured noise with the limits specified in Tables 1 and 2, in accordance with the requirements of the Noise Policy for Industry (NSW EPA, 2017).

The noise limits set out in Table 1 and Table 2 do not apply under: wind speeds greater than 3 metres per second (measured at 10 metres above ground level); or under stability category G temperature inversion conditions; or under stability category F temperature inversion conditions and wind speeds greater than 2 metres per second at 10 metres above the ground.

Stability category temperature inversion conditions are to be determined by the sigma-theta method referred to in the Noise Policy for Industry (NSW EPA, 2017).

The data to be used for determining meteorological conditions is that recorded by the meteorological weather station located at the Unit Stack 1 power station.

Table 2 - Noise Limits for Tallawarra Lands Residential Areas

Location	Day	Evening	Night	Night
	<i>L_{Aeq} (minute)</i>	<i>L_{Aeq} (minute)</i>	<i>L_{Aeq} (minute)</i>	<i>L_{Amax}</i>
<i>Most affected residence - proposed northern residential area</i>	<i>If the Noise Policy for Industry (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)</i>	<i>If the Noise Policy for Industry (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)</i>	<i>If the Noise Policy for Industry (NSW EPA, 2017) Modification Factors for Low Frequency Noise apply – 40 dB(A), otherwise 38 dB(A)</i>	<i>50 dB(A)</i>
<i>Most affected residence - proposed central residential area</i>	<i>40 dB(A)</i>	<i>40 dB(A)</i>	<i>40 dB(A)</i>	<i>50 dB(A)</i>
<i>Most affected residence - proposed south-western residential area</i>	<i>41 dB(A)</i>	<i>41 dB(A)</i>	<i>41 dB(A)</i>	<i>51 dB(A)</i>

Note: Further noise conditions are listed in Project Approval No. 07_0124, which may be applied for noise management at the premises.

E4 Ongoing Operational Noise Monitoring

E4.1 The Licensee shall prepare and implement an Operational Noise Monitoring Program to assess ongoing compliance against the operational noise limits set out in conditions L6.1 and L6.2 of this licence. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA. Noise monitoring is to be consistent with the guidelines provided in the Noise Policy for Industry (NSW EPA, 2017) and must include, but not be limited to:

- noise monitoring at the locations specified in Table 1 and in Table 2 of this licence, in accordance with the requirements of conditions L6.1 and L6.2 of this licence;
- attended noise monitoring;
- monitoring of operations that have the potential to cause offensive noise including, but not limited to, safety valve operation, blowdown operation and the operation of circuit breakers during the day, evening and night time periods; and



d) monitoring of the effectiveness of any noise mitigation measures implemented under condition 7.2 of Project Approval No. 07_0124, against the noise limits specified in conditions L6.1 ad L6.2 of this licence.

5. NOISE MONITORING LOCATION AND METHODOLOGIES

A brief outline of the methodology applied to the measurement undertaken for this operational noise review has been detailed below. Attended noise monitoring was conducted 26th June 2025.

5.1 INSTRUMENT AND METHODOLOGY

Methodology and reporting were undertaken as per requirements of the OEMP (see section 1.1).

The assessment utilised attended noise monitoring equipment to determine compliance with the noise criteria. The attended noise measurements were carried out by three consultants simultaneously using 2x SVANTEK SVAN957 Type 1 Precision Sound Level Meter. And 1x HBK 2255 Sound Level Meter is an advanced, single-channel, class 1 sound level meter.

The instrument sets were calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets complied with AS IEC 61672.1–2004. The operator attended noise monitoring was undertaken over 15-minute statistical intervals during what was considered to be normal site operating conditions. This procedure therefore, allows for a detailed understanding of site-specific noise characteristics and a meaningful final analysis to determine compliance.

To ensure accuracy and reliability in the results, field reference checks were applied both before and after the measurement period with acoustic calibrators (Rion Sound Level Calibrator NC-73 & Pulsar Measurement Acoustic Calibrator Model 105). There were no excessive variances observed in the reference signal between the pre-measurement and post-measurement calibration. The instruments were set on A-weighted Fast Response. QA/QC procedures applied for the measurement and analysis of noise levels have been presented in the Attachments. The microphones were fitted with windsocks and were positioned between 1.2 and 1.5 metres above ground level.

5.2 NOISE MONITORING LOCATIONS

Noise monitoring has been undertaken at the receiver locations identified in Table 1 and Table 2 (see section 3). The noise monitoring locations are presented in the table and figure below. They include noise monitoring at future residential Tallawarra Lands (CP1, NP1, NP2, NP3, CP2) and at nearest sensitive residential receptors. No noise monitoring was undertaken at the Tallawarra Lands proposed southwestern residential area as the southwestern residential area is no longer proposed for sale and development by Energy Australia.

Noise measurement locations were selected at the most affected point within 30 m of the dwelling (proposed dwelling). This corresponds to the closest property boundary for all small residential lots NP1, NP2, T2, NP3, ML#9, ML#10, ML#11. CP1 is located on a large residential lot at the most affected point within 30m of the proposed dwelling at the coordinates presented.

Due to access constraints, TP4 measurements were taken on the street outside 17 Malonga Place Koonawarra (TP4(1)) and opposite 58 Wyrandarra Way (TP4(2)) where a vacant site presented minimal shielding.

Table 5-1: Noise Monitoring Locations

ID	X – UTM (mE)	Y – UTM (mS)	Measurement details	Equipment Serial Number
CP1	297825.95	6177494.69	Attended	15336
NP1	299116.44	6178530.21	Attended	15335
NP2	299668.05	6178333.30	Attended	15335
T2	297722.91	6177944.49	Attended	HBK 2255-100038
T4	298544.75	6178764.91	Attended	HBK 2255-100038
NP3	298892.72	6178507.28	Attended	15335
CP2	297880.23	6177785.40	Attended	15336
ML#9	299761.66	6174254.16	Attended	HBK 2255-100038
ML#10	301662.94	6175469.81	Attended	HBK 2255-100038
ML#11	297397.68	6175736.10	Attended	HBK 2255-100038

Figure 5-1: Noise Monitoring Locations

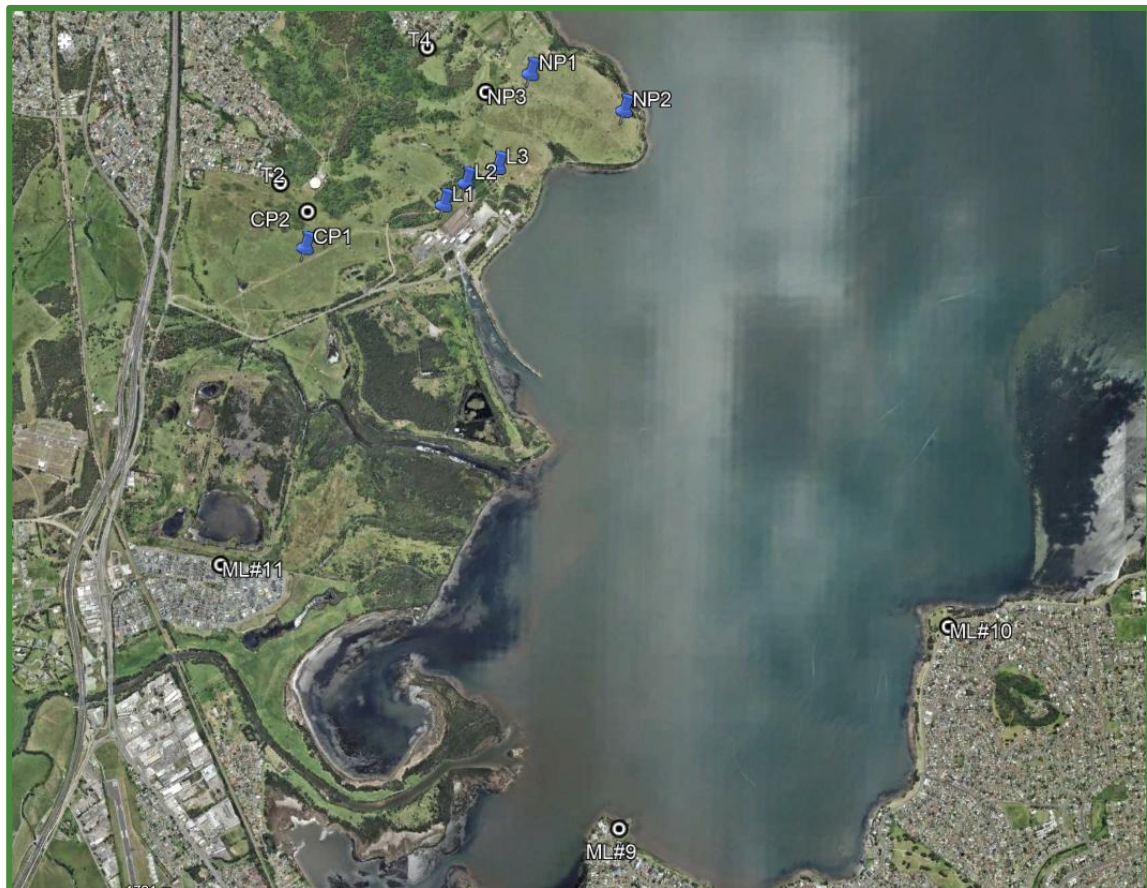


Figure 5-2: Central Precinct Noise Monitoring Location

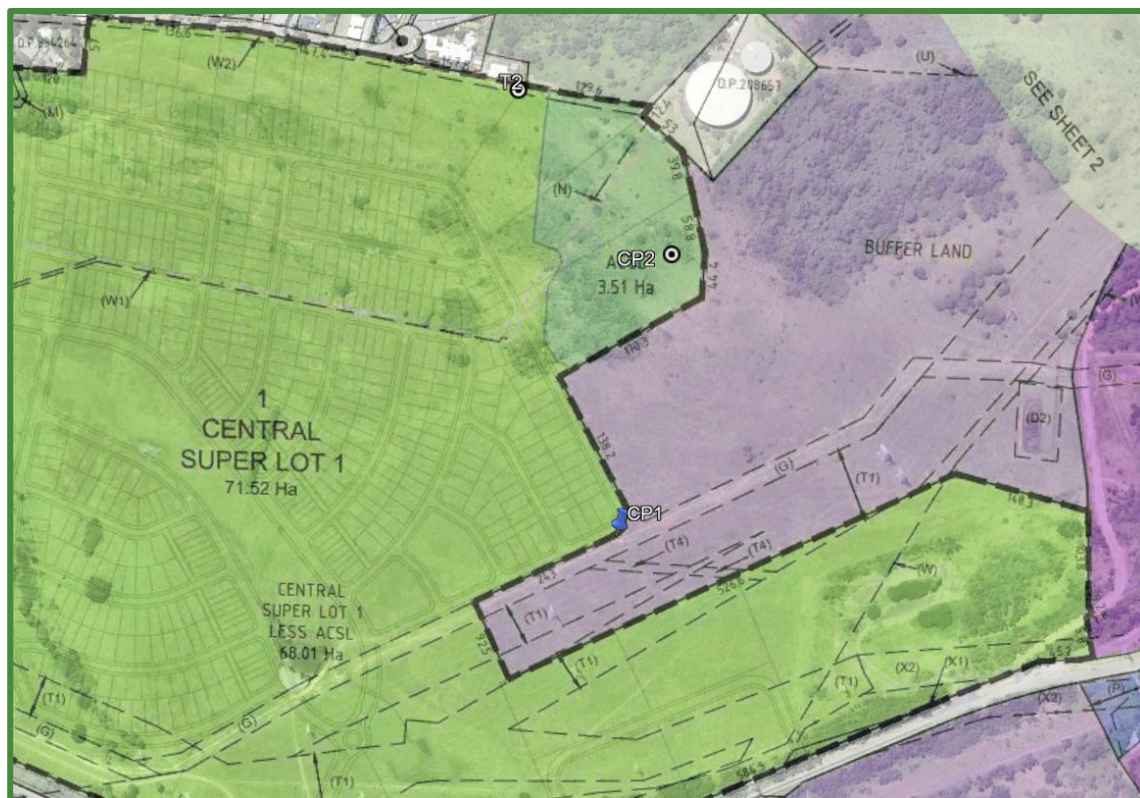
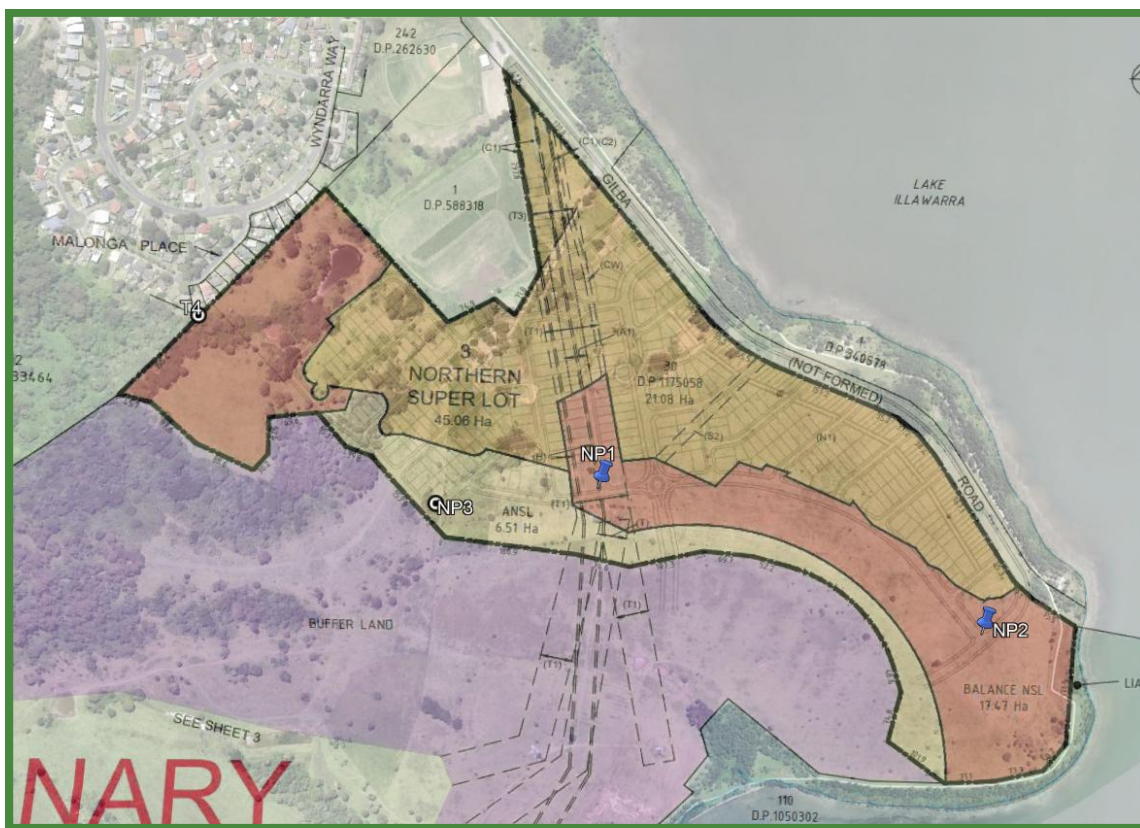


Figure 5-3: Northern Precinct Noise Monitoring Locations



5.3 NOISE MONITORING FREQUENCY

Attended noise monitoring was undertaken during the day and evening during peak energy demand at each location.

5.4 WEATHER CONDITIONS DURING MONITORING

The weather conditions during monitoring have been obtained from Albion Park (Shellharbour Airport) 068241 and are consistent with field measurements are presented in the table below.

Table 5-2: Weather Conditions

Date/Time	Rain in last hour (mm)	Temperature Degrees C	Wind Speed (m/s)	Wind Direction (degrees)	Stability Class
25062617	0	12.6	3.2	210	D
25062618	0	9	2.4	225	F
25062619	0	6.5	2.3	261	D
25062620	0	5.5	2.8	281	D
25062621	0	6.1	2.4	276	D

As can be seen in the table above noise enhancing weather conditions were present for the northern precinct during monitoring.

As per the original noise impact assessment (Ref: 191115_NIA1_Rev4) noise enhancing weather conditions apply to R8 (ML#10), R25, R26 and R27 (NP2).

5.5 TALLAWARRA A & B OPERATIONS DURING MONITORING

During the testing period, both Tallawarra A & B Power Stations were running. Tallawarra B, running a full load of 320 MW in order to determine the impacts on the various locations listed in the project approval in a worst-case scenario and Tallawarra A was running at 200-300 MW (44-67% load) during the same period.

6. NOISE MONITORING RESULTS

6.1 EXISTING RESIDENCES

The following table presents the attended monitoring results for the residential locations during the day and evening.

6.1.1 Justification of Compliance

Section 7 of the NPfl provides a range of compliance assessment techniques that may be used in determining compliance with a noise limit. An estimate of site noise levels at existing residence is not warranted to determine the status of compliance as this is easily determined based on the high margin of compliance described in the justification below.

The site being completely inaudible or barely audible at residence combined with the understanding of the constant nature of the noise from the site that is verified from nearfield measurements results in the contribution from the site necessarily being 10 dB(A) less than L_{A90} of the measurement or less. Furthermore, considering the measurements taken at the closer Tallawarra lands receptor, nearfield measurements in conjunction relative noise levels predicted in the modelling assessments previously undertaken by Benbow Environmental the estimated site noise levels at existing residence will be less than 30 dB(A). Confidence of compliance with the limits at the existing residence is very high and based on Benbow Environmental's professional judgement using quantitative acoustic understanding of noise from the site as per section 7 of the NPfl.

Table 6-1: Operator Attended Noise Measurements, dB(A)

Location	Date/Time	Total Measurement				Comments	Site Noise Contribution		Criteria	
		L _{Aeq}	L _{A90}	L _{A10}	L _{A1}		L _{AEQ}	L _{AMAX}	L _{AEQ}	L _{AMAX}
T2	Day/Evening 26/06 17:47	54	52	56	58	Site Noise Inaudible Distant traffic audible Highway Traffic ≤ 59 dB(A) Bike (along highway) ≤ 61 dB(A) Plane ≤ 54 dB(A) Door slam ≤ 52 dB(A) Car along driveway ≤ 57 dB(A) Primary source of noise from highway	Site Inaudible <35✓	-	35	-
T4(1)	Day 26/06 16:54	49	38	53	58	Site Noise Inaudible Birds ≤ 46 – 56 dB(A) Kids playing ≤ 61 - 65 dB(A) Dog barking ≤ 53 - 56 dB(A) Door slam ≤ 60 - 70 dB(A) Truck ≤ 48 dB(A) Primary source of noise from residents	Site Inaudible <30✓	-	35	-
T4(2)	Day 26/06 17:17	51	39	55	61	Car ≤ 56 – 61 dB(A) SUV ≤ 57- 64 dB(A) Truck ≤ 62 - 65 dB(A) Plane overhead ≤ 47 dB(A) Dog barking ≤ 50 dB(A) Birds ≤ 43 dB(A) Very faint drone from direction of site, duration of less than 30 seconds < 38 dB(A)	<30✓	-	35	-

Location	Date/Time	Total Measurement				Comments	Site Noise Contribution		Criteria	
		L _{Aeq}	L _{A90}	L _{A10}	L _{A1}		L _{AEQ}	L _{AMAX}	L _{AEQ}	L _{AMAX}
ML9	Evening 26/06 18:59	47	43	50	55	Site Noise Inaudible Bike ≤ 58 dB(A) Car ≤ 49 - 57 dB(A) Plane overhead ≤ 45 dB(A) Sirens ≤ 50 - 55 dB(A) Music from residence ≤ 45 dB(A) Primary source of noise from sirens and the occasional plane overhead	Site Inaudible <33✓	-	38	-
ML10	Evening 26/06 19:28	51	40	55	60	Car ≤ 54 - 61 dB(A) Van ≤ 60 dB(A) Door slam ≤ 58 dB(A) Car beep ≤ 55 dB(A) Primary source of noise from passing traffic Direct line of sight to Talla across the water Very faint drone from site, when no cars passing	<30✓	-	38	-
ML11	Evening 26/06 18:22	57	54	58	68	Site Noise Inaudible Distant traffic audible Car ≤ 64 - 71 dB(A) Helicopter ≤ 56 dB(A) Plane overhead ≤ 57 dB(A) Primary noise from insects and highway traffic	Site Inaudible <35✓	-	35	-

6.2 TALLAWARRA LANDS

6.2.1 Attended Noise Monitoring Results

Table 6-2: Operator Attended Noise Measurements, dB(A)

Location	Date/ Time	Total Measurement				Comments	Site Noise Contribution		Criteria	
		L _{Aeq}	L _{A90}	L _{A10}	L _{A1}		L _{AEQ}	L _{AMAX}	L _{AEQ}	L _{AMAX}
NP1	Day 26/06 16:53	47	37	43	60	Birds + light breeze + horses + site ≈ 35-38 dB(A) Birds < 51 dB(A) – intermittent throughout typically 41- 45 dB(A) Horses < 69 dB(A) Distant revving < 46 dB(A) Distant traffic + site hum ≈ 37 dB(A) Person talking to horse < 45,47,58 dB(A) Aeroplane < 65 dB(A) Light breeze blowing from site	35✓	-	38-40	-
NP2	Day 26/06 17:36	41	39	43	45	Distant revving < 43 dB(A) Horse < 53 dB(A) – eating near measurement – reduced noise after first 4 mins Site + distant traffic ≈ 38-40 dB(A) Aeroplane < 43 dB(A) Light wind blowing from site	38✓	-	38-40	-
NP3	Evening 26/06 18:22	39	35	42	46	Aeroplane < 47 dB(A) Bird < 40 dB(A) Distant revving < 46 dB(A) Helicopter < 51 dB(A) Distant clapping < 39 dB(A) Distant traffic < 39 dB(A) Distant traffic + site ≈ 35 (site approx. 70-80% contribution at this low level) Distant dogs barking < 41 dB(A)	34✓	-	38-40	-



Location	Date/ Time	Total Measurement				Comments	Site Noise Contribution		Criteria	
		L _{Aeq}	L _{A90}	L _{A10}	L _{A1}		L _{AEQ}	L _{AMAX}	L _{AEQ}	L _{AMAX}
CP1	Evening 26/06 19:23	50	48	52	54	Site Inaudible Traffic noise dominated measurement Traffic + insects/frogs ≈ 47-51 Passing car < 56 dB(A) Traffic + insects + truck < 52 dB(A) Traffic + insects + aircraft < 49 dB(A) [Talla A stack is visible from this location]	Site Inaudible (<34) ✓	-	40	-
	Evening 26/06 19:50	50	48	52	55	Site Inaudible Traffic noise dominated measurement Frogs/insect constant but not very audible Traffic + insects + train < 52 dB(A) Traffic + passing car < 54 Traffic + truck < 53 dB(A) Traffic ≈ 47-54 Traffic + motorbike < 55 dB(A)	Site Inaudible (<34) ✓	-	40	-
CP2	Day 26/06 17:45	52	50	54	56	Site Inaudible Traffic noise dominated measurement Very minor insect noise constantly audible Traffic + aircraft < 56 dB(A) Traffic + truck braking < 62 dB(A)	Site Inaudible (<34) ✓	-	40	-
	Evening 26/06 18:15	52	49	54	59	Site Inaudible Traffic noise dominated measurement Very minor insect/frog noise constantly barely audible Traffic + aircraft < 60 dB(A) Traffic + helicopter < 60 dB(A) Traffic + truck horn < 56 dB(A) Traffic + train < 51 dB(A) Traffic + car revving < 60 dB(A)	Site Inaudible (<34) ✓	-	40	-

6.3 ASSESSMENT OF ANNOYING CHARACTERISTICS

6.3.1 Low Frequency

Low frequency noise penalties are considered applicable in accordance with the Noise Policy for Industry when:

Measure/assess source contribution C- and A-weighted $L_{eq,T}$ levels over the same time period.

Correction to be applied where the C minus A level is 15 dB or more and:

- *Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.*
- *Where any of the one-third octave noise levels in Table c2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dB(A) positive adjustment applies for the daytime period.*

Table C2: One-third octave low-frequency noise thresholds.

Hz/dB(Z)	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

Notes:

- dB(Z) = decibel (Z frequency weighted).
- For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for

6.3.2 Tonal Noise

Tonal noise is considered an annoying characteristic in accordance with the Noise Policy for Industry if:

Level of one-third octave band exceeds the level of the adjacent bands on both sides by:

- *5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz*
- *8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz*
- *15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.*

Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.

If the above occurs, then a 5 dB penalty applies.

This is assessed in the following section.

6.3.3 Low Frequency/Tonal Noise Analysis

As the site was inaudible or barely audible at existing residential locations and the Tallawarra Lands Central Precinct, low frequency and tonal noise analysis was only conducted at the future Tallawarra Lands Receptors Northern Precinct.

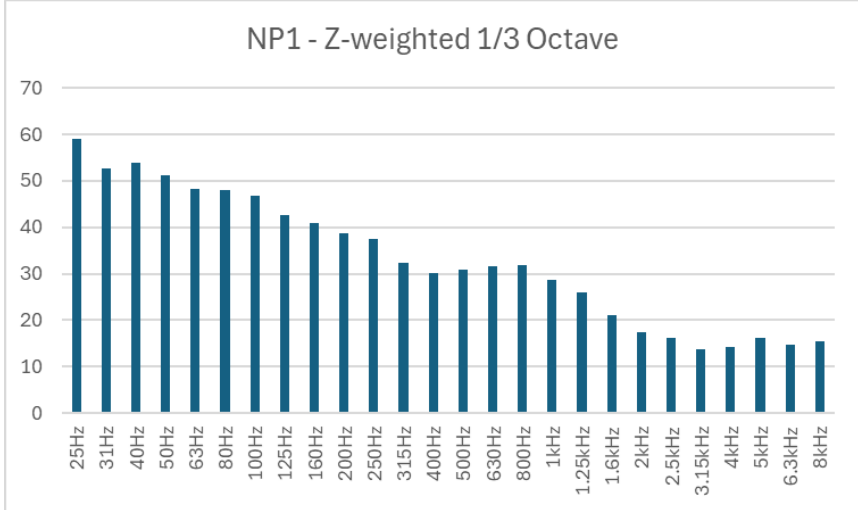
6.3.3.1 Attended Noise Measurements

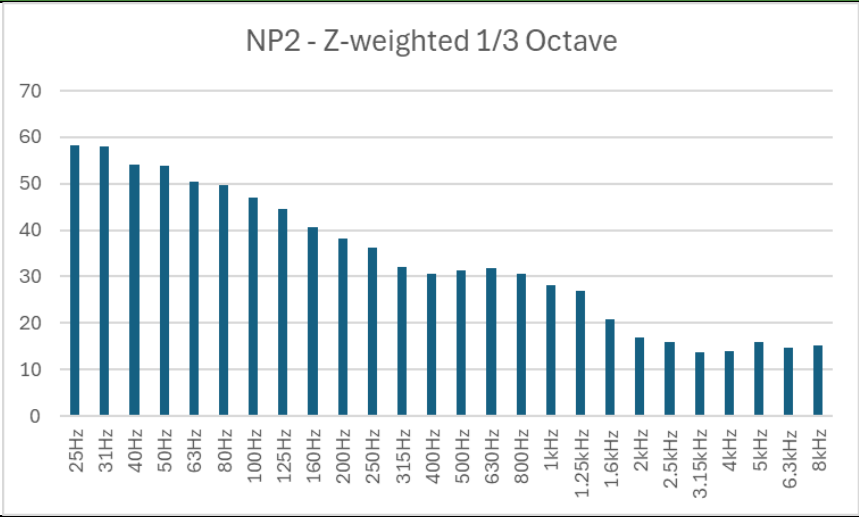
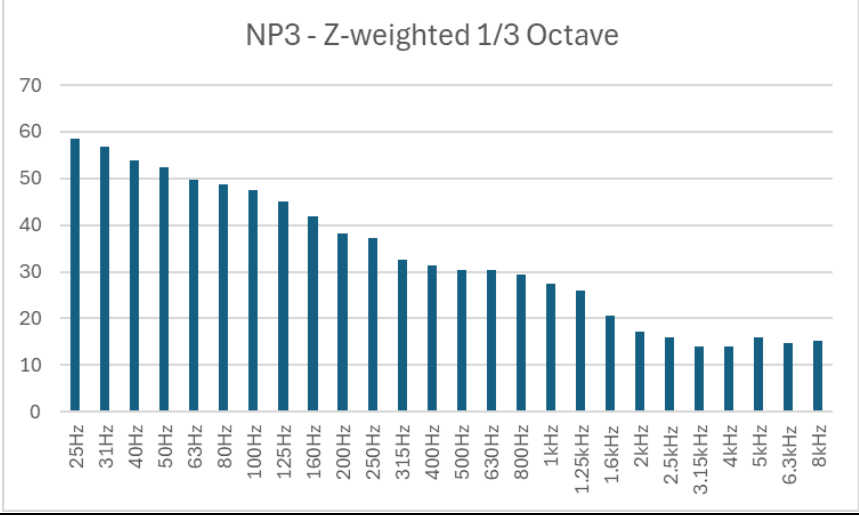
The following table presents the Z-weighted spectrums of the results of the total measurements including noise not from the site. Tonal noise is not a characteristic from the site at the measurement locations and a tonal penalty does not apply.

Most of the Z-weighted levels from the attended measurements were well below table C-2 low frequency thresholds. The 50Hz frequency exceeded the low frequency threshold by 1-4 dB at NP1, NP2 and NP3 and the 63Hz frequency at NP2 by 1 dB.

Therefore, a 2dB penalty applies to the site contributions presented in section 6.2. With the low frequency penalty, the site complies with the project approval criteria.

Table 6-3: Attended Measurements - Spectrum

Location	Date/Time	Spectrum (dB(Z))																																																						
NP1	Day 26/06 16:53	NP1 - Z-weighted 1/3 Octave <table><thead><tr><th>Frequency</th><th>Level (dB(Z))</th></tr></thead><tbody><tr><td>25Hz</td><td>58</td></tr><tr><td>31Hz</td><td>52</td></tr><tr><td>40Hz</td><td>53</td></tr><tr><td>50Hz</td><td>50</td></tr><tr><td>63Hz</td><td>47</td></tr><tr><td>80Hz</td><td>47</td></tr><tr><td>100Hz</td><td>46</td></tr><tr><td>125Hz</td><td>42</td></tr><tr><td>160Hz</td><td>40</td></tr><tr><td>200Hz</td><td>38</td></tr><tr><td>250Hz</td><td>37</td></tr><tr><td>315Hz</td><td>32</td></tr><tr><td>400Hz</td><td>30</td></tr><tr><td>500Hz</td><td>30</td></tr><tr><td>630Hz</td><td>31</td></tr><tr><td>800Hz</td><td>31</td></tr><tr><td>1kHz</td><td>28</td></tr><tr><td>1.25kHz</td><td>25</td></tr><tr><td>1.6kHz</td><td>21</td></tr><tr><td>2kHz</td><td>17</td></tr><tr><td>2.5kHz</td><td>16</td></tr><tr><td>3.15kHz</td><td>14</td></tr><tr><td>4kHz</td><td>15</td></tr><tr><td>5kHz</td><td>16</td></tr><tr><td>6.3kHz</td><td>15</td></tr><tr><td>8kHz</td><td>15</td></tr></tbody></table>	Frequency	Level (dB(Z))	25Hz	58	31Hz	52	40Hz	53	50Hz	50	63Hz	47	80Hz	47	100Hz	46	125Hz	42	160Hz	40	200Hz	38	250Hz	37	315Hz	32	400Hz	30	500Hz	30	630Hz	31	800Hz	31	1kHz	28	1.25kHz	25	1.6kHz	21	2kHz	17	2.5kHz	16	3.15kHz	14	4kHz	15	5kHz	16	6.3kHz	15	8kHz	15
		Frequency	Level (dB(Z))																																																					
		25Hz	58																																																					
31Hz	52																																																							
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4kHz	15																																																							
5kHz	16																																																							
6.3kHz	15																																																							
8kHz	15																																																							
40Hz	50Hz	63Hz																																																						
54	51	48																																																						

Location	Date/Time	Spectrum (dB(Z))
NP2	Day 26/06 17:36	
		40Hz 50Hz 63Hz 54 54 51
NP3	Evening 26/06 18:22	
		40Hz 50Hz 63Hz 54 53 50

6.3.4 Intermittent Noise

No intermittent noise where the source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible was observed during the operational noise review.

7. CONCLUDING REMARKS

Benbow Environmental completed operational noise testing for Energy Australia's Tallawarra A&B Power Station during the day and evening period during peak energy demand.

Attended monitoring was undertaken at the future Tallawarra lands, and at the existing residences. The site was either not audible or barely audible at the existing residences and readily complied with the relevant criteria. The site was not audible at the future Tallawarra lands central precinct.

Weather conditions were worst case for the worst effected receptors at the future Tallawarra Lands Northern Precinct under worst case operating conditions when Tallawarra B was at full load and Tallawarra A was operating simultaneously. Under these conditions, a 2dB low frequency penalty applied to the northern precinct receptors. With the low frequency penalty, the site complied with the L_{Aeq} criteria of 40 dB(A) at all locations.

Based on the results of the attended monitoring, Tallawarra A&B Power Station complied with Table 1 and Table 2 of the Project Approval (07_0124) and with Condition L6 of Environment Protection Licence (EPL) 555 at all locations. Therefore, the site also complies with Table 3 and Table 4 of the Project Approval criteria at all locations.

This concludes the report.



Prasanna Manoharan
Chemical Engineer



Emma Hansma
Senior Engineer



R T Benbow
Principal Consultant



8. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of EnergyAustralia, as per our agreement for providing environmental services. Only EnergyAustralia is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by EnergyAustralia for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

ATTACHMENTS

Attachment 1: Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE No: **SLM36622**

EQUIPMENT TESTED: Sound & Vibration Analyser

Manufacturer: Svantek
Type No: SVAN-957
Mic. Type: 7052H
Pre-Amp. Type: SV12L
Filter Type: 1/3 Octave
Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Serial No: 15335
Serial No: 40814
Serial No: 18742
Test No: F036623

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1003 hPa ± 1 hPa	Date of Receipt :	27/06/2023
Temperature	24 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$	Date of Calibration :	30/06/2023
Relative Humidity	32 % $\pm 5\%$	Date of Issue :	03/07/2023

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: *[Signature]* AUTHORISED SIGNATURE: *[Signature]*
Jack Kiehl

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



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Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: **SLM36595**

EQUIPMENT TESTED: Sound & Vibration Analyser

Manufacturer: Svantek
Type No: SVAN-957
Mic. Type: 7052E
Pre-Amp. Type: SV12L
Filter Type: 1/3 Octave
Test No: F036598

Serial No: 15336
Serial No: 47869
Serial No: 18743

Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1003 hPa ± 1 hPa	Date of Receipt :	27/06/2023
Temperature	24 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$	Date of Calibration :	28/06/2023
Relative Humidity	36 % $\pm 5\%$	Date of Issue :	03/07/2023

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: *[Signature]* AUTHORISED SIGNATURE: *[Signature]*

Jack Riello

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Sydney Calibration Laboratory
Unit 21, 1 Talavera Road, Macquarie Park NSW 2113, Australia
Accredited for compliance with ISO/IEC 17025 - Calibration. Laboratory No. 1301



CERTIFICATE OF CALIBRATION

Certificate No: CAU2401003

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CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2255	No: 2255-100038
Microphone:	Brüel & Kjær	4966	No: 3348186
Preamplifier:	Brüel & Kjær	ZC-0043	No: 3351854
Supplied Calibrator:	None		
Software version:	BZ7300 Version 1.2.0.1151	Pattern Approval:	-
Instruction manual:	BE1917-11	Identification:	N/A

CUSTOMER:

Benbow Environmental
25-27 Sherwood St
Northmead NSW 2152

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 °C
Environment conditions:	see actual values in Environmental conditions sections

SPECIFICATIONS:

The Sound Level Meter has been calibrated in accordance with the requirements as specified in IEC61672-3:2006 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests. The measurements included in this document are traceable to Australian / International standards through accredited calibration of all relevant reference equipment.

PROCEDURE:

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System B&K 3630 with application software type 7763 (version 8.6 - DB: 8.60) and test procedure 2255-N, 4966 (BZ-7300).

RESULTS:

	Initial calibration		Calibration prior to repair/adjustment
X	Calibration without repair/adjustment		Calibration after repair/adjustment

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of Calibration: 25/10/2024

Certificate issued: 28/10/2024

Barath Chandar Rajendran
Calibration Technician

Sajeeb Tharayil
Approved signatory

Reproduction of the complete certificate is allowed. Parts of the certificate may only be reproduced after written permission.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C39738

EQUIPMENT TESTED : Acoustic Calibrator

Manufacturer: Rion

Type No: NC-73

Serial No: 10186522

Class: 1

Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Tests Performed: Measured Output Pressure level, Frequency & Distortion

Comments: See Details and Class Tolerance overleaf.

CONDITION OF TEST:

Ambient Pressure 1005 hPa ± 1 hPa

Temperature 24 °C ± 1 °C

Relative Humidity 59 % ± 5 %

Date of Receipt : 06/05/2024

Date of Calibration : 13/05/2024

Date of Issue : 27/05/2024

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY: 

AUTHORISED
SIGNATURE:


Hein Soc

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.


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WORLD RECOGNISED
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No. 9262
Acoustic and Vibration
Measurements



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Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Calibrator

IEC 60942:2017

Calibration Certificate

Calibration Number **C24677**

Client Details Benbow Environmental Pty Ltd
25-27 Sherwood Street
Northmead NSW, 2152

Equipment Tested/ Model Number : Pulsar Model 105
Instrument Serial Number : 101545

Atmospheric Conditions

Ambient Temperature : 22.6 °C
Relative Humidity : 37.4 %
Barometric Pressure : 100.81 kPa

Calibration Technician : Shaheen Boaz
Calibration Date : 05 Sep 2024

Secondary Check: Cooper Sallway
Report Issue Date : 6 Sep 2024

Approved Signatory :

Juan Agüero

Characteristic Tested	Result
Generated Sound Pressure Level	Pass
Frequency Generated	Pass
Total Distortion	Pass

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94	1000	93.88	1000.30

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Uncertainties of Measurement -

Specific Tests	Environmental Conditions
Generated SPL	Temperature
Frequency	Relative Humidity
Distortion	Barometric Pressure

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.



This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.



Sydney Calibration Laboratory
Unit 21, 1 Talavera Road, Macquarie Park NSW 2113, Australia
Accredited for compliance with ISO/IEC 17025 - Calibration. Laboratory No. 1301



CERTIFICATE OF CALIBRATION

Certificate No: CAU2401003

Page 1 of 11

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2255	No: 2255-100038
Microphone:	Brüel & Kjær	4966	No: 3348186
Preamplifier:	Brüel & Kjær	ZC-0043	No: 3351854
Supplied Calibrator:	None		
Software version:	BZ7300 Version 1.2.0.1151	Pattern Approval:	-
Instruction manual:	BE1917-11	Identification:	N/A

CUSTOMER:

Benbow Environmental
25-27 Sherwood St
Northmead NSW 2152

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 °C
Environment conditions:	see actual values in Environmental conditions sections

SPECIFICATIONS:

The Sound Level Meter has been calibrated in accordance with the requirements as specified in IEC61672-3:2006 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests. The measurements included in this document are traceable to Australian / International standards through accredited calibration of all relevant reference equipment.

PROCEDURE:

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System B&K 3630 with application software type 7763 (version 8.6 - DB: 8.60) and test procedure 2255-N, 4966 (BZ-7300).

RESULTS:

	Initial calibration		Calibration prior to repair/adjustment
X	Calibration without repair/adjustment		Calibration after repair/adjustment

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of Calibration: 25/10/2024

Certificate issued: 28/10/2024

Barath Chandar Rajendran
Calibration Technician

Sajeed Tharayil
Approved signatory

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Glossary of Noise Terminology

'A' FREQUENCY WEIGHTING

The 'A' frequency weighting roughly approximates to the Fletcher-Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' ($L_{Aeq,T}$).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc.. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' ($L_{A90,T}$). Background Noise Levels are often determined for the day, evening, and night-time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days). For a 15-minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

'C' FREQUENCY WEIGHTING

The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (h) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of

the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10} (10^{(50/10)} + 10^{(50/10)})$) and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

dBC – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - L_{Aeq}) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.

'F' (FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FLETCHER–MUNSON EQUAL LOUDNESS CONTOUR CURVES

The Fletcher–Munson curves are one of many sets of equal loudness contours for the human ear, determined experimentally by Harvey Fletcher and Wilden A. Munson, and reported in a 1933 paper entitled "Loudness, its definition, measurement and calculation" in the Journal of the Acoustic Society of America.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

IMPACT ISOLATION CLASS (IIC)

The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and

measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus, the higher the IIC, the better the impact sound isolation. Not commonly used in Australia.

'I' (IMPULSE) TIME WEIGHTING

Sound level meter time constant now not in general use. The 'I' (impulse) time weighting is not suitable for rating impulsive sounds with respect to their loudness. It is also not suitable for assessing the risk of hearing impairment or for determining the 'impulsiveness' of a sound.

IMPACT SOUND INSULATION ($L_{nT,w}$)

Australian Standard AS ISO 717.2—2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured 1/3 octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE

An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LAF_{max}

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LAS_{max}

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE RATING NUMBERS

A set of empirically developed equal loudness curves has been adopted as Australian Standard AS 1469—1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the 'A' frequency weighted dB level minus five.

NOISE

Noise is unwanted, harmful, or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid, or solid. Noise usually includes vibration as well as sound.

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient"

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997).

"Offensive Noise means noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE

Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T₆₀

The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T₆₀. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α

Sound is absorbed in porous materials by the viscous conversion of sound energy to a small amount of heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α . An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2 kHz is termed the Noise Reduction Coefficient (NRC).

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure, or some other device. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average ($L_{Aeq, T}$) by the formula $L_{Aeq, T} = L_{AE} - 10 \log_{10} T$. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (L_{AE}).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m^2).

SOUND PRESSURE LEVEL, L_p

The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10} (Pa/Po)^2$ dB (or $20 \log_{10} (Pa/Po)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is $20 \mu Pa$ (20×10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, L_w

The sound power level of a noise source is the inherent noise of the device. Therefore sound power level does not vary with distance from the noise source or with a different acoustic environment. $L_w = L_p + 10 \log_{10} 'a'$ dB, re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION CLASS (STC)

An internationally standardised method of rating the sound transmission loss of partition walls to indicate the sound reduction from one side of a partition to the other in the frequency range of 125 Hz to 4000 kHz. (Refer: Australian Standard AS 1276—1979). Now not in general use in Australia see: weighted sound reduction index.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS 1191—2002.

STATISTICAL NOISE LEVELS, L_n .

Noise which varies in level over a specific period of time 'T' (standard measurement times are 15 minute periods) may be quantified in terms of various statistical descriptors for example:-

- The noise level, in decibels, exceeded for 1 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF1, T}$. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.
- The noise level, in decibels, exceeded for 10 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF10, T}$. In most countries the $L_{AF10, T}$ is measured over periods of 15 minutes, and is used to describe the average maximum noise level.
- The noise level, in decibels, exceeded for 90 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF90, T}$. In most countries the $L_{AF90, T}$ is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

STEADY NOISE

Noise, which varies in level by 6 dB or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1—1997).

WEIGHTED SOUND REDUCTION INDEX, R_w

This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall $R_w + C$ ratings are frequency weighted to simulate insulation from human voice noise. The $R_w + C$ is similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. The spectrum adaptation term C_{tr} adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

WHITE NOISE

White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1—2019: '*Electroacoustics – Sound level meters – Specifications*'.

Calibration of Sound Level Meters

A sound level meter requires regular calibration to ensure its measurement performance remains within specification. Benbow Environmental sound level meters are calibrated by a National Association of Testing Authority (NATA) registered laboratory or a laboratory approved by the NSW Environment Protection Authority (EPA) every two years and after each major repair, in accordance with AS 1259–1990.

The calibration of the sound level meter was checked immediately before and after each series of measurements using an acoustic calibrator. The acoustic calibrator provides a known sound pressure level, which the meter indicates when the calibrator is activated while positioned on the meter microphone.

The sound level meters also incorporate an internal calibrator for use in setting up. This provides a check of the electrical calibration of the meter, but does not check the performance of the microphone. Acoustical calibration checks the entire instrument including the microphone. Calibration certificates for the instrument sets used have been included as Attachment 1.

Care and Maintenance of Sound Level Meters

Noise measuring equipment contains delicate components and therefore must be handled accordingly. The equipment is manufactured to comply with international and national standards and is checked periodically for compliance. The technical specifications for sound level meters used in Australia are defined in Australian Standard AS 1259–1990 “*Sound Level Meters*”.

The sound level meters and associated accessories are protected during storage, measurement and transportation against dirt, corrosion, rapid changes of temperature, humidity, rain, wind, vibration, electric and magnetic fields. Microphone cables and adaptors are always connected and disconnected with the power turned off. Batteries are removed (with the instrument turned off) if the instrument is not to be used for some time.

Investigation Procedures

All investigative procedures were conducted in accordance with AS 1055.1–1997 *Acoustics – Description and Measurement of Environmental Noise Part 1: General Procedures*.

The following information was recorded and kept for reference purposes:

- type of instrumentation used and measurement procedure conducted;
- description of the time aspect of the measurements, ie. measurement time intervals; and
- positions of measurements and the time and date were noted.

As per AS 1055.1–1997, all measurements were carried out at least 3.5 m from any reflecting structure other than the ground. The preferred measurement height of 1.2 m above the ground was utilised. A sketch of the area was made identifying positions of measurement and the approximate location of the noise source and distances in meters (approx.).

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Class 1 Precision Sound Level Meter. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS 1259 and was set on A-weighted, fast response.

The microphone was positioned at 1.5 metres above ground level and was fitted with a windsock. The instrument was calibrated using a Rion NC-73 sound level calibrator prior and subsequent to the measurement period to ensure the reliability and accuracy of the instrument sets. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 1.

WEATHER CONDITIONS

It was clear, fine without significant breeze.

METHODOLOGY

The attended noise measurements were carried out generally in accordance with Australian Standard AS 1055-1997 "Acoustics – Description and Measurement of Environmental Noise".