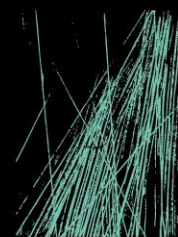


NOISE AND VIBRATION IMPACT ASSESSMENT FOR SSDA

OPAL BAYVIEW RACF

ANNAM ROAD



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1 INTRODUCTION

JHA Consulting Engineers has been engaged by Opal to provide a noise and vibration impact assessment to be submitted to the Department of Planning, Housing and Infrastructure (DPHI) as part of the SSDA submission.

This Acoustic report is submitted to the Department of Planning, Housing and Infrastructure (DPHI) on behalf of Principal Healthcare Finance Pty Limited (Opal Healthcare) in support of a State Significant Development Application (SSDA) (SSD-77240466) for a 177-bed residential aged care facility (RACF) at 36-42 Cabbage Tree Road, Bayview (the site).

This report shall be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the SSDA.

The objectives of this acoustic assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Establish appropriate noise criteria in accordance with the relevant standards, guidelines and legislation for noise emissions of:
 - Noise emissions from mechanical plant from the development to the surrounding receivers.
 - Noise intrusion from surrounding road noise sources
 - Noise emissions from waste collection.
 - Traffic noise generated by the proposed development.
- Carry out noise surveys to determine existing ambient and background noise levels on site.
- Determine whether the relevant criteria can be achieved based on the proposed operations. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Determine whether the relevant criteria can be achieved based on the indicative operations and construction methods. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Carry out a traffic noise impact assessment to define the building envelope's sound insulation requirements to achieve compliance with the relevant noise level criteria within the spaces.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed use development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.

The following documentation has been used for the preparation of this report:

- Architectural documentation prepared by Calder Flower Architecture
- *Opal Bayview – Traffic and Parking Assessment*, prepared by Transport and Traffic Planning Associates (TTPA). September 2025. (TAPA Report).
- Noise data collected on site through the use of noise loggers and a hand held spectrum analyser.
- Mechanical documentation prepared by JHA Consulting Engineers.

This document and related work have been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001:2015 and ISO 14001:2015, respectively.

1.1 PROPOSED WORKS

The proposal is for the development of an Opal RACF project on approximately 6000m² of land located within the existing Aveo Bayview Gardens Retirement Living site. The proposed development will comprise the following:

- Demolition of the existing aged care building and driveway on the site;
- Construction of a three-storey residential aged care facility, accommodating:
 - 177 beds,
 - Basement parking,
 - Ground floor ancillary facilities;
- Construction of a community room, to be located on the Aveo Bayview Gardens Retirement Living (Aveo BGRL) site;
- Construction of a new driveway, to be located on the Aveo BGRL site;
- Torrents Title subdivision of the Opal Healthcare Bayview site from Aveo BGRL;
- Associated amenities and landscaping works;
- Augmentation of, and connection to, existing utilities as required.

For a detailed project description, refer to the Environmental Impact Statement prepared by Beam Planning.

1.2 RESPONSE TO SEARS

The acoustic report is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD-77240466. Table 1 below identifies the relevant acoustic SEARs requirements addressed in this report.

<i>ID</i>	<i>Issue and Assessment Requirements</i>	<i>Reference</i>
10	<p>Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines.</p> <p>The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.</p>	Section 5 and Section 6

Table 1: SEARS and relevant references.

2 DESCRIPTION OF THE SITE AND PROPOSAL

The proposed Opal site will be approximately 6,000sqm in size and access to the Opal lot will be via Annam Rd from the north via an existing link road.

The site is currently comprised of an established retirement living village known as Aveo Bayview Gardens Retirement Living consisting of a mixture of ILU's and residential care facilities. The site is bounded by Annam Rd to the north, west and south linking around on both ends to Cabbage Tree Rd which borders the site to the east. Figure 1 shows the proposed layout of the site.

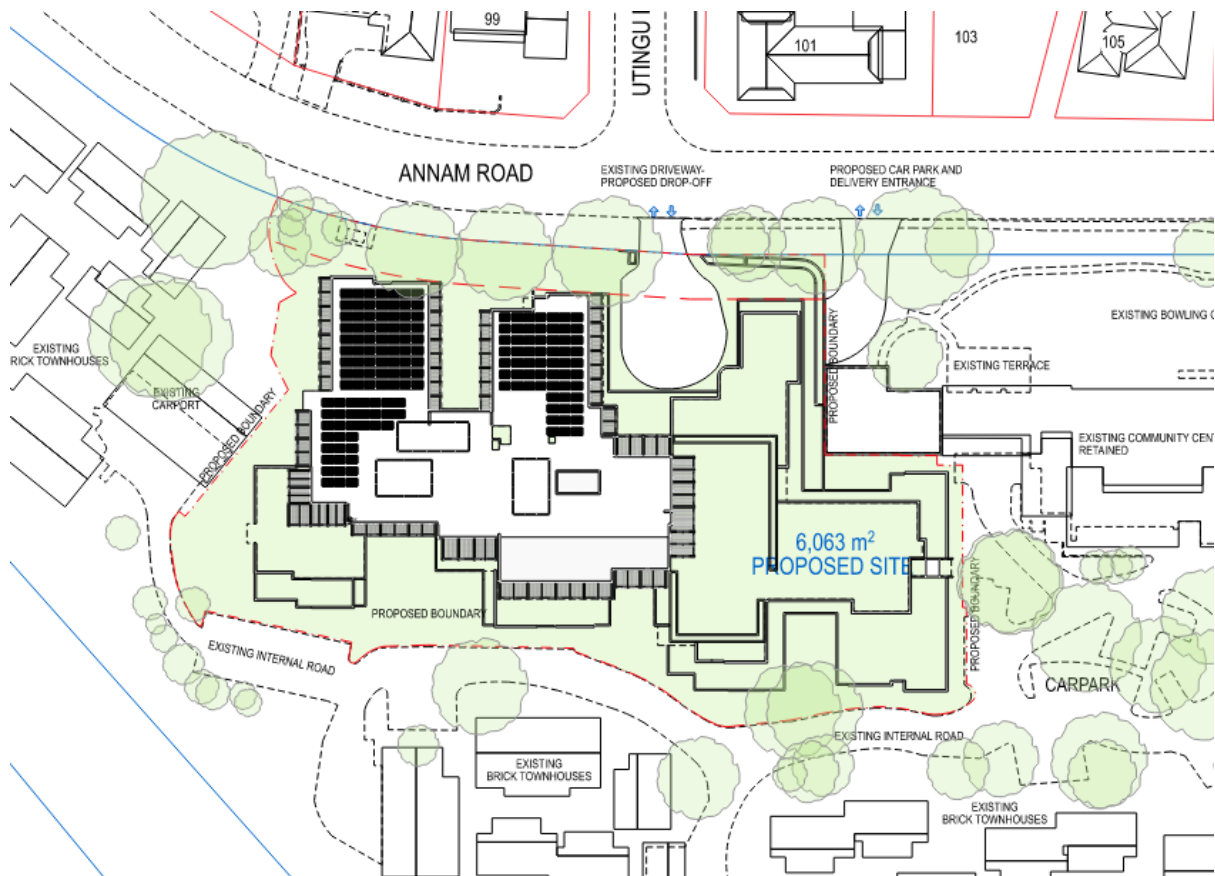


Figure 1: Overall layout of the proposed development.

Figure 2 shows the proposed site location (orange shaded), and the surrounding residential receivers including the existing Aveo Bayview Gardens Retirement Living site (shaded green). The site is predominantly surrounding by residential receivers.

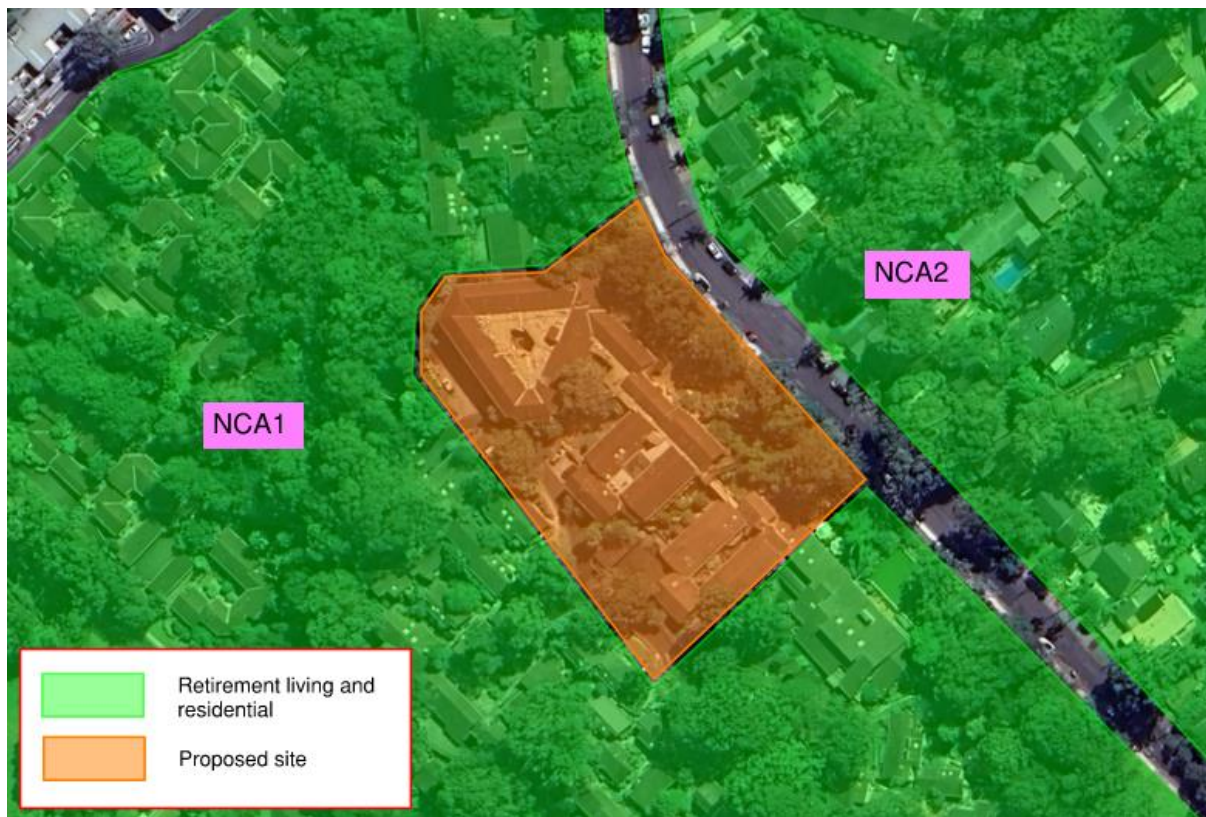


Figure 2: Site (orange shaded) and surrounding noise receivers.

It is noted that if noise impacts associated with the proposed development are controlled at the nearest sensitive receivers, then compliance with the recommended criteria at all noise sensitive receivers will be achieved.

A summary of the nearest sensitive receivers surrounding the site location is shown in Table 2, including the approximate distances between closest lot boundaries.

<i>ID</i>	<i>Sensitive Receiver</i>	<i>Receiver Type</i>	<i>Distance (m)</i>
NCA1	Aveo Bayview Retirement Living	Residential	10
NCA2	Residential Properties across Annam Road	Residential	20

Table 2: Nearest sensitive receivers surrounding the site location plus approximate distances.

3 SITE MEASUREMENTS

3.1 GENERAL

An attended and unattended noise survey were conducted in order to establish the ambient and background noise levels of the site and surrounds, and to determine traffic noise levels incident upon the proposed development.

The location at L1 was found to be representative of the nearest most affected residential receivers in regard to background noise levels. The ambient noise levels around the site and the surrounding residential receivers are similar. Noise surveys have been carried out in accordance with the method described in the AS/NZS 1055:2018 'Acoustics – Description and measurement of environmental noise'. The long-term and short term noise monitoring locations are shown in Figure 3.



Figure 3: Long-term noise monitoring location (L1) and short-term noise monitoring location (M1).

3.2 LONG-TERM NOISE MONITORING

Long-term noise monitoring was carried out from Friday 16th May to Friday 30th May 2025 with a Rion NL-52 noise logger (Serial Number 01254316). The noise logger recorded L_{A1} , L_{A10} , L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise logger was checked before and after use and no deviations were recorded.

This location was secure and considered to be representative of the typical ambient and background noise levels. The microphone was mounted 1.5 meters above the ground and a windshield was used to protect the microphone.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. Weather conditions were monitored for the duration of the noise survey.

As stated in the NSW NPI, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations.

Rating Background Levels (RBLs) are shown in Table 3, together with the ambient noise levels (L_{Aeq}) measured for each period. The RBLs are determined in accordance with the methodology from the NSW NPI.

Location	Rating Background Level, dB(A)			L_{Aeq} Ambient Noise Levels, dB(A)		
	Day	Evening	Night	Day	Evening	Night
	7am-6pm	6pm-10pm	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
L1	37	38	35	51	52	45

Table 3: Background and ambient results of the long-term noise monitoring.

3.3 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site. On Friday 30th May 2025, short-term noise measurements were carried out during day-time. Short-term noise measurements were carried out with NTI XL-3 hand-held Sound Level Meter (SLM) (Serial Number A3A-00494-D1). The calibration of the SLM was checked before and after each use and no deviations were recorded. The SLM microphone was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free-field – i.e. more than 3 metres away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the attended noise monitoring.

A summary of the results of the short-term noise monitoring are shown in Table 4.

Location	Date and Time	Parameter	Sound Pressure Level, dB re 20 μ Pa								
			Overall dB(A)	Octave Band Centre Frequency, Hz							
				63	125	250	500	1k	2k	4k	8k
M1	30/05/2025 12:20pm	$L_{90,15min}$	38	44	40	33	34	34	30	27	19
		$L_{eq,15min}$	57	57	54	52	52	54	48	44	37
		$L_{10,15min}$	54	57	55	51	49	50	46	44	35
M2	30/05/2025 12:40pm	$L_{90,15min}$	33	41	35	32	30	29	24	20	14
		$L_{eq,15min}$	45	54	46	41	39	39	37	38	33
		$L_{10,15min}$	45	52	46	41	40	40	38	35	27

Table 4: Results of the short-term noise monitoring.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

Regulatory Framework

- Protection of the Environment Operations (POEO) Act 1997.
- Environmental Planning and Assessment (EP&A) Act 1979.
- State Environmental Planning Policy (Housing) 2021.

Planning Framework

- Pittwater Development Control Plan (DCP) 2019, Amendment 25.
- Pittwater Local Environmental Plan (LEP) 2014

Noise Intrusion

- State Environmental Planning Policy (SEPP) (Housing) 2021.
- AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors'.

Noise Emissions

- NSW Environment Protection Authority (EPA) Noise Policy for Industry (NPI) 2017.

Transport Noise

- NSW DECC Road Noise Policy (RNP) 2011.

Construction Noise

- NSW Interim Construction Noise Guideline (ICNG) 2009.

4.1 REGULATORY FRAMEWORK

4.1.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulatory framework for the protection of the environment in NSW. The EP&A Act is relevantly about planning matters and ensuring that “environmental impact” associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of “environmental impact” relies upon the identification of acceptable noise criteria which may be defined in a Development Control Plan or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2023).

4.1.2 PROTECTION OF THE ENVIRONMENTAL OPERATIONS ACT

The Protection of the Environment Operations (POEO) Act 1997 has the objective of protecting, restoring and enhancing the quality of NSW environment. Abatement of noise pollution is underpinned by the definition of “offensive noise” as follows:

“...

(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 is likely to be harmful to) a person who is outside the premises 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.

..."

4.2 INTERNAL NOISE LEVELS

4.2.1 STATE ENVIRONMENTAL PLANNING POLICY

The Schedule 8 of the State Environmental Planning Policy (SEPP) (Housing) notes the following in relation to senior housing and acoustics:

"Schedule 8 – Design principles for Senior Housing...

2. Visual and acoustic privacy...

(b) ensuring acceptable noise levels in bedrooms of new dwellings by locating them away from driveways, parking areas and paths...

Specific values of acceptable noise levels are not given, however, the previous SEPP (Housing for Seniors or People with Disability) 2004 references the application of the internal noise levels from AS/NZS 2107:2000 and AS 3671:1989. Note that AS 3671:1989 references AS/NZS 2107:2000 for establishing criteria. AS/NZS 2107:2000 has been superseded by AS/NZS 2107:2016, and therefore, AS/NZS 2107:2016 will be used to establish the internal noise targets to satisfy the requirements of the SEPP.

4.2.2 AUSTRALIAN STANDARD AS/NZS 2107:2016

Based on the requirements of the SEPP, the recommended internal noise levels from AS/NZS 2107:2016 have been used to set the criteria. Other spaces in the development have been designed to achieve internal noise levels as per AS/NZS 2107:2016. These internal noise targets are for noise from external sources such as traffic. Refer to Table 5 for the recommended internal noise targets.

<i>Type of occupancy / activity</i>	<i>Design sound level ($L_{Aeq,t}$) range, in dB(A)</i>
Apartment common areas (Suburban areas)	45 – 50
Consulting rooms	40 – 45
Corridors and lobby spaces	<50
Dining areas	40 - 45
Executive office	35 - 40
Kitchen, laundry and maintenance areas	<55
Living areas (Suburban areas)	30 – 40
Meeting rooms (small)	40 – 45
Nurses' stations	40 – 45
Office areas	40 – 45
Quiet rooms	40 – 45
Restrooms and break-out spaces	40 - 45
Sleeping areas within Suburban areas (night time)	30 - 35
Small retail stores (general)	<50
Staff rooms	40 – 45
Staff studies/collegiate	40 - 45
Waiting rooms, reception areas	40 – 50
Weight training/Fitness room	<50

Table 5: Internal traffic noise level ($L_{Aeq,t}$) range as per AS/NZS 2107:2016.

4.3 PLANNING FRAMEWORK

4.3.1 PITTWATER LOCAL ENVIRONMENTAL PLAN

The Pittwater Local Environment Plan (LEP) is the environmental planning instrument that applies to the site. As per the NSW Spatial Planner, the site and the surroundings are zoned as low density residential (R2), Environmental Living (E4) and Public Recreation (RE1). Figure 4 shows the land zoning map.

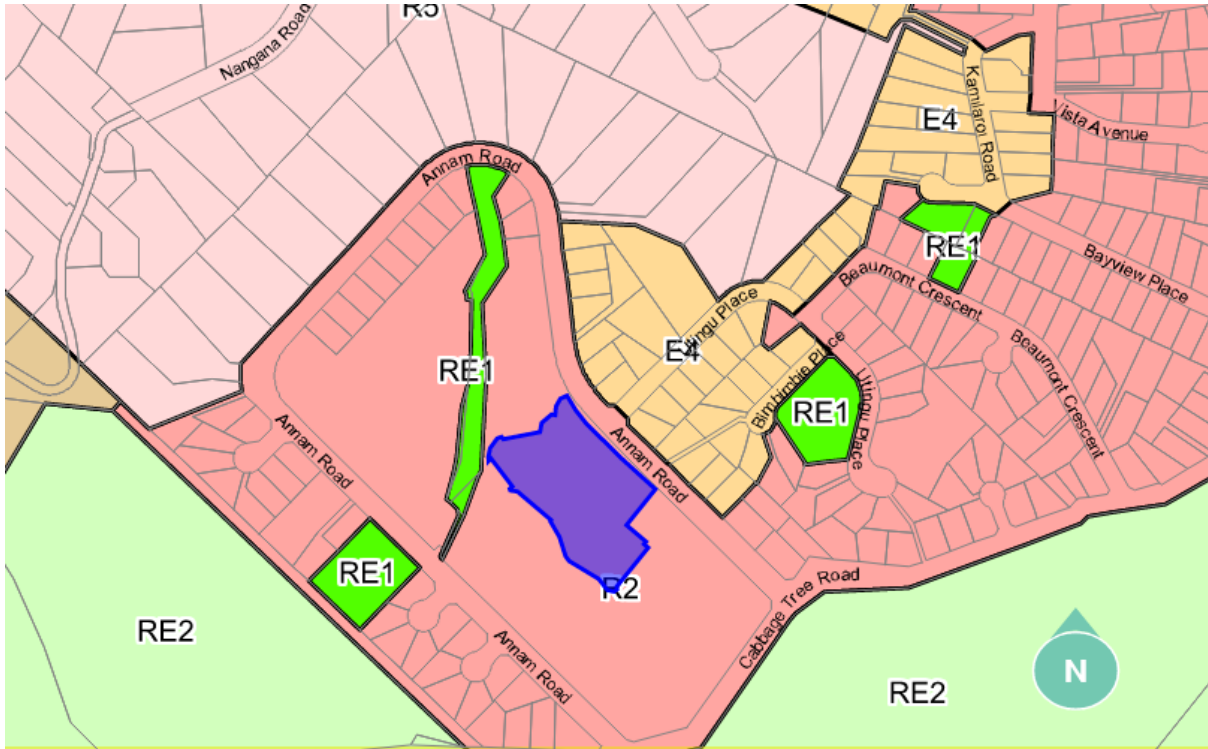


Figure 4: Land zoning of the site (shaded blue) and surroundings.

4.3.2 PITTWATER DEVELOPMENT CONTROL PLAN

The Pittwater Development Control Plan (DCP) has been reviewed for any relevant noise requirements or criteria for the development, relevant acoustic criteria expressed in the DCP is as follows:

"C1.6 Acoustic Privacy

Controls

Noise generating plants including pool/spa motors, air conditioning units and the like shall not produce noise levels that exceed 5dBA above the background noise when measured from the nearest property boundary..."

Based on the above, the DCP criteria is less stringent than NSW NPI, therefore, compliance with NSW NPI will result in compliance with DCP criteria.

4.4 NOISE EMISSIONS AND INTRUSIVE NOISE

4.4.1 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent of the two criteria sets the Project Noise Trigger Level (PNTL).

4.4.1.1 Intrusiveness Criteria

The NSW NPI defines the intrusiveness criteria as follows:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15 minute period, and does not exceed the background noise level by more than 5 dB when beyond a minimum threshold."

Based on the intrusiveness criteria definition and the background noise levels recorded, Table 6 shows the intrusiveness criteria for the noise sensitive residential receivers.

Indicative Noise Receiver	Period	Rating Background Level $L_{A90,period}$ dB(A)	Intrusiveness Criterion dB(A)
Residential Receivers	Day	37	42
	Evening	37*	42
	Night	35	40

Table 6: Determination of the intrusiveness criterion. *Note: Per NSW NPI, evening and/or night RBLs can be no greater than the day-time RBL.

4.4.1.2 Amenity Criteria

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Based on the amenity criteria definition and the land zoning, Table 7 shows the amenity criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	Period	Amenity Noise Level $L_{Aeq,period}$ dB(A)	Adjusted Amenity Criterion $L_{Aeq,15minutes}$ dB(A)
Suburban Residential (R2)	Day	55	53 (55-5+3)
	Evening	45	43 (45-5+3)
	Night	40	38 (40-5+3)
Rural Residential (C4)	Day	50	48 (50-5+3)
	Evening	45	43 (45-5+3)
	Night	40	38 (40-5+3)

Table 7: Determination of amenity criterion.

4.4.1.3 Project Noise Trigger Levels

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

Indicative Noise Amenity Area	Period	Intrusiveness Criterion	Amenity Criterion
		$L_{Aeq,15min}$ dB(A)	$L_{Aeq,15min}$ dB(A)
Suburban Residential (R2)	Day	42	53
	Evening	42	43
	Night	40	38
Rural Residential (E4)	Day	42	48
	Evening	42	43
	Night	40	38
Active Recreation	When in Use	-	55
Commercial	When In Use	-	65

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

4.4.2 TRAFFIC NOISE GENERATED

The NSW Road Noise Policy (RNP) establishes criteria for traffic noise from:

- Existing roads,
- New road projects,
- Road development projects,
- New traffic generated by developments.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited up to 2.0dB above the existing noise levels. An increase of up to 2.0dB represents a minor impact that is considered barely perceptible to the average person.

In cases where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria.

4.5 CONSTRUCTION NOISE AND VIBRATION

4.5.1 NOISE CRITERIA

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 10dB(A). This noise level represents the point above which there may be some community reaction to noise.

However, in the case of a highly noise affected area, the Management Level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 5dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. Table 9 below summarises the airborne construction noise criteria for receivers surrounding the site.

<i>Sensitive Receiver</i>		<i>Airborne Construction Noise Criteria, L_{Aeq} dB(A)</i>	
		<i>Within Standard Hours</i>	<i>Outside Standard Hours</i>
<i>Residential Receivers</i>	Noise affected / External	RBL+10	RBL+5
	Highly noise affected / External	75	N/A
<i>Active Recreation</i>	External (when in use)	65	N/A
<i>Commercial</i>	External (when in use)	70	N/A

Table 9: ICNG construction airborne noise criteria for noise sensitive receivers surrounding the site.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40dB(A) - internal
- Night: $L_{Aeq,15min}$ 35dB(A) - internal

The internal noise levels are assessed at the centre of the most affected habitable room.

4.5.2 VIBRATION CRITERIA

4.5.2.1 Human Comfort

The Department of Environment and Climate Change (DECC) developed the document 'Assessing Vibration: A Technical Guideline' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 'Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting'.

The guideline does not address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time). Vibration criteria for continuous and impulsive vibration are presented in Table 10 below, in terms of vibration velocity levels.

Place	Time	r.m.s. velocity, mm/s [dB ref 10 ⁻⁶ mm/s]			
		Continuous Vibration		Impulsive Vibration	
		Preferred	Maximum	Preferred	Maximum
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]

Table 10: Continuous and impulsive vibration criteria applicable to the site.

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) it is recommended to be used. Table 11 shows the acceptable VDV values for intermittent vibration.

Place	Time	Vibration Dose Values, m/s ^{1.75}	
		Preferred	Maximum
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80

Table 11: Intermittent vibration criteria applicable to the site.

4.5.2.2 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:2016 'Vibration in Buildings – Effects on Structures' are to be adopted. Guideline values from DIN 4150.3:2016 are presented in Table 12.

Structural type	Vibration velocity, mm/s (Peak Particle Velocity - PPV)				
	Foundation			Plane of floor uppermost full storey in horizontal direction	Floor slabs, vertical direction
	1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies	All frequencies
Type 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
Type 2: Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
Type 3: Structures that because their particular sensitivity to vibration, cannot be classified under Type 1 and 2 and are of great intrinsic value (e.g. heritage buildings)	3	3 to 8	8 to 10	8	20

Table 12: DIN 4150.3:2016 Guideline values of vibration velocity (PPV) for evaluating the effects of short-term vibration.

5 NOISE IMPACT ASSESSMENT

The following sources of noise emissions from the proposed development have been assessed to the relevant criteria:

- Noise emissions from mechanical plant from the development to the surrounding receivers.
- Noise emissions from waste collection.
- Noise intrusion from surrounding road networks.
- Traffic noise generated by the proposed development.

5.1 NOISE EMISSION FROM MECHANICAL PLANT

Noise from proposed development mechanical plant should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the noise sensitive receivers. At this stage, mechanical plant selections have yet been finalised, therefore, a detailed assessment cannot be undertaken. Nevertheless, based on preliminary selections for the rooftop condenser units a high-level assessment has been undertaken.

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to finalise and confirm any noise control measures to achieve the relevant noise criteria at the nearest noise sensitive receivers.

Figure 5 shows the proposed location of the rooftop building services in relation to the site.

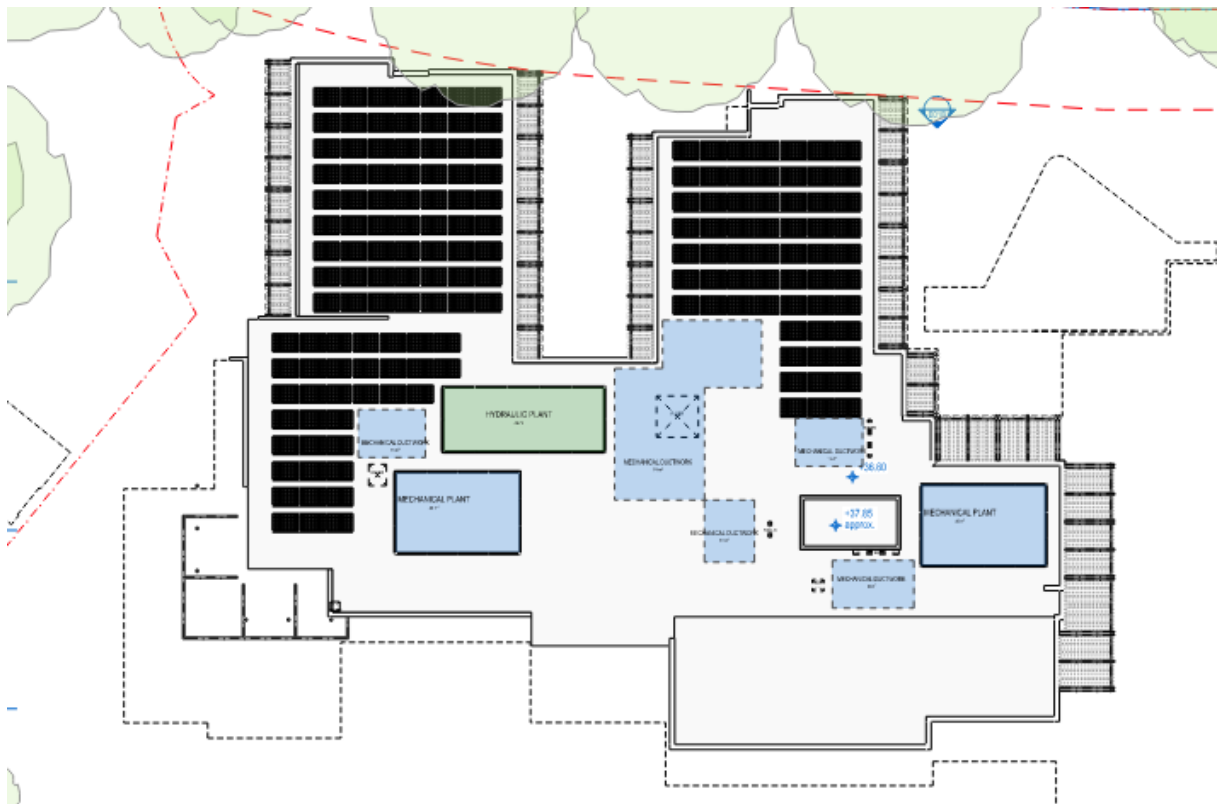


Figure 5: Proposed location of rooftop plant.

Based on the architectural drawings, the following assumptions have been made in the noise assessment:

- The location of rooftop external plant as per Figure 5. The mechanical and hydraulic plantrooms are partially enclosed with 2m high weatherproof louvres and no roof.

- The nearest noise sensitive receivers are Aveo Bayview Retirement Living (i.e. NCA 1) and 99 Annam Rd Bayview (i.e. NCA 2). Both receiver boundaries are approximately 40m away.
- A total of 27 x condenser units are proposed on the roof. Preliminary selections along with their associated sound pressure levels are as follows:
 - 11x Daikin REYQ12BYM9 (Lp at 1m – 59db[A] each)
 - 14x Daikin REYQ20BYM9 (Lp at 1m – 65 dB[A] each)
 - 1x Daikin RZAV60C2V1 (Lp at 1m – 50 dB[A])
 - 1x Daikin RZAV140F2V1 (Lp at 1m – 53 dB[A])

Based on the above, acoustic screening is required as shown in Figure 6, the height of the screening is to be minimum 300mm above the height of the tallest condenser unit.

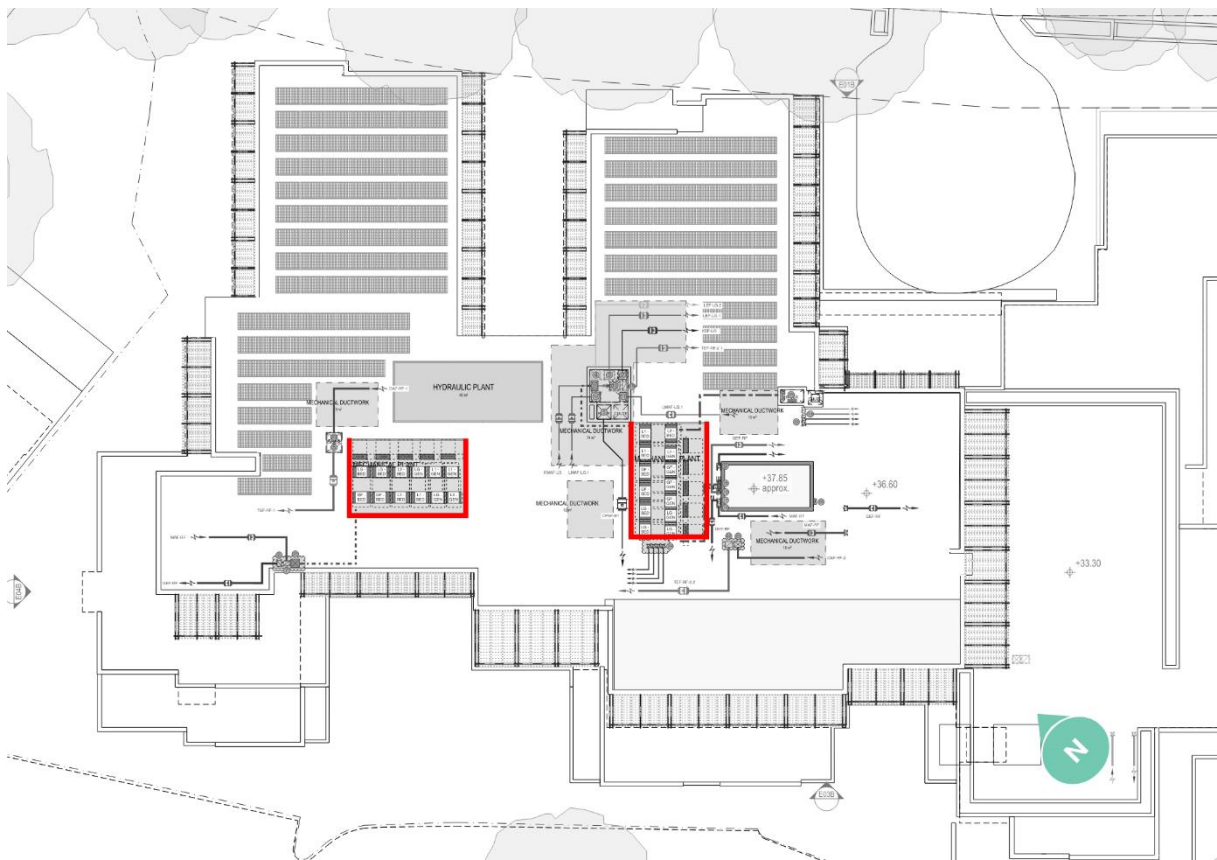


Figure 6: Location of acoustic screening (red).

The acoustic screen shall comprise of either a continuous solid lining (e.g. fibre cement) or acoustic louvre (i.e. ACRAN 200 or acoustically equivalent).

Noise controls and equipment selections will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant to the nearest noise sensitive receivers meets the NSW NPI noise level criteria – refer to Table 8.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

Strategic location and selection of mechanical plant to ensure the cumulative noise levels at the receiver boundaries is met.

Selection of appropriate quiet plant.

Acoustic noise control measures to be put in place to minimise noise impacts such as:

- In-duct attenuation
- Noise enclosures as required
- Sound absorptive panels
- Acoustic louvres as required
- Noise barriers as required
- Acoustic screening to condenser if required

5.2 WASTE COLLECTION / LOADING DOCK

Waste collection is proposed to be conducted by Council, therefore shall adhere to council requirements. Noise impacts from on site operations within the loading dock are not expected to result in any acoustic amenity impacts as it is located on lower ground in a predominantly enclosed area with no line of sight to surrounding receivers. Aside from council waste collection, loading dock operations are generally recommended to take place between 7am and 10pm where possible.

5.3 TRAFFIC NOISE GENERATION

As noted in Section 4.6.2, when considering land use development and the impact on sensitive land uses the NSW Road Noise Policy (RNP) states that an increase up to 2dB in relation to existing noise levels is anticipated to be insignificant.

A traffic assessment has been undertaken based on the Traffic and Parking Assessment report (TAPA report) prepared by TTPA. Section 5.1 of the TAPA report notes the following in relation to the increase in traffic due to the development:

"... It is anticipated that the Allied Health Care operation will only generate some 2 vehicle trips per hour during the peak periods..."

Based on the above, Table 13 below summarises the existing and future peak hour traffic volumes as provided in the TAPA report.

Road	Time	Peak Traffic flows (Vehicles/hr)		dB increase	Complies (Yes/No)
		Existing	Future		
Cabbage Tree Road	AM Peak	642	644	≤0.01	Yes
	PM Peak	693	695	≤0.01	Yes
Annam Road	AM Peak	52	54	0.2	Yes
	PM Peak	33	35	0.3	Yes

Table 13: Predicted traffic noise level increase.

Based on the predicted results, the increase of traffic noise levels due to the development are less than the maximum allowable increase of 2dB. Therefore, the traffic increase due to the proposed development will not result in any noticeable change in traffic noise levels and is expected to meet the NSW RNP recommendations.

5.4 TRAFFIC NOISE INTRUSION

An assessment has been carried out for traffic noise intrusion on the development due to surrounding traffic noise on Annam Road. The noise levels on Annam Road are relatively small, and impacts onto the development are low. Noise levels impacting the façade where based on the attended and unattended measurements conducted.

Based on the results of the noise measurements, the recommended glazing systems and their corresponding sound insulation performances are presented below in Table 14.

<i>Location</i>	<i>Glazing</i>	<i>Min. R_w Rating</i>
All facades	6.38mm Laminated	32

Table 14: Glazing Recommendations.

Based on the above, we consider that traffic noise break-in will not be an issue if a typical façade design and the nominated glazing recommendations are followed. Nevertheless, the acoustic design of the façade is to be progressed further throughout the design stage. The façade requirements shall be designed to achieve all requirements at minimum, including acoustics, ESD etc.

6 CONSTRUCTION NOISE AND VIBRATION PLANNING

Currently a detailed construction program is not yet fully defined. This section of the Construction Noise and Vibration Planning provides general recommendations only and provides applicable criteria together with feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedance once construction methods and stages are known.

Any noise from demolition and construction activities to be carried out on site must not result in '*offensive noise*' to any noise sensitive receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

6.1 RELEVANT STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 6 of this report contains the relevant legislation, codes, and standards in addition to construction noise and vibration criteria for this project.

6.2 WORKING HOURS

Standard working construction hours are as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- Sundays and Public Holidays: No excavation or construction works.

Noise control measures are to be implemented during these hours following consultation and engagement with the community.

It is recommended that high noise level works – i.e. piling, excavation, etc – shall be scheduled to not occur during shoulder periods of the recommended standard hours – i.e 7am to 8am and 5pm to 6pm. A detailed Construction Noise & Vibration Management Plan (CNVMP) shall further assess the noise impact of construction works and shall include a protocol to minimise any potential noise impacts to identified sensitive receivers and ensure that appropriate noise control measures are defined and implemented to comply with all relevant noise guidelines.

6.3 PRELIMINARY CONSTRUCTION NOISE ASSESSMENT

A preliminary construction noise assessment has been carried out based on typical plant and machinery expected throughout the construction stages. The preliminary noise assessment has been considered at the nearest existing residential receivers.

6.3.1 NOISE

These levels are based on the database published by the UK Department for Environmental, Food and Rural Affairs (DEFRA) & Australian Standard AS2436:2010 '*Guide to Noise Control on Construction, Maintenance & Demolition Sites*' for a 15-minute period.

The expected construction noise sources and the predicted noise levels at the nearest residential receivers (i.e. NCA 1 and NCA 2) are shown in the table below as a range from the closest distance to the receiver boundary and the middle of the site to the receiver boundary.

<i>Item</i>	<i>Typical Power Noise Level L_{A10} (dB ref 1μW)</i>	<i>Typical Noise Level $L_{A10,15m}$ at 7m (dB ref 20μPa)</i>	<i>Predicted Noise Level $L_{Aeq,15m}$ Aveo residences</i>	<i>Predicted Noise Level $L_{Aeq,15m}$ Annam St residences</i>
Angle grinders	104	76	60-73	59-66
Truck (>20 tonne)	108	80	64-76	62-70
Circular saw	115	87	72-84	70-78
Piling rig	120	92	73-85	71-78
10-40tn Excavator	117	89	73-85	71-79
40-50tn Mobile crane	111	83	68-80	66-74
Concrete pump	114	86	70-82	68-76
Concrete truck	110	82	68-81	67-74
Drill	94	66	51-63	49-57

Table 15: Predicted airborne noise levels for typical construction plant used during construction works.

Based on the results of the preliminary assessment as shown above, the noise associated with the normal construction works is expected to exceed the noise limits for highly noise affected receivers within standard hours. This assessment is based on typical noise levels associated with construction sites and machinery. This is due to the proximity of the site to the surrounding residential receivers.

Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures such as acoustic screening around the site. These noise mitigation measures are to be provided in a detailed Construction Noise & Vibration Management Plan and prepared by a qualified acoustic consultant prior to Construction Certificate. The detailed CNVMP will provide the acoustic requirements to the screening around the site.

6.3.2 VIBRATION

The NSW RMS 'Construction Noise and Vibration Guideline' provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DECC's 'Assessing Vibration: A Technical Guideline'). The recommended safe working distances for typical construction plant are provided in Table 16.

<i>Plant Item</i>	<i>Description</i>	<i>Cosmetic Damage</i>	<i>Human Response</i>
Small Hydraulic Hammer	5-12 tonne	2m	7m
Medium Hydraulic Hammer	12-18 tonne	7m	23m
Large Hydraulic Hammer	18-34 tonne	22m	73m
Vibratory Pile Driver	Sheet piles	2-20m	20m
Pile Boring	<800mm	2m	N/A
Jackhammer	Handheld	1m	Avoid Contact with Structure

Table 16: Recommended minimum working distances for vibration intensive plant from sensitive receivers.

For any vibration intensive plant expected to be within proximity of the minimum distances described above, the contractor must engage a qualified engineer to carry out a vibration survey in order to assess any potential risks.

The vibration survey and assessment will determine whether the vibration levels might exceed the relevant criteria then vibration mitigation and management measures will need to be put in place to ensure vibration impacts are minimized as far as practicable.

6.4 MITIGATION MEASURES

In order to meet the noise and vibration requirements of the site, the Contractor will be required to engage a qualified acoustic consultant to assist in the compilation of a CNVMP and undertake noise and vibration monitoring for the duration of the project.

6.4.1 PROJECT SPECIFIC ACOUSTIC MEASURES

Acoustic amelioration measures will be required due to the expected exceedances of the noise level criteria. Temporary shielding such as solid hoarding/acoustic curtains may reduce the expected noise impacts and is proposed as a noise control measure during construction. The location and extent of the shielding are to be defined in the detailed Construction Noise and Vibration Management Plan (CNVMP).

6.4.2 GENERAL CONTROL ELEMENTS

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort. Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment.* In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
 - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.

- Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.
- Operate plant in a quietest and most effective manner.
- Where appropriate, limit the operating noise of equipment.
- Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
- *On site noise management.* Practices that will reduce noise from the site include:
 - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
 - Undertaking noisy fabrication work off-site where possible.
 - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms
 - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
 - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
 - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
 - Installing purpose built noise barriers, acoustic sheds and enclosures.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
 - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
 - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
 - Scheduling work to coincide with non-sensitive periods, to reduce impact on examinations.
 - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
 - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
 - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
 - Designating, designing and maintaining access routes to the site to minimise impacts.
 - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
 - Provide information to neighbours before and during construction.
 - Maintain good communication between the community and Project staff.
 - Have a documented complaints process and keep register of any complaints.
 - Give complaints a fair hearing and provide for a quick response.
 - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that

any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

6.4.3 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds either the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal and underground works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

7 SUMMARY AND CONCLUSION

A noise impact assessment has been carried out for the proposed Opal Bayview RACF. This report forms part of the documentation package submitted to The Department of Planning, Housing and Infrastructure as part of the SSDA.

This report establishes relevant noise level criteria, details the acoustic assessment, and provides comments and recommendations for the proposed development.

Ambient and background noise surveys have been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines. The noise assessments have adapted methodology from relevant guidelines, standards and legislation to assess noise impacts.

At this stage, mechanical plant selections have not been finalised. Therefore, a detailed noise assessment cannot be carried out, nevertheless a high-level assessment has been undertaken based on the preliminary rooftop condenser units and acoustic mitigation measures have been provided to achieve project noise trigger levels.

A traffic noise generation assessment has been undertaken based on predicted peak hour flows as provided in the TAPA report. Based on the assessment the increase in traffic due to the development is not anticipated to result in any noticeable change in noise levels and is expected to meet the NSW RNP recommendations.

An acoustic assessment of the external traffic noise intrusion has been carried out based on noise monitoring data. Based on the assessment, recommendations have been provided for the sound insulation performance of the façade in order to meet the recommended internal noise levels.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted modifications to the building and introduction of any additional noise sources.

APPENDIX A: LONG-TERM NOISE MONITORING RESULTS

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

