75-85 Crown St & 116 Princes Hwy, St Peter

Master Planning Assessment

C&M Antoniou Pty Ltd

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1 INTRODUCTION

Pulse White Noise Acoustics Pty Ltd (PWNA) has been engaged by C&M Antoniou Pty Ltd to undertake an acoustic assessment for the proposed mixed-use development located at 75-85 Crown St & 116 Princes Highway, St Peters.

This assessment will address the following:

- Potential surrounding environmental noise intrusion impacts on the development (i.e., traffic noise from the surrounding roadways and other external noise sources).
- Noise emissions to nearby receivers from the operation of the base building services, vehicle noise and other noise generating components.

This report will discuss the relevant acoustic criteria which have been adopted and the subsequent expected noise mitigating construction methods to ensure compliance.

A list of acoustic terminology used in this report is included in Appendix A of this report.

1.1 Proposed Development

The proposed project is located at 75-85 Crown St & 116 Princes Hwy, St Peter and is located within the Inner West Council local government area. The rezoning request is accompanied by an indicative design scheme by Scott Carver Architects and includes the following:

- Demolition of existing structures
- A mixed use development with:
    - Two basement levels accessed from Crown Street incorporating 81 car parking spaces, end of trip facilities and plant.
    - A ten-storey building composed of 8 residential levels above two commercial floor levels (retail, light industry and office)
    - A three storey plus mezzanine building component facing Crown Street
    - A four-storey street wall to Princess Highway
    - A maximum building height of RL 51 to the top of the lift overrun
    - Gross floor area equal to 9,408 square meters
    - A total of 87 apartments (16 x studio, 24 x 1 bedroom, 40 x 2-bedroom, 7 x 3 bedroom)
    - Common open space areas at levels 1,2 and 4 with provision for integrated landscaping and 15% canopy tree cover
    - A residential lobby to Campbell Street
    - A loading dock, additional car parking, EOT facilities and waste room at ground floor level
    - Deep soil zones along Campbell and Crown Streets
    - Integration of public art into the south façade and materiality that references the industrial heritage of the area.

The site is located in close proximity to Princes Highway and is defined as a busy road carrying over 40,000 Annual Average Daily Traffic (AADT) as per the RTA's *Traffic Volume Maps for Noise Assessment for Buildings on Land Adjacent to Busy Roads*.

1.2 Site Layout

The project site's location is defined as mixed use (B4) and low density residential (R1) as per the NSW Planning ePlanning Spatial Viewer Zoning Maps.

The nearest noise sensitive receivers around the site are identified below.

Location 1

- Existing residential receiver bounding the northeast of the proposed project site:
  - 73 Crown Street, St Peters NSW 2044

Location 2

- Existing residential receivers located to the east of the proposed project site to the eastern side of crown street:
  - 33 Campbell Road, St Peters NSW 2044
  - 35 Campbell Road, St Peters NSW 2044
  - 42 Campbell Road, St Peters NSW 2044
  - 40 Crown Street, St Peters NSW 2044
  - 42 Crown Street, St Peters NSW 2044
  - 44 Crown Street, St Peters NSW 2044

Location 3

- Existing industrial receiver located to the west of the project site, to the western side of the Princes Highway:
  - 129 Princes Highway, St Peters NSW 2044

Location 4

- Existing commercial receiver located to the southwest of the project site, to the western side of Princes Highway:
  - 145 Princes Highway, St Peters NSW 2044

Location 5

- Existing industrial receiver bounding the northern and western boundary of the subject site:
  - 90 Princess Highway, St Peters NSW 2044

The site location is detailed in Figure 1 below.

Figure 1 Site Location and Surrounding Receivers – Sourced from SIX Maps

2 ACOUSTIC CRITERIA

The acoustic criteria which have been adopted for this assessment are outlined below. All criteria have been separated into; *Noise Intrusion* (Assessment of building envelope), *Noise Emissions* (Assessment of noise to surrounding receivers) or *Acoustic Separation* (Assessment of noise within the building).

2.1 Noise Intrusion Criteria

External noise intrusion into the building will generally be via the building envelope (External wall, glazing or external roof). The design of the building envelope should be such that the requirements listed below are achieved.

2.1.1 Marrickville Development Control Plan (2011)

As the project site is located within the former Marrickville Council Area, the Marrickville DCP 2011 establishes relevant noise criteria based on the site's proximity to busy roads and its' location within the 2039 ANEF Contours. For developments near busy roads and rail lines, the document refers to the *State Environmental Planning Policy (Infrastructure) 2007 SEPP (Infrastructure SEPP)* which has been superseded by the *State Environmental Planning Policy (Infrastructure) 2021*. Thus, this document has been adopted to establish relevant noise criteria and is included in section 2.1.2.

For internal areas not included in the *State Environmental Planning Policy (Infrastructure) 2021*, the Marrickville DCP 2011 refers to the *Australian and New Zealand Standard AS/NZS 2107:2016 Acoustics–Recommended design sound levels and reverberation times for building interiors* for recommended internal noise levels in various occupancies for developments in different acoustic environments. The relevant criteria established in this guideline is included in section 2.1.3.

Similarly, due to the site's location within proximity to Sydney Airport, the Marrickville DCP 2011 requires new developments on land within an ANEF affected area to be design and constructed in accordance with *Australian Standard AS 2021:2015 Acoustics–Aircraft noise intrusion–Building siting and construction*. An assessment of the site in accordance with this document is included in section 2.1.4 and indicative construction requirements to satisfy the required aircraft noise reduction (ANR) are included in section 3.2.

The relevant acoustic criteria referred to in the Marrickville DCP 2011 has been extracted and included below.

> ***2.6.3 Controls***
>
> *C1 Aircraft noise*
>
> *i. New development on land within an ANEF affected area must be designed and constructed in accordance with the relevant Australian Standard and other guidelines issued by relevant agencies and authorities; and*
>
> *ii. The introduction of acoustic measures to reduce aircraft noise must not unacceptably detract from the streetscape value of individual buildings.*
>
> *C2 General acoustic privacy*
>
> *i. New dwellings close to high noise sources such as busy roads, rail lines and industry must be designed to locate habitable rooms and private open spaces away from noise sources or protect those areas with appropriate noise shielding devices. Development for the purpose of childcare centres, educational establishments, hospitals, places of public worship and residential accommodation close to busy roads and rail lines must also comply with the relevant Australian Standards and State Environmental Planning Policies (SEPPs)*
>
> *ii. Decks, balconies and verandas alongside boundaries and noisy walking surfaces or elevated side passages must be avoided where they face a residential building; and*

iii. Recreational facilities such as swimming pools and barbecue areas must be located away from the bedroom areas of adjoining dwellings.

2.1.2 The State Environmental Planning Policy (Infrastructure) 2021

Section -2.120 Impact of road noise or vibration on non-road development states the following:

2.120 Impact of road noise or vibration on non-road development

1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of RMS) and that the consent authority considers is likely to be adversely affected by road noise or vibration—

- *Residential accommodation,*
- *A place of public worship,*
- *A hospital,*
- *An educational establishment or centre-based childcare facility.*

2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this clause and published in the Gazette.

3) if the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded—

- *In any bedroom in the residential accommodation – 35 dB(A) at anytime between 10pm and 7am,*
- *Anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at anytime.*

4) In this clause, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.

2.1.3 Australian and New Zealand Standard AS/NZS 2107:2016 Acoustics– Recommended design sound levels and reverberation times for building interiors

Since the *State Environmental Planning Policy (Infrastructure) 2007* does not provide a criteria for all occupancies possible within a residential apartment, the *Australian and New Zealand Standard AS/NZS 2107:2016 Acoustics– Recommended design sound levels and reverberation times for building interiors* is adopted as a supplement.

Recommended ambient noise levels and reverberation times for internal spaces are given in a number of publications including Table 1 of Australian / New Zealand Standard 2107:2016 "*Acoustics - Recommended design sound levels and reverberation times for building interiors*". Unlike the previous version of this Standard, this latest edition recommends a range with lower and upper levels (rather than "satisfactory" and "maximum" internal noise levels) for building interiors based on room designation and location of the development relative to external noise sources. This change has occurred due to the fact that sound levels below 'satisfactory' could be interpreted as desirable, but the opposite may in fact be the case. Levels below those which were listed as 'satisfactory' can lead to inadequate acoustic masking resulting in loss of acoustic isolation and speech privacy.

Internal noise levels due to the combined contributions of external noise intrusion and mechanical ventilation plant should not exceed the maximum levels recommended in this Standard. The levels for areas relevant to this development are given in table below. The mid to maximum points of the internal noise level ranges are generally adopted as the internal design noise criteria for the combined effect of mechanical services and external noise intrusion.

Table 1 AS2107 Design Sound Levels for Occupancies excluded from SEPP (Infrastructure) 2021

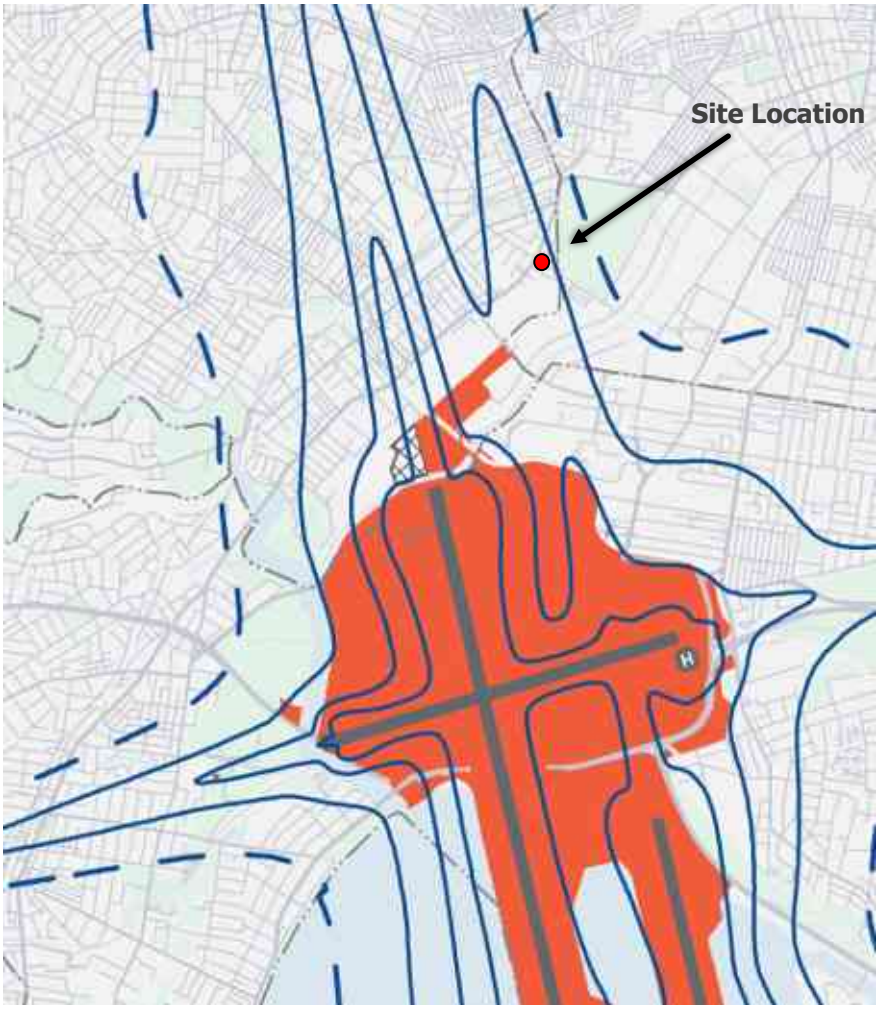
Type of occupancy/activity	Design Sound Level Range $L_{Aeq\ (Period)}$ [1] (dBA)	Time Period	Project Criteria $L_{Aeq\ (Period)}$ [1] (dBA)
Houses and apartments near major roads			
Apartment common areas (eg. foyer, lift lobby)	45 to 50	Anytime	<50
Work areas	35 to 45		<35
Department stores			
Small retail stores (general)	<50	Anytime	<50
Specialty shops (where detailed discussion is necessary in transactions)	<45		<45
Industrial buildings			
Assembly lines-			
Light machinery	<70	Anytime	<70
Packaging and delivery	<60		<60

Note 1: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound

2.1.4 Australian Standard AS 2021:2015 Acoustics–Aircraft noise intrusion–Building siting and construction

Figure 2 below shows the site location in accordance with the Sydney Airport 2039 ANEF model.

Figure 2 Sydney Airport ANEF 2039 Model



As shown in Figure 2 above, the proposed dwelling at 75-85 Crown St & 116 Princes Hwy, St Peter is located inside the ANEF 25 contour, however outside the ANEF 30 contour.

Standard AS 2021:2015 recommends that the architectural acoustic treatment should be designed to achieve the indoor design noise levels listed in Table 3.3 of the Standard. These levels are shown in Table 2 *with explanatory text added in italics.*

Table 2 Indoor design noise levels in order to determine acoustic treatment for aircraft noise intrusion

Building type and activity	Indoor Design Noise Level[1], dBA
Houses, home units, flats, caravan parks	
Sleeping areas, dedicated lounges (N/A)	50
Other habitable spaces:	55
• Kitchen areas, including mezzanine level	
• Office	
Bathrooms, toilets, laundries	60

Notes:

1. ** These indoor design sound levels are not intended to be used for measurement of adequacy of construction. For measurement of the adequacy of construction against aircraft noise intrusion see Appendix D of AS2021:2015.*

Please note the indoor design noise levels should not be used to confirm, with on-site measurements, the adequacy of the implemented construction, as part of the compliance process. Instead, these measurements should be based on the aircraft noise reduction (ANR) of the completed building space. The ANR is determined as the arithmetic average of the aircraft noise reduction calculated for each flyover (ANRn). Hence the ANRn is defined by the following equation:

$$ANR = L_{Aout} - L_{Ain}$$

where L_{Aout} is the maximum sound pressure level obtained outside the relevant space and L_{Ain} is the maximum sound pressure level obtained inside the relevant space. Both sound pressure levels should be measured simultaneously for each flyover using "A" frequency weighting and slow (S) time weighting.

2.2 Noise Emission Criteria

Noise emissions from the operation of the site impacting on the adjacent land users are outlined below. Noise emissions expected from the use of the site include mechanical services and communal areas.

2.2.1 Marrickville Development Control Plan (2011)

As the Marrickville DCP 2011 does not establish a relevant noise criterion for emissions of mechanical plant to surrounding sensitive receivers, the NSW EPA Noise Policy for Industry (NPfI) 2017 has been adopted and is further discussed in section 2.2.2.

2.2.2 NSW EPA Noise Policy for Industry (NPI) 2017

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

The NSW EPA has recently released a document titled *Noise Policy for Industry* (NSW NPI) which provides a framework and process for determining external noise criteria for the assessment of noise emission from industrial developments. The NSW NPI criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

2.2.2.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

2.2.2.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

Project amenity noise level for industrial developments is specified as the recommended amenity noise level (Table 2.2 of the NPI) minus 5 dB(A). To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the $L_{Aeq,15min}$ will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level, the project amenity noise levels can be set at 10 dB below existing industrial noise levels.

2.2.2.3 Area Classification

The NSW NPI characterises the "Urban Residential" noise environment as an area that has the following characteristics:

> *An acoustical environment that:*
>
> - *Dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources.*
> - *Has through-traffic with characteristically heavy and continuous traffic flows during peak periods.*
> - *Is near commercial districts or industrial districts.*

The site and its' nearest surrounding receivers are located in an area defined as R1 (general residential). The most appropriate zoning for the site and its' surrounding receivers is *Urban Residential*.

For residential and non-residential receivers in an urban residential area, the recommended amenity criteria are shown in Table 3 below.

When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPI.

Table 3 NSW NPI – Recommended L_{Aeq} Noise Levels from Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2] (dBA)
Residence	Urban	Day	60
		Evening	50
		Night	45
Commercial		When in use	65
Industrial		When in use	70

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound

Note 3: As per section 2.6 of the Noise Policy for Industry, external noise levels 10 dB(A) above the internal noise levels apply

2.2.3 Sleep Disturbance

In accordance with the NSW NPI, sleep disturbance is to be assessed in two stages addressing the likelihood of sleep disturbance and sleep awakening.

For the criterion addressing the likelihood of sleep disturbance, the NSW NPI recommends that the maximum noise level event should not exceed the following:

- 40 dB $L_{Aeq, 15\ minutes}$ or the prevailing RBL plus 5 dB, whichever is the greater; and / or
- 52 dB L_{AFmax} or the prevailing RBL plus 15 dB, whichever is the greater

As the existing noise levels during the night-time period has not been determined, a conservative criterion of 52 dB L_{AFmax} is adopted as the criterion for the likelihood of sleep disturbance at all residences.

Regarding sleep awakening, ongoing research is still being undertaken to quantify an appropriate criterion. The NSW Road Noise Policy (NSW RNP) provides guidelines and a summary of current research being undertaken on this topic. According to the NSW RNP, an accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition, the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or $L_{A1(1\ minute)}$, and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during early morning shoulder periods).

Currently the information relating to sleep disturbance impacts indicates that:

- Maximum internal noise levels below 50–55 dBA are unlikely to cause an awakening from a sleep state.

- One or two noise events per night with maximum internal noise levels of 65–70 dBA are not likely to affect health and wellbeing significantly.

As a result, the adopted sleep awakening criterion for the project is an internal noise level of 50–55 dB L_{AFmax}. This criterion is applicable for noise emissions generated by short term events occurring during the night time period. Therefore, allowing for a 10 dB noise reduction for open windows, it is proposed that the noise screening criterion for sleep awakening should be 60–65 dB L_{AFmax} external noise level at residential properties.

2.3 NSW Road Noise Policy (RNP) (Noise on Local Roads)

Noise impacts from the increase in vehicle movements along the surrounding roadways is to be assessed in accordance with the NSW EPA Road Noise Policy (RNP) 2011.

A peak hour increase proposed for the number vehicles associated with the development will not exceed a 2dBA increase at the nearest residential receivers. As summarised in the NSW EPA RNP, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person and is therefore considered acoustically acceptable.

3 ACOUSTIC ASSESSMENT

In addressing all the criteria shown above, each component of the development is assessed and presented below.

3.1 WestConnex Tunnelling Impact

In order to address the potential impacts of vibration at sensitive receivers due to construction activities within the WestConnex, Transport for NSW will need to monitor and assess the expected vibration levels and apply treatments in accordance with the document *Department of Environment and Conservation NSW Assessing Vibration: a technical guideline*.

As the WestConnex tunnel development is utilised for light and heavy vehicle passthrough, section 3.6.2 of the document *Ground borne noise* of the *Development Near Rail Corridors and Busy Roads – Interim Guideline* states that the potential negative impacts from ground borne noise is more closely associated with rail operations rather than roads, thus a detailed assessment of ground-borne noise is not required.

3.2 Predicted Aircraft Noise Levels

Using the procedures given in Standard AS 2021:2015, the project site is located at the distances listed in Table 4 from the airport's runways.

Table 4 Distances from project site relative to airport's runway

Runway	Distance (m)		
	DS	DL	DT
Main North/South Runway	1200	1800	N/A
Parallel North/South Runway	100	4500	3900

Notes:

1. *The sideline projection is a line which is perpendicular to the extended runway centreline, and which passes over the project site*
2. *DS: Distance from project site to the extended runway centreline measured along the sideline projection*
3. *DL: Distance from closer end of runway to the intersection of the extended runway centreline and the sideline projection*
4. *DT: Distance from further end of runway to the intersection of the extended runway centreline and the sideline projection.*

Based on these distances and the procedures discussed in Standard AS 2021:2015 (including typical maximum noise levels for jet and non-jet aircrafts), the project site will be exposed to the following maximum noise levels:

- Arrival: 79 dB(A) (Parallel North/South Runway)
- Departure 66 dB(A) (Parallel North/South Runway)

Please note the following calculations are in regard to these maximum noise levels:

- These maximum noise levels are mostly related to flyovers which use the parallel North-South Runway.
- Noise levels indicated above are from a Boeing 737-800 aircraft.

Table 5 below summarises the ANRs required in order to achieve the internal design noise levels listed in Table 2. These ANRs will be used to determine the sound insulation performance of architectural components which form part of the building envelope.

Table 5 Recommended aircraft noise reductions (ANRs)

Building Type and Spaces	Recommended ANRs, dB
Houses, home units, flats, caravan parks	
Sleeping areas, dedicated lounges (N/A)	29
Other habitable spaces:	24
• *Kitchen areas, including mezzanine level*	
• *Office*	
Bathrooms, toilets, laundries	19

3.3 Building Envelope Assessment

3.3.1 Glazing Recommendations

As the project is currently in the masterplan phase, the recommended construction summarised in Table 6 below should be revised once more detail is known, including location and orientations of noise sensitive areas such as bedrooms where applicable.

Table 6 In-principle Glazing Recommendations

Façade Orientation	Room Type	Minimum Glazing System Rating Requirements [1]	Indicative Glass Doors and Windows Construction [1 2]
Ground Floor & Mezzanine			
All applicable Façades	Potential commercial	Rw (C;Ctr): 29 (0;-3)	6.38mm laminated glazing
	Potential industrial		
	Potential residential [noise sensitive areas] [3]	Rw (C;Ctr): 42 (2;-6)	12.38mm laminated glass /12mm airgap / 6.38mm laminated glazing
	Potential residential [all other areas]	Rw (C;Ctr): 34 (-1;-2)	10.38mm laminated glazing
Level 1			
All applicable Façades	Potential commercial	Rw (C;Ctr): 29 (0;-3)	6.38mm laminated glazing
	Potential residential [noise sensitive areas] [3]	Rw (C;Ctr): 42 (2;-6)	12.38 mm laminated glass /12 mm airgap / 6.38mm laminated glazing
	Potential residential [all other areas]	Rw (C;Ctr): 34 (-1;-2)	10.83mm laminated glazing
Level 2 – Level 8			
All applicable Façades	Potential residential [noise sensitive areas] [3]	Rw (C;Ctr): 42 (2;-6)	12.38 mm laminated glass /12 mm airgap / 6.38mm laminated glazing
	Potential residential [all other areas]	Rw (C;Ctr): 34 (-1;-2)	10.83mm laminated glazing

Note 1: These are preliminary selections; they will be confirmed in the detailed design stage once the layouts and façade orientations are approved.

Note 2: Indicative construction includes all forms of glazed elements including operable and fixed windows, sliding glass doors etc.

Note 3: Noise sensitive areas include bedrooms and any other rooms other than a garage, kitchen, bathroom, or hallway.

Please note for windows, this performance is not only subject to the glazing selection but also to the construction of the window frame and the frame seal selection. Therefore, it is recommended that the window manufacturer should confirm that the required sound insulation can be achieved. It is anticipated that the window system should comprise Q-Lon (or equivalent) or fin seals with deep C channels as part of the window track (i.e., Performance levels outlined above need to be achieved with glazed panels + frame + seals).

3.3.2 External Wall Construction

If external wall constructions are constructed either from existing concrete or a masonry construction, no further acoustic upgrading is required. If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

Any light-weight external plasterboard walls should be constructed from a construction with a minimum acoustic performance of Rw 50.

3.3.3 External Roof Construction

The required external roof and ceiling constructions for the project are required to include the following:

1. Concrete external roof construction – no additional treatments required.
2. Light Weight Construction – Install acoustic insulation within the external roof/ceiling cavity similar to a 75 mm thick 14 kg/m^3 insulation.

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

3.4 External Noise Emissions from Engineering Services

At this stage of the project, the exact locations of key plant items, and the selection of items to be installed, have not been selected. As such, a detailed assessment of noise associated with engineering services cannot be undertaken.

All future plant and equipment are to be acoustically treated to ensure the noise levels at all surrounding receivers comply with noise emission criteria detailed within this report. Experience with similar projects indicates that it is both possible and practical to treat all mechanical equipment such that the relevant noise levels are achieved. Examples of the possible acoustic treatments to mechanical equipment includes the following:

- Supply and Exhaust Fans – location of fans within the building and treated using internally lined ductwork or acoustic silencers.
- General supply and exhaust fans – general exhaust and supply fans such as toilet, kitchen, lobby and other small mechanical fans can be acoustically treated using acoustic flex ducting or internally lined ducting.
- Condensers – The project will likely involve external condenser units which will be located on the future roof. Providing condenser equipment is selected using suitable noise level data, then acoustic treatments can be implemented such as screening, enclosures, and treatment to exhaust to ensure that the relevant noise emission criteria will be achieved.

Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

Experience with similar projects indicates that the acoustic treatment of whatever mechanical equipment is to be installed on the project is both possible and practical.

3.5 Alternative Ventilation Requirements

Based on the location of the site it would be expected that internal noise levels with windows open would include levels which are 10dB(A) above the internal levels detailed in this report.

Based on the requirements of the NSW Planning an alternative method outside air ventilation is required to be provided to all apartments in accordance with relevant regulations including the Building Code of Australia and AS1668.

The installation of the ventilation should not comprise the performance of the external building shell and is required to comply with the noise emission criteria detailed in section 2.1.

4 CONCLUSIONS

Pulse White Noise Acoustics Pty Ltd (PWNA) has been engaged by C&M Antoniou Pty Ltd to undertake an acoustic assessment for the proposed residential development at 75-85 Crown Street & 116 Princes Highway, St Peters.

As part of this assessment, we have undertaken a review of the building envelope and noise emissions from the use of the site. From this assessment we note the following:

- Indicative minimum acoustic performances and associated indicative constructions for the building envelope have been provided in section 3.3 of this report based on the predicted noise levels from aircraft flyover included in section 3.2. The recommended treatments have been provided to ensure compliance with the objectives presented in section 2.1.

As such, we believe the proposal is acoustically acceptable and meets all the detailed acoustic criteria listed above.

Kind Regards,

George Kinezos
Acoustic Engineer
PULSE WHITE NOISE ACOUSTICS PTY LTD

APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing 30dB(A) A quiet country park 40dB(A) Whisper in a library 50dB(A) Open office space 70dB(A) Inside a car on a freeway 80dB(A) Outboard motor 90dB(A) Heavy truck pass-by 100dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115dB(A) Limit of sound permitted in industry 120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] *(Sound Transmission Loss)*	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.

Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*