DA Noise Impact Assessment

Proposed Residential & Child Care Centre Development

21 - 23 Ellis Street, Condell Park

VMS AUSTRALIA

Report Number 22016

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Quality Management

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22016	Revision 1	9 May 2022	Lee Hudson	Sam Demasi	Sam Demasi
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This Report by VMS Australia Pty Ltd is prepared for the Client listed above and is based on the objective, scope, conditions and limitations as agreed. The Report presents only the information that VMS Australia Pty Ltd believes, in its professional opinion, is relevant and necessary to describe the issues involved. The Report should not be used for anything other than the intended purpose. All surveys, forecasts, projections, and recommendations contained in or associated with this report are made in good faith and on the basis of information supplied to VMS Australia Pty Ltd at the date of this report, and upon which VMS Australia Pty Ltd relied.

VMS Australia Pty Ltd does not accept any liability or responsibility to any party with respect to the information and opinions contained in this report.

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1 Introduction

VMS Australia Pty Ltd has been commissioned by Matzo Co Constructions Pty Ltd to undertake a noise impact assessment for a proposed residential and child care centre development at 21 – 23 Ellis Street, Condell Park. Being located between the ANEF 20 and 25 contours, as defined by the Endorsed ANEF 2039 which forms part of the Bankstown Airport Master Plan 2019, triggers the requirement to assess site suitability in accordance with the provisions of AS 2021:2015 *Acoustics: Aircraft noise intrusion- Building siting and construction*. This assessment has been prepared to assist Canterbury Bankstown Council's consideration of the Development Application submission.

This report presents an assessment of the potential noise impact associated with the child care centre operation. The impact of the exposure of the site to noise from aircraft operations out of Bankstown Airport are also considered. Where required, recommendations are documented for design measures to mitigate potential noise impacts associated with the child care centre and to achieve internal acoustical amenity requirements during aircraft operations.

The assessment makes reference to the following guidelines:

- *Bankstown Local Environmental Plan 2015.*
- AS 2021:2015 *Acoustics: Aircraft noise - Building siting and construction*.
- *Bankstown Airport Master Plan 2019* (Bankstown Airport Limited 2019).
- NSW Planning and Environment *Child Care Planning Guideline* (August 2017).
- Association of Australasian Acoustical Consultants *Guideline for Child Care Centre Acoustic Assessment* V3.0 (September 2020).
- NSW *Noise Policy for Industry* (EPA 2017).
- NSW *Road Noise Policy* (EPA 2011).

A glossary of the acoustical terminology used throughout this report is contained within **Appendix A**.

2 Proposed Development

2.1 Site Location

The proposed development site is located at 21 – 23 Ellis Street, Condell Park, within an R2 Low Density Residential zone. Each allotment is currently occupied by a single storey residential dwelling. The property falls between the ANEF 20 and 25 contours as defined by the Endorsed ANEF 2039 which forms part of the Bankstown Airport Master Plan 2019.

Ellis Street is a local road that carries two-way traffic and has a signposted 50km/hr speed limit.

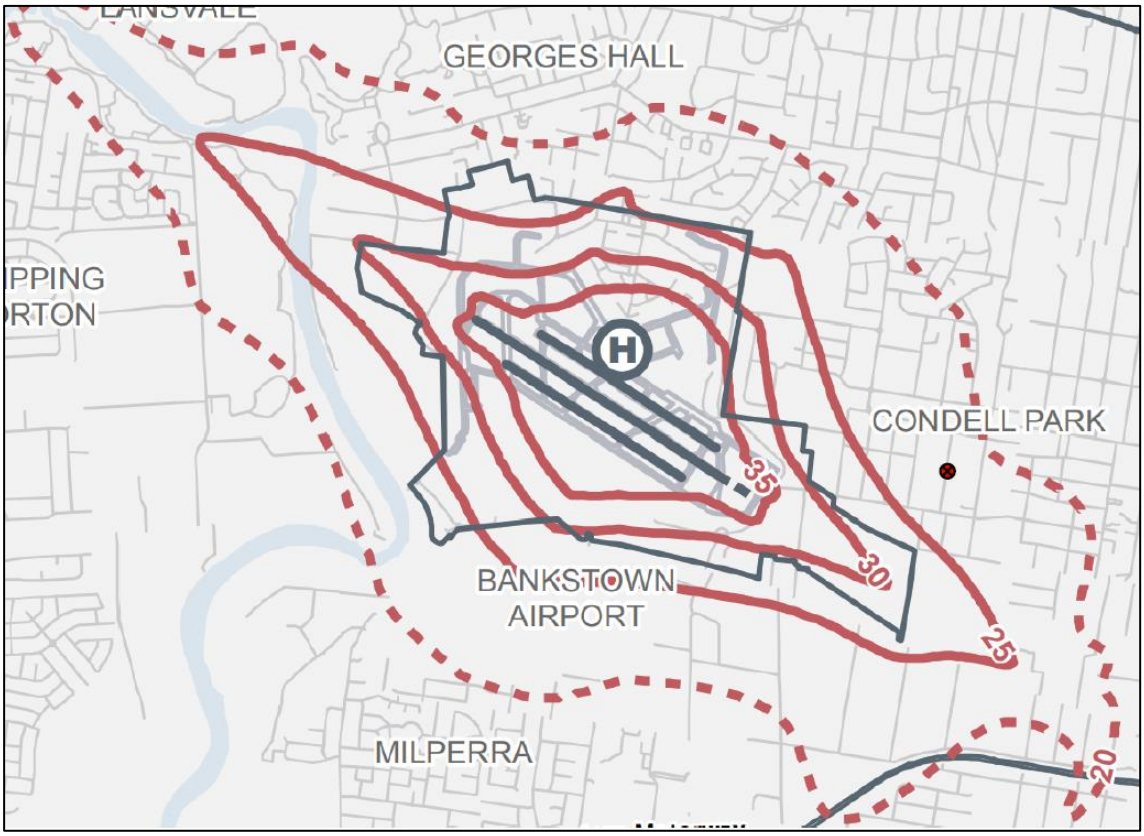
Surrounding properties are residential with a residential townhouse development on the site immediately to the north and other townhouse developments along the western side of Ellis Street.

The site and surrounding receivers are shown in **Figure 2-1**. The site location relative to the Endorsed ANEF 2039 is shown in **Figure 2-2**.

Figure 2-1 Site & Surrounding Receivers

Source: Google Maps

Figure 2-2 Site Location on Endorsed ANEF 2039



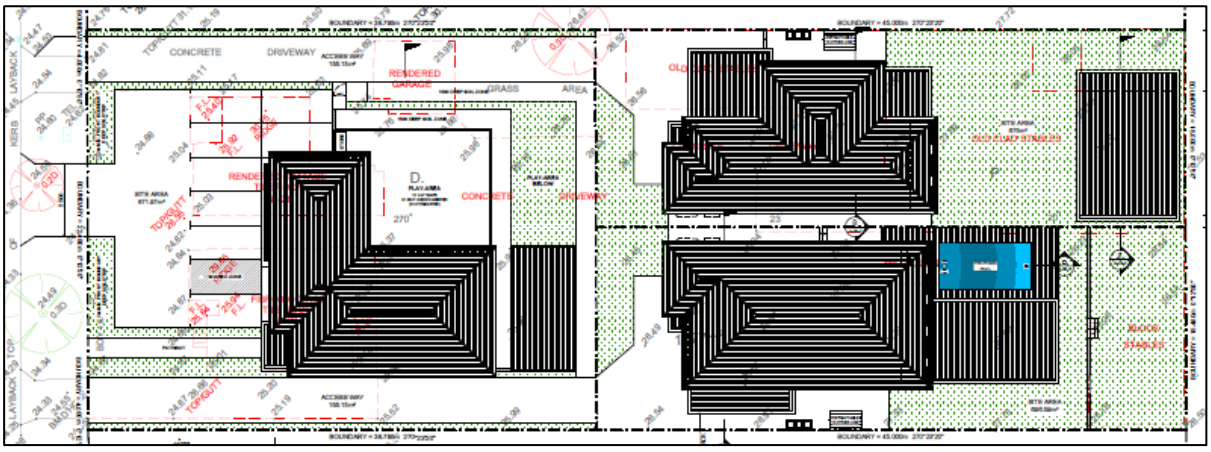
Source: Bankstown Airport Master Plan 2019

2.2 Proposed Development

The proposal is to consolidate the two residential allotments and then subdivide into three portions. A child care centre catering for up to 40 children aged from 0 – 5 years and 8 staff will be developed on the front allotment with a two storey residential dwelling constructed on each of the two rear allotments.

The proposed site layout is shown in **Figure 2-3**.

Figure 2-3 Proposed Site Layout



Source: Femme Build

Off street parking for 8 cars will be provided on the child care centre frontage. The residential units at the rear (Unit A and Unit B) will each be accessed via separate crossovers to driveways along the northern and southern site boundaries, respectively.

All properties will be airconditioned.

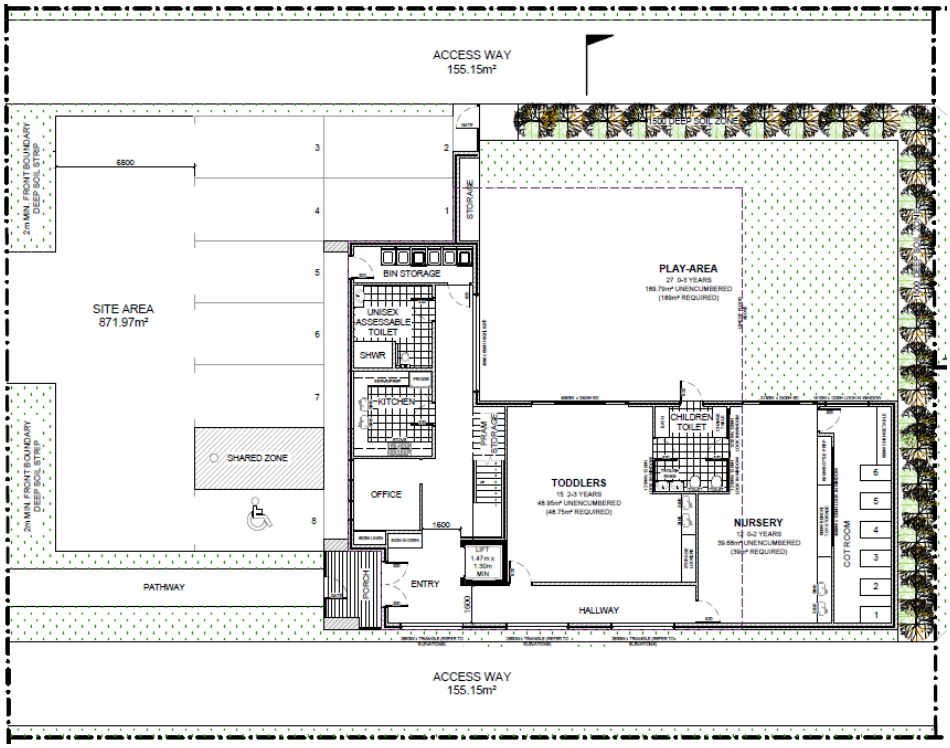
The proposed first and second floor layouts for the child care centre are shown in **Figure 2-4** and **Figure 2-5**.

The centre will operate between 7.00am and 6.00pm Monday to Friday and will accommodate a maximum of 40 children. The age breakdown of children is as follows:

- 0 – 2 years 12 Children
- 2 – 3 years 15 Children
- 3 – 5 years 13 Children

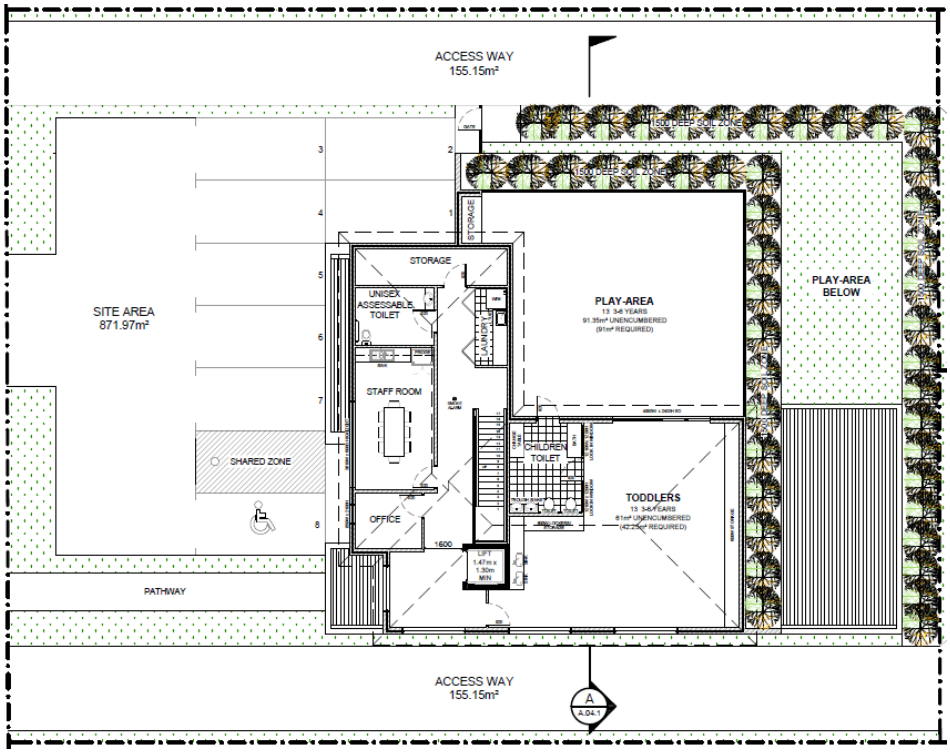
The receivers most potentially impacted by the operation of the child care centre will be the occupiers of the new residential units (Unit A and Unit B) developed on the rear portion of the site and the occupants of the townhouses adjacent to the northern boundary (19 Ellis Street).

Figure 2-4 Proposed Ground Floor Layout



Source: Femme Build

Figure 2-5 Proposed First Floor Layout



Source: Femme Build

3 Existing Noise Environment

3.1 Unattended Noise Monitoring

In order to characterise the existing acoustical environment of the area, unattended monitoring was conducted between Monday 14 March and Wednesday 23 March 2022 in the rear yard of 23 Ellis Street (refer **Figure 2-1**).

Instrumentation for the survey comprised an ARL 316 environmental noise logger (serial number 16-004-018), fitted with a microphone windshield. Calibration of the logger was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

The measured data has been filtered to remove periods affected during adverse weather conditions following a review of weather data recorded at the nearest and most appropriate Bureau of Meteorology (BOM) weather station to the site.

3.2 Existing Ambient Noise

To assess the impact of noise emission from the child care centre to residential receivers, the data obtained from the noise logging was processed in accordance with the procedures contained in the NSW Environment Protection Authority (EPA) *Noise Policy for Industry* (NPfI). The results of this analysis are presented in **Table 3-1**. Charts presenting summaries of the measured daily noise data can be provided upon request if necessary.

Table 3-1 Measured Ambient Noise Levels

Location of Logger	Daytime **Noise Level – dBA**	
	7:00 am-6:00 pm	
23 Ellis Street Condell Park	**RBL**	**L_{Aeq}**
	40	57

Note: The RBL noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

3.3 Bankstown 2039 ANEF and Building Siting

The Australian Noise Exposure Forecast (ANEF) predicts the exposure of land to noise from aircraft operations at a specific airport in a specific year. The ANEF contours assist to determine aircraft noise impacts on surrounding land and communities and assist planning authorities to regulate land use and future development around airports. The 2019 Master Plan for Bankstown Airport includes the Endorsed 2039 ANEF in which minor changes in the level of noise generated by aircraft activity are shown when compared with the 2033/34 ANEF included in the 2014 Master Plan. Bankstown Airport accommodates an average of 700 aircraft movements each day and operates on a 24/7 basis. According to the 2019 Master Plan, the airport averages 247,500 movements each year and is the third most active airport in Australia in terms of aircraft movements.

The site is located between the 2039 ANEF 20 and 25 contours and would be affected by aircraft movements associated with all three runways.

3.4 Aircraft Noise Levels

In addition to the ambient noise monitoring conducted on-site, the procedures documented in AS 2021:2015 were used to determine the maximum noise levels experienced at the project site due to aircraft activity.

Following a review of the expected fleet mix in 2039, the most prevalent aircraft type operating out of the airport (94.5%) are in the general aviation category which includes single engine and small twin engine piston aircraft such as the Piper Cherokee Six and Hawker Beech Baron. Based on flight paths and the aircraft nominated in the 2019 Bankstown Airport Master Plan, the typical maximum noise levels experienced at the site are shown in **Table 3-2**.

Table 3-2 Maximum Aircraft Noise Levels

Aircraft	Arrival (L_{ASmax}) dBA	Departure (L_{ASmax}) dBA
Piper PA-42	74	< 60
Beech Baron 58P	75	< 60

Review of the maximum noise events from the environmental noise logging data showed good correlation with the predicted 75dBA level. Accordingly, a level of 75dBA, being the typical future maximum noise level expected at the site, has been adopted as the basis for determining reasonable and feasible constructions for the development.

4 Assessment Criteria

4.1 Aircraft Noise

4.1.1 City of Canterbury Bankstown

Clause 6.6 of the *Bankstown Local Environmental Plan 2015* has been included unchanged as Clause 6.8 in the *Draft Consolidated Canterbury Bankstown LEP* which is currently under review by the NSW Department of Planning and Environment. The objectives of, and requirements under Clause 6.6 "*Development in areas subject to aircraft noise*" are as follows:

(1) The objectives of this clause are as follows—

(a) to prevent certain noise sensitive developments from being located near the Bankstown Airport and its flight paths,

(b) to assist in minimising the impact of aircraft noise from that airport and its flight paths by requiring appropriate noise attenuation measures in noise sensitive buildings,

(c) to ensure that land use and development in the vicinity of the Bankstown Airport do not hinder or have any other adverse impacts on the ongoing, safe and efficient operation of Bankstown Airport.

(2) Development consent may be granted to development that is the erection of a dwelling (other than a dwelling house) on land in the vicinity of the Bankstown Airport where the ANEF contour is between 20 and 25 only if the dwelling meets the standards specified in AS 2021—2000.

(3) Development consent may be granted to development that is the erection of a dwelling house or seniors housing on land in the vicinity of the Bankstown Airport where the ANEF contour exceeds 25 only if the consent authority is satisfied that the nature of occupation or internal noise attenuation measures enable reasonable amenity for the occupants.

(4) Development consent must not be granted to development for the purposes of a dual occupancy, multi dwelling housing, attached dwelling, boarding house or centre-based child care facility on land in the vicinity of the Bankstown Airport where the ANEF contour exceeds 25.

(5) Development consent may be granted to development that is the erection of hotel or motel accommodation, office premises or a public administration building on land in the vicinity of Bankstown Airport where the ANEF contour for the Bankstown Airport is above 25 only if the building meets the standards specified in AS 2021—2000.

(6) In this clause—

ANEF contour means a noise exposure contour shown as an ANEF contour on the Noise Exposure Forecast Contour Map for the Bankstown Airport prepared by the Department of the Commonwealth responsible for airports.

AS 2021—2000 means AS 2021—2000, Acoustics—Aircraft noise intrusion—Building siting and construction.

It is noted that the current applicable standard is Australian Standard AS2021:2015 *Acoustics - Aircraft noise intrusion - Building siting and construction*.

4.1.2 Child Care Planning Guideline

According to the Guideline child care facilities located near major roads, rail lines, and beneath flight paths are likely to be subject to noise impacts. Clause C26 states:

An acoustic report should identify appropriate noise levels for sleeping areas and other non play areas and examine impacts and noise attenuation measures where a child care facility is proposed in any of the following locations:

- *on industrial zoned land.*
- *where the ANEF contour is between 20 and 25, consistent with AS 2021 – 2000.*

4.1.3 Australian Standard 2021:2015

AS 2021:2015 documents the process for determining the acceptability of land designated as subject to aircraft noise exposure for potential future development.

The general procedure involves the following:

- Determine the suitability of the site for development based on the ANEF at the site;
- Determine the location of the site with respect to all runways of the airport;
- Determine the types of aircraft likely to over-fly the site;
- Determine the maximum noise levels for the relevant aircraft types;
- Determine indoor design sound levels for aircraft flyovers for building/activity types;
- Determine appropriate building materials and constructions to achieve the required reduction of aircraft noise to meet the recommended indoor design sound levels.

The recommended acceptable internal noise levels within residential premises are presented in Table 4-1. Specific recommendations relating to child care centres are not included in AS 2021, however an internal noise level of 55dBA is recommended within teaching areas which is consistent with habitable areas within residences. For areas where the children will sleep, the recommendations for sleeping areas within residential premises are considered appropriate.

Table 4-1 AS 2021:2015 Recommended Indoor Design Sound Levels

Area of Occupancy	Indoor Design Sound Level (L_{ASmax})
Sleeping Areas	50 dBA
Other Habitable Areas	55 dBA
Bathrooms, Toilets, etc	60 dBA

The internal design sound levels assume that the windows and external entry doors are closed.

4.1.4 Association of Australasian Acoustical Consultants (AAAC)

A guideline for the assessment of noise from childcare centres has been prepared by the Association of Australasian Acoustical Consultants (AAAC) as a result of an NSW Australian Acoustical Society (AAS) Technical Meeting held in September 2007 on Child Care Noise. The document, AAAC *Guideline for Child Care Centre Acoustic Assessment*, Version 3.0 (October 2020), provides criteria for the assessment of noise intrusion into and noise emissions from child care centres and also provides recommendations for treatment to minimise acoustical impacts upon neighbouring premises. The guideline has been placed before the Land and Environment Court during matters involving Child Care Centre applications.

The AAAC guideline recommends the L_{ASmax} noise level from aircraft at any location within the indoor play or sleeping areas of the centre during the hours when the Centre is operating shall not exceed 50 dBA in accordance with Australian Standard AS 2021. Whilst this level is appropriate for seeping areas, 55dBA, which is consistent with AS 2021:2015 recommendations for teaching areas, and would be applicable within the children's home environment, is considered acceptable for indoor learning areas.

4.2 Child Care Centre

There are typically two considerations when conducting a noise impact assessment for a child care centre:

- The impact of the operation on nearby receivers; and
- The impact of noise from the surrounding environment on the development itself.

Assessment of operational noise from the child care centre includes the following sources:

- Children, primarily from outdoor (and to a lesser extent indoor) play areas;
- Mechanical ventilation plant;
- Vehicular events associated with the carpark/drop-off/pick-up; and
- Additional traffic on nearby local/arterial roads.

Assessment of the impact of noise from the surrounding environment on the centre includes:

- Noise impacting internal and external areas of the child care centre.

4.2.1 SEPP (Educational and Child Care Facilities) 2017

SEPP (*Educational and Child Care Facilities*) 2017 requires the consent authority to consider the applicable provisions of the Child Care Planning Guideline prior to determining a development application in relation to a proposed development.

The *Child Care Planning Guideline* documents general planning measures to promote acoustic privacy for children attending a Centre and for the surrounding neighbours. The impact of environmental noise is to be assessed against recommended acceptable limits. Criteria for assessment are not quantified in either the SEPP or Guideline.

4.2.2 Canterbury Bankstown Council

The *Draft Consolidated Local Environmental Plan* replacing the *Bankstown LEP 2015* and *Canterbury LEP 2012* is currently under review by the NSW Department of Planning & Environment. Council has adopted the *Draft Consolidated Development Control Plan* to support the Draft LEP. However, the Draft DCP will not come into effect until the Draft LEP is approved. In the interim, the Bankstown DCP 2105 remains applicable.

Part B6 of *Bankstown Development Control Plan 2015* provides objectives and development controls to enhance the function and appearance of child care centres in the City of Bankstown. The development controls include storey limits, setbacks, building design, acoustic privacy, landscaping, traffic management, access and parking.

Section 5 documents development controls intended to promote acoustic privacy and management and includes the following specific controls:

- Air conditioning, mechanical ventilation or any other continuous noise source must not exceed the ambient level at any specified boundary by more than 5dBA.
- Application of control measures to ensure the noise of children playing in outdoor areas does not exceed 10dBA above the background noise level.

4.2.3 Association of Australasian Acoustical Consultants (AAAC)

Indoor Activities, Mechanical Plant and On-Site Traffic

The AAAC guideline recommends the $L_{Aeq(15minute)}$ noise level emitted from the cumulative operation of indoor activities, mechanical plant and traffic on the site should not exceed the background noise level by more than 5dB at the assessment location. The assessment location is defined as the most affected point on or within any residential receiver property boundary.

On this basis, the recommended design limit for assessment of noise generated by indoor activities, mechanical plant and on-site traffic is as follows:

- $L_{Aeq(15minute)}$ 45dBA when assessed at the most affected point on or within any residential property boundary.

Outdoor Play

Since the time in which children are involved in outdoor play is limited, the potential impact associated with these noise emissions is minimised. The AAAC consider a total limit of 4 hours outdoor play per day (typically 2 hours in the morning and 2 hours in the afternoon) reasonable to apply a criterion that the $L_{Aeq,15min}$ noise level emitted from the outdoor play area does not exceed the background noise level by more than 10dBA at the assessment location. A "background + 10dBA" criterion has also been applied in other local government areas within the Sydney metropolitan area and has been found acceptable within Land and Environment Court hearings.

On this basis, the noise level emitted from outdoor play shall not exceed the following noise criteria assuming up to 4 hours (total) of outdoor play per day:

- $L_{Aeq(15minute)}$ 50dBA when assessed at the most affected point on or within any residential property boundary.

Noise Intrusion to the Child Care Centre

The AAAC child care centre guideline also presents recommendations for external noise impact upon children in child care centres.

- The $L_{Aeq,1hr}$ intrusive noise level from road traffic or industry at any location within an outdoor play area should not exceed 55dBA.
- The $L_{Aeq,1hr}$ intrusive noise level from road traffic or industry within the indoor play areas should not exceed 40dBA and 35dBA in sleeping areas.

4.2.4 Additional Traffic on the Road Network

Road traffic generated by the proposed centre may result in increased levels of noise at residential receivers primarily on Ellis Street which is classified as a local road. Based on the recommendations of the NSW *Road Noise Policy* (EPA 2011) the relevant criterion for daytime operations is presented in **Table 4-2** to assess impacts along local roads.

Table 4-2 Road Traffic Noise Assessment Criterion – Additional Traffic

Road Category	Type of Project/Land Use	Assessment Criterion - dBA
Local	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hr)}$ 55

Note: The assessment criteria are applied externally and to residential receivers only.

Where predicted noise levels exceed the project-specific noise criterion, an assessment of all feasible and reasonable mitigation options should be considered. The RNP states that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

4.3 Residential Development

Operational noise generated by any mechanical plant installed as part of the residential component of the development must to comply with the mandatory requirements of the *Protection of the Environment Operations Act 1997* and associated regulations.

The *Noise Policy for Industry* (NPfI) provides a framework and process for deriving noise criteria for consents and licences that enable the EPA and others to regulate premises that are scheduled under the *Protection of the Environment Operations Act 1997*. Whilst specifically aimed at assessment and control of noise from industrial premises regulated by the EPA, the policy is also appropriate for use by the DP&E when assessing major development proposals and may be of assistance to Local Government in noise assessment and land-use planning.

The NPfI documents a procedure for assessment and management of industrial noise which involves determining the project noise trigger levels for a development. The project noise trigger level is a benchmark level above which noise management measures are required to be considered. It is derived by considering short-term intrusiveness due to changes in the existing noise environment (applicable to residential receivers only) and maintaining noise level amenity for particular land uses for residents and other sensitive receivers.

Since this assessment involves only residential receivers and maintaining noise level amenity from the influence of contributions from subsequent industrial developments is not a consideration, the project noise trigger level is most appropriately based on intrusiveness.

For assessing intrusiveness, the background noise generally needs to be measured. The Project Intrusiveness Noise Level essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5dBA above the measured Rated Background Level (RBL), over any 15-minute period.

Based on the minimum measured RBL of 40dBA (day, evening and night-time), the applicable limit for operational noise from HVAC and other mechanical plant associated with the proposed residential development is:

- $L_{Aeq(15min)} \leq 45dBA$

5 Assessment of Noise Impacts

5.1 Aircraft Noise Assessment

5.1.1 Required Sound Insulation

The recommended indoor design sound levels presented in **Table 4-1** have been used to determine the building constructions required to achieve the necessary reductions in the aircraft noise levels received. As such, the aircraft noise reduction values (ANR) required for the proposed development have been calculated in accordance with the procedures outlined in AS 2021:2015 and are presented in **Table 5-1.**

Table 5-1 Required Aircraft Noise Reduction

Area of Occupancy	Aircraft Noise Reduction (ANR)
Sleeping Areas	25dBA
Other Habitable Areas	20dBA
Bathrooms, Toilets, Laundries etc	15dBA

Calculations of the required sound insulation performance of each surface component to achieve acceptable indoor noise levels have been conducted in accordance with the procedures contained in AS 2021:2015.

In essence, the AS 2021:2015 calculation procedure establishes the required sound insulation performance of each exterior construction element so that the recommended internal noise level is achieved whilst an equal contribution of aircraft noise energy is distributed across each surface element. Thus, exterior construction elements with a greater surface area must offer greater sound insulation performance.

Table 5-2 presents the minimum required R_w (weighted noise reduction) for each external building element.

Table 5-2 Minimum Acoustic Rating (R_w) Required for each External Building Element

Room	R_w of Building Element		
	External Wall	Glazing	Roof/Ceiling
Child Care Centre			
Ground Floor – Toddlers	28	28	-
Ground Floor – Nursery	26	22	-
Ground Floor – Cot Room	36	23	-
First Floor - Toddlers	33	30	35
House A			
Study	26	23	-
Family/Dining	28	25	-
Games	26	23	-
Master Bedroom	33	Refer Note 1.	34
Retreat	31	25	32
Bedroom 2	34	30	36
Bedroom 3	34	30	36

Room	R_w of Building Element		
	External Wall	Glazing	Roof/Ceiling
Secondary Dwelling			
Living/Kitchen	32	27	32
Bedroom 1	37	30	35
Bedroom 2	36	31	35
House B			
Living/Dining	29	25	-
Guest Bedroom	30	31	-
Family/Dining/Kitchen	28	27	-
Master Bedroom	34	34	36
Retreat	31	29	33
Bedroom 2	36	30	36
Bedroom 3	36	31	35
Bedroom 4	33	29	35
Bedroom 5	33	29	35

Note 1: The DA issue architectural documentation does not show a window to the Master Bedroom. If a window is included the sound insulation performance required is R_w 30.

5.2 Mechanical Plant

At this stage, mechanical services design and equipment selection has yet to be finalised and documented. For the child care centre, a typical split system will be installed with the outdoor unit likely to be located on the deep soil section on the northern elevation, adjacent to the storage area. For the residential units, the location of future outdoor units is nominated as on the southern elevation of Unit A, adjacent to the foyer and stairway. The equivalent location is indicated for the outdoor unit at Unit B i.e., on the northern elevation adjacent the living room.

Given the intrusiveness noise trigger level of 45dBA (applicable during day, evening and night-time periods), currently available low-noise condenser units would be capable of comfortably achieving this limit with the implementation of typical engineering noise controls including judicious equipment selection, placement and screening.

In the case of the residential development, noise emissions from air-conditioning are principally controlled through the permissible hours of use under the POEO Regulations. Based on review of the indicative plant locations, and assuming the construction of an intervening solid boundary fence, operational noise from these units is unlikely to adversely impact the neighbouring residential occupants when operating within permissible hours.

The filtration plant associated with the Unit B swimming pool will also be required to achieve the project noise trigger level of 45dBA.

Further assessment of noise emissions from mechanical plant may be warranted when equipment selection has taken place.

5.3 Child Care Centre Operations

5.3.1 Noise from Indoor Activities

The reverberant noise level generated during indoor activities will vary depending on the space, activity, age group and number of children. The typical range of levels are between 60 to 75dBA, however it is unlikely that these levels would be sustained for more than 5minutes. Based on a worst case scenario involving active play, the following reverberant noise levels have been adopted as the maximum that could be expected over a 15 minute period:

- 0-2 year internal space – typical reverberant sound level of 68dBA.
- 2-3 year internal space – typical reverberant sound level of 75dBA.
- 3-6 year internal space – typical reverberant sound level of 76dBA.

The potentially most affected receivers to indoor activity noise emissions are Unit A to the east and 25 Ellis Street to the south.

The predicted worst case noise level received at Unit A with windows open to all playrooms, is 34dBA. With windows closed, the received noise level will be well below 30dBA.

The predicted worst case noise level received at the neighbouring residence to the south (25 Ellis Street) with windows open is 42dBA and < 30dBA with windows closed.

Impacts associated with breakout noise from within the spaces are considered negligible for this development, particularly when compared to the noise generated from outdoor play. Noise from indoor activities will achieve the project design limit of 45dBA at all surrounding receivers. Further assessment is therefore not considered warranted.

5.3.2 Noise from Outdoor Play

A variety of activities will be provided throughout the day, appropriate to the range of age groups. These activities involve both indoor free-play and structured learning and outdoor play. A management plan has not been supplied at this stage, however Centres typically operate on seasonally-based, flexible routines/timetables.

During the summer, outdoor activities, which include both free-play and structured-programs, are generally held in the morning period (depending on weather conditions). In the afternoon, outdoor activities generally commence until later in the day, again weather depending. The implementation of a sun-safe policy restricts outdoor programs. During the colder winter period, children can be expected to remain inside until later in the morning.

Outdoor play is also dependent upon weather conditions and is reduced during colder, inclement periods. Any single outdoor activity program would typically be held for a maximum one hour duration throughout the day.

The times over which all the children would be engaged in outdoor play simultaneously are normally limited and would generally occur upon arrival in the morning until the commencement of indoor structured learning, possibly after lunch and again in the afternoon prior to departure (although this would vary according to seasonal conditions). However, the segregated outdoor areas design would allow all age groups to play safely at the same time.

Although the duration of outdoor play and the number of children involved may vary, the Centre will manage outdoor play so that no more than a total of 4 hours will occur per day. On this basis, a limiting criterion of $L_{Aeq(15minute)}$ 50 dBA at the most affected point on or within any residential property boundary (RBL + 10dBA) is appropriate.

Calculations of the potential noise emissions generated have been based on the conservative assumption that a maximum of 40 children aged 0 – 5 years may be simultaneously involved in outdoor play in the ground level and first floor play areas. The contribution of the 0 – 2 year group to "active" play is generally minimal, given the limitations of speech development at this age.

The AAAC's range of sound power levels for groups of children playing are shown in **Table 5-3**. These levels have been applied to groups of children located across the outdoor play areas and the noise level emissions potentially generated at the closest sensitive receiver locations predicted.

Table 5-3 Effective Sound Power Levels for Groups of 10 Children Playing

Number and Age of Children	Sound Power Level - $L_{Aeq(15min)}$ - dBA
12 Children – 0 to 2 years	79
15 Children – 2 to 3 years	87
13 Children – 3 to 5 years	88

Based on the source noise levels shown in **Table 5-3** the predicted noise emissions from outdoor play are shown in **Table 5-4**. Note that predictions include a 1.2m high solid screen constructed above the parapet (TOW RL 29.6) surrounding the perimeter of the first floor play area. The finished top of screen is accordingly RL 30.8.

Table 5-4 Predicted $L_{Aeq(15\ min)}$ Noise Levels from Outdoor Play

Receiver	Predicted Level $L_{Aeq(15min)}$ - dBA	Assessment Criteria $L_{Aeq(15min)}$ - dBA	Assessment
Units A & B	48	50	Complies
19 Ellis Street	50	50	Complies

With the inclusion of the 1.2m solid screen around the perimeter parapet, noise from outdoor play will achieve the project design limits at the nearest potentially sensitive receivers.

5.3.3 Carpark

Vehicular noise emissions generated during drop off and pickup occur in the carpark area on the Ellis Street frontage.

The NSW RMS *Guide to Traffic Generating Development* document publishes trip generation rates for "long day care" for child care centres as follows:

- 0.8 trips per child between 7am and 9am.
- 0.7 trips per child between 4pm and 6pm.

Staff arrival will be staggered but some staff will arrive prior to the 7.00am commencement. Staff departure is expected to be staggered from 4.00pm until just after the 6.00pm close. The majority of staff enter and leave directly from Ellis Street.

The morning arrival and drop-off period will generate a higher number of vehicular events being generally concentrated over a shorter period. The afternoon pickup and departure period tends to extend over a longer duration, commonly from 3.00pm onwards. This is reflected by the RMS trip generation rates.

On this basis, the estimated trips during the morning drop off and afternoon pickup are shown in **Table 5-5** with the net trip generation per peak hour in **Table 5-6**. For calculations it has been assumed that 50% of children would arrive/leave per hour over the two-hour peak period.

Table 5-5 Total Trips Generated

Peak Hour	Number of Children	Trip rate/child	Trips Generated
AM	40	0.8	32
PM	40	0.7	28

Table 5-6 Net Trips During Peak Hour (incl staff)

Peak Hour	Arrival	Departure	Net Trips Generated
AM	40	32	72
PM	28	36	64

Noise levels received at the neighbouring residential properties due to vehicles entering and leaving the carpark, based on the trip generation shown in **Table 5-6** are shown, with the recommended assessment criterion, in **Table 5-7**. A solid 1.8m high boundary fence has been assumed along the northern and southern boundaries.

Table 5-7 Carpark Noise

Receiver	Predicted Level $L_{Aeq(15min)}$ - dBA	Assessment Criteria $L_{Aeq(15min)}$ - dBA	Assessment
19 Ellis Street	45	45	Complies
25 Ellis Street	43	45	Complies

5.3.4 Road Traffic

The potential impact of noise from additional traffic generated as a result of the development has been considered to residential receivers along Ellis Street (staff and children).

The *Calculation of Road Traffic Noise* (CoRTN) 1988 algorithm was used to predict the L_{Aeq1hr} traffic noise level generated by the proposed development at residential properties along Ellis Street.

No traffic report had been prepared at the time of assessment. Accordingly, prediction of road traffic noise is based on the estimated trip generation shown in **Table 5-6**. Existing traffic generation on Ellis Street during peak hour is not known.

Predictions are based on a typical receiver distance of 12m, vehicle speed of 40km/h and it has been assumed that 50% of children would arrive/leave per hour over the two-hour peak period. **Table 5-8** shows the predicted L_{Aeq1hr} noise level generated as a result of the child care centre traffic.

Table 5-8 Predicted Peak Traffic Noise Levels

Location	Traffic Scenario	Predicted $L_{Aeq(1hr)}$ dBA	Assessment Criterion $L_{Aeq(1hr)}$ dBA	Assessment
Ellis Street	Future	50	55	COMPLIES

Assuming a potential worst case that traffic volume along Ellis Street doubles during peak hour, the L_{Aeq1hr} cumulative level would still comply with the recommended assessment criterion (L_{Aeq1hr} 55dBA). The impact from road traffic noise on existing acoustic amenity of residential receivers is considered negligible.

5.4 Noise Intrusion to the Child Care Centre

Based on the results of ambient noise monitoring external noise intrusion from transportation and other environmental noise sources will be well within relevant criteria within the Centre.

6 Construction for Aircraft Noise Insulation

6.1 Exterior Construction

Constructions to achieve the required sound insulation performance determined in accordance with the procedure documented in Appendix G of the standard "*Selection of Building Components for the Reduction of Aircraft Noise*" are shown in **Table 6-1**.

Table 6-1 Standard Sound Insulating Construction

Building Element	Sound Insulation	Standard Construction
Glazed Windows /Doors	R_w 22	Minimum 4mm monolithic glass glass and standard weather seals.
Glazed Windows/Doors	R_w 23 - 27	Minimum 6mm monolithic glass glass and full perimeter acoustic seals.
Glazed Windows/Doors	R_w 28 - 32	Minimum 6.38mm laminate glass glass and full perimeter acoustic seals.
Glazed Windows/Doors	R_w 33 - 36	Minimum 10.38mm laminate glass glass and full perimeter acoustic seals.
External Walls	R_w 45	Brick veneer construction – comprising 110mm brick, 90mm timber stud or 92mm steel stud, minimum 50mm cavity between masonry and stud framework, 10mm standard plasterboard internal lining.
Roof	R_w 40	Pitched concrete or terracotta tile or sheet metal roof with sarking, 1 layer of 10mm plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.
Entry Doors	R_w 30	40mm solid core timber door fitted with full perimeter acoustic seals and rubber gasket seal along rebated meeting junction. Drop seal at base.

6.2 Ventilation

In order to fully comply with AS 2021:2015, alternative ventilation is required to habitable rooms to enable external windows and doors to be closed during noisy periods when required. By so doing, the indoor noise goals can be achieved whilst providing room ventilation that meets the requirements of the Building Code of Australia.

Suggested methods to provide comfort ventilation are:

- Ducted air-conditioning (AC) system with fan coil units that provide outside air mixed with the return air. AC ductwork to supply/return vents must be acoustically treated.

- Aeropac acoustic air ventilator (or similar) - contact Acoustica 1300 722 825.

7 Conclusion

VMS Pty Limited has conducted an acoustic assessment for a proposed Child Care Centre and residential development at 21 – 23 Ellis Street Condell Park. The assessment has included review of the site and surrounding area, acoustical measurements to characterise the ambient noise environment, establishment of noise criteria, and a comparison of predicted noise levels with regard to guidelines recommended by the Association of Australasian Acoustical Consultants and other regulatory criteria. The exposure of the site to noise from aircraft operations at Bankstown Airport has also been addressed.

Aircraft Noise

Assessment has been carried out in accordance with AS 2021:2015 procedures. Based on the predicted maximum level received at the site during typical aircraft operations, levels of noise intrusion into the critical areas of the proposed child care centre and future residential dwellings have been calculated to determine the sound insulation requirements of the external construction elements. Recommendations have been made for reasonable and feasible treatment measures to reduce noise intrusion from aircraft to achieve the recommended acceptable levels within habitable and sleeping spaces.

With the inclusion of the acoustical treatment recommendations into the proposed design, the development will meet the requirements of AS 2021:2015.

Noise Emissions

Predictions of noise emissions from indoor activities comply with recommended design limits and will not be acoustically significant at nearby residential receivers.

Predictions of noise emissions associated with the outdoor playground activities, based upon a worst-case scenario with all children playing simultaneously in the outdoor playground areas demonstrate that the project specific criterion will be achieved with the addition of a 1.2m solid screen on the parapet around the perimeter of the first floor play area. The minimum required TOW is RL 30.8.

Mechanical Noise Sources

Mechanical services design and equipment selection has yet to be documented. The intrusiveness noise trigger limit of 45 dBA (applicable to day periods) is expected to be achieved at surrounding potentially sensitive receivers with typical low noise outdoor units.

Further assessment of noise emissions from mechanical plant may be warranted when equipment selection has taken place.

External Noise Impact

External noise intrusion from traffic and other environmental noise sources will be well within relevant criteria within the Centre.

Road Traffic and Vehicular Noise

Noise generated due to vehicular activity associated with the on-site carpark will achieve project specific trigger limits at the neighbouring residences with the provision of a solid 1.8m minimum height fence along the northern and southern boundaries.

Road traffic noise generated as a result of the proposed development will achieve recommended noise limits on Ellis Street Road.

Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW ($20x10^{-12}$ Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times Log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
$D_{nT,w}$	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec^2.
Vibration Dose, VDV	When assessing intermittent vibration it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDVs are typically measured in the units of $m/s^{1.75}$.