palmer acoustics Australia Pty Ltd

PROPOSED CHILD CARE CENTRE

981 KINGSTON ROAD, WATERFORD WEST

LOGAN CITY COUNCIL

APPROVED DOCUMENT

This is an approved document for Development Application

MCUI/50/2018

NOISE IMPACT ASSESSMENT

Commissioned by:	Locality Planning & Consulting
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EXECUTIVE SUMMARY

Locality Planning & Consulting are proposing to develop a child care facility on a site located at 981 Kingston Road, Waterford West. The site locality is shown on Sketch 1, and is described as Lot 9 on RP889224.

Palmer Acoustics (Australia) Pty Ltd has been commissioned by Locality Planning & Consulting to complete a noise impact assessment addressing noise associated with the development. The report addresses:

- Traffic noise intrusion from Kingston Road.
- Noise emission (children play) into adjacent areas.
- Noise emission (car park and driveway) into adjacent areas.
- Recommended noise control measures to ensure compliance with the Logan City Council (LCC) noise intrusion and emission criteria.

The report has been prepared in accordance with the Logan City Planning Scheme 2015 and State Development Assessment Provisions (SDAP).

Based on the results presented, the following conclusions can be drawn:

- The proposed child care facility is required to comply with emission limits of the Logan City Council and the SDAP.
- The layout and placement of the facility on the site allows internal noise levels to be maintained with upgraded glazing, refer to Table 7;
- Noise emissions from children at play will comply with the LCC emission limits.
- Noise emissions from vehicles utilising the car parking space will comply with the 6am – 7am LCC emission limits;
- Noise emissions from mechanical plant will be required to be maintained below 54 dB(A) at the nearest residential façade.

To ensure compliance with the requirements of LCC for the control of traffic noise intrusion and noise emission from child care centre, the following is recommended:

- The Rw ratings and building treatments presented in Table 7 be incorporated into the design of the child care centre.
- Install a 1.8m high acoustic barrier on the eastern side of the playground 1 (refer to Figure 9).
- Install a 1.8m high acoustic barrier on the eastern and western side of the car park (refer to Figure 10).

CONTENTS

1.0 INTRODUCTION

Locality Planning & Consulting are proposing to develop a child care facility on a site located at 981 Kingston Road, Waterford West. The site locality is shown on Sketch 1, and is described as Lot 9 on RP889224.

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Figure 1: Site location

1.1 Existing site and surroundings

The subject site is located on the southern side of the Kingston Road between Beutel Street and Tygum Road. The site is adjacent to the Tygum Lagoon and Seasons Aged Care facility.

The site is located within a low density residential zone under the LCC Planning Scheme 2015.

1.2 Proposed development

It is proposed to remove the existing house as part of the development and to construct a building with 6 classrooms (serving a total roll of 99 children). 27 car parking spaces will be provided between Kingston Road and proposed child care building. The development is illustrated in Figure 2 and Figure 3, below.

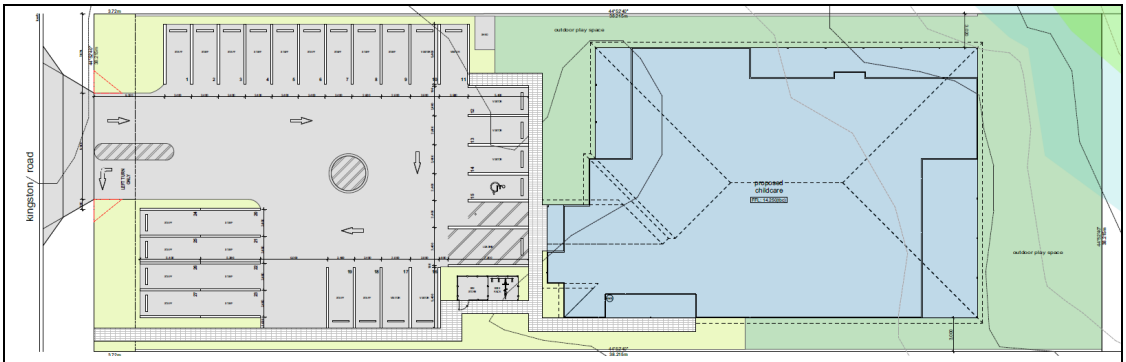

Figure 2: Site development

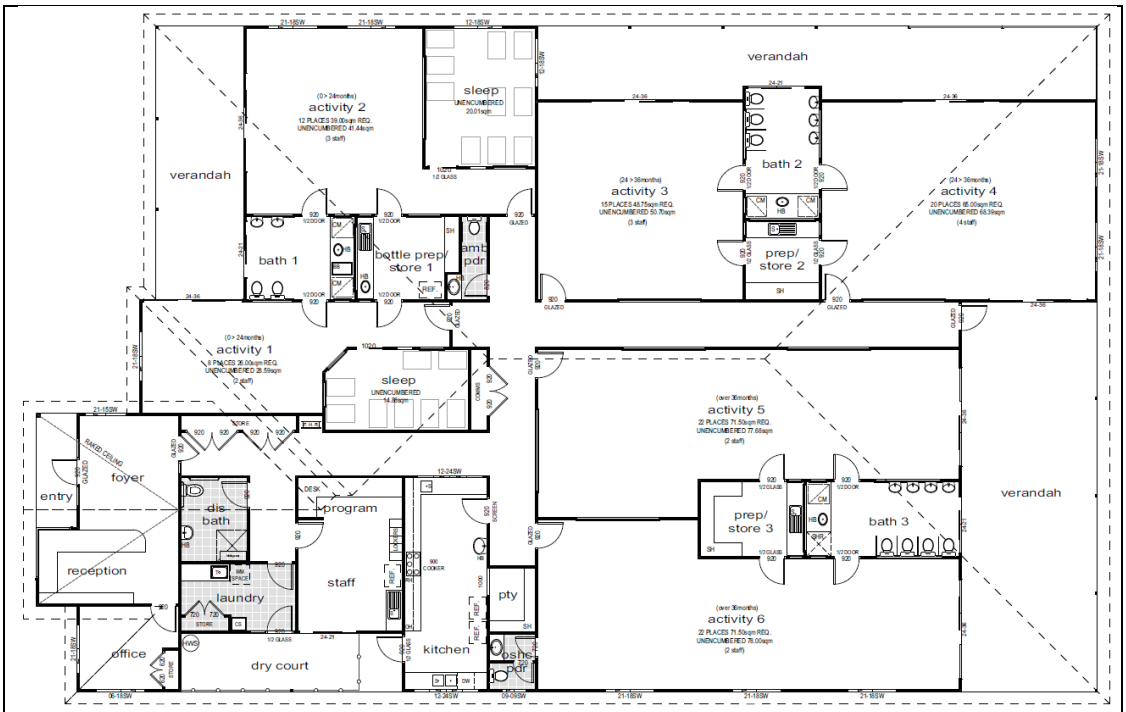

Figure 3: Internal Layout

2.0 EQUIPMENT AND PROCEDURES

2.1 Measurement Procedures

Environmental noise levels were measured over a five-day period commencing Friday 9th November 2018. The measurement location is shown as ML1 on Figure 4. ML1 was selected as the most appropriate location considering security, exposure to traffic noise levels and obtrusiveness. The result of the logging is presented in Figure 5 below. Examination of the logged record indicates generally typical environmental noise profiles for an area where noise from Kingston Road dominates the environment.

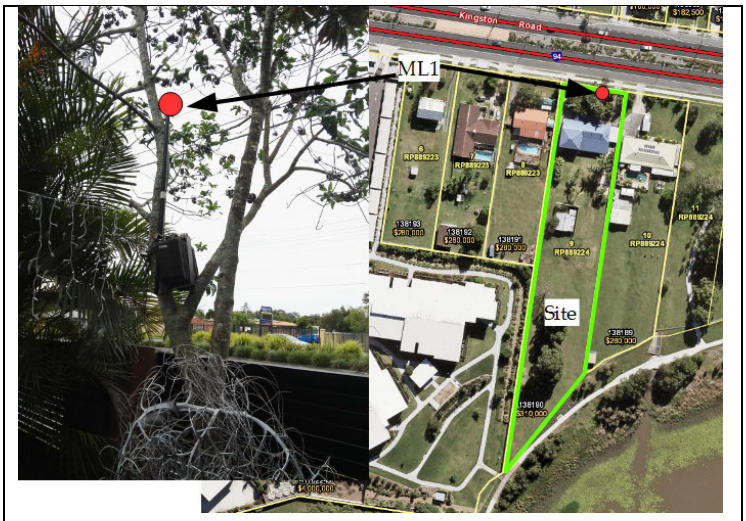

Figure 4: ML1 Logger location

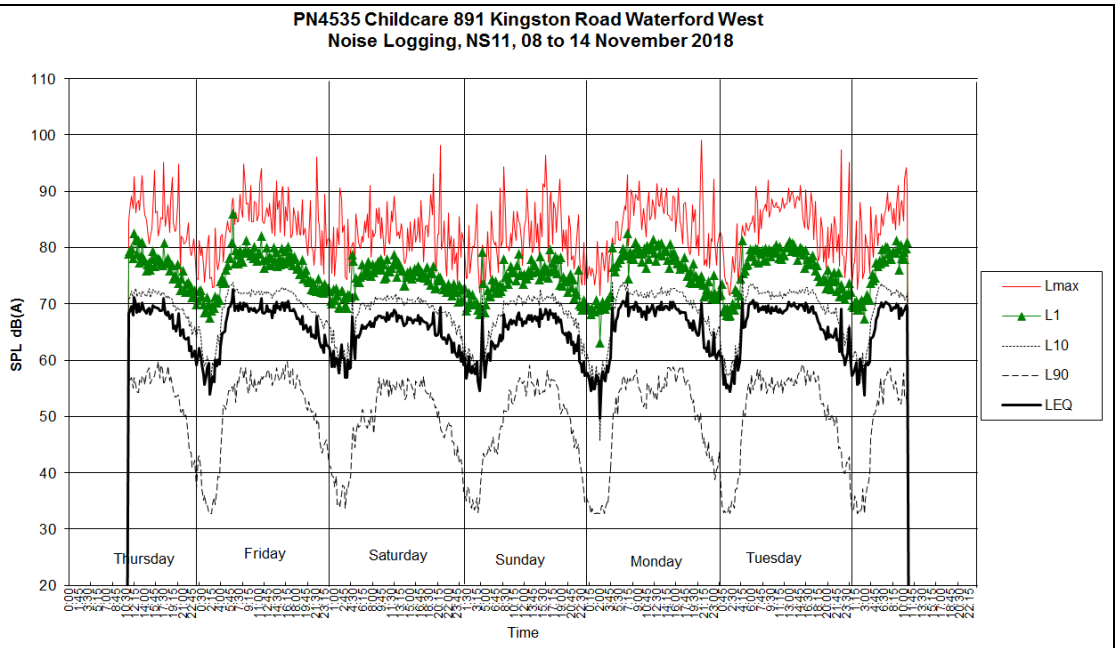

Figure 5: Ambient noise logging record

The logger was set to record 15 minute statistics over the logging period. The weather during the logging period was mostly dry with warm nights.

2.2 Instrumentation

The following instruments were used to measure the ambient noise levels:

- Rion NL21 Noise Logger (serial number 00521715)
- B & K 4230 Calibrator (serial number 1638750)

The operation of the sound level measuring equipment was field calibrated before and after each measurement session and was found to be within 0.3dB of the reference signal. The calibrator and noise logger used in this assessment has a current calibration certificate from a certified NATA calibration laboratory.

3.0 AMBIENT NOISE LEVELS

The typical average ambient noise levels measured at ML1 are presented in Table 1. The logger was located on the front fence, approximately 9m from the nearest running edge of Kingston Road. The dominant noise source was traffic noise from Kingston Road.

Table 1: Measured Ambient Noise Levels ML1

Time	Measured Noise Levels[1] dB(A)[2]				
	L_{Amax}[3]	L_{A01}[4]	L_{A10}[5]	L_{Aeq}[6]	L_{A90}[7]
Day: 7 am to 6 pm	86	78	72	69	54
Evening: 6 pm to 10 pm	83	74	69	65	49
Night: 10 pm to 7 am	80	73	65	62	36

[1] *Average noise levels throughout the period, with the exception of L_{A90} which is the average below the median noise levels for the period.*
[2] *dB(A) decibels, A-weighted*
[3] *L_{Amax} refers to the maximum a-weighted sound pressure level occurring during the sampling period*
[4] L_{A01} *for a specified time interval, means the A-weighted sound pressure level that is equalled or exceeded for 1% of the interval*
[5] L_{A10} *for a specified time interval, means the A-weighted sound pressure level that is equalled or exceeded for 10% of the interval*
[6] L_{Aeq} *for a specified time interval, means the time average A-weighted sound pressure level, within the meaning given by AS1055.1 for the interval*
[7] *L_{A90} refers to the noise level exceeded 90% of the time period, commonly referred to as the background noise level*

4.0 NOISE INTRUSION

4.1 Transport Noise Corridor Overlays

Parts of the site lie within Noise Categories 1 - 4 of the Transport Noise Corridor overlay of the state controlled Kingston Road and are therefore subject to the requirements of the Queensland Development Code Mandatory Part 4.4 – buildings in a transport noise corridor.

However, as the proposal does not contain residential components, the provisions of QDC MP4.4 do not apply.

The site also lies within 25 m of a State Controlled Road and is therefore subject to the requirements of Module 1 of the "State Development Assessment Provisions" (SDAP) Version 2.4 dated 16 November 2018 by Department of State Development, Infrastructure and Planning. See Figure 6, below.

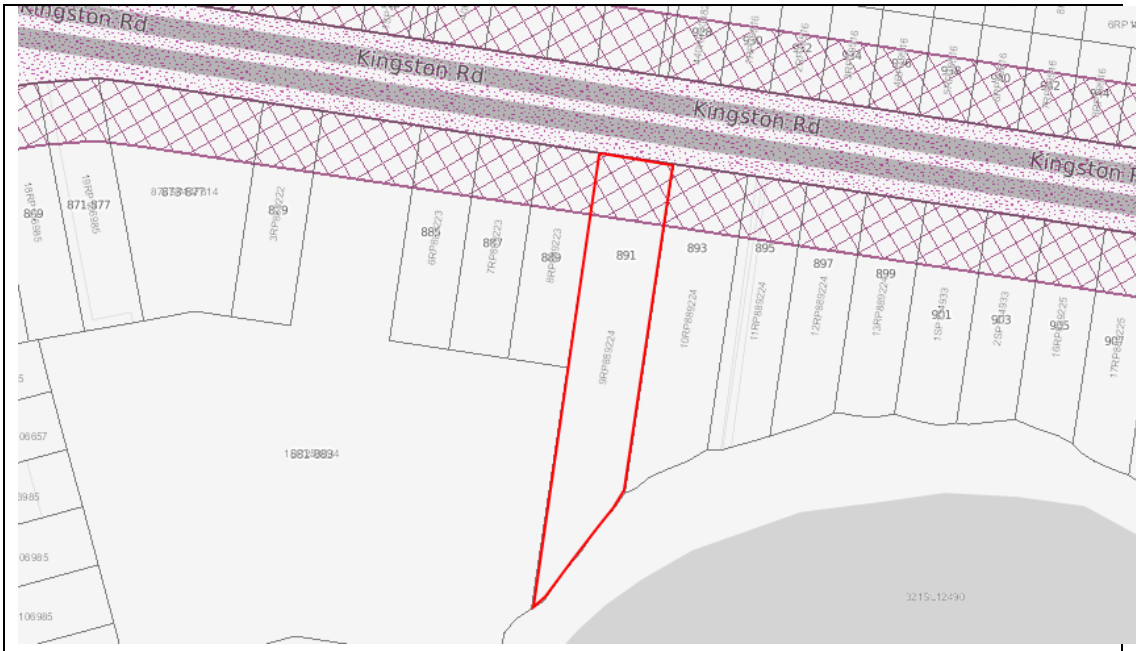

Figure 6: SDAP Overlay

4.2 SDAP Noise Criteria

As the site is within the overlay "Area within 25m of State Controlled roads" the site is subject to road traffic noise criteria pursuant to State Development Assessment Provisions (SDAP) State Code 1, V2.4. The applicable performance outcomes are PO25 & 26, (see below) extracted from Table 1.2.2: *Environmental emissions.*

Table 2: Extract from SDAP - Table 1.2.2: Environmental emissions

Performance outcomes	Acceptable outcomes
Childcare centres and educational establishments	
PO25 Development involving a: (1) child care centre, or (2) educational establishment minimises noise intrusion from a state-controlled road or type 1 multi-modal corridor in indoor education areas and indoor play areas.	**AO25.1** A noise barrier or earth mound is provided which is designed, sited and constructed: 1. to meet the following external noise criteria at all facades of the building envelope: a. ≤58 dB(A) L10 (1 hour) façade corrected (maximum hour during normal opening hours) 2. in accordance with chapter 7 – Integrated noise barrier design of the Transport Noise Management Code of Practice: Volume 1 (Road Traffic Noise), Department of Transport and Main Roads, 2013. Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report is provided, prepared in accordance with the SDAP Supporting Information: Environmental emissions in a state controlled road environment, Department of Transport and Main Roads 2017. If the building envelope is unknown, the deemed-to-comply setback distances for buildings stipulated by the local planning instrument or relevant building regulations should be used. OR all of the following acceptable outcomes apply: **AO25.2** Buildings which include **indoor education areas** and **indoor play areas** are setback the maximum distance possible from a **state-controlled road** or **type 1 multi-modal corridor**. AND **AO25.3** Buildings are designed and oriented so that **indoor education areas** and **indoor play areas** are located furthest from the **state-controlled road** or **type 1 multi-modal corridor**. AND **AO25.4** Buildings are designed and constructed using materials which ensure **indoor education areas** and **indoor play areas** meet the following internal noise criteria: 1. ≤35 dB(A) Leq (1 hour) (maximum hour during opening hours). Note: Noise levels from a **state-controlled road** or **type 1 multimodal corridor** are to be measured in accordance with AS1055.1– 1997 Acoustics – Description and measurement of environmental noise. To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report is provided, prepared in accordance with the SDAP Supporting Information: Environmental emissions in a state controlled road environment, Department of Transport and Main Roads 2017.

Performance outcomes	Acceptable outcomes
PO26 Development involving a: 1. **childcare centre**; or 2. **educational establishment** minimises noise intrusion from a state-controlled road or type 1 multi-modal corridor in outdoor education areas and outdoor play areas.	**AO26.1** A noise barrier or earth mound is provided which is designed, sited and constructed: 1. to meet the following external noise criteria in each **outdoor education area** or **outdoor play area**: a. ≤63 dB(A) L10 (12 hour) free field (between 6am and 6pm) 2. in accordance with chapter 7 – Integrated noise barrier design of the Transport Noise Management Code of Practice: Volume 1 (Road Traffic Noise), Department of Transport and Main Roads, 2013. Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report is provided, prepared in accordance with the SDAP Supporting Information: Environmental emissions in a state controlled road environment, Department of Transport and Main Roads 2017. OR **AO26.2** Each **outdoor education area** and **outdoor play area** is shielded from noise generated from a **state-controlled road** or **type 1 multi-modal corridor** by a building, solid gap-free fence, or other solid gap-free structure.

4.3 Application of SDAP Criteria

Road traffic noise modelling was undertaken to assess the impact of road traffic noise onto the site against the SDAP criteria.

5.0 ROAD TRAFFIC NOISE

An acoustic model of the noise impacts from Kingston Road, Waterford West was constructed using Pen3D modelling software. The software was used to predict the noise impact onto the logging location ML1 and confirmed to be accurately modelling. The model was then adjusted to incorporate the traffic volume growth until the year 2028, a ten-year planning interval. The adjusted model was then used to predict noise levels at specific location over the site.

5.1 Measured Noise Levels

Table 3: Measured road traffic noise levels at ML1

Road Traffic Noise Descriptor	Measured Level dB(A)	Offset from $L_{A10\ (18\ hour)}$
$L_{A10\ (18\ hour)}$[8]	71.1	
$L_{Aeq\ (day)}$[9]	72.6	1.6
$L_{A10\ (day)}$[10]	74.2	3.2
$L_{A10\ (12\ hour)}$[11]	72.3	1.3

5.2 Existing and Future Traffic Volumes

The existing and future traffic flows for Kingston Road were obtained from the Department of Infrastructure, Local Government and Planning SPP Interactive mapping system (2015 data). Predicted traffic flows are based upon a ten year projection and incorporate a 1.9% and 1.3% growth rate per annum for inbound and outbound traffic date respectively. Existing and predicted traffic volumes are set out in Table 4.

Table 4: Existing and future traffic flows

Road	AADT[12]		Commercial Vehicles %	Speed Zone
	2018	2028		
Kingston Rd – Inbound	14,111	17,033	6.55	70km/h
Kingston Rd – Outbound	14,205	16,196	6.57	70km/h

[8] $L_{A10\ (18\ hour)}$ *for a specified time interval, means the arithmetic average of 18 individual* $L_{A10(1hour)}$ *levels measured between 6:00 am and midnight on the day*

[9] $L_{Aeq\ (day)}$ *for a specified time interval, means the maximum time average A-weighted sound pressure level, within the meaning given by AS1055.1, for the interval 6:00 am to 10:00 pm*

[10] $L_{A10\ (day)}$ *for a specified time interval, means the maximum* L_{A10} *A-weighted sound pressure level, within the meaning given by AS1055.1, for the interval 10:00 pm to 6:00 am*

[11] $L_{A10\ (12\ hour)}$ *for a specified time interval, means the arithmetic average of 12 individual* $L_{A10(1hour)}$ *levels measured between 6:00 am and 6:00pm on the day*

[12] *Annual average daily traffic volume*

5.3 Verification of Traffic Noise Model

The PEN 3D2000 computer model has been used to predict the road traffic noise levels at the proposed site. This program uses the algorithms from the *Calculation of Road Traffic Noise* UK Department of Transport (1992) traffic noise prediction model. To determine the validity of the model, the measured noise levels have been compared to the predicted noise levels for the existing scenario. All surrounding buildings have been included in the modelling of the site.

Table 5: Inputs into the road traffic noise prediction model for the existing scenario

Parameter	Kingston Rd - Inbound	Kingston Rd - Outbound
18 hour road traffic volume	13,405 vehicles	13,495 vehicles
Traffic composition (%CV)	6.55	6.57
Traffic speed (km/h)	70	70
Road gradient (%)	<1%	<1%
Free field/façade corrected	Free Field	Free Field
Receiver height (m)	2.5m	2.5m
Road surface	DGA	DGA
Distance from road to receiver	9m	-

The road traffic noise prediction model generated an existing traffic noise level of 71.2 (free field). The measured noise level was 71.1dB. The prediction error is within the allowable tolerance of ± 2 dB.

5.4 Predicted Future Noise Exposure

Road traffic noise levels have been predicted for the 2028 scenario based on the traffic volumes presented in Table 4 and the parameters in Table 5. Noise level predictions are presented in Table 6. The modelling points are presented in Figure 7. Receiver heights are 1.8m above the FFL.

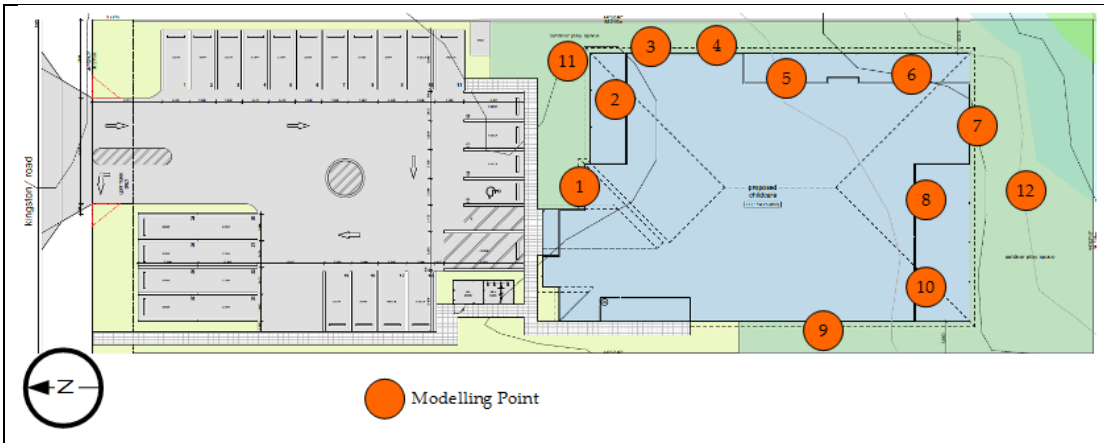

Figure 7: Acoustic Modelling points

The traffic noise impact levels for the most affected locations are presented in Table 6.

Table 6: Predicted future traffic noise levels

Location (Ref Figure 7)	Receptor height (m)	Predicted Noise Levels dB(A)			
		$L_{A10\ (18\ hour)}$	$L_{Aeq\ (day)}$	$L_{A10\ (1hour)}$	$L_{A10\ (12\ hour)}$
1 – Room1	1.8	62	63	65	63
2 – Room 2 N	1.8	62	63	65	63
3 – Room 2 E	1.8	60	61	63	61
4 – Room 2 sleep	1.8	59	60	62	60
5 – Room 3	1.8	57	59	61	59
6 – Room 4 E	1.8	57	59	60	59
7 – Room 4 S	1.8	53	54	56	54
8 – Room 5	1.8	53	54	56	54
9 – Room 6 W	1.8	58	59	61	59
10 – Room 6 S	1.8	53	54	56	54
11 – Outdoor Play area (front) (free field)	1.5	59	61	62	60
12 – Outdoor Play area (rear) (free field)	1.5	54	55	57	55

5.5 Comments

- The $L_{A10\ (1\ hour)}$ results indicate that the noise level at the building facades exceeds the Acceptable Outcome 25.1 limit.
- To meet Performance Outcome PO25, AO 25.2 to AO25.4 will apply to this child care Building.
    - AO25.2 the building is setback to the maximum possible distance from the road (behind the proposed car parks).
    - AO25.3 the building is designed so that the services are facing the road and most of the indoor education areas are located furthest from Kingston Road.
    - AO25.4 Building façades will be upgraded to meet the internal noise limit of less than 35dB(A) in the indoor education or play areas. These façade upgrades will be presented in 5.6, below.
- The $L_{A10\ (12\ hour)\ free\ field}$ results meet the criteria of AO26.1 for all outdoor play areas. Therefore no acoustic treatment will be required at the outdoor play areas.

5.6 Noise Attenuation Requirements

To determine the extent of the attenuation required to comply with the internal noise criteria, the Rw[13] value for a particular building component (e.g. windows) was calculated in accordance with Australian Standard AS3671 1989 *Road Traffic Noise Intrusion – Building Siting and Construction*.

At this stage of the development the building construction details have not yet been finalised. Window sizes have been scaled from current plans and it is anticipated that these may change. Should window sizes or room dimensions change, the acoustic performance ratings will require upgrading.

Table 7 recommends the minimum acoustic treatments for the noise affected units. For the affected units, windows and glass sliding doors need to be closed with tightly fitted seals.

Table 7: Recommended minimum acoustic treatments for noise affected units

Activity Room	Minimum Acoustic Performance Requirement	Suitable Glazing Systems (To be confirmed with supplier)
Room 1 all façade	Rw33	10.38 laminated glass in commercial frames
Room 2 North façade	Rw33	10.38 laminated glass in commercial frames
Room 2 East façade	Rw30	6.38 laminated glass in commercial frames
Room 2 sleep area	Rw24	Standard glass in standard frames
Room 3	Rw24	Standard glass in standard frames
Room 4 East façade	Rw25	6 mm glass in commercial frames
Room 4 South façade	Rw21	Standard glass in standard frames
Room 5	Rw21	Standard glass in standard frames
Room 6 West façade	Rw27	6 mm glass in commercial frames
Room 6 South façade	Rw23	Standard glass in standard frames

Note to Table 7:

- It is assumed that the building façade elements (excluding glazing and doors) will have isolation in excess of Rw43, with conventional masonry construction. For light weight construction use CSR external wall system CSR5080 or equivalent.

[13] Rw - *the weighted sound reduction index of a building element is a single number evaluation of its ability to attenuate sound. Rw takes into account the sound transmission loss in each band of a specified set of one-third octave bands. To determine the Rw rating of a building element tests should be conducted in accordance with AS1276 – 1999 Acoustics – Rating of Sound Insulation in Buildings of Building Elements Part 1 – Airborne Sound Insulation. For windows and doors Rw rates must take into account the acoustic isolation performance of the frame and not just consider the performance of a fixed piece of glass*

- The ratings specified are minimum levels to meet internal requirements. If a higher level of internal amenity is desired, consideration should be given to providing glazing systems that achieve greater acoustic isolation.
- To achieve the minimum acoustic ratings shown in Table 7 it is assumed that windows and doors are kept closed. Air conditioning or mechanical ventilation should be considered to meet the ventilation requirements of the Building Code of Australia.
- The glazing options specified in Table 7 should be used as a guide only. An assessment should be made once architectural details are finalised. The Rw ratings for a particular glazing component must comply with the relevant standards when testing under AS1276 – 1999 *Acoustics – Rating of Sound Insulation in Buildings of Building Elements Part 1 –* Airb*orne Sound Insulation*. Test certification from the glazing supplier is required to confirm these ratings.

6.0 EMISSION NOISE

The development site is located in within a low density residential zone under the LCC Planning Scheme 2015. Noise emanating from the site (playground noise and car parks) onto surrounding residences is subject to LCC emission standards Planning Scheme Policy 3 (PSP3), noise emission standard.

6.1 Council's Noise Limits

The site is within Logan City and subject to the Logan Planning Scheme 2015. The proposed development is within a low density residential zone - suburban.

Under the amenity criterion of the code General emissions are to comply with:

PO5 Development protects the intended amenity for the zone and precinct and an adjoining premise in a residential zone category by having regard to:

(a) noise emissions;

And Acceptable outcome:

AO5 Development complies with the following emissions standards of Planning Scheme Policy 3 – Environmental management (PSP 3):

(a) Table 3.2.1.1 – Noise emission standards for the protection of residential amenity where adjoining a residential zone category – see Table 8, below;
(b) Table 3.2.1.2 - Noise emission standards for the protection of general amenity – see Table 9, below;
The tables have been edited to indicate the allowable emission levels based on the environmental factors from Table 1.

Table 8: Noise emission standards for the protection of residential amenity

Noise level at the boundary of premises			
Noise Type	**Time Period**	**Noise emission level**	**Derived Noise Limit $L_{Aeq,\,adj,T}$ dB(A)**
Non-steady sound	Day - 7am-6pm	$L_{Aeq,adj,T} \leq L_{A90}$ plus 5dB(A)	54+5 = **59**
	Evening - 6pm-10pm	$L_{Aeq,adj,T} \leq L_{A90}$ plus 5dB(A)	49+5 = 54
	Night - 10pm-7am	$L_{Aeq,adj,T} \leq L_{A90}$ plus 0dB(A) and $L_{Amax} \leq$ 60dB(A)	36+0 = **36**
Continuous noise	Anytime	$L_{A90,T}$ plus 0dB(A)	Day – 54dB(A); Evening – 49dB(A); and Night – 36dB(A)

Table 9: Noise emission standards for the protection of general amenity

Noise level at the boundary of premises				
Noise Type	**Time Period**	**Monday to Saturday**	**Sunday and public holiday**	**Derived Noise Limit $L_{Aeq,\,adj,T}$ dB(A)**
Non-steady sound	Day 7am-6pm	$L_{Aeq,adj,T} \leq L_{A90}$ plus 10dB(A)	$L_{Aeq,adj,T} \leq L_{A90}$ plus 5dB(A)	54+5 = **59**
	Evening 6pm-10pm	$L_{Aeq,adj,T} \leq L_{A90}$ plus 10dB(A)	$L_{Aeq,adj,T} \leq L_{A90}$ plus 5dB(A)	49+5 = 54
	Night 10pm-7am	$L_{Aeq,adj,T} \leq L_{A90}$ plus 5dB(A) and $L_{Amax} \leq$ 80dB(A)	$L_{Aeq,adj,T} \leq L_{A90}$ plus 5dB(A) and $L_{Amax} \leq$ 80dB(A)	36+5 = 41
Continuous noise	Anytime	$L_{A90,T}$ plus 5dB(A)	$L_{A90,T}$ plus 5dB(A)	Day – 59dB(A); Evening – 54dB(A); and Night – 41dB(A)

6.2 Playground Noise Assessment

(i) Noise source

The Association of Australian Acoustical Consultants (AAAC) provide guidelines in their publication, Guideline for Child Care Centre Acoustic Assessment, concerning noise from outdoor play areas.

The guideline noise levels are presented in Table 10, below.

Table 10: Sound Power Levels for groups of 10 children playing

Children's age range	Sound power level
10 Children aged 0 to 2 years	77 to 80 dB(A)
10 Children aged 2 to 3 years	83 to 87 dB(A)
10 Children aged 3 to 6 years	84 to 90 dB(A)

(ii) Noise sensitive location

The distance from the eastern residence to the centre of the playground 1 is approximately 15m and from the south western aged care residences it is 35m to the centre of the playground 2. Refer to Figure 8.

Figure 8: Playground locations

(iii) Playground noise calculations

From Table 8 above, the limit for the noise emissions under amenity criteria is 59 dB(A) $L_{Aeq,adj,T.}$ during daytime: 7am to 6pm.

The noise emissions from the play spaces have been calculated and are presented in Table 11. The calculations do not include the screening effect of the 1.8m high acoustic privacy fences (along eastern boundary of playground 1) that can be expected to have an attenuation of up to 8 dB.

Table 11: Playground Noise Calculation

Play area @ source level - SWL	Distance	Directivity	Shielding	No. Children	Impact
Centre of playground 1 @ 84 - 90	15	0	0	40	59 – 65 dB(A)
Centre of playground 2 @ 84 - 90	35	0	0	40	51 – 57 dB(A)

Discussion

From Table 11, playground 2 complies with LCC noise limit during day time and emissions from playground 1 exceed the emission limits by 6dB. A 1.8m high acoustic fence (with surface mass of min 10kg/m²) is required along the eastern side of the playground 1. (Refer to Figure 9) While numbers of children may exceed the above numbers the combination of the fence barrier and the range of noise source levels will ensure that noise emissions remain below the emission limits. The hours of use of the playground are from 7pm to 6pm; the children will need to be indoors before 7am and after 6pm.

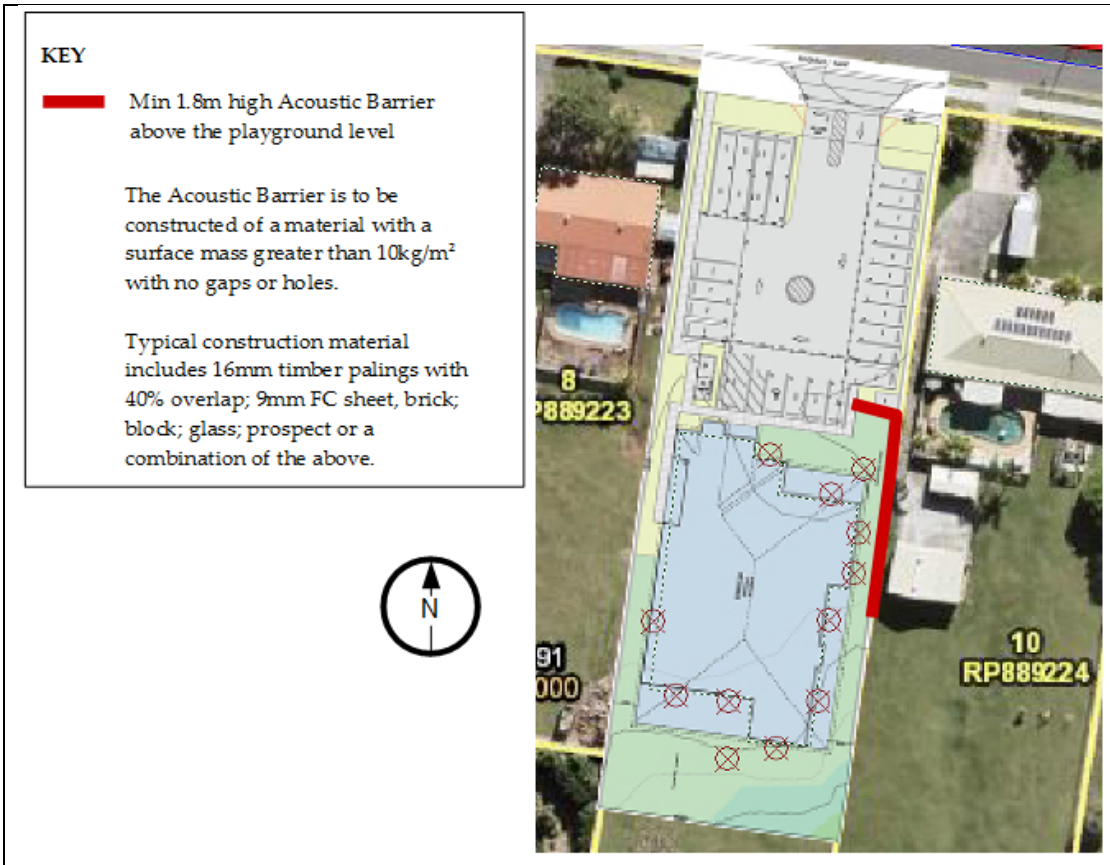

Figure 9: Proposed acoustic barrier location for Playground 1

6.3 Driveway Noise Assessment

The following section addresses the noise impact from the proposed driveway noise onto the adjacent residences.

(i) Noise source levels

Measurements of typical vehicle manoeuvring noise have been conducted by this office and presented in Table 12.

Table 12: Typical maximum measured noise levels from vehicle manoeuvres

Source – individual event	Noise Level at 10m	
	L_{Amax}	L_{Aeq}
Car start and pass by	61 dB(A)	50dB(A)
Car door slam	64 dB(A)	52dB(A)

(ii) Driveway Noise Calculations

From Table 8 above, the limit for the noise emissions under amenity criteria is 59 dB(A) $L_{Aeq,adj,T.}$ during the day, 7am to 6pm.

From the on-site logging, the average background noise level, $L_{A90,}$ between 6am and 7am is 56dB. The derived noise limit between 6am and 7am is 56dB(A).

The distance from the middle of the driveway to eastern residence is approx. 13m and to western residence is approx. 14m. The distance from middle car park spaces to the eastern residences is approx. 4m and to western residence is approx. 5m.

Table 13 and Table 14 present the predicted noise impacts from the proposed driveway and car parks. The presented calculation is based on distance attenuation of 6 dB per doubling of distance attenuation and 1.8m high acoustic fences along the eastern and western property boundary.

Table 13: Predicted car park and driveway noise impacts to Eastern residence

Source	L_{Aeq} Noise Level @ 10m	Distance Attenuation	Barrier Attenuation	Noise Level dB(A) at Nearby Residences	Complies With Noise Limit 56dB at 6am
Car start and pass by	50dB	-2 dB	-8dB	40dB	Yes
Car door slam	52dB	8dB	-8dB	52dB	Yes

Table 14: Predicted car park and driveway noise impacts to Western residence

Source	L_{Aeq} Noise Level @ 10m	Distance Attenuation	Barrier Attenuation	Noise Level dB(A) at Nearby Residences	Complies With Noise Limit 56dB at 6am
Car start and pass by	50dB	-4 dB	-8dB	38dB	Yes
Car door slam	52dB	6dB	-8dB	50dB	Yes

Table 13 and Table 14 indicate that the predicted driveway and car parking noise complies with Council's day and 6am- 7 am time limits with 1.8m high acoustic fences.

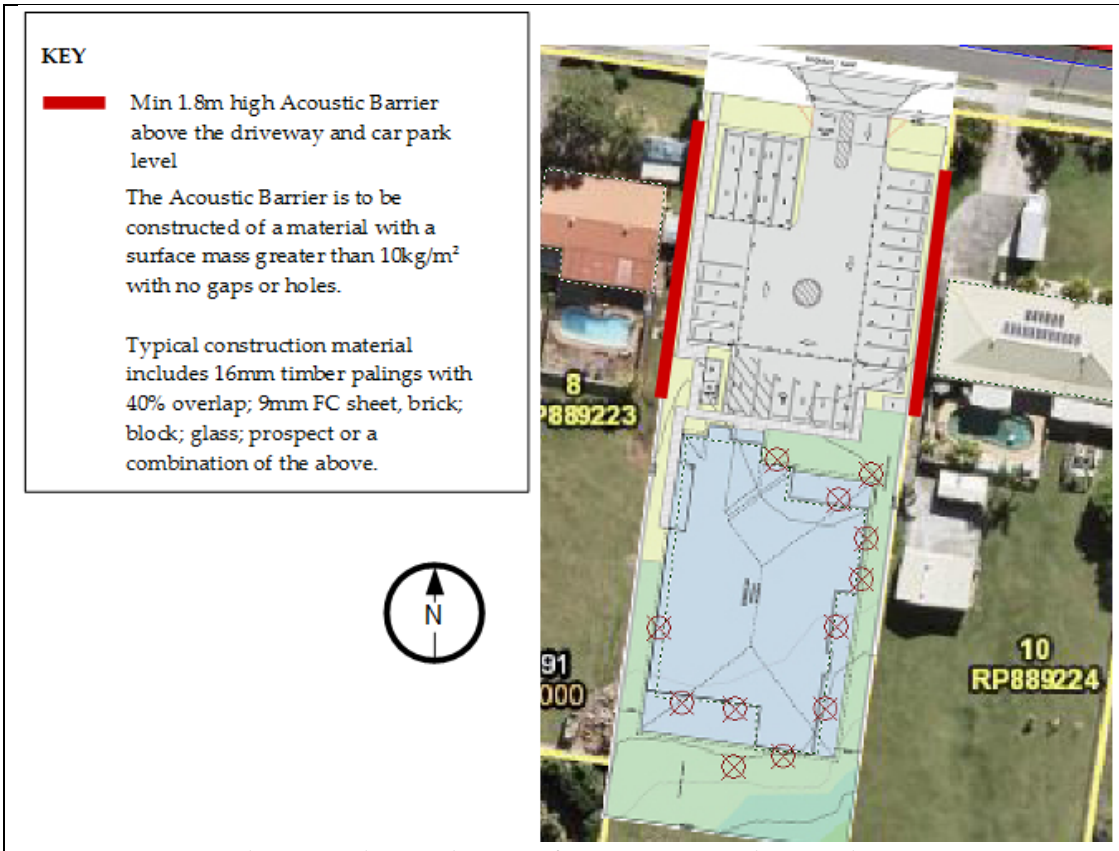

Figure 10: Proposed acoustic barrier location for Driveway and car parking

7.0 MECHANICAL PLANT EMISSION NOISE

Designs for mechanical services have not yet been completed and plant selections and locations are unknown. Therefore, we are only able to recommend design limits for the control of mechanical plant noise emissions at the nearest noise sensitive receptor.

7.1 Noise Emission Criteria

The Logan City Council requires that noise emissions for mechanical plant be limited to 54 dB(A) L_{Aeq} for the preservation of residential amenity. When plant is selected emissions will be required to be kept below this limit.

7.2 Assessment

To comply with these limits, there are a number of engineering solutions available. Low noise levels are achieved by the engineered selection and application of:

- Low sound power level equipment
- Silencers
- Acoustic enclosures
- Noise barriers
- Vibration isolation systems

The application of such principles and treatments, along with providing maximum separation distances between noise sources and sensitive areas will ensure that noise from plant and equipment complies with limits.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results presented, the following conclusions can be drawn:

- The proposed child care facility is required to comply with emission limits of the Logan City Council and the SDAP.
- The layout and placement of the facility on the site allows internal noise levels to be maintained with upgraded glazing, refer to Table 7;
- Noise emissions from children at play will comply with the LCC emission limits.
- Noise emissions from vehicles utilising the car parking space will comply with the 6am – 7am LCC emission limits;
- Noise emissions from mechanical plant will be required to be maintained below 54 dB(A) at the nearest residential façade.

To ensure compliance with the requirements of LCC for the control of traffic noise intrusion and noise emission from child care centre, the following is recommended:

- The Rw ratings and building treatments presented in Table 7 be incorporated into the design of the child care centre.
- Install a 1.8m high acoustic barrier on the eastern side of the playground 1 (refer to Figure 9).
- Install a 1.8m high acoustic barrier on the eastern and western side of the car park (refer to Figure 10).

Subject to the recommended acoustic treatments, it is the opinion of Palmer Acoustics (Australia) Pty Ltd that the proposed development will comply with the requirements of LCC's Planning Scheme 2015.

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