RODNEY STEVENS ACOUSTICS
Acoustic Consultants

REPORT R190617R2

Revision 0

Noise Impact Assessment
Proposed Child Care Centre
19 Todd Row, St Clair NSW

PREPARED FOR:
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Noise Impact Assessment

Proposed Child Care Centre

19 Todd Row, St Clair NSW

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1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (here forth referred to as RSA) has been engaged by Baini Design to prepare a noise impact assessment report for the proposed child care centre to be located at 19 Todd Row, St Clair.

This report details the results of a noise survey and assesses the likely impact of noise (principally from traffic noise) incident upon the proposed child care centre as well as noise from the proposed child care centre upon nearby residential premises.

Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in Appendix A.

2 PROPOSED DEVELOPMENT

2.1 Development Site

The proposed child care centre is to be located at 19 Todd Row, St Clair. The development site is bounded by residential dwellings to the south, east and west and Holy Spirit Parish and Primary School to the north.

The development site and its surrounding environment are mainly influenced by distant traffic. Figure 2-1 shows an aerial image of the site area and the surrounding environment.

Figure 2-1 Site Location

Image Courtesy of Near Map © 2019.

The following figure presents the proposed child care centre layout:

Figure 2-2 Proposed Child Care Centre Layout – Ground Floor

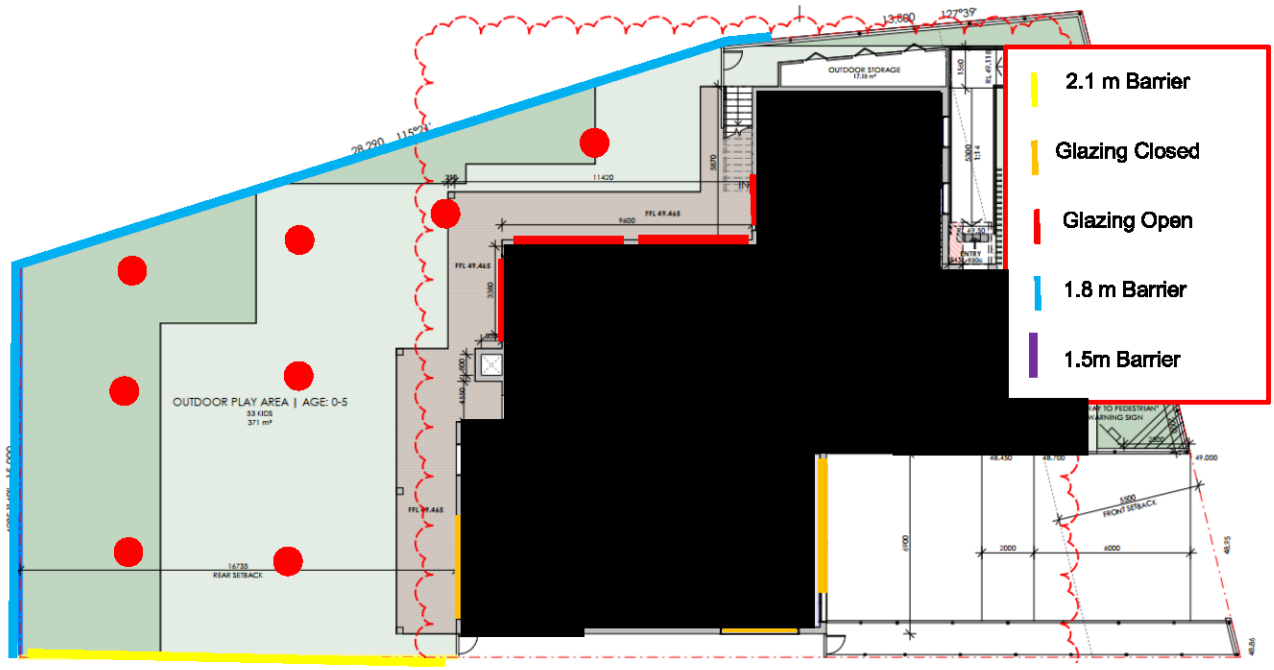
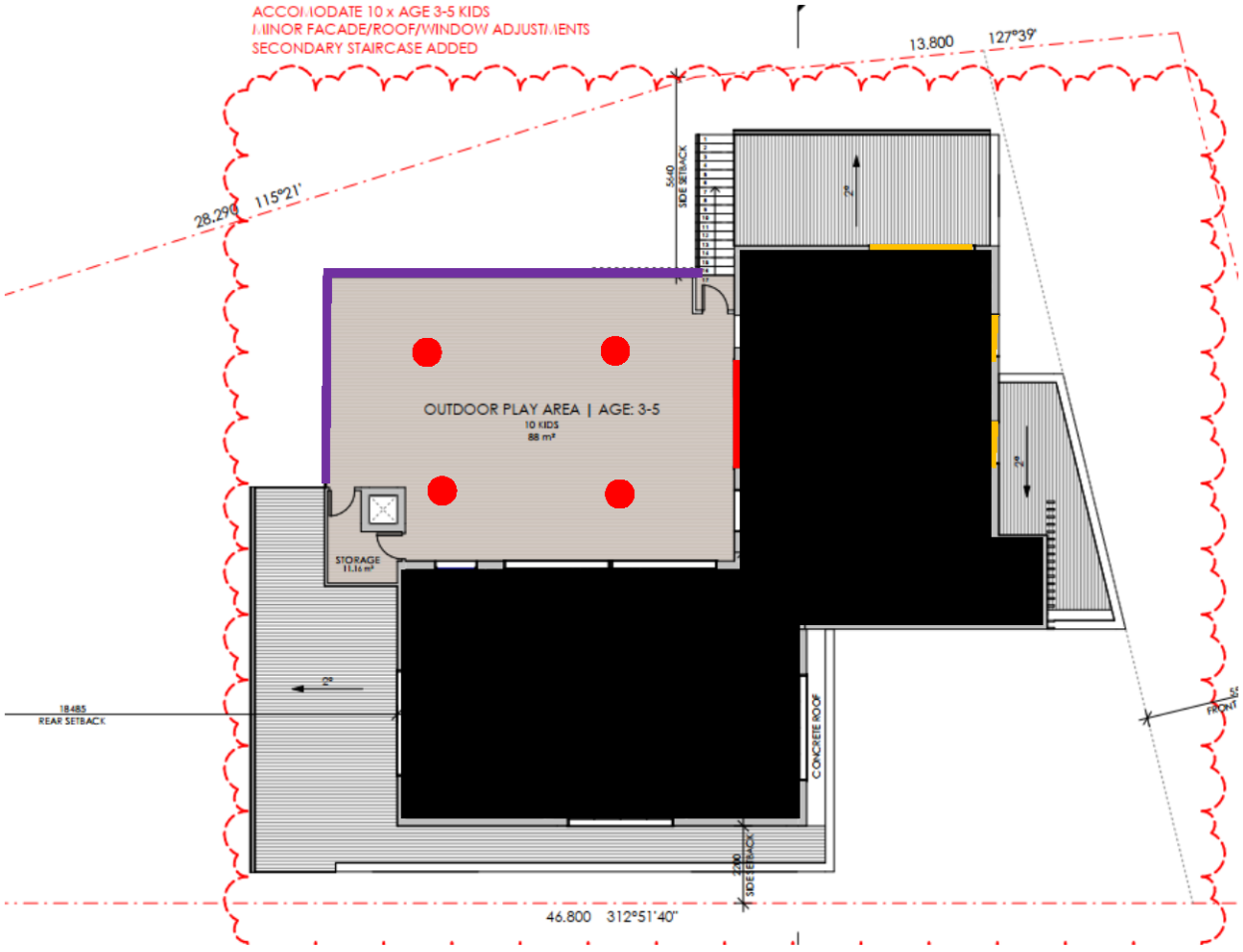


Figure 2-3 Propose Child Care Centre Layout – First Floor



The Development

The proposal is to construct a double storey childcare centre. The building will have 1 outdoor play area as well as a basement carpark.

2.2 Hours of Operation

The following hours of operation are proposed:

- Monday to Friday 7:00 am until 6:00 pm

2.3 Enrolment Numbers

The proposed child care centre plans to cater for up to 63 children between the ages of 0 and 5 years of age. The number of children and their age groups are as follows:

- 0-2 years old - 8 Children
- 2-3 years old - 15 Children
- 3-5 years old - 40 Children

2.4 Outdoor Play Activities

In RSA's experience with child care centres, potential noise issues occur primarily when children are engaged in outdoor play activities, in terms of intrusive environmental noise to the play areas and play area noise to nearby sensitive receivers.

3 BASELINE NOISE SURVEY

3.1 Unattended Noise Monitoring

In order to characterise the existing acoustical environment of the area unattended noise monitoring was conducted between the dates of 6th February and 13th February 2020 at the logging locations shown in Figure 2-1

A noise logger was located on the western façade of the proposed site and monitored the ambient noise of the area, this logger provides the baseline background noise environs of the surrounding residential areas adjacent to the project site. A second logger was set up on Todd Row and monitored traffic noise levels and the potential noise impact from the road to the proposed development.

Logger locations were selected with consideration to other noise sources which may influence readings, security issues for noise monitoring equipment and gaining permission for access from residents and landowners.

Instrumentation for the survey comprised of 2 RION NL-42 environmental noise loggers (serial numbers 710677 & 572559) fitted with microphone windshields. Calibration of the logger was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Measured data has been filtered to remove data measured during adverse weather conditions upon consultation with historical weather reports provided by the Bureau of Meteorology (BOM). As per the weather stations from BOM closer to the site, there was rain throughout the monitoring period. Excessive rain was recorded on 10th February with 112mm of rain fall. Due to the excessive weather, the noise logger for ambient measurements shut down on 11th February. Drift calibration checks on the equipment did not exceed ±0.5 dB(A).

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10}, L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary for definitions in Appendix A).

Detailed results at the monitoring location are presented in graphical format in Appendix B. The graphs show measured values of L_{A1}, L_{A10}, L_{A90} and L_{Aeq} for each 15-minute monitoring period

3.2 Data Processing

3.2.1 Noise Emission (*Noise Policy for Industry*)

In order to assess noise emission from the proposed child care centre, the data obtained from the noise logger has been processed in accordance with the procedures contained in the NSW Environmental Protection Authority's (EPA) *Noise Policy for Industry* (NPfI, 2017) to establish representative noise levels that can be expected in the residential vicinity of the site. The monitored baseline noise levels are detailed in Table 3-1.

Table 3-1 Measured Baseline Noise Levels Corresponding to Defined NPfI Periods

Location	Measurement Descriptor	Measured Noise Level – dB(A) re 20 µPa		
		Daytime 7 am - 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm – 7 am
Logger on western boundary (Rear of site)	L_{Aeq}	55	59	49
	RBL (Background)	38	40	34

L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

L_{A90} Noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

3.2.2 Noise Intrusion (*Road Noise Policy*)

To assess noise intrusion into the outdoor play areas and internal areas of the child care centre, the data obtained from the logger location has been processed to establish representative ambient noise levels from Todd Row.

The time periods used for this assessment are as defined in the EPA's *Road Noise Policy* (RNP, 2011). Results are presented below in Table 3-2.

Table 3-2 Ambient Noise Levels Corresponding to Defined RNP Periods

Location	Period	External Noise Levels dB(A)
28 Todd Row	Day Time 7:00 am - 10:00 pm	$L_{Aeq(1hour)}$ 60 dB
28 Todd Row	24 Hour	$L_{Aeq(24hour)}$ 62 dB

4 NOISE GUIDELINES AND CRITERIA

4.1 Penrith Council DCP 2014 Criteria

Penrith Council has specific acoustic requirements for child care centers in the DCP 2014 Visual and Acoustic Privacy. The relevant excerpts are as follow:

6) Noise

a) Outside playing areas shall be designed and located to minimise noise impact on any noise sensitive adjacent properties. Separation between boundary fencing and areas occupied by the children may be required.

b) Where there may be noise impact on adjacent properties, fencing shall be of a height, design and material (e.g. masonry) suitable to contain noise generated by the children's activities. This ensures the children may play outside without time limitations in accordance with licensing requirements.

c) Where a site may be affected by traffic, rail or aircraft noise, the child care centre shall be designed to minimise any impact on the children and staff. A report from an acoustic consultant may be required to support the proposal. (Design elements may include double glazing, insulated walls, locating sleeping rooms in protected areas and solid fencing).

d) A noise impact assessment may be required for the development of a child care centre proposing to cater for 40 children or more, or where surrounding land uses may have an impact on the proposal.

The objectives should be to limit the impact of the child care centre on adjacent properties, and also to limit the impact noise from external sources may have on the child care centre. While noise can be measured, the intent is to also minimise nuisance which is subjective by nature. This may be achieved either by physical separation, design and layout of the centre or by implementing noise mitigation measures, such as acoustic treatments to buildings.

e) A noise impact assessment report should address the relevant provisions of the Noise and Vibration section of this Plan.

4.2 Operational Noise From Child Care Centre

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the EPA. The EPA oversees the Noise Policy for Industry (NPfI) October 2017 which provides a framework and process for deriving project trigger noise level. The NPfI project noise levels for industrial noise sources have two (2) components:

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

4.2.1 Intrusiveness Noise Levels

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness noise level essentially means that the equivalent continuous noise level (LAeq) of the source should not be more than 5 dB(A) above the measured Rated Background Level (RBL), over any 15 minute period.

4.2.2 Amenity Noise Levels

The amenity noise level is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The noise levels relate only to other industrial-type noise sources and do not include road, rail or community noise. The existing noise level from industry is measured.

If it approaches the project trigger noise level value, then noise levels from new industrial-type noise sources, (including air-conditioning mechanical plant) need to be designed so that the cumulative effect does not produce total noise levels that would significantly exceed the project trigger noise level.

4.2.3 Area Classification

The NPfI characterises the "Suburban" noise environment as an area with an acoustical environment that:

- has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry.

- This area often has the following characteristic: - evening ambient noise levels defined by the natural environment and human activity

The area surrounding the proposed development falls under the “Suburban” area classification.

4.2.4 Project Specific Trigger Noise Levels

Having defined the area type, the processed results of the attended noise monitoring have been used to determine project specific project trigger noise level. The intrusive and amenity project trigger noise level for nearby residential premises are presented in Table 4-1. These project trigger noise levels are nominated for the purpose of assessing potential noise impacts from the proposed development.

In this case, the ambient noise environment is not controlled by industrial noise sources and therefore the project amenity noise level are assigned as per Table 2.2 of the NPfI (Recommended Amenity Noise Levels). For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive project trigger noise level are adopted. These are shown in bold text in Table 4-1.

Table 4-1 Operational Project Trigger Noise Levels

Receiver	Time of Day	ANL [1] $L_{Aeq(15min)}$	Measured		Project Trigger Noise Levels	
			RBL [2] $L_{A90(15min)}$	Existing $L_{Aeq(Period)}$	Intrusive $L_{Aeq(15min)}$	Amenity $L_{Aeq(15min)}$
Residential	Day	55	38	55	**43**	58
	Evening	45	40	59	**45**	48
	Night	40	34	49	**39**	43

Note 1: ANL = “Amenity Noise Level” for residences in Suburban Areas.

Note 2: RBL = “Rating Background Level”.

4.2.5 Noise Emissions from Children Play Activities

A guideline for the assessment of noise from childcare centres has been prepared by the Association of Australian Acoustical Consultants (AAAC) as a result of a NSW Australian Acoustical Society (AAS) Technical Meeting held in September 2007 on Child Care Noise. The document, *AAAC Technical Guideline Child Care Centre Noise Assessment*, 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.

Since the time in which children are involved in outdoor play can be limited, the potential impact associated with these noise emissions reduces. The AAAC considers a total limit of 2 hours outdoor play per day (typically 1 hour in the morning and 1 hour in the afternoon) reasonable to apply a criterion of $L_{Aeq(15minute)}$ noise level emitted from the outdoor play area not exceed the background noise level by more than 10 dB at the assessment location. A “background + 10 dB(A)” criterion has also been applied in other local government areas within the Sydney metropolitan area. However, if the proposed outdoor play time is more than 2 hours per day, the $L_{Aeq(15minute)}$ noise level emitted from the outdoor play area not exceed the background noise level by more than 5 dB at the assessment location.

We have assumed that the proposed childcare center will operate for more than 2 hours of outdoor play time per day, therefore, the noise criterion for noise emissions from outdoor activities to all surrounding residential receivers is (daytime L_{A90} 38 dB(A) + 5 dB(A) **$L_{Aeq(15minute)}$ 43 dB(A)**. This is based on a measured background noise level of $L_{A90(15minute)}$ 38 dB(A).

4.2.6 Road Noise Intrusion to Outdoor Playground

Noise levels within outdoor play areas are not covered by the Penrith Council's DCP 2013. For the assessment of road traffic noise impact on the outdoor play areas, the NSW EPA's *Road Noise Policy* (RNP) has been used to determine the appropriate noise level. In accordance with the RNP, the noise criterion for outdoor play areas is as follow:

- Outdoor play areas – $L_{Aeq,(1hour)}$ 55 dB(A) (external).

4.2.7 Noise Intrusion to Indoor Areas

Penrith Council's DCP 2013 requires the internal area noise levels to not exceed the $L_{Aeq,(24hour)}$ 40 dB(A) (internal).

5 NOISE IMPACT ASSESSMENT

5.1 Road Traffic Noise Intrusion into Centre

The proposed child care centre is located in a suburban area, the proposed site is located near local roads with traffic flows traffic noise might have an impact on the proposed child care centre. With the provision of 6.38mm laminate glass on aluminum acoustically sealed frame will enable centre to meet internal noise levels.

5.2 Mechanical Plant Noise Assessment

Mechanical ventilation may be installed at the proposed childcare centre, the operation of such mechanical plant must be in accordance with the relevant regulations such as the Building Code of Australia (BCA Vol.1, Part 4.5 *Ventilation of rooms*) and AS1668.2-2002 *The use of ventilation and air conditioning in buildings* will be required.

A specific mechanical plant selection has not been supplied at this stage. It is anticipated that the building will be serviced by typical mechanical ventilation/air conditioning equipment.

It is likely that the criteria set out in Table 4-1 may be met through the use of conventional noise control methods (e.g. selection of equipment on the basis of quiet operation and, where necessary, providing enclosures, localised barriers, silencers and lined ductwork).

An appropriately qualified acoustic consultant should review the mechanical plant associated with the development at the detailed design stage when final plant selections have been made.

5.3 Operational Noise Emissions to Nearby Residences

5.3.1 Outdoor Play Activities Noise Impact

Potential noise management issues occur primarily when children are engaged in outdoor play activities. Noise generated by the children in the outdoor play area will occur at limited times throughout the day, with numbers of children playing and periods of play managed by the Centre staff.

The Association of Australian Acoustical Consultants (AAAC) provides a technical guideline for Child Care Centre Noise Assessment. Within this guideline it stipulates the following assumed sound power levels (Lw) for various age groups of children:

- 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 5 years: 84 to 90 dB(A)

Spectra for energy-average noise levels (L_{Aeq}) have been measured by RSA of children at play at a similar facility, given below in Table 5-1**.** The measured spectra have been scaled based upon the overall sound

power levels offered by the AAAC and the number of children expected to be in the outdoor play area at any given time.

Table 5-1 Outdoor Free Play Activities Noise Spectrum Measured in a Typical Child Care Centre

Noise Descriptor	Noise Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1 k	2 k	4 k	8 k	Overall dB(A)
Leq	61	58	53	54	57	56	48	41	61

Calculations have been made based on the spectra above assuming 2 operational scenarios The noise levels were scaled to reflect the overall power levels presented by the AAAC to determine the likely noise levels at nearby receivers due to 53 children playing in the Outdoor Play areas of the proposed child care centre.

The following assumptions have been made in the noise modelling of the Outdoor Play areas noise impacts on the neighbouring residences:

- 8 children between the ages of 0 and 2 with total sound power level of 79 dB(A), 15 children between the ages of 2 and 3 with total sound power level of 89 dB(A) will be playing in the proposed outdoor play area. 20 children between the ages of 3 and 5 with total sound power level of 94 dB(A) will be playing in the proposed outdoor play area
- The height of the residential receivers has been assumed to be 1.5 metres for residential buildings on their respective level;
- Source height in the outdoor play area, i.e. children height, have been taken to be 0.5 meters for children between the ages of 0 and 3, and heights of 0.7 metre for children between the ages of 3 and 5;
- The proposed 1.5m, 1.8m and 2.1m high solid barrier (Refer to Figure 2-2) along the boundaries of the outdoor play areas have been taken into account in the noise model;
- 50% of 3-5 year old in the outdoor play area
- 3 children on the climbing mounds at any one time
- Resulting noise levels have been calculated to the most affected point on the boundary of the affected receivers

The following figure shows the receiver locations in relation to the proposed child care centre.

Figure 5-1 Receiver Locations

The predicted noise levels experienced by nearest residential receivers are presented in Table 5-2 below. Noise levels have been calculated at the most affected boundary heights. The noise levels presented below are representative of the above scenario for receiver.

Table 5-2 Predicted Outdoor Play Activities Noise Emission

Receiver	Predicted Outdoor Play Activities Noise at Neighbouring Residents – dB(A)	Criteria	Compliance
R1	43	43	Yes
R2	43	43	Yes
R3	40	43	Yes
R4	34	43	Yes

Noise from the outdoor play activities at the surrounding residences is predicted to comply with the 43 dB(A) criterion with scenario presented above.

Based on the above assessment of the outdoor play activities noise emissions, 2.1 meters high solid barriers must be implemented along the boundaries marked in Figure 2-2. (Please refer to Figure 2-2 for further details)

5.3.2 Noise Emissions from Indoor Activities

Calculations have been carried out to ascertain the noise breakout from indoor activities to the neighbouring premises. The predicted noise levels indicate that the noise criteria will not be exceeded if the windows are in the configuration shown in Figure 2-2, the resulting noise levels are presented in Table 5-3 below. Noise levels have been calculated at the most affected boundary heights.

Table 5-3 Predicted Indoor Play Activities Noise Emission

Receiver	Predicted Indoor Play Activities Noise at Neighbouring Residents – dB(A)	Criteria	Compliance
R1	32	43	Yes
R2	32	43	Yes
R3	30	43	Yes
R4	21	43	Yes

The assessment criterion for indoor play of 41 dB(A) can be achieved with the windows in the configuration shown in Figure 2-2.

Noise emissions from indoor activities will meet recommended design limits at the neighbouring residential receivers with the internal layout proposed.

5.3.3 Carpark Emission

The proposed basement car park will have capacity for 6 employee and 8 visitor car spaces, calculations of noise from the carpark have been based on typical noise generating events within a carpark such as, door slams, engine starts and cars driving away. We have assumed a scenario were 15 cars enter or leave the carpark in a span of 15 minutes.

The calculated noise levels from the activities carried out within the carpark are presented in the table below:

Table 5-4 Calculated Carpark Noise Levels

Receiver	Predicted Carpark Activities Noise at Neighbouring Residents – dB(A)	Criteria	Compliance
R1	40	43	Yes
R2	37	43	Yes
R3	35	43	Yes
R4	42	43	Yes

* We note that an exceedance of 1 dB(A) is generally regarded as being acoustically insignificant

The calculation for the operation of the carpark complies with the established noise criteria for 43 dB. No further noise control measures are required.

6 RECOMMENDATIONS

The following recommendations must be implemented in order to achieve compliance with the criteria requirements from Penrith Council

6.1 Outdoor Play Areas

In order to achieve compliance with council's noise requirements for outdoor play, the following must be implemented:

- Only 50% of 3-5 year olds in the outdoor area at any one time
- No music is to be played in the outdoor areas
- Playground equipment that allows a child to be more than 0.5 above the ground level should not be used
- Children must be supervised at all times

6.2 Indoor Play Areas

In order to achieve compliance with council's noise requirements for outdoor play, the following must be implemented:

- The windows must follow the configuration shown in Figure 2-2
- Windows facing Todd Row to be upgraded to 6.38mm laminated on aluminium frames and acoustically sealed.

6.3 Acoustic Barrier Details

A 2.1, 1.8m and 1.5m high solid barriers must be implemented (Refer to Figure 2-2)

Acoustic barrier is required to provide the adequate noise attenuation, the construction material of the barriers must have a surface density of 10-15 kg/m^2 and be free from holes and gaps. Some suitable materials include:

- 25 mm thick plywood timber panelling
- 9 mm thick fibre cement sheet
- 75mm thick Hebel Powerpanel
- Any other approved material which meets the above surface density specification

A typical material used in childcare centres is Perspex, which is a polycarbonate material. The use of the 12 mm thick Perspex or 6 mm glass for this purpose which has a surface mass of 11 kg/m^2 will meet the mass requirements detailed above and be suitable for use as it is transparent and will not unduly restrict light or vision.

All barriers must be free of gaps and penetrations and it is particularly important to ensure that the gap at the bottom of the barrier is minimised as far as practicable. The base of the barriers should be well sealed at the junction where the barrier meets the floor, but still be designed to allow proper water drainage.

7 CONSTRUCTION NOISE & VIBRATION MANAGEMENT

7.1 Proposed Construction Works

All construction works required to complete the proposed development will be undertaken during standard daytime construction hours of 7:00 am – 5:00 pm Monday to Friday and 8:00 am – 5:00 pm Saturday only. Works outside of the standard daytime construction hours will only be undertaken with prior assessment and required approvals.

The construction program is to include the following key work stages and potential noise and ground vibration generating activity:

- Demolition of the parts of the existing building located at the project site;
- Excavation of some of the bedrock adjacent to the residence;
- Construction of the new parts of the residential building including foundation works, concreting and infrastructure installation of framework, walls, roof and electrical fit out;

The construction phases will include some limited site clearance, foundation preparation and infrastructure installation. It is our understanding that the construction programme is proposed to be more than 3 weeks in duration.

7.2 Construction Noise and Vibration Criteria

7.2.1 Construction Noise

Noise criteria for construction works are established in accordance with the EPA *Interim Construction Noise Guidelines* (ICNG).

All construction works are to be undertaken during daytime core hours of 7:00 am – 5:00 pm Monday to Friday and 8:00 am – 5:00 pm Saturday. No construction works are anticipated to be required outside of the standard daytime standard construction hours unless otherwise approved.

The ICNG provides recommended construction (airborne) noise management levels for residential receivers as detailed in Table 7-1.

Site specific noise management levels (NML) have been established adopting the background noise levels (L_{A90}) measured within the project site.

The noise management levels are design as a trigger for the project to investigate feasible and reasonable noise management and mitigation measures to reduce noise impacts at nearest noise affected receivers.

Table 7-1 Recommended Residential Construction Noise Criteria

Time of construction	Noise Management level $L_{Aeq,\ 15min}$	Adopted noise NML $L_{Aeq,\ 15min}$ at neighbouring residences
Standard construction hours Monday to Friday 7 am – 5 pm Saturday 8 am - 5 pm No work on Sundays or public holidays	Noise affected receivers RBL + 10 dB(A)	48 dB(A)

Note: RBL rating background level, the measured L_{A90} noise level.

As construction works for the proposed development will only be carried out during the daytime period a standard daytime construction noise management level for the neighbouring residential receivers of $L_{Aeq,\ 15min}$ 48 dB(A) has been adopted in accordance with the ICNG. NMLs for the evening and night periods are not applicable to this assessment.

There are no noise sensitive receivers such as places of worship that have been identified within the study area. However, there is a school in the immediate vicinity of the development.

A $L_{Aeq,15min}$ 75 dB(A) highly noise affected construction noise management level will be applied as a trigger for the application of additional construction noise controls such as respite periods or restriction of construction hours of operation. This trigger would apply to noise impacts on residential receivers only.

The recommended noise management levels are planning goals only. Factors such as the social benefits of the activity, economic constraints, and the nature and duration of the proposed construction program need to be considered when assessing potential noise impacts from construction works.

7.2.2 Construction Vibration

Vibration during construction works is considered an intermittent source associated with two main types of impact; disturbance at receivers and potential architectural/structural damage to buildings.

Generally, if disturbance issues are controlled, there is limited potential for structural damage to buildings.

Council recommends the criteria outlined in EPA *Interim Construction Noise Guidelines* be adopted for the construction of the proposed development.

Detailed in Table 7-2, the ICNG guidance adopts the *Environmental Noise Management Assessing Vibration: a technical guideline* (2006) for the assessment of human annoyance due to construction vibration. German Standard DIN 4150: Part 3-1999, provides guidelines for evaluating the effects of vibration on structures.

Dependent upon the dominant frequency of vibration, assessed in Hertz (Hz), structural vibration limits are established at the foundation of nearest buildings.

Table 7-2 Adopted Vibration Constriction Criteria

Receiver	Annoyance VDV criteria, $m/s^{1.75}$		Structural PPV criteria, mm/s
	Preferred	Maximum	
Residential	0.2	0.4	0.28 – 0.56
Critical working areas (hospital operating theatres)	0.1	0.2	0.14 – 0.28

Notes: structural vibration goals established for < 10 – 100 Hz dominant frequency of vibration. VDV = vibration dose value; PPV = peak particle velocity

7.3 Construction Noise & Vibration Management Plan

7.3.1 Construction Noise

The basis for the project-specific construction airborne noise goals for approved daytime hours is shown in Table 7-1.

Where the noise goals shown in Table 7-1 cannot be achieved, the construction contractor will use all reasonable and feasible noise mitigation and management measures to reduce noise generation and impacts.

7.3.2 Construction Vibration

The construction contractor will, if required, ensure compliance with the criteria of Table 7-2. It is anticipated that there will be minimal Construction Vibration within this development.

7.3.3 Typical Plant & Equipment Sound Pressure Levels

Sound pressure levels for typical items of plant are listed in Table 7-3. These noise levels are representative of modern plant operating with noise control measures in good condition.

Table 7-3 Noise Levels of Typical Construction Plant & Equipment

Item	Typical Plant Type	Typical L_{Aeq} Noise Level at 15 metres – dB(A)
Excavator	5 to 8 tonne	75
Bob Cat		71
Tip trucker		72
Hand Tools:- saws, nail gun, drills, hammers,		70
Concrete pump		75
Cement mixer		75
Crane		70
Kango		75

7.4 Noise & Vibration Mitigation Measures

7.4.1 Noise Control

The following noise mitigation measures will, if required, be implemented. The construction contractor will, where reasonable and feasible, apply best practice noise mitigation measures including:

- Maximising the offset distance between noisy plant items and nearby noise sensitive receivers.
- Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers.
- Minimising consecutive works in the same locality.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

In order to minimise noise impacts during the works, the construction contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

Silenced air compressors, fitted with noise labels indicating a maximum (L_{Amax}) sound pressure level of not more than 75 dB(A) at 7 m will be used on site. The sound pressure level of noise emitted from a compressor used will comply with noise label requirements.

7.4.2 Vibration Control

The following vibration mitigation measures will be implemented by the construction contractor:

- Relocate any vibration generating plant and equipment to areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of excavation plant and equipment e.g. smaller capacity rockbreaker hammers.
- Minimise consecutive works in the same locality (if applicable).
- Schedule a minimum respite period of at least 1 hour before activities commence which are to be undertaken for a continuous four hour period. The respite period is to be between 12:00 pm to 1:00 pm prior to the 1:00 pm to 5:00 pm continuous four hour activity.

7.4.3 Summary of Mitigation Measures

The noise and vibration mitigation measures to be implemented by the construction contractor are listed in Table 7-4.

Table 7-4 Summary of Noise & Vibration Mitigation Measures

Item	Description
Construction Hours	Works will be carried out within the standard construction hours.
Deliveries	Deliveries will be carried out within the standard construction hours.
Site Layout	Where possible, plant and equipment will be located and orientated to direct noise away from sensitive receivers.
Quietest Suitable Equipment	Plant and equipment will be selected to minimise noise emission, where possible, whilst maintaining efficiency of function. Residential grade silencers will be fitted and all noise control equipment will be maintained in good order.
Hammer Equipment	Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles at site, and monitor the profiles in use.
Reversing Alarms	Mobile plant and trucks operating on site for a significant portion of the project will have reversing alarm noise emissions minimised, where possible, recognising the need to maintain occupational safety standards.
PA System	No public address system will be used at this site.
Truck Noise (off site)	All trucks regularly used for the project are to have mufflers, and any other noise control equipment, maintained in good working order. Trucking routes will use main roads, where feasible.
Construction Hours	Works will be carried out within the standard construction hours.

7.5 Identifying and Managing Future Noise & Vibration Issues

If additional activities or plant are found to be necessary that will emit noise and/or vibration emissions significantly exceeding those assumed for this assessment, these will, if required, be assessed by the Acoustical Consultant on a case-by-case basis and appropriate mitigation measures will be implemented.

7.6 Complaint Handling

The construction contractor will adopt the following protocol for handling complaints. This protocol is intended to ensure that the issues are addressed and that appropriate corrective action is identified and implemented as necessary:

- The project manager will record all verbal and telephone complaints in writing and will forward all complaints to the contractor, together with details of the circumstance leading to the complaint and all subsequent actions.
- Complaints received by the contractor will, as an initial step, be referred to the project manager who will respond as described above.
- The contractor will investigate the complaint in order to determine whether a criterion exceedance has occurred or whether noise and/or vibration have occurred unnecessarily.
- If excessive or unnecessary noise and/or vibration have been caused, corrective action will be planned and implemented by the project manager.
- Complainants will be informed by contractor that their complaints are being addressed, and (if appropriate) that corrective action is being taken.

Complainants will be informed of the implementation of the corrective action that has been taken to mitigate the adverse effects.

8 CONCLUSION

RSA has conducted a noise impact assessment of the proposed child care centre at 19 Todd Row, St Clair. The assessment has comprised the establishment of noise criteria and assesses noise impacts with regard to relevant statutory requirements.

Noise emissions from the indoor play activities to the nearest residential receivers have been calculated to comply with the noise criterion, with the configurations shown in Figure 2-2

Noise emissions from the outdoor area play activities to the nearest sensitive receivers have been calculated to comply with the noise criterion, with recommendations set out in this report. A 2.1 meter, 1.8m and 1.5m solid barrier along one of the boundaries must be implemented to minimise the noise impact from the outdoor areas (Refer to Figure 2-2).

Noise emissions from the carpark to the nearest receivers have been calculated to comply with the noise criterion.

Criteria for noise emissions from mechanical plant have been established, a further acoustic survey by a qualified acoustic consultant will be required once mechanical plant schedules have been selected.

As per the Plan of Management there would be open days for parents at the child care centre. The open days are proposed to be on Saturdays between 9am and 3pm. The purpose of open days is to highlight the elements of the centre to parents. From previous centres, RSA has observed that the open days has fewer than 'normal' number of children. The noise criteria established in this report can be achieved on open days without any additional noise control measures.

Based on our assessment the proposed child care centre at 19 Todd Row, St Clair is deemed to not cause "Offensive Noise" to neighbouring residences provided that the noise control measures recommended is implemented. It is therefore recommended that planning approval be granted for the proposed development on the basis of acoustics.

Approved:-

[redacted]

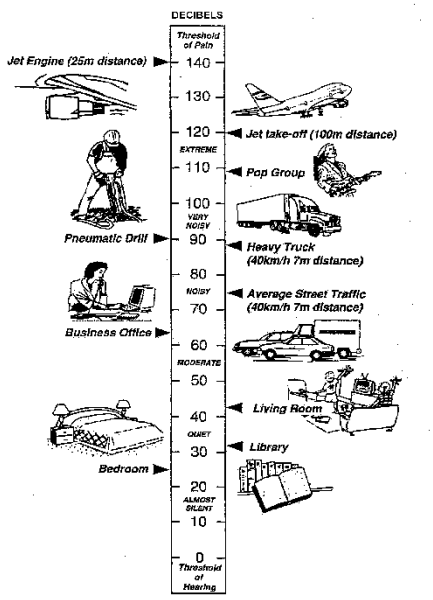
Rodney Stevens

Manager/Principal

Appendix A – Acoustic Terminology

A-weighted sound pressure	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).
Ambient noise	The total noise in a given situation, inclusive of all noise source contributions in the near and far field.
Community annoyance	Includes noise annoyance due to: ▪ character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content) ▪ character of the environment (e.g. very quiet suburban, suburban, urban, near industry) ▪ miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations) ▪ human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative noise level	The total level of noise from all sources.
Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: ▪ Noise mitigation benefits (amount of noise reduction provided, number of people protected). ▪ Cost of mitigation (cost of mitigation versus benefit provided). ▪ Community views (aesthetic impacts and community wishes). ▪ Noise levels for affected land uses (existing and future levels, and changes in noise levels).
Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.

Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
Noise level (goal)	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
Rating Background Level (RBL)	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10th percentile min L_{A90} noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound power Level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

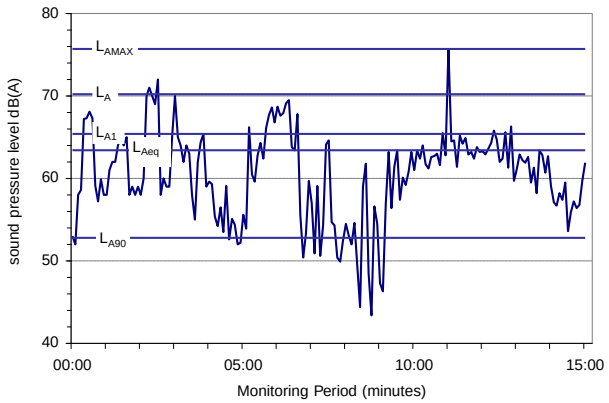
Sound Pressure Level (SPL)

The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistic noise levels

Noise levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:



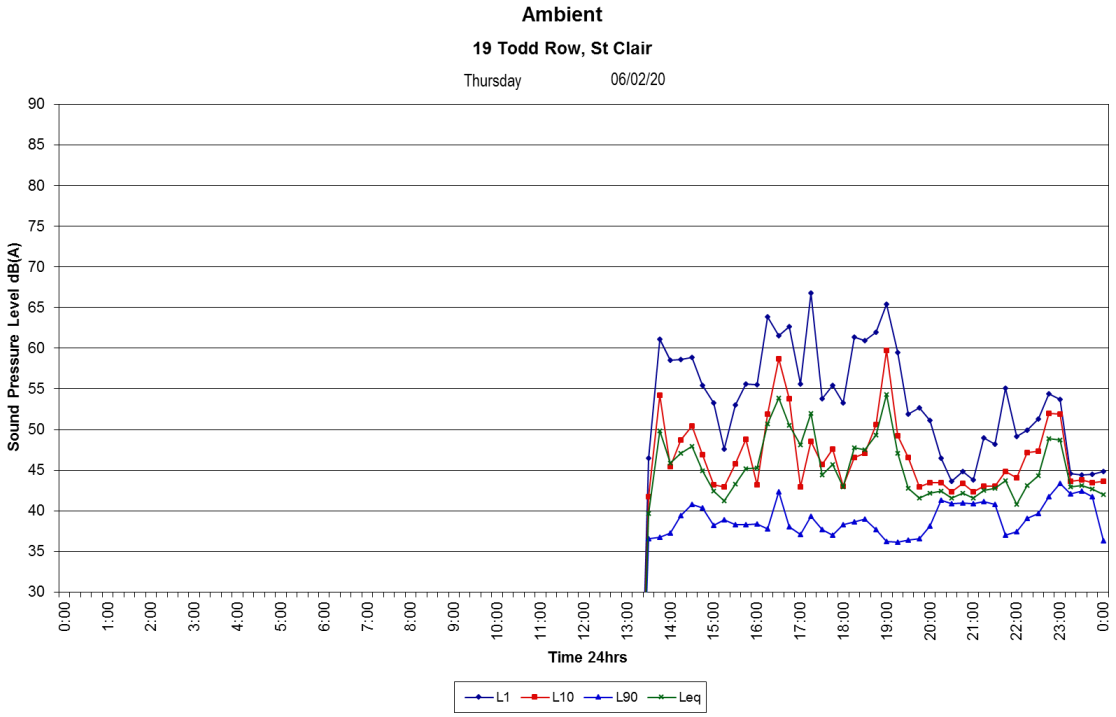
Key descriptors:

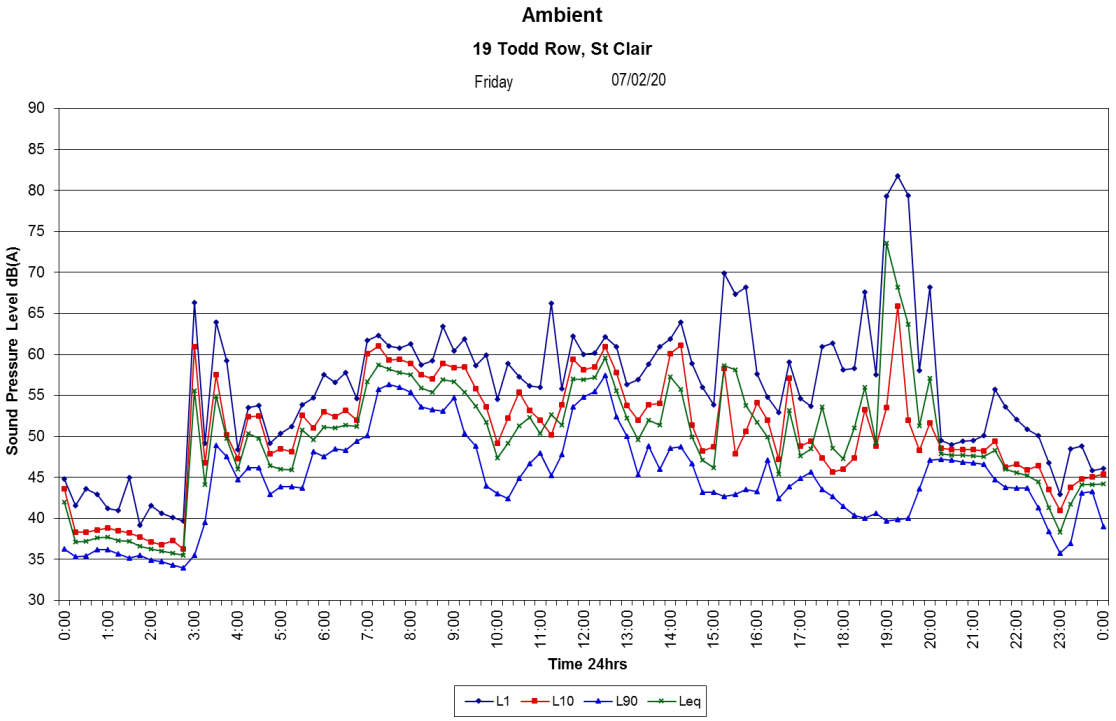
L_{Amax} Maximum recorded noise level.

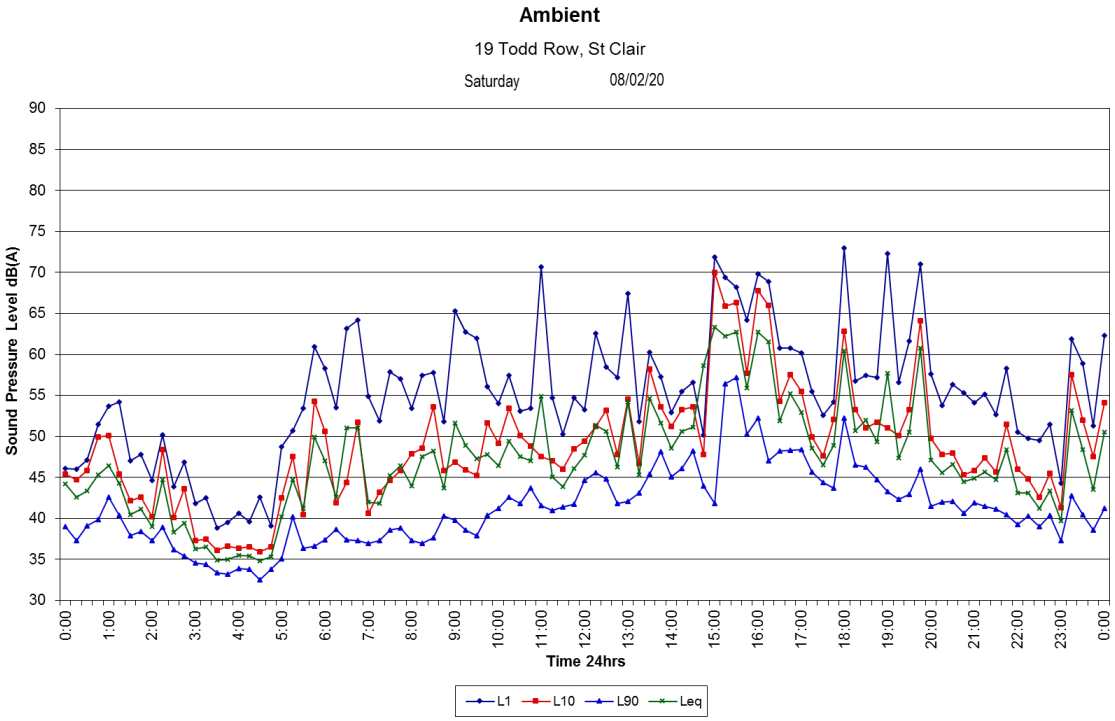
L_{A1} The noise level exceeded for 1% of the 15 minute interval.

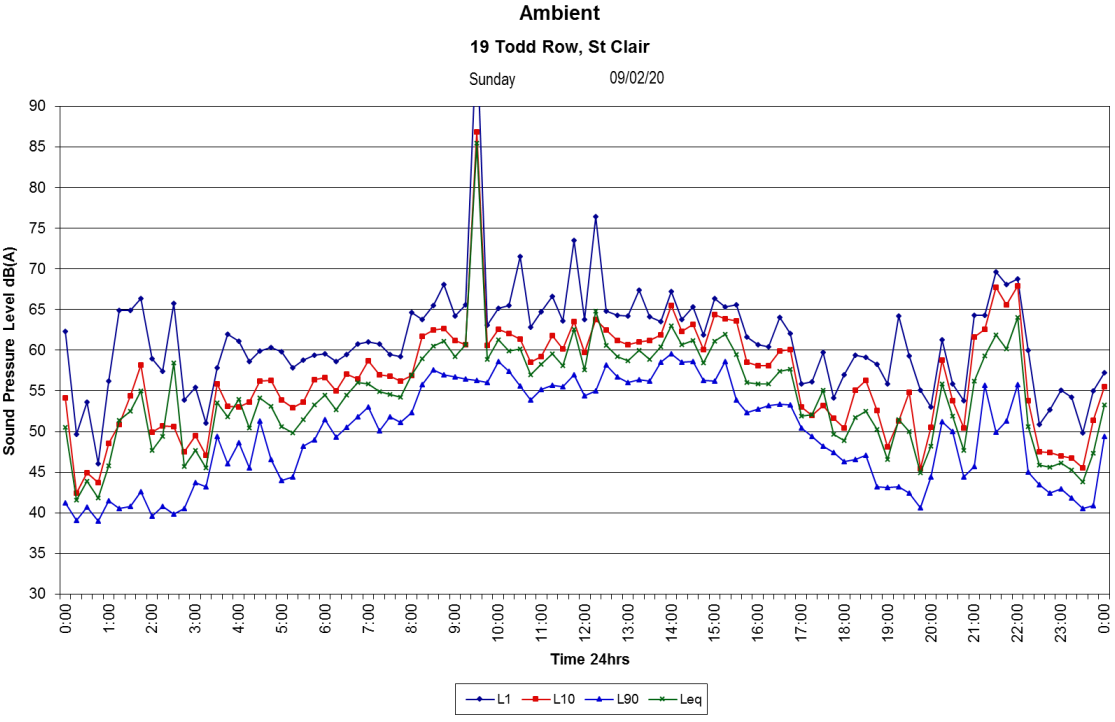
	L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level. L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound. L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).
Threshold	The lowest sound pressure level that produces a detectable response (in an instrument/person).
Tonality	Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dB(A) penalty is typically applied to noise sources with tonal characteristics

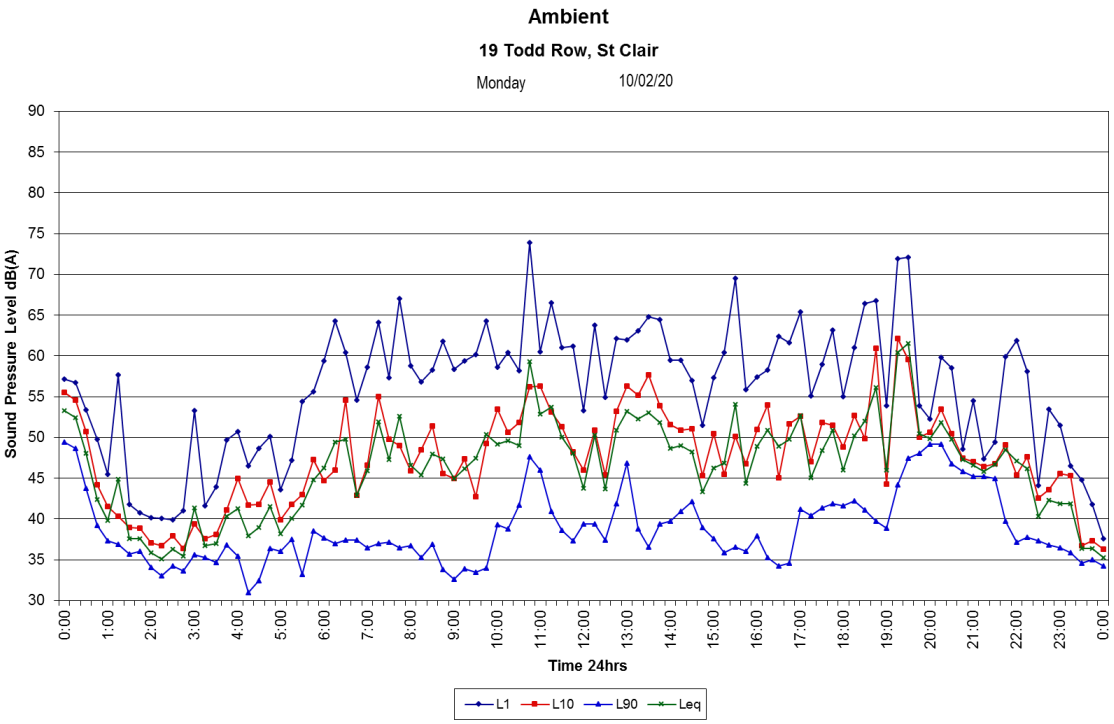
Appendix B – Logger Graphs

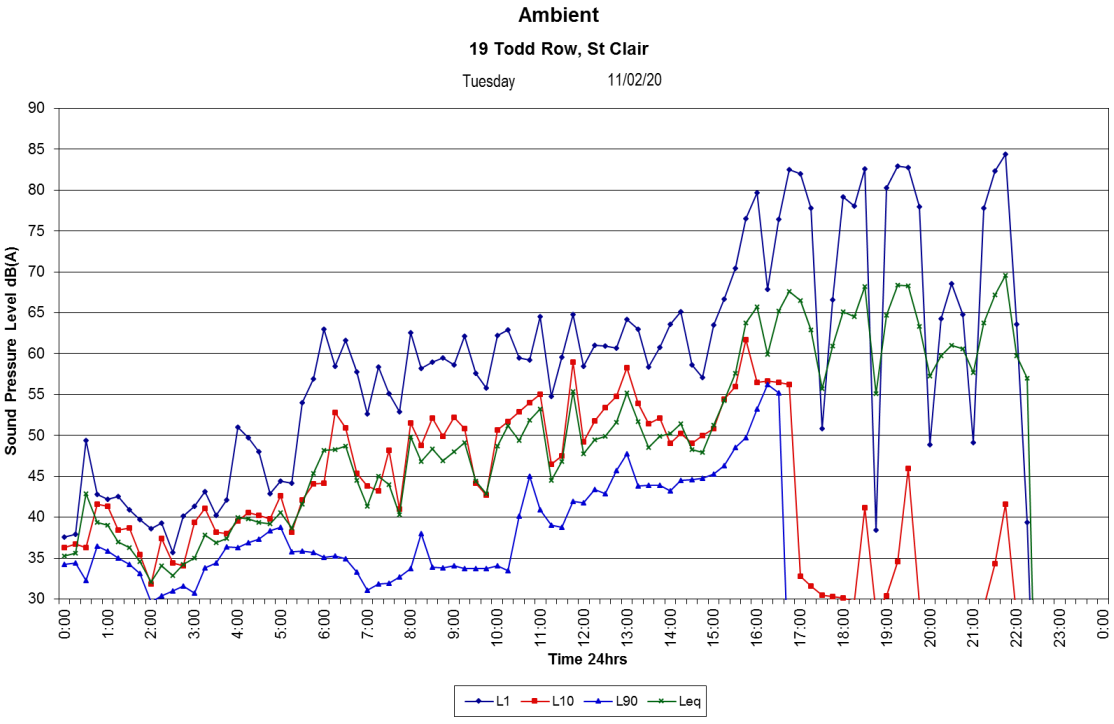


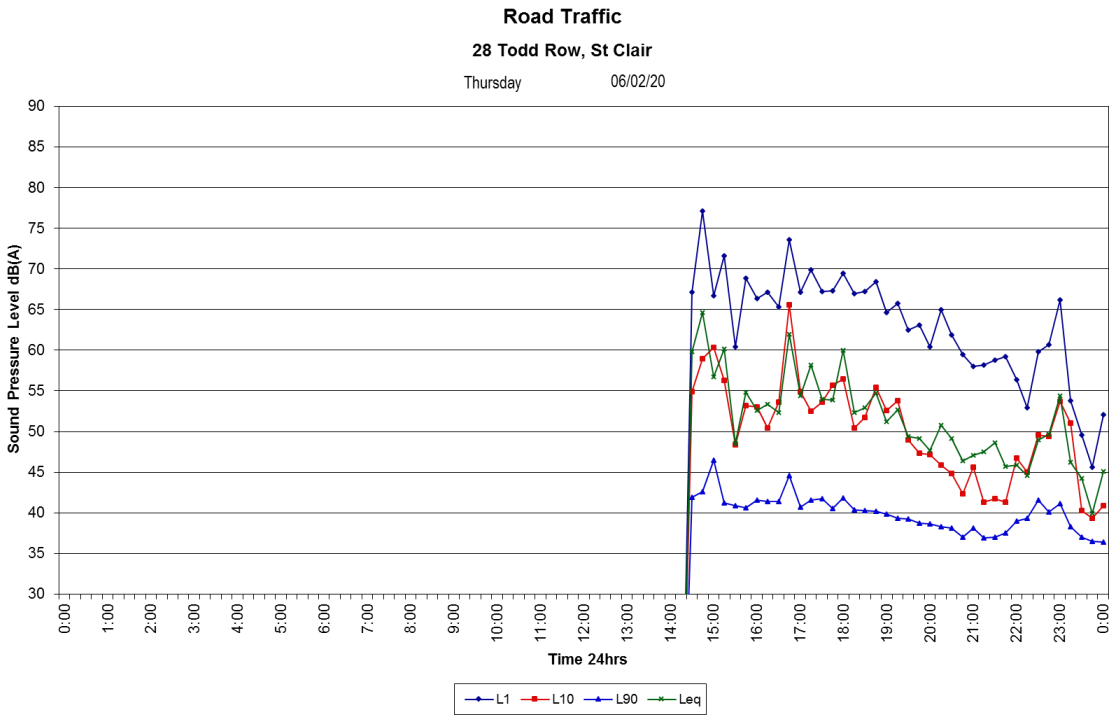


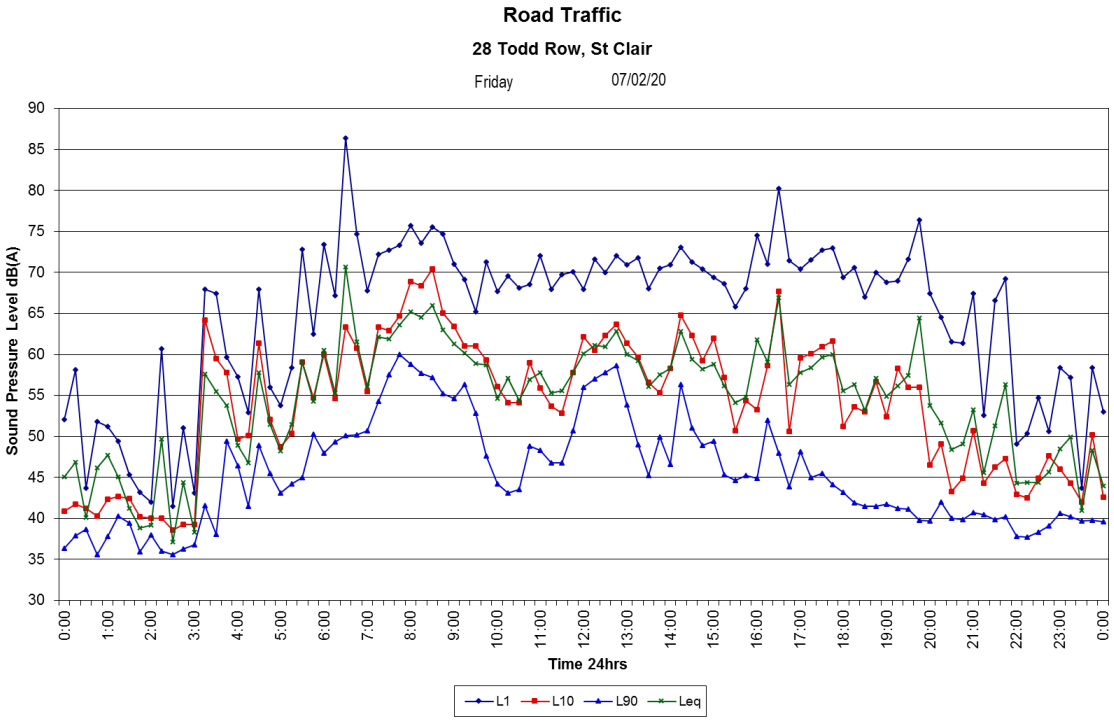


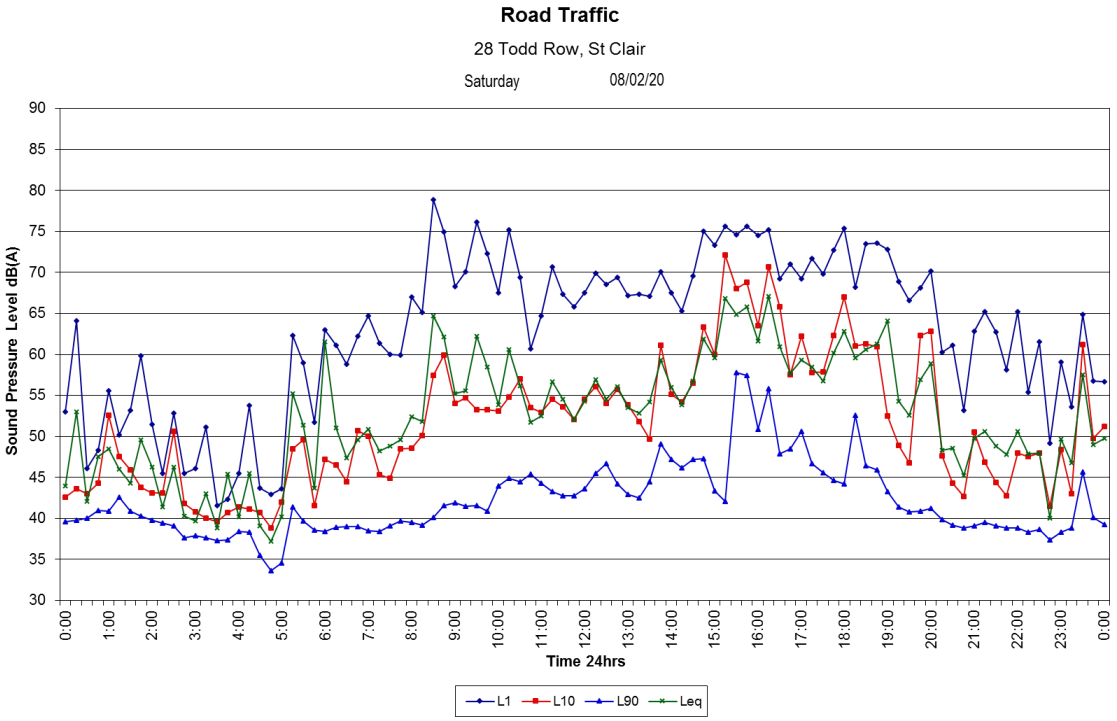


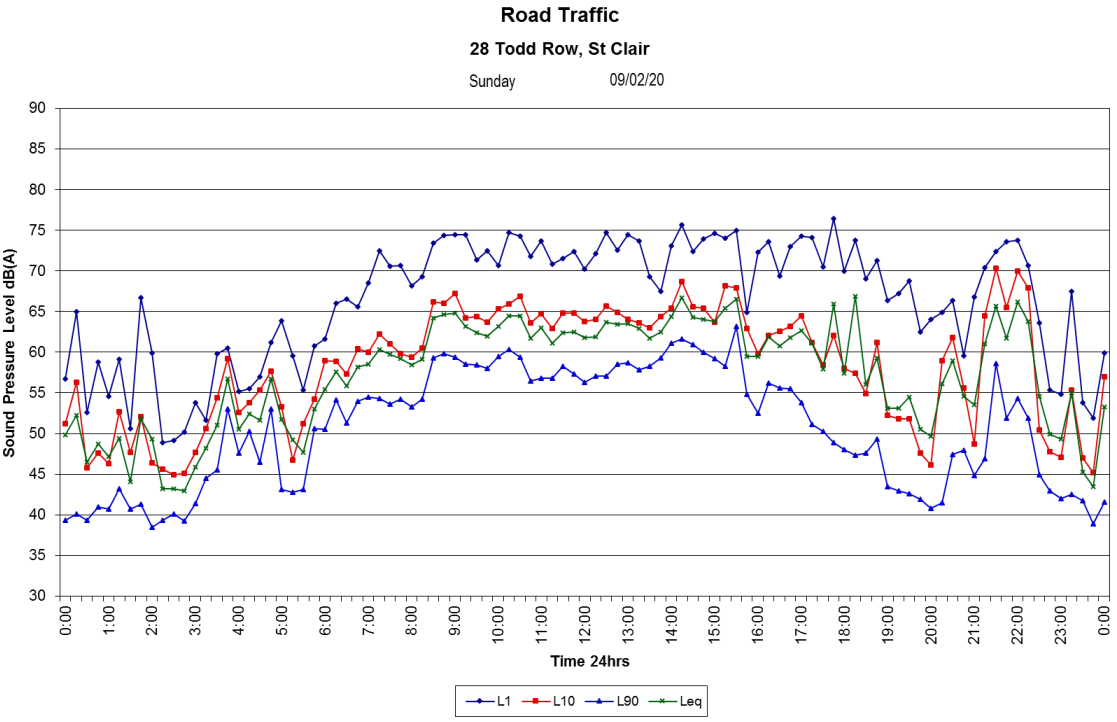


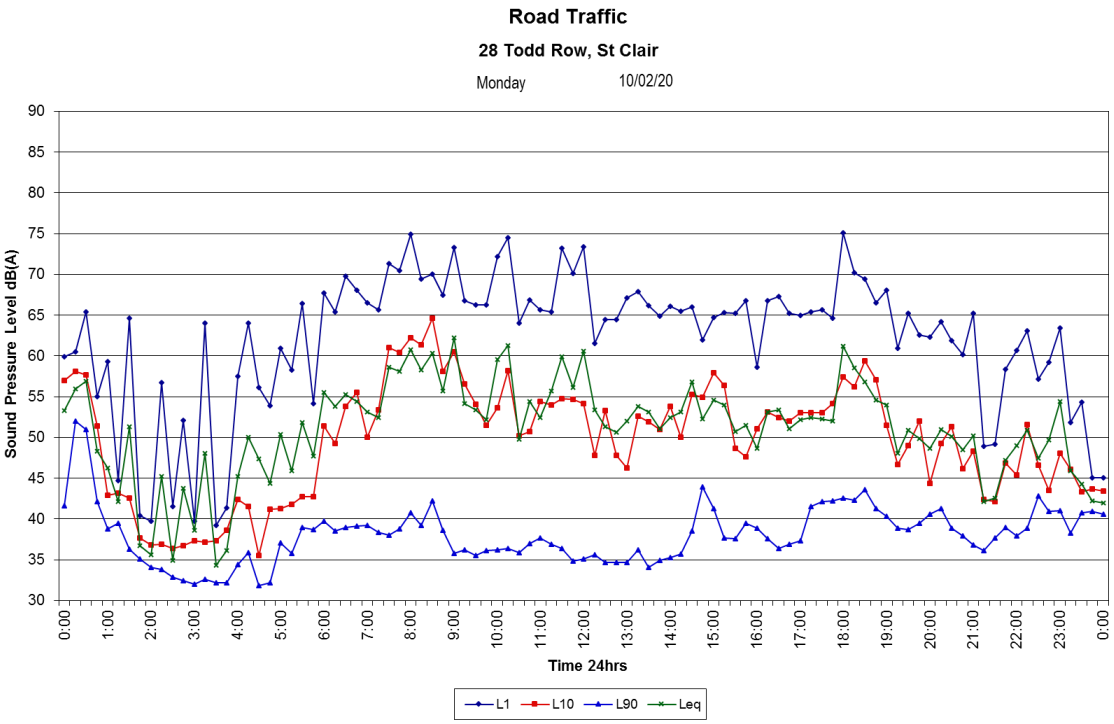


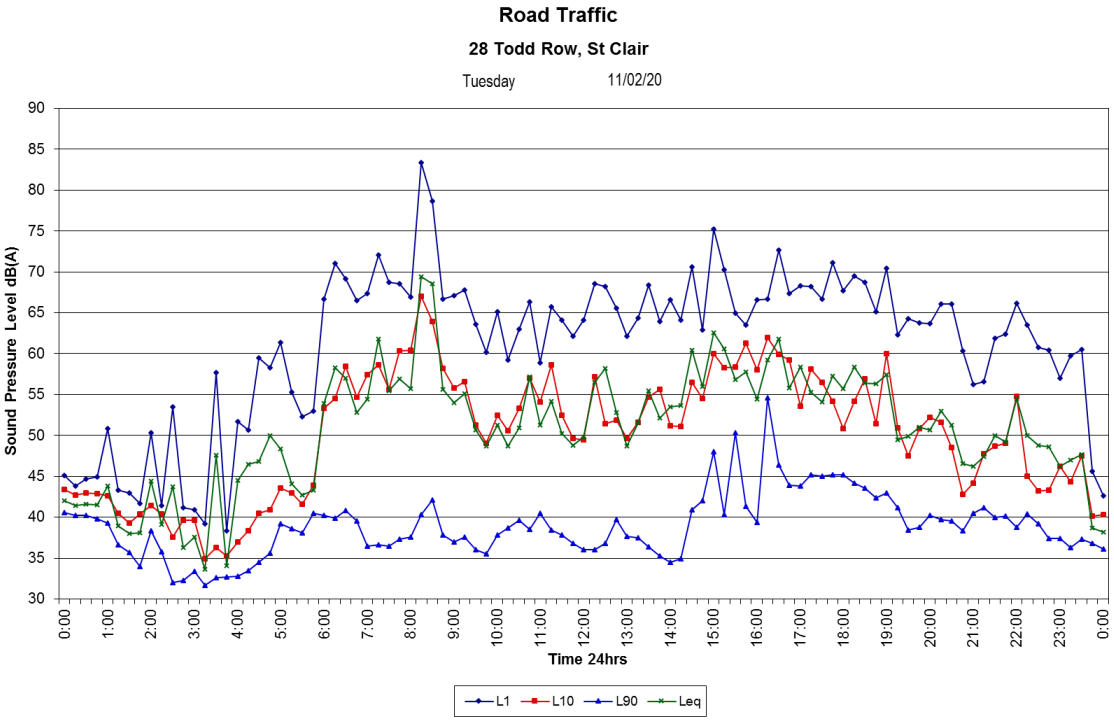


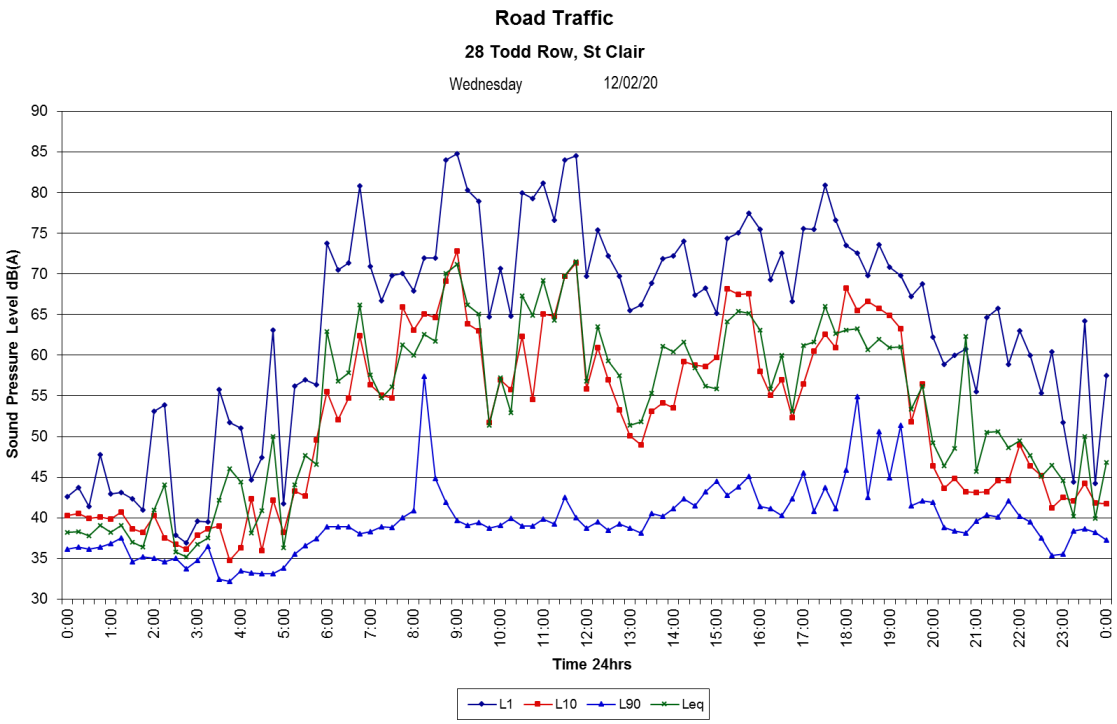


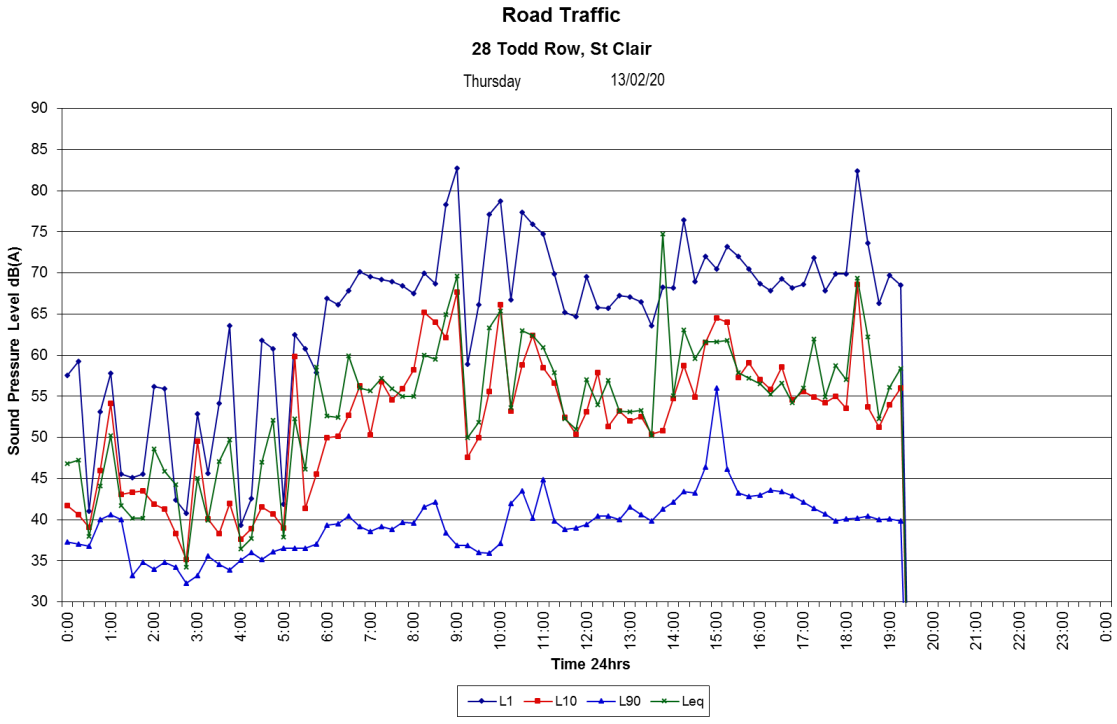












Appendix C – Calibration Certificates

Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C18362

Client Details	Acoustic Research Labs Pty Ltd Level 7, 423 Pennant Hills Road Pennant Hills, NSW 2120
Equipment Tested/ Model Number :	Rion NL-42EX
Instrument Serial Number :	00810712
Microphone Serial Number :	172452
Pre-amplifier Serial Number :	10713

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	21.7°C	**Ambient Temperature :**	22°C
Relative Humidity :	47.6%	**Relative Humidity :**	46%
Barometric Pressure :	100.74kPa	**Barometric Pressure :**	100.77kPa

Calibration Technician : Vicky Jaiswal
Secondary Check: Lewis Boorman
Calibration Date : 2 Jul 2018
Report Issue Date : 3 Jul 2018
Approved Signatory : [redacted] Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.3°C*
12.5kHz	*±0.21dB*	*Relative Humidity*	*±2.5%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

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

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

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

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

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

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