Appendix F

Acoustic Assessment

ST PATRICKS PRIMARY SCHOOL, MACKSVILLE

NOISE ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 00529
VERSION A

WILKINSON MURRAY

ST PATRICKS PRIMARY SCHOOL, MACKSVILLE

NOISE ASSESSMENT

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VERSION A

JANUARY 2011

PREPARED FOR

THE TRUSTEES OF THE ROMAN CATHOLIC CHURCH, LISMORE DIOCESE
NAMBUCCA VALLEY CATHOLIC PARISH

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GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

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

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

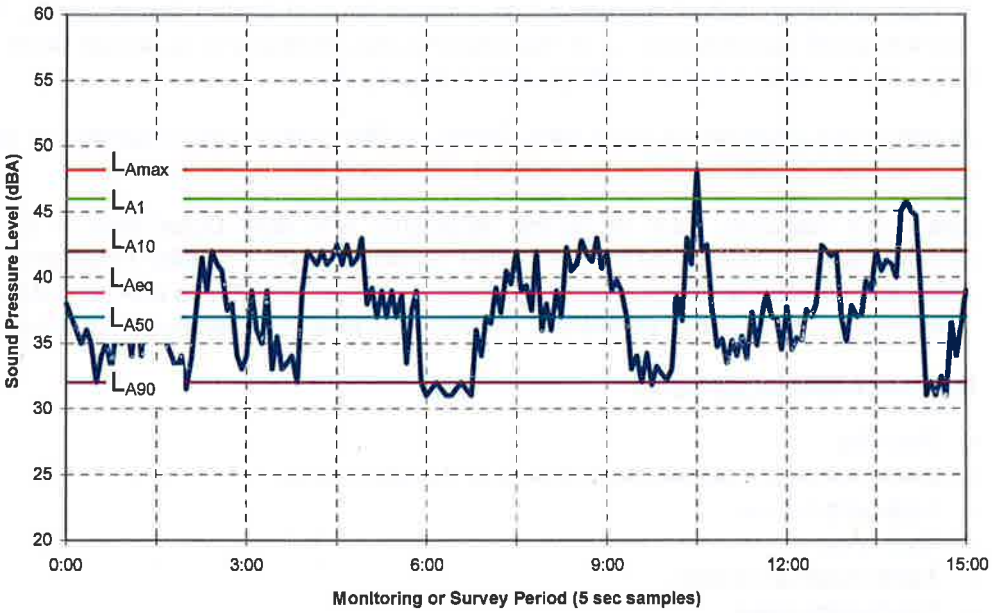
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise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

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

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

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)

1 INTRODUCTION

St Patricks Primary School is proposed on a vacant block of land in Dudley Street, Macksville. The school will accommodate up to 400 students and includes four classroom blocks, a school hall, a library, administration buildings and a free-play area.

As part of the Development Application, Nambucca Shire Council has requested an assessment of noise impacts relating to the development. This report details that assessment.

Assessment has been made in general accordance with NSW Department of Environment, Climate Change & Water (DECCW) guidelines contained within the *NSW Industrial Noise Policy (INP)*, the *Interim Construction Noise Guideline (ICNG)* and the *Environmental Criteria for Road Traffic Noise (ECRTN)*. Our assessment considers the following operational noise impacts.

Noise Generated by the School

- Free-play
- School hall use, including music lessons and performances
- Public address use
- Plant noise
- Traffic noise generation
- Construction noise

Noise Impacting upon the School

- School plant noise impacting upon classrooms

Traffic noise impacting upon the school is not addressed in this assessment. This issue has been addressed in our letter dated 22 July 2010.

The site location is shown in Figure 1-1.

Figure 1-1 Site Location

2 SITE DESCRIPTION

The site is located on the outskirts of Macksville, east of the town centre. Immediately bordering the site are:

- Donnell Welsh playing fields to the west, beyond which are residents along East Street;
- Macksville Adventist School to the north, beyond which are residents along River Street/Gumma Road; and
- vacant land to the east and south.

Of significance to the existing and future noise environment in this area are the existing Pacific Highway and the proposed Warrell Creek to Urunga, Pacific Highway Upgrade. The existing Pacific Highway runs through the centre of Macksville, approximately 600+ metres from the school (see Figure 1-1). The proposed Upgrade is to be constructed 375m to the east of the school.

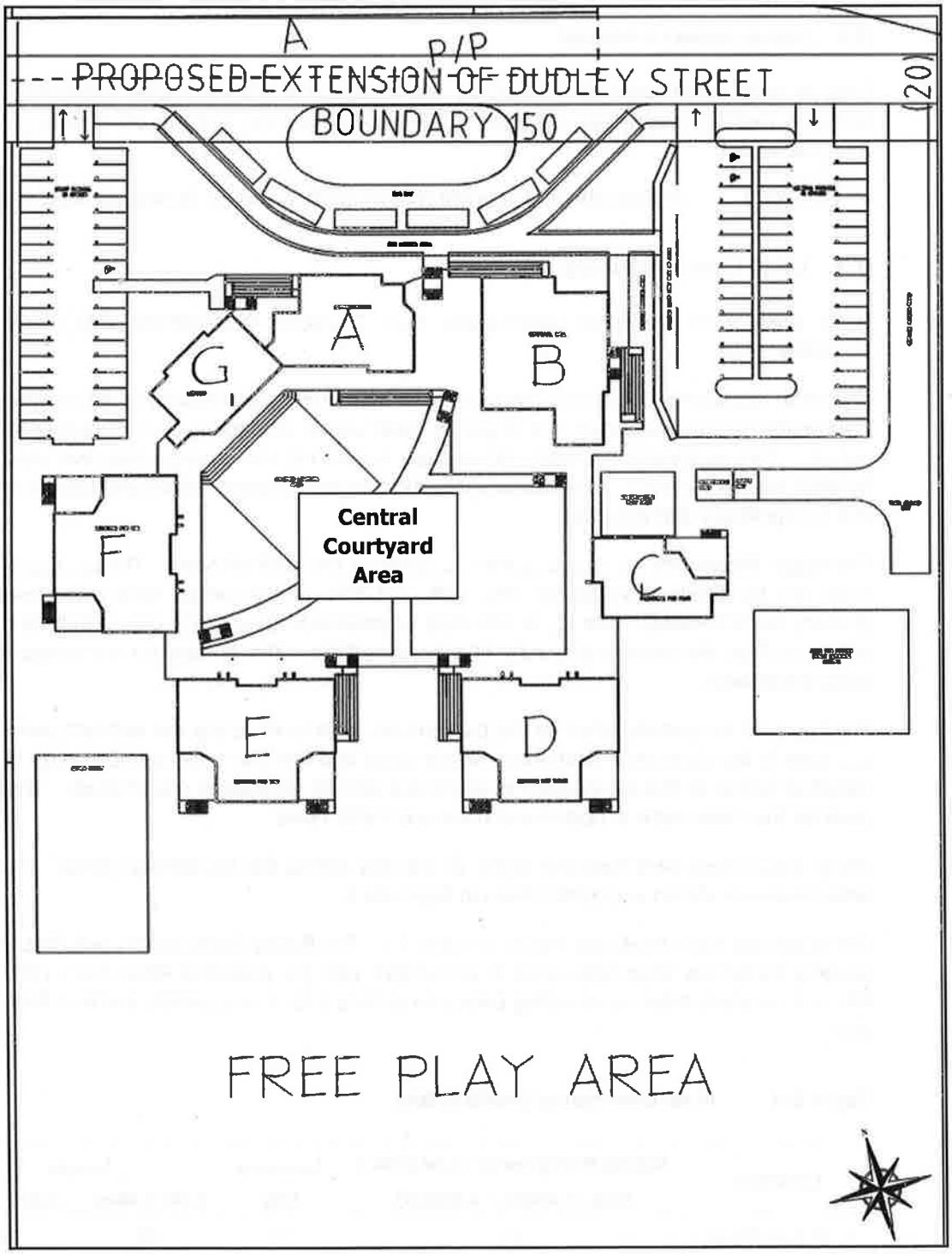
Figure 2-1 presents an aerial photograph of the site and surrounds. The nearest potentially impacted residences are shown.

Figure 2-1 Aerial Photograph of the Site

An indicative school layout is shown in Figure 2-2. Features pertinent to this noise assessment are as follows.

1. Blocks A & G are Administration and Library areas and are not likely to create significant noise.
2. Blocks C, D & E & F all contain general classrooms.
3. Block B is a communal hall. There are no openings proposed to the north of the building, with all openings from the hall being directed back towards the school. Music will be taught in this building.
4. The external playground area is located to the south of the school buildings. This area will generally be used during recess and lunch or for sport activities. During the mornings and afternoons (before and after school), the school has advised that the students will be generally contained within the internal courtyard area.
5. There is a PA system proposed for the school. This will consist of a central microphone with internal speakers to each building. Speakers will also be located in the central courtyard and also to the rear southern playground. The school has advised that the speakers to the playground are only expected to be used during emergencies and special events such as school carnivals. The speaker to the central courtyard will be used frequently, but this is surrounded by the school buildings.
6. There are no workshops.

Figure 2-2 Indicative School Layout



3 EXISTING NOISE LEVELS

3.1 Measurement Location

Existing noise levels were determined by unattended and attended noise monitoring at the following location, being representative of the residences most likely to be affected by noise from the school:

- Location 1 27 East Street, Macksville (the southern corner of Dudley and East Streets)

3.2 Long-Term Monitoring

Noise levels were monitored continuously from Thursday, 9 December until Monday, 20 December 2010.

The noise monitoring equipment used for these measurements consisted of an environmental noise logger set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift occurred.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see glossary for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional passby of a heavy vehicle. This is used for the assessment of sleep disturbance.

The L_{A90} level is normally taken as the background noise level during the relevant period. The L_{Aeq} level is the Equivalent Continuous Sound Level and has the same sound energy over the sampling period as the actual noise environment with its fluctuating sound levels. The L_{Aeq} is used for the assessment of operational noise and traffic noise.

These noise levels were recorded every 15-minutes during the monitoring period. Monitored noise levels are shown in graphical form in Appendix A.

The measured noise levels are shown in Table 3-1. The Rating Background Level (RBL) for the daytime period has been determined in accordance with the *Industrial Noise Policy (INP)*. The RBL is a summary value representing background noise over a long period, and is defined in the *INP*.

Table 3-1 Measured Noise Levels (dBA)

Location	Rating Background Level (RBL)	$L_{Aeq,period}$	$L_{Aeq,1hr}$	
	Day (7.00am – 6.00pm)	Day	8.30-9.30am	2.30-3.30pm
1. 27 East Street	35	51	49	51

3.3 Short-Term Monitoring

During installation of the noise logger, attended measurements were conducted. A summary of these measurements is presented in Table 3-2.

Table 3-2 Summary of Attended Measurements –Thursday 9 December, 2010

Start Time	Measured Level (dBA)		Comments
	L_{Aeq}	L_{A90}	
8.35am	51	43	Traffic noise on East St and Dudley St dominated L_{Aeq}. 11 light vehicle passbys in East St and 6 passbys in Dudley St. Pac Hwy noise (L_{A90} 43 dBA) dominated measured L_{A90}.
8.50am	57	45	School bus to and from Adventist School elevated L_{Aeq} noise level. 11 light vehicle passbys in East St and 4 passbys in Dudley St. 2 heavy vehicle (bus) passbys in both East and Dudley Streets.

From the attended monitoring observations we conclude that the measured L_{Aeq} during the school arrival and departure times (8.30-9.30am and 2.30-3.30pm) is likely to be dominated by traffic noise on the local road network.

The L_{A90} is likely to be a function of the noise from the Pacific Highway. We note that the noise was audible from both the western and northern directions. This indicates that the noise environment is relatively diffuse and that most building facades, with the possible exception of the southern facades, would be exposed to similar noise levels from the Pacific Highway. We note that this situation is not typical and is likely a function of the Highway alignment, which turns 90 degrees north of the Nambucca River and runs along the river side, thus exposing the western and northern facades of receivers.

3.4 Future Noise Levels

Noise levels in the future will be impacted by the proposed Warrell Creek to Urunga, Pacific Highway Upgrade. The Environmental Assessment (EA) for this upgrade predicts that L_{Aeq} noise levels at the receivers surrounding the school will vary between 48-56 dBA, depending upon the receiver setback distance and the road surface selected. L_{A90} noise levels for these traffic volumes and distances could be expected to be approximately 5 dBA below L_{Aeq} noise levels, and this could represent a significant increase in the background noise level at potentially-affected residences.

For the purpose of assessing the noise generated by the school, lower background noise levels, and hence noise criteria, will exist prior to the highway upgrade. Therefore compliance with noise criteria prior to the upgrade will ensure that compliance is achieved after the upgrade also. Further discussion of noise criteria is therefore limited to the "existing Pacific Highway" condition.

4 OPERATIONAL NOISE CRITERIA

This section of the report discusses noise criteria for the assessment of operational noise which includes:

- free play;
- school hall use, including music lessons and performances;
- PA use; and
- plant noise

These noise sources have been assessed in terms of the requirements of the *Industrial Noise Policy (INP)* to consider amenity and intrusiveness.

4.1 *Industrial Noise Policy*

The *INP* specifies two noise criteria – intrusiveness criteria and amenity criteria. The intrusiveness criterion is relative to the level of existing background noise and is defined as a permitted level above the Rating Background Level (RBL). The amenity criterion sets an upper limit for industrial noise in an area.

The *INP* prescribes different amenity criteria for an area depending on the characteristic environment of that area. In this case, the potentially affected residences are in an area which would be classified as "Suburban", and the relevant recommended "acceptable" amenity levels for $L_{Aeq,Period}$ are 55, 45 and 40 dBA for daytime, evening and night time periods respectively.

To set the amenity criteria for any project, the *INP* has a sliding scale based on the level of existing industrial noise. As there is no significant source of industrial noise in this area the amenity criteria are set at the acceptable levels cited in the previous paragraph.

Where ambient noise levels are currently low, noise levels from the proposed operation are generally limited by the intrusiveness criterion. In general, the L_{Aeq} noise level from industrial noise sources should not exceed the Rating Background Level (RBL) by more than 5 dBA at any residential receiver. These criteria are suitable for the assessment of plant noise and other similar sources generated by the school. However, given that play would only occur for a small part of the day and that the character of this noise is generally more accepted by most residents than industrial noise, a criterion of RBL + 10 dBA is generally adopted for the assessment of school play. For simplicity, in the present assessment an intrusiveness criterion of RBL + 5 dBA has been applied to all sources, however we note that this is conservative in the case of playground noise.

The *INP* recommends that an acceptable internal noise level for school classrooms is 35 dBA $L_{Aeq,1hr}$. Assuming a 10 dB reduction from outside to inside (through open windows), this noise level equates to an external noise criterion of 45 dBA. This criterion has been adopted for assessment of noise impacting on the existing Macksville Adventist School.

The noise level criteria for potentially affected receivers are presented in Table 4-1. Where practicable, noise levels should be controlled to below these limits.

Table 4-1 Noise Level Criteria

Location	Intrusiveness Criterion (dBA)	Amenity Criterion (dBA)
	Day	Day
Residences	40 $L_{Aeq,15min}$	55 $L_{Aeq,period}$
Adventist School	N/A	45 $L_{Aeq,1hr}$

In the case of residential receivers, the intrusiveness criterion is more stringent than the amenity criterion and so this is adopted as the project specific noise criterion.

4.2 AS2107:2000 Recommended Design Noise Levels

The noise level inside classrooms needs to be considered. The impacts of traffic noise from the Pacific Highway Upgrade have been addressed in our letter dated 22 July 2010. This section of the report deals only with noise generated from school plant equipment.

Australian Standard AS 2107:2000 "*Acoustics- Recommended design Sound Levels and Reverberation Times*" lists recommended sound levels for different areas of occupancy in buildings. AS2107 recommended L_{Aeq} design sound levels for relevant spaces are shown in Table 4-2.

Table 4-2 AS2107:2000 Recommended Design Noise Levels

Activity	Satisfactory	Maximum
Teaching spaces, Primary schools	35dBA	45dBA
Computer rooms, Teaching	40dBA	45dBA

Wilkinson Murray recommend an internal criterion of $L_{Aeq,1hr}$ 40dBA for all rooms.

5 OPERATIONAL NOISE ASSESSMENT

This portion of the report details the prediction and assessment of noise generated by the school.

5.1 Noise Source Levels

The noise source levels assumed in our assessment are presented below. Table 5-1 presents the L_{Aeq} sound level of typical speech, which was determined from laboratory testing and provides guidance in determining playground noise levels. Table 5-2 presents the total noise source levels for each activity. Note that the noise source levels presented do not account for the duration of use within a 15-minute period. This is detailed for each source in the comments column, and appropriate adjustments have been made to the sound power level used in the noise model.

Table 5-1 Speech Noise Levels

Speech Level	Sound Pressure Level at 1m (dBA)	Sound Power Level (dBA)
Raised	68	79
Very Loud	74	85
Shout	83	94

Table 5-2 Noise Source Levels

Source	Sound Power Level (dBA)	Comments
Public Address – free play area	115*	We have assumed that directional horns will be used to project sound to the free play area / oval. Modelling has assumed that this system would be used for no more than 1 minute in any 15 minute period.
Public Address – outdoor learning area / courtyard	103* each	Based on several loudspeakers projecting into the courtyard to produce a distributed sound pressure level of approximately 70 dBA. Modelling has assumed that the PA would operate for, at most, 30% of the time in a 15 minute period.
Children Playing – outdoor courtyard	99	Assumes 150 students with 50% of students using a raised voice for 50% of the time.
Children Playing – free play recess, lunch and sport	101	Assumes 250 students with 50% of students using a raised voice for 50% of the time.
Communal Hall – music performance	97	Assumes approximately 40m^2 openings on the southern side of the hall (towards the courtyard)
Classroom Plant	70 each / 7 enclosed units	Each of the units will be housed in a raised "enclosure". Conservatively a 5 dB reduction has been allowed for this enclosure.

* On-axis equivalent sound power level

5.2 Predicted Receiver Noise Levels

Noise level predictions were made using the CadnaA noise prediction software implementing ISO 9613 noise prediction algorithms. Meteorological conditions were not considered, though we note the potential for prevailing wind conditions during school times to increase the noise level by 2-3 dBA.

Table 5-3 presents the individual noise level prediction for each activity or source. Table 5-4 presents the cumulative noise level predictions for activities that are likely to occur in a single 15 minute period.

Table 5-3 Individual Source Noise Predictions

Location	Criterion (dBA)	Individual Noise Source Predictions (dBA)					
		Plant	Courtyard Play	Oval Play	Courtyard PA	Oval PA	Hall
Residences in East Street	40	9-14	23-25	28-31	30-34	25-34	25-34
Residences in Gumma Road	40	11-14	24-29	26-29	32-36	9-19	24-34
Adventist School	45	13	29	27	37	11	23

Table 5-4 Cumulative Source Noise Predictions

Location	Criterion (dBA)	Cumulative Noise Source Predictions (dBA)				
		Plant + Courtyard Play	Plant + Courtyard Play + Courtyard PA	Plant + Oval Play	Plant + Oval Play + Oval PA	Plant + Hall
Residences in East Street	40	23-26	30-35	28-31	30-36	25-34
Residences in Gumma Road	40	24-29	33-37	26-29	26-29	24-34
Adventist School	45	29	38	27	27	24

The results show that the noise generated by the school is predicted to comply with relevant criteria. This is also the case if an additional 2-3dBA is allowed for potential adverse wind conditions.

5.3 Internal Classroom Noise Levels

With regard to internal classroom noise levels resulting from air-conditioning units, we anticipate that an attenuation from outside to inside in the order of 15-20 dBA will be required, depending on the equipment selected. This will be achieved by positioning the condenser units away from windows and ensuring adequate wall construction. Acoustic attenuation of ducting and ceiling elements may also be necessary to meet these levels, and this can be addressed at the detailed design stage.

For the purpose of the DA we consider that internal design noise levels can be achieved through acoustic design at the detailed design stage.

6 TRAFFIC NOISE CRITERIA

This section of the report presents an assessment of the operational traffic noise generated by the proposal against *DECCW* noise level goals for "new developments which generate additional traffic on public roads". The predictions are based on the traffic report prepared by *de Groot & Benson*.

The school will be accessed via Dudley Street, which connects to East Street. East Street connects to the Pacific Highway via three roads: River Street to the north; Partridge Street, approximately 100m north of Dudley Street; and Boundary Street to the south.

6.1 Road Traffic Noise Goals

The *Environmental Criteria for Road Traffic Noise* (*ECRTN*) sets out criteria for assessment of noise from vehicles on public roads.

The *ECRTN* sets out noise criteria for 'arterial', 'sub-arterial', 'local roads' and 'collector roads'. Both East Street and Dudley Street would be considered local roads, whilst River Street, Partridge Street and Boundary Street would be considered as collector roads. Relevant criteria for "land use developments with potential to create additional traffic" are as follows:

Local Roads

- Daytime (7.00am-10.00pm) $L_{Aeq,1hr}$ = 55 dBA

Collector Roads

- Daytime (7.00am-10.00pm) $L_{Aeq,1hr}$ = 60 dBA

Where criteria are already exceeded, the development should not increase existing levels by more than 2 dBA. This criterion is to be met at a time 10 years after the opening of the development.

7 TRAFFIC NOISE ASSESSMENT

7.1 Traffic Volumes

The traffic report details the following existing traffic volumes for relevant roads.

Table 7-1 Existing Traffic Volumes

Road	Peak Vehicle Movements Per Hour*
Dudley Street	24
East Street	53
Partridge Street	262

* The peak hourly periods exist between 8-9am and 3-4pm. These coincide with the peak generation periods of the school.

The traffic volumes predicted to be generated by the school are shown in Table 7-2.

Table 7-2 Traffic Generated by the School

Road	Peak Vehicle Movements Per Hour*
Students being delivered/collected by private car	53
Staff	30
Buses	30

* The existing peak hourly periods coincide with the peak generation periods of the school.

The traffic report assumes that all vehicles will access the Pacific Highway via Partridge Street. This represents a conservative approach for the purpose of the traffic assessment but it is considered unlikely to eventuate in reality. Rather we would expect that light vehicles will utilise the three roads joining East Street and the Pacific Highway equally. Buses will follow a prescribed route and this will likely utilise Partridge Street. Based on these assumptions the traffic volumes with the inclusion of the school are shown in Table 7-3.

Table 7-3 Future Traffic Volumes

Road	Section	Peak Vehicle Movements Per Hour[1]		
		Existing	School (LV/HV)[2]	Total (LV/HV)[2]
Dudley Street	all	24	83 / 30	107 / 30
East Street	Between Dudley St & Partridge St	53	56 / 30	109 / 30
	North of Partridge St		28 / 0	81 / 0
	South of Dudley St		27 / 0	80 / 0
Partridge Street	all	262	28 / 30	290 / 30
River Street	all	Unknown	28 / 0	28+ / 0
Boundary Street	all	Unknown	27 / 0	27+ / 0

Note: 1. The existing peak hourly periods coincide with the peak generation periods of the school.
2. Light vehicles / Heavy vehicles

7.2 Traffic Noise Levels

Traffic noise levels for each street have been calculated using the *CoRTN* road traffic noise prediction algorithms, with the exception of the intersection between East Street and Dudley Street. This intersection will handle all the traffic generated by the school and consequently forms the most critical part of the traffic noise assessment.

Because the *CoRTN* algorithms fail to adequately predict low speed noise levels, noise level predictions at the intersection of Dudley Street and East Street are based on attended noise measurements during installation of the noise logger. These measurements included a return trip of a school bus, possibly accessing the existing Adventist School or the sporting grounds. The noise levels have been adjusted for the increased traffic numbers.

Table 7-4 Predicted Traffic Noise Levels

Road	Receivers	Criteria (dBA)	Predicted Traffic Noise Level (dBA)	
			Existing	Future
Dudley St	23 and 27 (corner of East Street)	55	48.4	62.3
East St	Between Dudley St & Partridge St	55	52.8	62.8
	North of Partridge St		52.8	54.6
	South of Dudley St		52.8	54.6
Partridge St	all	60	59.7	63.5
River St	all	60	Unknown	50.0[1]
Boundary St	all	60	Unknown	50.0[1]

Note: 1. Noise level from the traffic generated by the school only.

The noise level predictions show some exceedances of the noise level criteria. These are associated with the buses accessing the school. Some reduction could be achieved at some residences by distributing the buses amongst the three routes. However this is likely to have implications at the intersections with the Pacific Highway and regardless, some exceedances will remain in Dudley Street and part of East Street.

The context of these exceedances needs to be considered. We note that exceedances will only occur during the periods before and after school, as the traffic generation will be concentrated during these times. The development presents significant value to the community and is otherwise located and designed to comfortably comply with operational noise criteria.

The criteria contained within the *ECRTN* are not mandatory performance requirements, but rather are targets to ensure due consideration of road traffic noise in the planning process. The *ECRTN* states:

"*This document [ECRTN] provides a framework that guides the consideration and management of traffic noise issues associated with new building developments near existing or new roads, and new or upgraded road developments adjacent to new or planned building developments.*

The framework embodies a ***non-mandatory*** *performance-based approach. The criteria are applied as targets, but recognise that there will be situations where planning strategies are not feasible.*"

With regard to land use developments with potential to create additional traffic the *ECRTN*

states the following:

"The criteria contemplate accepting an increase in levels of existing traffic noise only after all feasible and reasonable mitigation measures have been applied. The intent is to limit any additional traffic noise impacts as far as practicable. In practice, the application of the 2 dB(A) allowance would need to take into account the prevailing circumstances."

In this instance no reasonable mitigation measures are available and increases greater than 2 dBA are predicted. In the context of the development, which provides significant benefit to the community, the concentrated traffic noise generation during the before and after school periods is considered to be acceptable.

8 CONSTRUCTION NOISE CRITERIA

This section of the report details criteria for the assessment of the potential for noise impacts during the construction phase.

8.1 Construction Noise Goals

The DECCW *Interim Construction Noise Guideline (ICNG)* recommends the following noise objectives:

Recommended standard hours of work

- Monday to Friday 7.00am to 6.00pm
- Saturday 8.00am to 1.00pm
- No work on Sundays or Public Holiday

Management Noise Goals

Noise goals are detailed in Table 8-1. With reference to the background noise levels presented in Table 3-1, the noise affected management level for daytime construction becomes 45 dBA.

Table 8-1 Noise at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,15min}$*	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10 dB(A)	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	• The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. • If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

9 CONSTRUCTION NOISE ASSESSMENT

Construction would occur in the following phases:

- earthworks;
- paving;
- building structure; and
- installation and commissioning.

The following construction plant items and associated maximum sound pressure levels at 7m are expected to be required.

• Hydraulic Hammer	95 dBA
• Front End Loader	88 dBA
• Dozer	88 dBA
• Excavator	84 dBA
• Tip Truck	83 dBA
• Concrete Trucks	83 dBA
• Concrete Vibrator	80 dBA
• Mobile Crane	85 dBA
• Formwork Tools	88 dBA
• Hand Power Tools	70-75 dBA

Based on a typical operating scenario for the various construction equipment, including the proportion of time that specific items may operate during a 15-minute period, the following source L_{Aeq} sound pressure levels at 7m for each phase of work have been assumed in our assessment.

• Earthworks	87 dBA
• Paving	87 dBA
• Building structure	85 dBA
• Installation and commissioning	70-75 dBA

Based on attenuation due to distance, the following range of L_{Aeq} noise levels is predicted at the nearest residences from the various activities on different parts of the site.

Table 9-1 Calculated Construction L_{Aeq} Noise Levels - dBA

Location	Management Level	Earthworks	Paving	Building Structure	Installation of Plant
Residences in East St	45	51-56	51-56	49-54	39-44
Residences in Gumma Rd		52-62	52-62	50-64	40-50
Adventist School		55-63	55-63	53-61	43-51

Noise levels up to 17 dBA above the noise management level are predicted. This is typical of noise from construction activities in close proximity to receivers.

We note that noise levels at the Adventist School have the potential to result in internal noise levels exceeding AS2107. Though these are only likely to prevail for short durations, we consider that management of these noise impacts is necessary.

We recommend that the following noise control measures be considered to limit the potential for noise impacts during construction.

- A temporary hoarding to be constructed around the northern, eastern and western boundaries such that the majority of works are shielded. This hoarding would need to be at least 2m high to provide affective mitigation.
- Loud works to be scheduled during times that are less sensitive to the existing school (i.e. before and after school and during school holidays).
- Construction to be limited to the *DECCW's* recommended standard hours of 7.00am-6.00pm Monday to Friday and 8.00am-1.00pm Saturday, with no audible work on Sunday or Public Holidays.
- Consultation to be undertaken with affected residents and other surrounding receivers.
- Use of the quietest available plant, which is regularly maintained and fitted with appropriate mufflers.
- Tonal reversing alarms to be eliminated by using spotters, closed circuit television monitors, "smart" reversing alarms, or "squawker" type reversing alarms.
- Appropriate training to be provided for onsite staff.
- Use of hydraulic hammers to be minimised. If required for significant durations, respite periods should be provided. The *DECCW* recommends respite periods between 12.00pm-2.00pm for this type of equipment.

For noise mitigation measures that result in a direct reduction in noise level, indicative noise reductions that can potentially be achieved by these measures, subject to the type and number of equipment and intensity of construction activities, are shown in Table 9-2.

Table 9-2 Measures to Reduce Construction Noise Levels

Management Measure	Potential Noise Reduction, dBA
Administrative Controls	
Turning off machinery when not in use	0-5
Engineering Controls	
Temporary screens	5-10
Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.	2-3
Orienting equipment away from sensitive receivers.	3-5
Using dampened tips on rock breakers.	3-6
Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks	5-10
Employ non noise-generating structures such as site offices, storage sheds, stockpiles and tanks as noise barriers	5-10

10 CONCLUSION

Wilkinson Murray has undertaken an assessment of noise impacts associated with the proposed St Patricks Primary School in Dudley Street, Macksville. The assessment has been undertaken in general accordance with *DECCW* publications and guidelines.

Operational noise is predicted to comply with the relevant criteria for all considered operating scenarios.

The traffic noise generated by the development is predicted to exceed relevant goals at some receivers along East Street and Partridge Street, during peak traffic periods before and after school hours. These goals do not constitute mandatory performance requirements, but rather provide guidance for consideration of road traffic noise. Consideration of the context of the development is necessary in determining the acceptability of traffic noise levels. There are no reasonable and feasible mitigation measures that can be adopted to reduce these noise levels. Given the context of the development, which presents a significant benefit to the local community, and also the nature of the traffic generation, which is concentrated into the periods shortly before and after school hours, we consider that the traffic noise levels are acceptable.

Construction noise is predicted to exceed goal levels during some phases. In particular, there is potential for construction noise to produce unacceptable noise levels within classrooms of the neighbouring Adventist School. We recommend that a combination of the mitigation measures detailed in Section 9 of this report be implemented to mitigate the impacts of construction noise. In particular we recommend that either temporary hoardings be constructed or the loudest construction activities should be scheduled to occur outside time periods that are sensitive to the Adventist School.

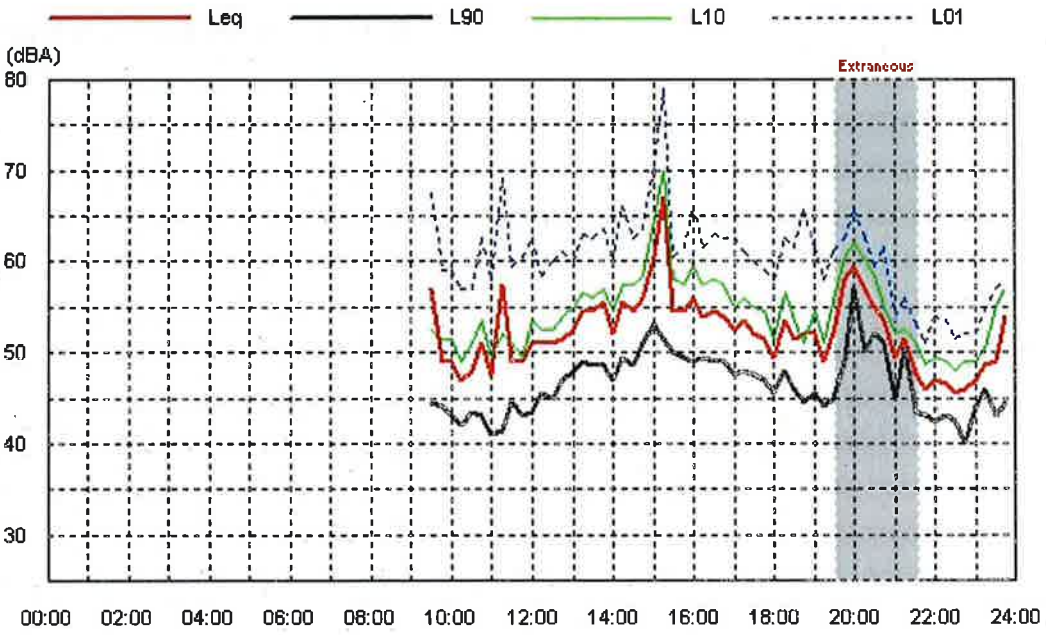
Version	Status	Date	Prepared by	Checked by
A	Final	10 January 2010	Adam Bioletti	Rob Bullen

APPENDIX A

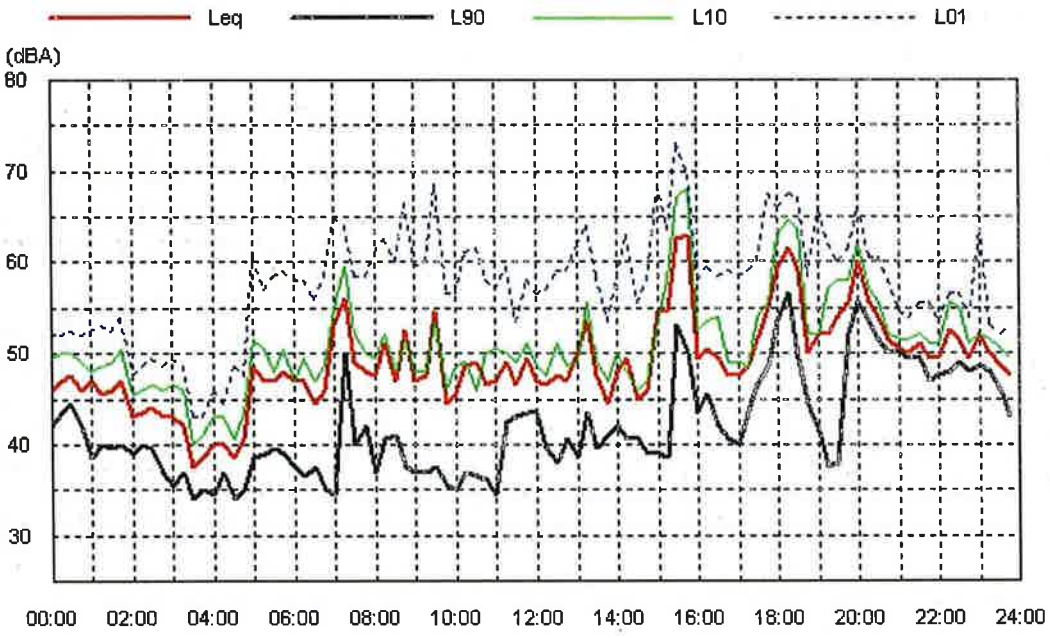
NOISE MEASUREMENT RESULTS

Location: 1. 27 East Street, Macksville - Dudley Street Facade
Data shaded: Extraneous; Weekend; Rain

Thu 09 Dec 10

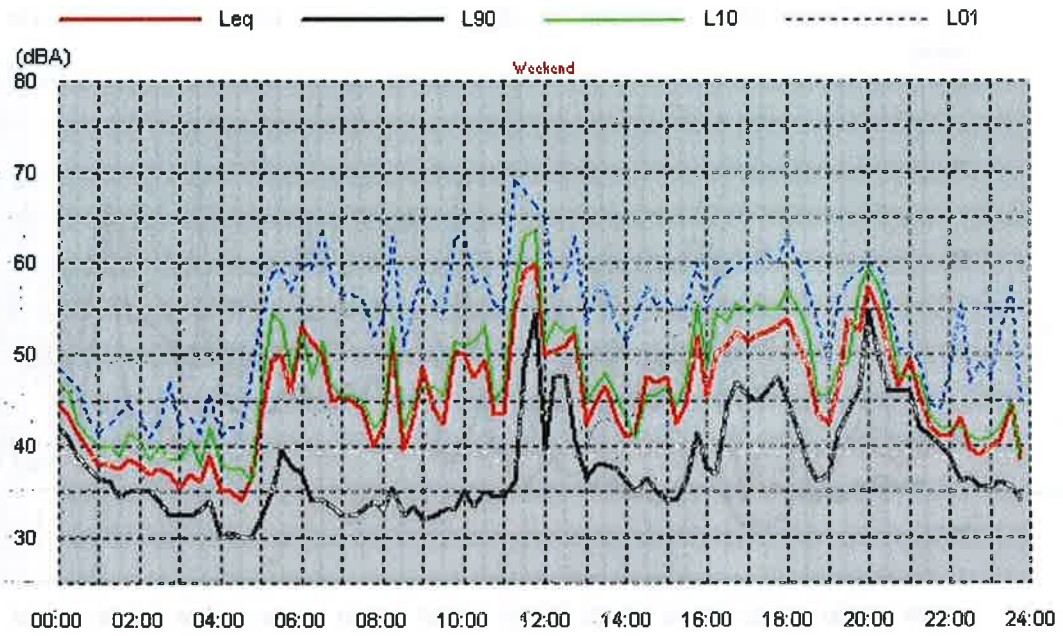


Fri 10 Dec 10

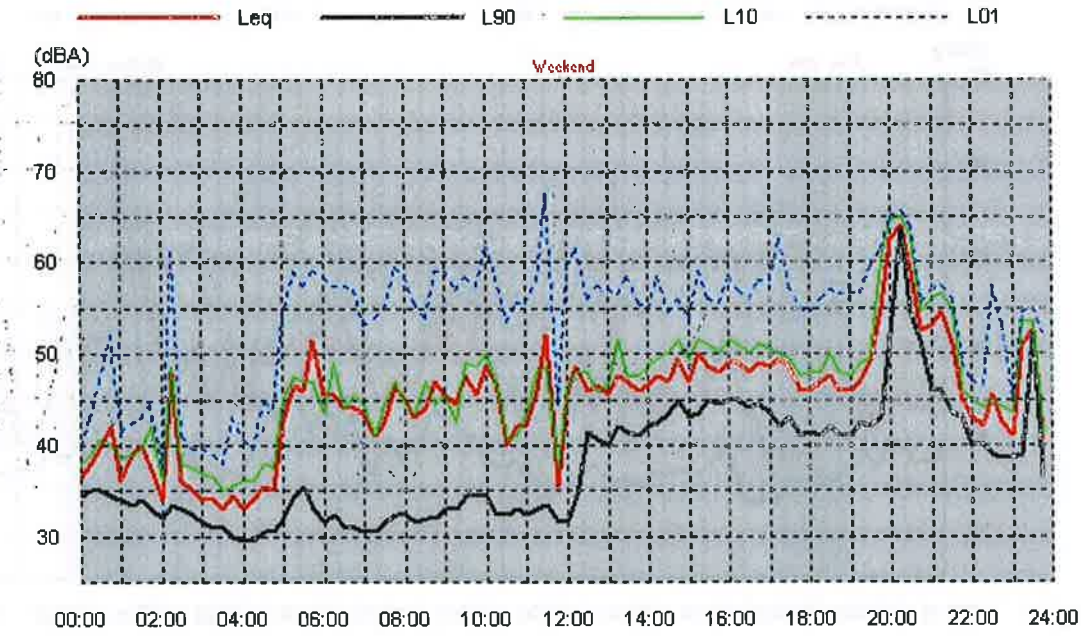


Location: 1. 27 East Street, Macksville - Dudley Street Facade
Data shaded: Extraneous; Weekend; Rain

Sat 11 Dec 10

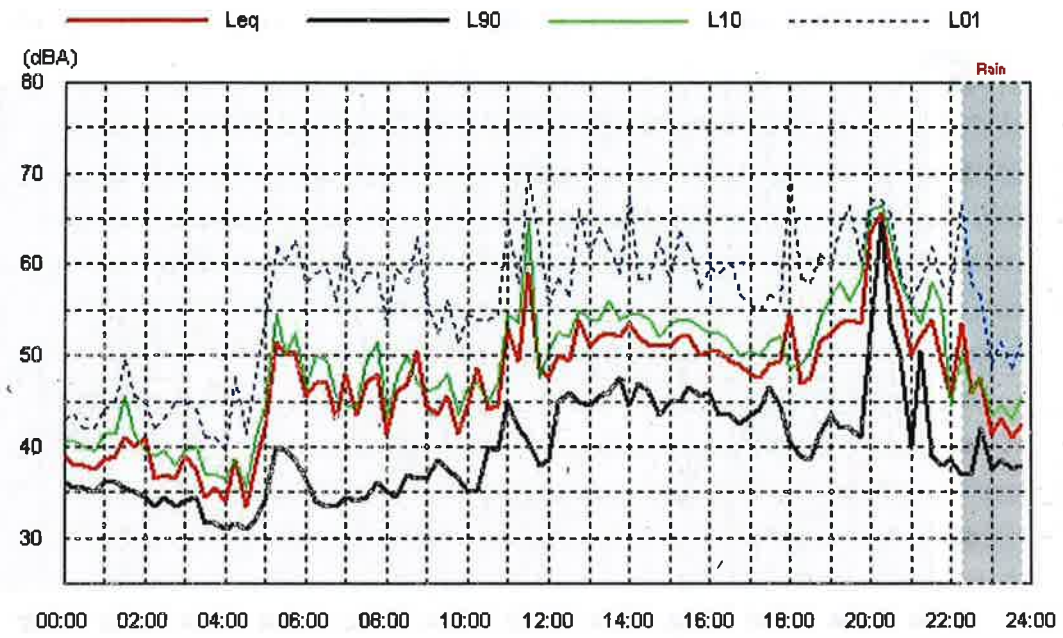


Sun 12 Dec 10

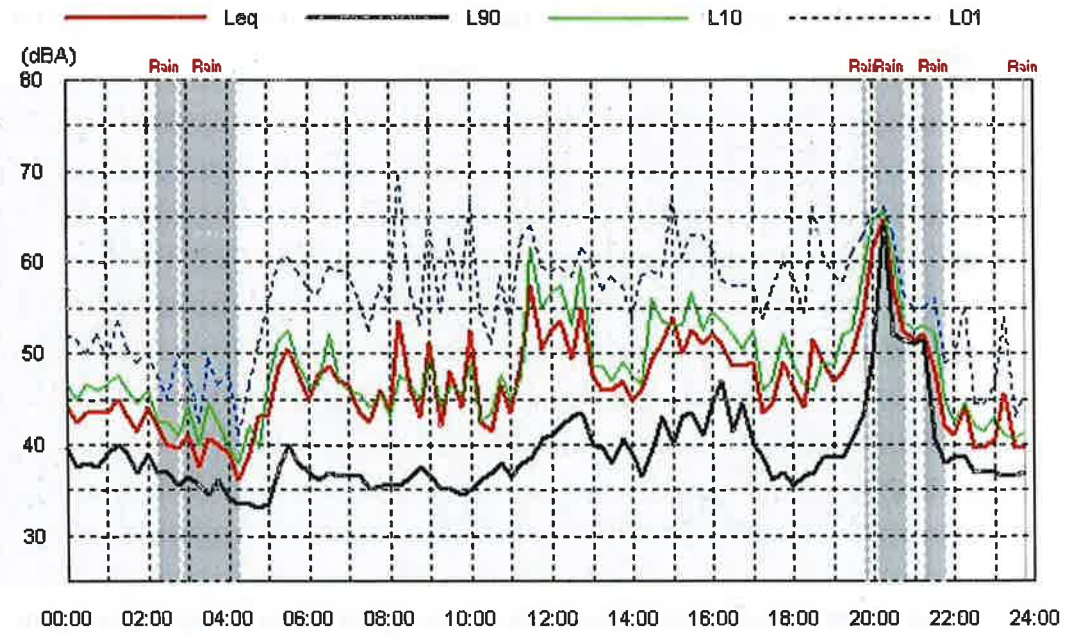


Location: 1. 27 East Street, Macksville - Dudley Street Facade
Data shaded: Extraneous; Weekend; Rain

Mon 13 Dec 10



Tue 14 Dec 10



Location: 1. 27 East Street, Macksville - Dudley Street Facade
Data shaded: Extraneous; Weekend; Rain

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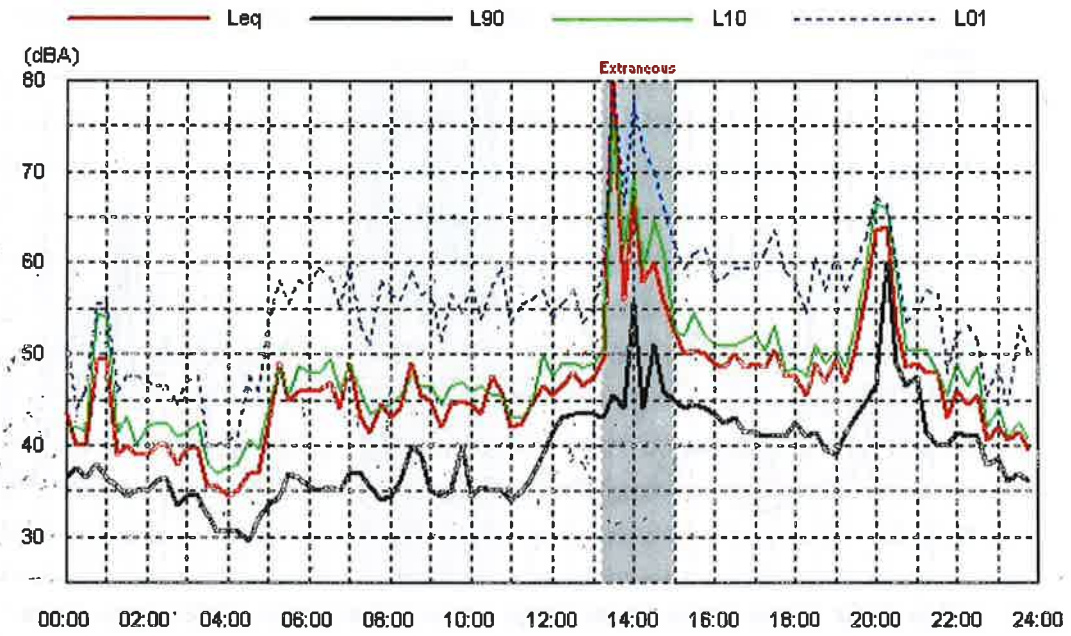
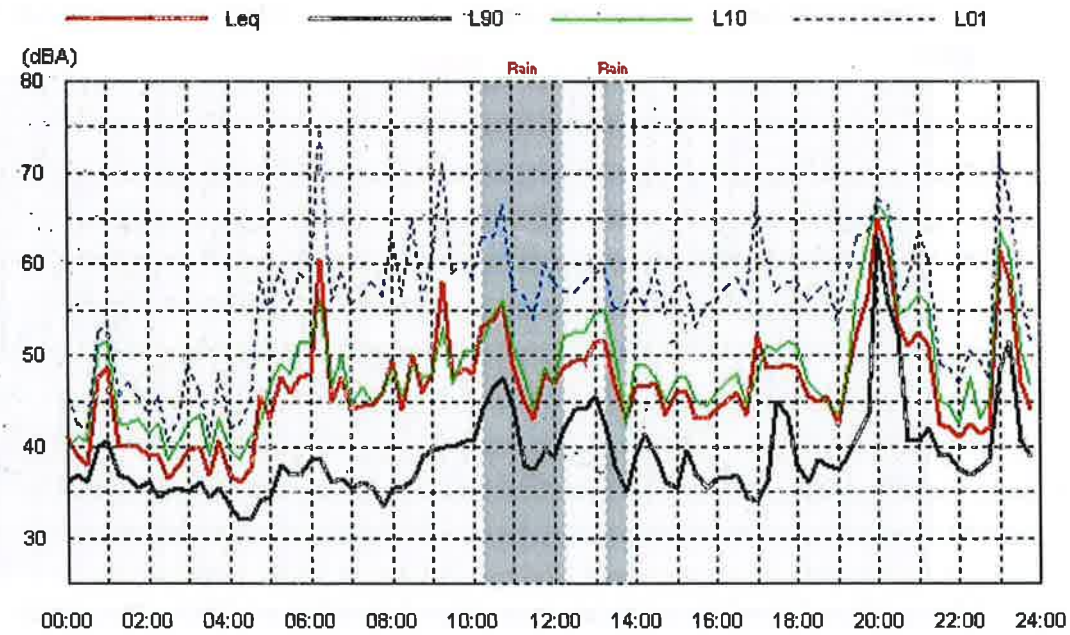
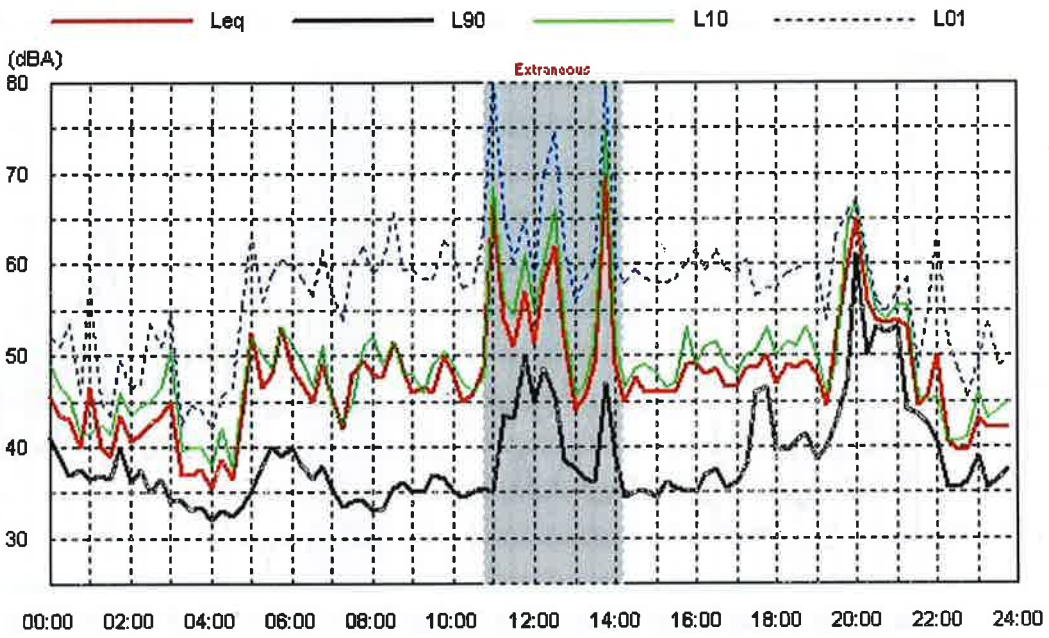


Thu 16 Dec 10



Location: 1. 27 East Street, Macksville - Dudley Street Facade
Data shaded: Extraneous; Weekend; Rain

Fri 17 Dec 10



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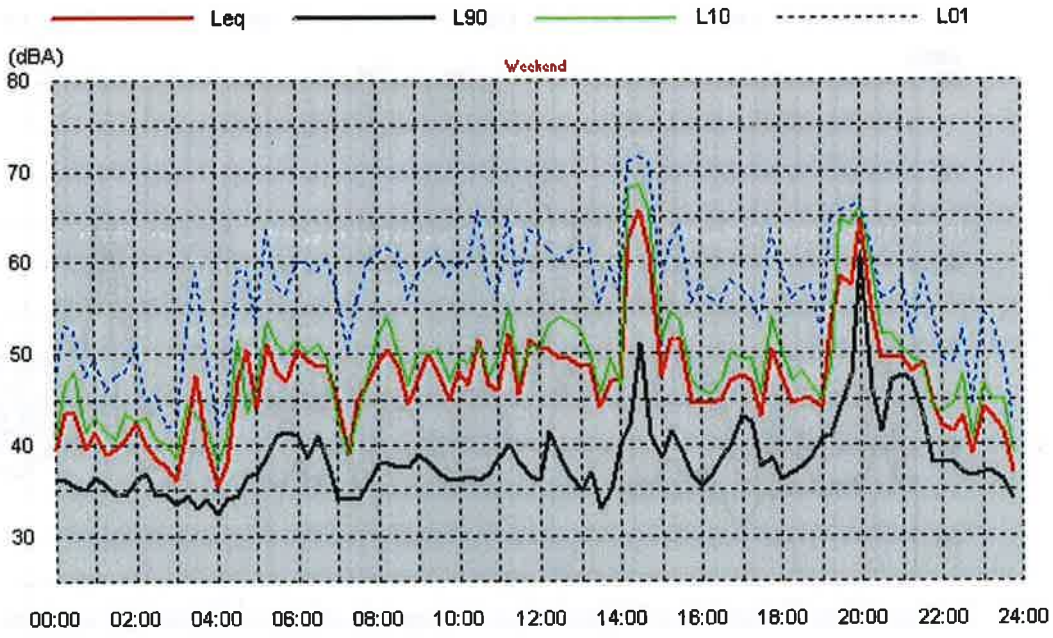
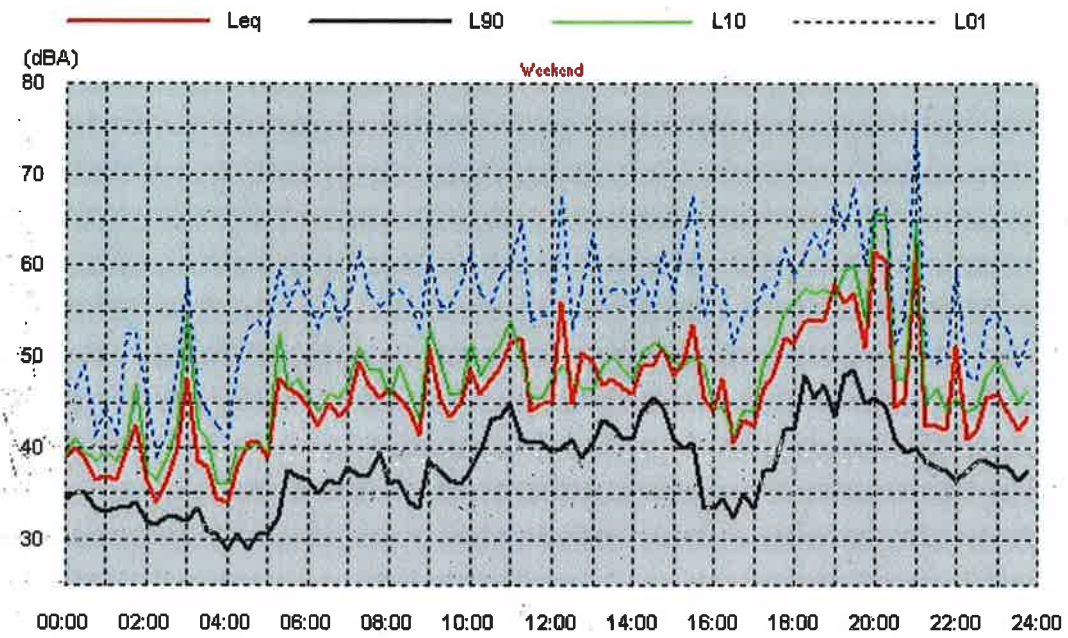


Location: 1. 27 East Street, Macksville - Dudley Street Facade
Data shaded: Extraneous; Weekend; Rain

Sun 19 Dec 10



Mon 20 Dec 10