

Report No 05056  
Version C

# NEPEAN RIVER PUMP AND PIPELINE ENVIRONMENTAL NOISE ASSESSMENT

April 2006



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Report No 05056  
Version C

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Prepared for

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## 1 INTRODUCTION

This noise assessment is part of an Environmental Assessment (EA) which is being prepared to address the environmental matters associated with the construction and operation of the Nepean River pump and pipeline. The EA is a requirement under Part 3A of the EP&A Act and will provide the supporting documentation that will be submitted to the Department of Planning for determination by the Minister for Planning.

The Penrith Lakes Scheme (PLS) is to be developed in accordance with the provisions of a Deed of Agreement between Penrith Lakes Development Corporation (PLDC) and the NSW Government (former Minister for Planning) that was made in 1987. Under Part 7 of the Deed, PLDC is required to construct a pump and pipeline to extract water from the Nepean River upstream of Penrith Weir to facilitate the initial filling of lakes within the Scheme.

The proposal involves the construction of the following:

- a pump station at Weir Reserve which will be designed to provide a flow to “Lake 1” of 1.0m<sup>3</sup>/s, whenever the flow in the river exceeds 350 ML/day. In order to provide some redundancy, it is proposed to install two pumps, each with a capacity of 0.5 m<sup>3</sup>/s when operating in parallel;
- a control building which would be located within Weir Reserve. The control building will be approximately 75m<sup>2</sup> in area and up to 3.8m in height (i.e. ground level to the top of the roofline). The design will incorporate the style of the existing buildings within the Weir Reserve and the external finishes and colours of the control building will be designed to integrate into the existing visual setting at Weir Reserve, subject to providing a secure structure and meeting the Integral Energy and plant maintenance requirements; and
- approximately 4.3 km of trenched 900mm diameter pipeline along the Option 3 route.

As part of the Environmental Impact Assessment stage of the project Wilkinson Murray has been commissioned by Maunsell to conduct a noise assessment. The noise assessment would review any construction and operational noise impacts as a result of the proposed Nepean River Pump and Pipeline Scheme.

The proposed construction works and associated noise impacts are associated with the installation of the pump station and control building at Weir Reserve and the water pipeline extending from Weir Reserve to the Penrith Lakes.

In terms of operational noise levels, the most significant new noise sources would be the proposed water pump station and the control building. The proposed location of the pump station and the control building is shown in Figure 1-1.



Figure 1-1 Location of the Proposed Pump Station and Control Building

The technology proposed for the pump station has been reviewed and it has been proposed that a wet well submersible pumping arrangement is preferred, with submersible pumps mounted on guide rails. It is proposed that the pump station be located at the edge of the Nepean River.

## 2 SURROUNDING NOISE SENSITIVE RECEIVERS

The noise and vibration-sensitive receivers potentially most affected by the works considered by this assessment are identified in Figure 2-1. These are the residential and commercial receivers to which impacts have been assessed. The pertinent characteristics of these receivers are summarised in Table 2-1 below. The Emu Plains Correctional Facility, motel on Castlereagh Road and Nepean River camping area are not strictly residential receivers, however, for this noise assessment they are considered residential since people would be staying and sleeping in these facilities.

*Table 2-1 Summary of Noise-Sensitive Receivers Considered by this Assessment*

No.	Location No.	Receiver Type	Location	Potential Impact
1	Motel	Residential	Castlereagh Rd, Penrith	Pipeline construction noise impacts
2	Residence	Residential	Castlereagh Rd, Penrith	Pipeline construction noise impacts
3	Church	Church	Castlereagh Rd, Penrith	Pipeline construction noise impacts
4	Sydney International Regatta Centre	Commercial	Castlereagh Rd, Penrith	Pipeline construction noise impacts
5	Emu Heights	Residential	Breton Cl, Emu Heights	Pipeline construction noise impacts
6	Emu Plains Correctional Facility	Residential	Bathurst Rd, Emu Plains	Pipeline construction noise impacts
7	Nepean River Camping Area	Residential	Mackellar St, Emu Plains	Pipeline and pump station construction noise impacts; and Operational noise impacts from pump station.
8	McCarthy Senior School	School	Mackellar St, Emu Plains	Pipeline and pump station construction noise impacts; and Operational noise impacts from pump station.
9	Avoca Street, Emu Plains	Residential	Avoca St, Emu Plains	Pipeline and pump station construction noise impacts; and Operational noise impacts from pump station.
10	Rowing Club	Commercial facility	Bruce Neale Dr, Emu Plains	Pipeline and pump station construction noise impacts; and Operational noise impacts from pump station.
11	Weir Reserve	Passive Recreation Area	Avoca St, Emu Plains	Pipeline and pump station construction noise impacts; and Operational noise impacts from pump station.
12	Commercial Area	Commercial	Peachtree Rd, Penrith	Pipeline and pump station construction noise impacts; and Operational noise impacts from pump station.
13	Commercial Area	Commercial	Jack Williams Dr, Penrith	Pipeline construction noise impacts
14	Commercial Area	Commercial	Cassola Pl, Penrith	Pipeline construction noise impacts

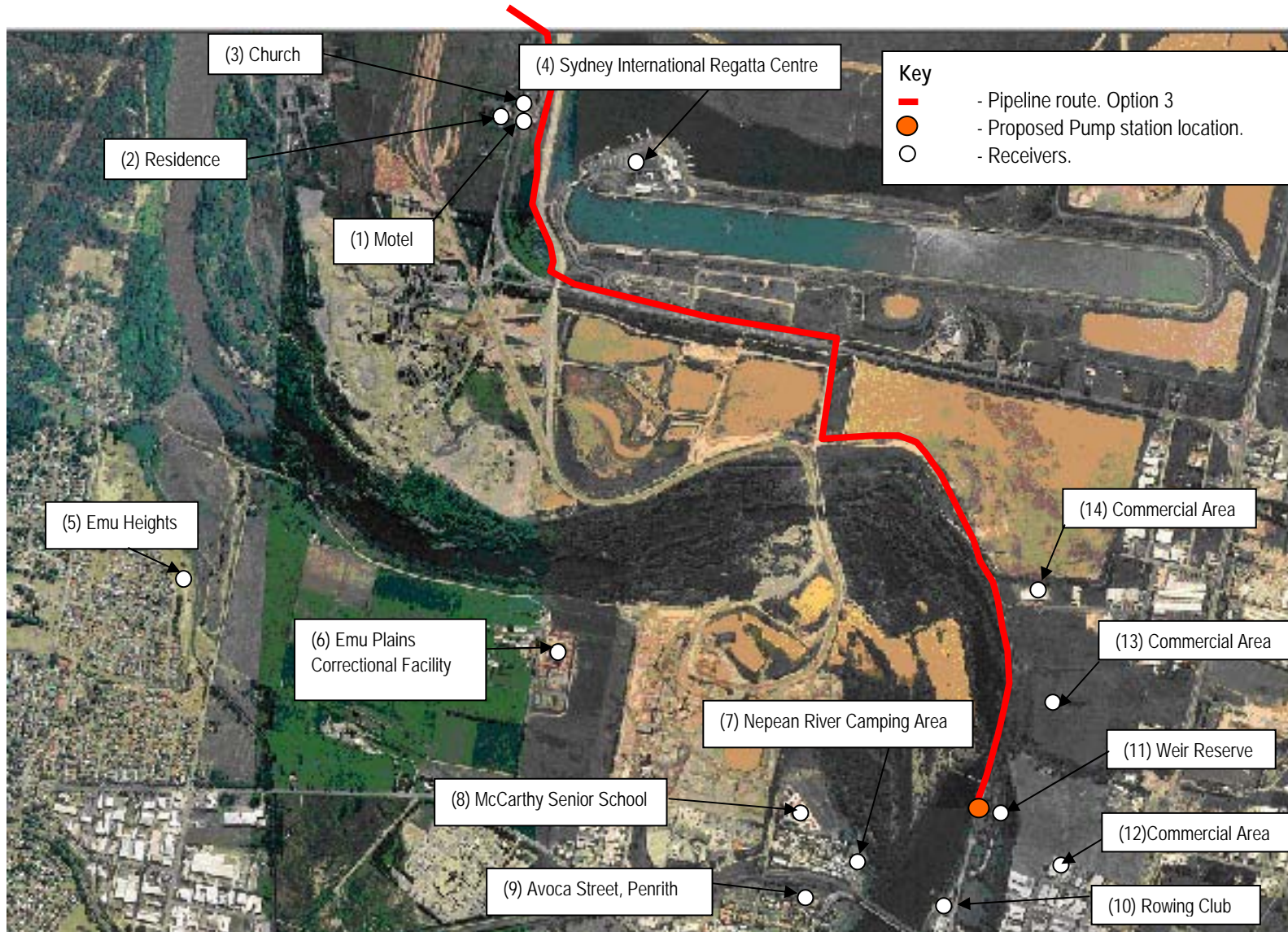


Figure 2-1 Location of Sensitive Receivers

### 3 ACOUSTIC PERFORMANCE CRITERIA

#### 3.1 Background Noise Levels

Existing ambient noise levels were measured using unattended noise loggers, at two locations along the proposed pipeline route, namely:

- Location 9 - 22 Avoca Avenue, Penrith; and
- Location 10 - Rowing Club.

Ambient noise monitoring was conducted over a period starting from the 8 June 2005 to 16 June 2005 for approximately one week for each site. The locations of the noise monitoring sites are shown in Figure 1-1.

The noise monitoring equipment used for these measurements consisted of environmental noise loggers 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.  $L_{A1}$ ,  $L_{A10}$  and  $L_{A90}$  are the levels exceeded for 1%, 10% and 90% of the sample time respectively. (Refer to Appendix A for a glossary of acoustic descriptors.) The  $L_{A1}$  is indicative of maximum noise levels due to individual noise events such as the occasional passby of a heavy vehicle. The  $L_{A90}$  level is normally taken as the background noise level during the relevant period. Detailed results from the unattended noise monitoring are shown as charts in Appendix B. The results of the unattended noise monitoring, in terms of the rating background level (RBL), is shown in Table 3-1. Corresponding meteorological information was sourced and noise monitoring data were excluded where they were affected by wind speeds greater than 5m/s at the microphone height, or by rain. Periods so affected are indicated in the charts.

Additional daytime attended noise measurements were conducted at three locations along the pipeline route on the 8 June 2005 using a Bruel &Kjaer 2231 sound level meter. The results of this daytime monitoring are also shown in Table 3-1.

Table 3-1 Background Noise Monitoring Results

No.	Location	RBL, Background Noise, dBA			L <sub>Aeq</sub> , Period Noise, dBA		
		Day	Evening	Night	Day	Evening	Night
9)	22 Avoca Avenue	44	44	34	54	51	51
10)	Rowing Club	44	44	37	54	51	50
1 & 2	Motel and Residence <sup>1</sup>	44	-	-	52	-	-
4	Emu Heights <sup>1</sup>	40	-	-	50	-	-
5	Emu Plains Correctional Facility <sup>1</sup>	39	-	-	49	-	--

Notes: 1 – Attended noise monitoring locations estimate of RBL levels.

The RBL at the Nepean River camping area was assumed to be the same as that measured at Avoca Avenue.

### 3.2 Operational Noise Criteria

The only noise sources likely to result in *operational* noise impacts are from the pump station and the control building located at Weir Reserve.

#### 3.2.1 Criteria for Residential Receivers

For operational noise, relevant criteria are described in the NSW Government's *Industrial Noise Policy (INP)*. For residential receivers, two forms of criterion are described, known as “intrusiveness” and “amenity” criteria.

The intrusiveness criterion applies to the L<sub>Aeq</sub> noise emission level for the introduced industrial source, measured over a period of 15 minutes. It requires that this should not exceed the RBL by more than 5dB.

The amenity criterion sets an absolute limit on the value of the L<sub>Aeq</sub> noise level measured over a day, evening or night period. In this case, the relevant receiver locations would generally be described as being in a “suburban” area, and the relevant “acceptable” noise levels are 55, 45 and 40 dBA for the day, evening and night periods respectively. These limits apply to the total noise from all industrial sources affecting a receiver location. Where existing industrial noise levels are above or near the acceptable noise levels the new noise source should be designed to a level where it does not contribute to the total level so that the L<sub>Aeq, period</sub> levels do not increase.

As can be seen from Table 3-1, the existing  $L_{Aeq}$  period level near the pump station and control building is above the acceptable noise levels. Assuming a worst case situation that the  $L_{Aeq,period}$  noise levels are a result of industrial noise then the INP recommends that the new noise source should be designed to 10dB below the acceptable noise levels.

Because noise sources from the proposed plant will be relatively constant, the  $L_{Aeq}$  level of noise measured over 15 minutes can be assumed to be equivalent to that measured over a longer period. Based on information presented in Table 3-1, Table 3-2 summarises the relevant operational noise criteria for those receiver locations potentially affected by operational noise from the proposal.

Table 3-2 Residential Operational Noise Criteria

No.	Location	Intrusive Noise Criteria			Amenity Noise Criteria		
		$L_{Aeq,15minute}$			$L_{Aeq,Period}$		
		Day	Evening	Night	Day	Evening	Night
7	Nepean River Camping Area	49	49	39	45	35	30
9	22 Avoca Avenue	49	49	39	45	35	30

The appropriate project specific noise level for residential receivers for this project would be the night time amenity criterion, as the pump station and control building could be operating 24 hours per day.

### 3.2.2 Criteria for Non-Residential Receivers

For non-residential receivers such as commercial premises, schools, and passive recreation areas the *INP* provides relevant operational noise criteria. Table 3-3 summarises the relevant operational noise criteria for those non-residential receiver locations potentially affected by operational noise from the proposal.

Table 3-3 Operational Noise Criteria for Non-Residential Receivers

No.	Location	$L_{Aeq,1hour}$		
		Day	Evening	Night
8	McCarthy Senior School	40 inside class rooms approximately 50 <sup>1</sup> outside		
10	Rowing Club	65		
11	Weir Reserve	50		
12	Commercial Area	65		

Notes: 1 – Assuming a 10dB reduction from inside to outside with windows open.

For a passive recreation area the *INP* noise criterion would typically be assessed at the closest boundary to the noise source. As the pump station and control build are located within Weir Reserve this is not possible. Therefore, it is proposed that the criterion be achieved at 10m from the pump station and control building.

### 3.3 Construction Noise Criteria

#### 3.3.1 Criteria for Residential Receivers

The EPA's *Environmental Noise Control Manual (ENCM)* is no longer considered to contain current information on noise management. Chapter 171 "Construction Site Noise" of the *ENCM* is currently being reviewed, however still presents the current policy on construction site noise, the Guideline states:

- For periods of 4 weeks or less, the  $L_{A10}$  level should not exceed the background ( $L_{A90}$ ) level by more than 20dBA.
- For periods greater than 4 weeks and less than 26 weeks, the  $L_{A10}$  level should not exceed the background ( $L_{A90}$ ) level by more than 10dBA.

Although not clearly stated by DEC, it is considered that for construction periods longer than 26 weeks, the  $L_{A10}$  noise level should not exceed the  $L_{A90}$  level by more than 5dBA. It is accepted that for determining noise criteria, the  $L_{A90}$  background noise level should be quantified by the Rating Background Level value.

In addition, the DEC specifies the following time restrictions for construction activities where the noise is audible at residential premises:

- Monday to Friday            7.00 am to 6.00 pm
- Saturday                      8.00 am to 1.00 pm
- No construction work is to take place on Sundays or Public Holidays.

The DEC noise criteria are objectives to try and achieve. Where they can not be met DEC recommends that a "best practice" approach be used to ensure that all possible steps are taken to reduce noise levels of construction site equipment so as to minimise the impact of construction noise.

The duration of construction of the total Nepean River pump and pipeline project would exceed 26 weeks, therefore the construction noise objective would be that the  $L_{A10}$  noise level should not exceed the  $L_{A90}$  level by more than 5dBA. Table 3-4 summarises the relevant construction noise criteria for those residential receiver locations potentially affected by construction noise from the proposal.

Table 3-4 *Daytime Residential Construction Noise Objectives*

No.	Location	LA10, Construction Noise Objectives <sup>1</sup>
1	Motel	49
2	Residence	49
5	Emu Heights	45
6	Emu Plains Correctional Facility	44
7	Nepean River Camping Area	49
9	22 Avoca Avenue	49

Notes: 1 – "Best practice" required where objectives can not be met.

### 3.3.2 Noise Criteria for Non-Residential Receivers

There are no construction noise criteria for non-residential receivers. For commercial receivers and schools it is not appropriate to assess construction noise impacts to residential receiver criteria. This is because the commercial activities and teaching within schools typically occur inside.

Therefore as a conservative measure, it is recommended that the operational noise criteria be used as the construction objectives, but applying to the LA10 level. If these levels are exceeded it would trigger the development of a construction noise management plan to consider all reasonable and feasible noise mitigation.

Table 3-5 *Construction Noise Criteria for Non-Residential Receivers*

No.	Location	Construction noise objectives, LA10		
		Day	Evening	Night
3	Church	40 inside rooms approximately 50* outside		
4	Sydney International Regatta Centre	65		
8	McCarthy Senior School	40 inside class rooms approximately 50* outside		
10	Rowing Club	65		
11	Weir Reserve	50		
12	Commercial Area	65		
13	Commercial Area	65		
14	Commercial Area	65		

Notes: \* - Assuming a 10dB reduction from inside to outside with windows open.

For a passive recreation area the construction noise criteria would typically be assessed at the closest boundary to the noise source. As the pump station, control building and to some extent the pipeline corridor are located within Weir Reserve this is not possible. Therefore, it is proposed that the construction noise criteria be considered at the edge of the construction compound required for the construction of the pump station, control building and pipeline corridor. This has been assumed to be 30m from the pump station, control building and pipeline corridor.



The proposed control building will house an air compressor and a transformer. The sound power levels for the equipment in the pump station and control building are presented in Table 4-1.

Table 4-1 Pump Station and Control Building Equipment Sound Power Levels

Equipment	Sound Power Level (dBA)
160kw Pumps	87
Air compressor	100
Transformer	75

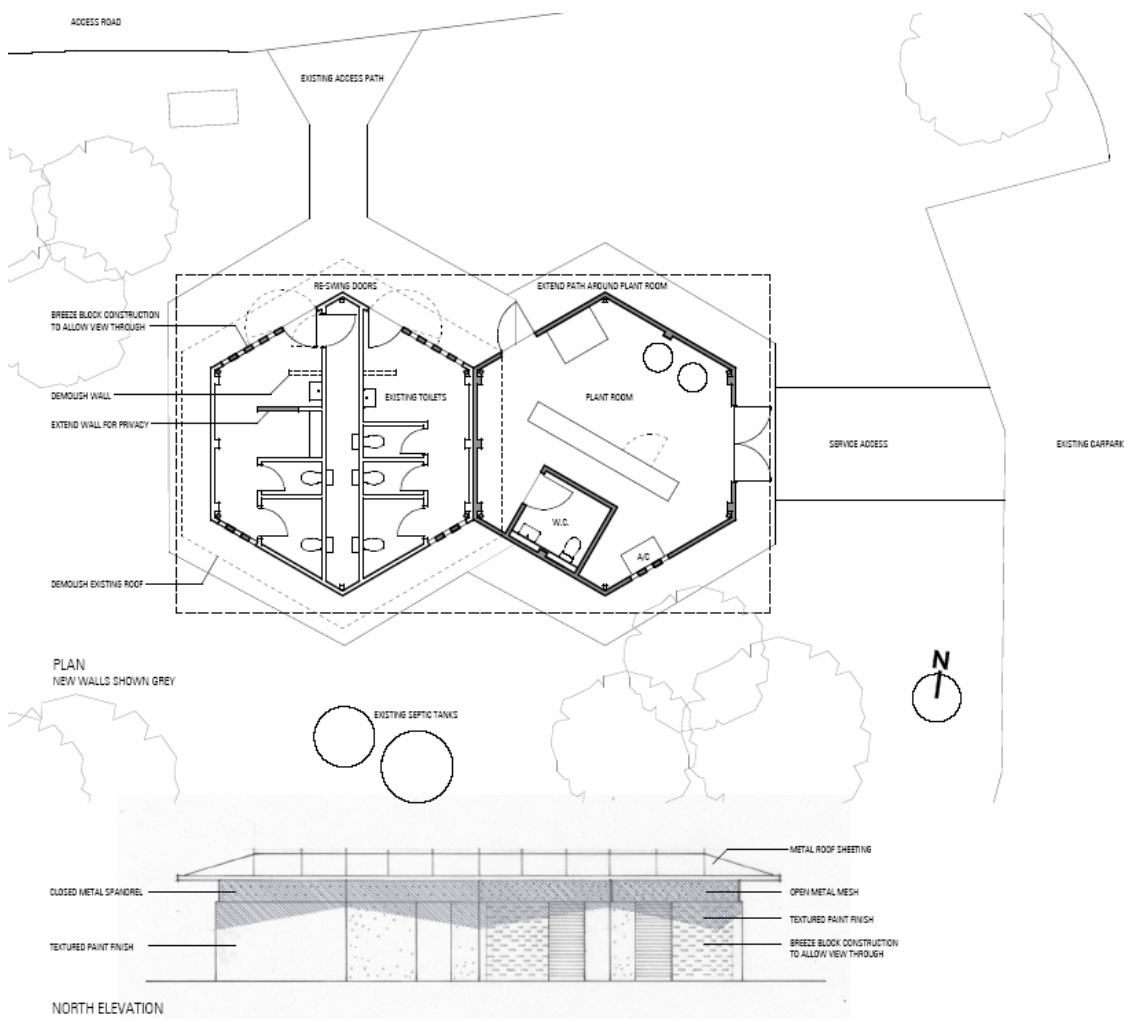


Figure 4-2 Proposed Layout of the Control Building

It is proposed that the pump station is located at the edge of the Nepean River. Submersible pumps are proposed to be located in a pit and the pit is covered with 200mm thick concrete panels.

The control building will be approximately 75m<sup>2</sup> in area and up to 3.8m in height (i.e. ground level to the top of the roofline). The design will incorporate the style of the existing buildings within the Weir Reserve and the external finishes and colours of the control building will be designed to integrate into the existing visual setting at Weir Reserve, subject to providing a secure structure and meeting the Integral Energy and plant maintenance requirements.

The building walls would be constructed of brick and metal spandrel, roof would be metal deck and there would be a large double solid core timber door in the eastern wall and a single solid core timber door in the northern wall

Assuming the transmission loss of the building elements and reverberant levels within the building structures and the proposed sound power levels a noise level of less 50dBA  $L_{Aeq, 1hour}$  at 10m would appear to be achievable for the pump station and the control building.

Additional acoustic treatments are readily available for the control of noise emissions from the pump station and control building, namely:

- specification and selection;
- absorptive treatments to internal spaces;
- separate acoustic enclosures; and
- vibration isolation of the plant.

## 4.2 Construction Noise Source

Trenching would be the major construction method that could be used to construct the pipeline. *Trenching would* involve laying the pipeline in a small trench formed by a single excavator. During this process, the most significant noise source will be the excavator, which would be expected to have a sound power level of approximately 112dBA. Other equipment used may include a backhoe, mobile crane, bobcat, roller and compactor, but these are unlikely to be used simultaneously. To estimate the  $L_{A10}$  noise level from these operations, a sound power emission level of 112dBA has been assumed.

The schedule of typical construction plant required for the construction of the pump station and control building are listed in Table 4-2. At other times, the major noise sources would be items such as hand tools, which will have a lower cumulative noise emission.

Table 4-2 Construction Equipment Sound Power Levels

Equipment	Sound Power Level (dBA)
Vibratory Sheet Piling	110
Excavator	112
Front End Loader	114
Dump Truck	110
Crane	110
Water Cart	110

The sound power levels shown represent the maximum noise level output from this machinery. However, all equipment would not operate at this rate simultaneously. Based on previous experience, 3dBA was subtracted from the total sound power level of all these sources to estimate the cumulative  $L_{A10}$  sound power level from a typical construction operation. To estimate the  $L_{A10}$  noise level from these construction activities, an overall sound power emission level of 115dBA has been assumed.

## 5 NOISE PREDICTIONS

The Environmental Noise Model (ENM) was used to calculate noise levels from these sources to the surrounding areas. Ground heights in the model were based on data from relevant topographic maps.

### 5.1 Operational Noise Predictions

Due to the proposed pumps being able to operate 24 hours per day and western Sydney's high prevalence of night time temperature inversion conditions, the *INP's* "default" temperature inversion condition of 3 degrees per 100m was assumed in all operational noise calculations.

Assuming that that the recommended criterion at Weir Reserve at both the pump station and the control building are met (50dBA at 10m), Table 5-1 presents calculated operational noise levels at the potentially worst affected receiver locations.

*Table 5-1 Calculated Operational Noise Levels at Closest Receivers*

No.	Location	Calculated L <sub>Aeq</sub> Noise Level (dBA)	Criterion (dBA)	Complies (Yes/No)
7	Nepean River Camping Area	<25	30	Yes
9	22 Avoca Avenue	<25	30	Yes
8	McCarthy Senior School	<25	50	Yes
10	Rowing Club	<25	65	Yes
12	Commercial Area	<25	65	Yes

With the controls and equipment specification incorporated in the final design, the calculated noise levels would be well within the relevant criterion.

### 5.2 Construction Noise Predictions

#### 5.2.1 Pump Station and Control Building

The construction of the pump station and control building is proposed to occur during normal construction hours as stated in Section 3.3.1. The resulting predicted noise levels from construction works at the closest receivers without any noise mitigation are presented in Table 5-2. As construction works are proposed to occur during the day the noise predictions were conducted under zero temperature inversion conditions.

*Table 5-2 Calculated Construction Noise Levels at Closest Receivers from Works at the Pump Station and Control Building without Noise Mitigation*

No.	Location	Calculated LA <sub>10</sub> Noise Level (dBA)	LA <sub>10</sub> , Construction Noise Objective (dBA)	Complies (Yes/No)
7	Nepean River Camping Area	54	49	No
9	22 Avoca Avenue	49	49	Yes
8	McCarthy Senior School	52	50	No
10	Rowing Club	56	65	Yes
11	Weir Reserve at 30 metre from the pump station	75	55	No
11	Weir Reserve at 30 metre from the control building	75	55	No
12	Commercial Area	57	65	Yes

Construction noise levels at the closest receivers across the Nepean River (Nepean River Camping Ground and McCarthy Senior School) are predicted to marginally exceed construction noise criteria.

It is recommended that consideration be given to possible methods for mitigation of construction noise for these receivers. The local community should be informed of the fact that construction activities will take place, but that their duration will be limited and the times of construction strictly controlled. Equipment with sound power levels equal to or below the sound power levels presented in Table 4-2 should be used. Options for noise control are principally barriers. Any barriers would need to be installed along the edge of the construction site, and would need to be at least 2m high to provide a significant reduction in noise level. The barrier attenuation from such a barrier would typically be 5dB. The requirement for, and feasibility of, such barriers would need to be addressed in a Construction Noise Management Plan to be prepared when the construction contractor is known.

At Weir Reserve construction of the pump station and the control building may disturb users of the Reserve. Temporary barriers should be considered along the edge of the compounds, and would need to be at least 2m high to provide a significant reduction in noise level. The barrier attenuation from such a barrier would typically be 5dB. The requirement for, and feasibility of, such barriers would need to be addressed for each site in a Construction Noise Management Plan to be prepared when the construction contractor is known.

### 5.2.2 Pipeline

The construction of the pipeline is proposed to occur during normal construction hours as stated in Section 3.3.1. The resulting predicted noise levels from the construction works without any noise mitigation at the closest receivers is presented in Table 5-3. As construction works are proposed to occur during the day the noise predictions were conducted under zero temperature inversion conditions.

*Table 5-3 Calculated Construction Noise Levels at Closest Receivers from Pipeline Construction without Noise Mitigation*

No.	Location	Calculated $L_{A10}$ Noise Level (dBA)	$L_{A10}$ , Construction Noise Objective (dBA)	Complies (Yes/No)
1	Motel	71	49	No
2	Residence	62	49	No
3	Church	65	50	No
4	Sydney International Regatta Centre	50	65	Yes
5	Emu Heights	37	45	Yes
6	Emu Plains Correctional Facility	40	44	Yes
7	Nepean River Camping Area	51	49	No
8	McCarthy Senior School	49	50	Yes
9	22 Avoca Avenue	46	49	Yes
10	Rowing Club	50	65	Yes
11	Weir Reserve 30 metre from the corridor	75	55	No
12	Commercial Area	51	65	Yes
13	Commercial Area	56	65	Yes
14	Commercial Area	56	65	Yes

Construction noise levels from pipeline construction are predicted to exceed construction noise criteria at the residence, motel and Church on Castlereagh Road due to the close proximity of the pipeline construction to this site. There is also a marginal exceedance at the Nepean River camping area. It should be noted that these exceedances would only occur when intensive pipeline construction is moving past the adjacent receiver for a period of between two and four weeks. At other times (e.g. landscaping) the construction works would be less intense and would be less than the construction noise criteria.

It is recommended that consideration be given to possible methods for mitigation of construction noise for these receivers. The local community should be informed of the fact that construction activities will take place, but that their duration will be limited and the times of construction strictly controlled. Where possible, equipment with low noise emission (less than 112dBA sound power level) should be used. The requirement for and feasibility of noise mitigation would need to be addressed in a Construction Noise Management Plan to be prepared when the construction contractor is known. The barrier attenuation from such a barrier would typically be 5 dB.

At Weir Reserve construction of the pipeline may disturb users of the Reserve. Temporary barriers should be considered along the edge of the pipeline route to reduce noise levels. The requirement for, and feasibility of, such barriers would need to be addressed in a Construction Noise Management Plan to be prepared when the construction contractor is known.

## 6 CONCLUSION

The construction and operation of the Nepean River Pumping Scheme may potentially result in noise impacts arising from:

- construction of the pipeline;
- construction of pump station and control building; and
- operation of the pump stations and control building.

Potential impacts have been assessed with respect to criteria derived from the NSW Government's *Industrial Noise Policy* (for operational noise) and *Environmental Noise Control Manual* (for noise impacts during construction). Ambient noise levels in surrounding areas were monitored in order to derive appropriate noise criteria in accordance with these policies.

Conclusions from the assessment are as follows.

- Noise levels during the construction of the proposed pump station and control building may exceed the construction noise criteria at Nepean River camping area and McCarthy Catholic School.

It is recommended that the community be informed of potential short-term noise impacts. A Construction Noise Management Plan would be formulated with particular reference to potentially-affected residences, and this should investigate specific noise control options including temporary screening near the site of proposed construction works, and the selection of low noise emission plant.

- For general construction work associated with the pipeline, construction noise criteria are likely to be exceeded at the residence, motel and Church on Castlereagh Road, Nepean River camping area and at Weir Reserve.

It is recommended that the local community be informed of potential short-term noise impacts, and that all efforts be made to reduce noise impacts at these residences. A Construction Noise Management Plan should be formulated with particular reference to potentially-affected receivers, and this would investigate other noise control options including temporary screening near the site of proposed construction works, and the selection of low noise emission plant.

- At Weir Reserve construction of the pump station and the control building may disturb users of the Reserve.

Barriers should be considered along the edge of the compounds, and would need to be at least 2m high to provide a significant reduction in noise level. The requirement for, and feasibility of, such barriers would need to be addressed for each site in a Construction Noise Management Plan to be prepared when the construction contractor is known.

- Operational noise emissions from pump station and control building are predicted to comply with the respective criteria at all potentially-affected receivers, assuming that the pump station and control building noise specification of 50dBA at 10m is met.

#### Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose.

#### Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2000 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

#### AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
A	Draft	27 June 2005	John Wassermann	Barry Murray
B	Draft	14 February 2005	John Wassermann	Barry Murray
C	Final	27 April 2006	John Wassermann	Barry Murray

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# APPENDIX A

## NOISE DESCRIPTORS

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## NOISE DESCRIPTORS

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.

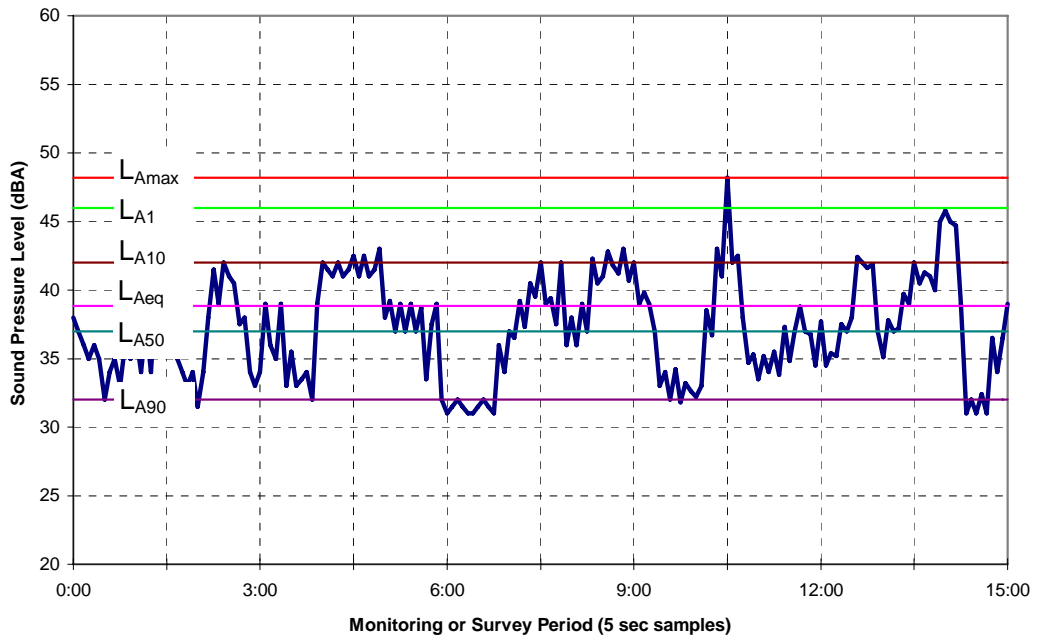
**$L_{Aeq}$**  – The equivalent continuous sound level ( $L_{Aeq}$ ) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental 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 (day, evening and night) for each day. It is determined by calculating the 10<sup>th</sup> percentile (lowest 10<sup>th</sup> 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, day, evening and night.



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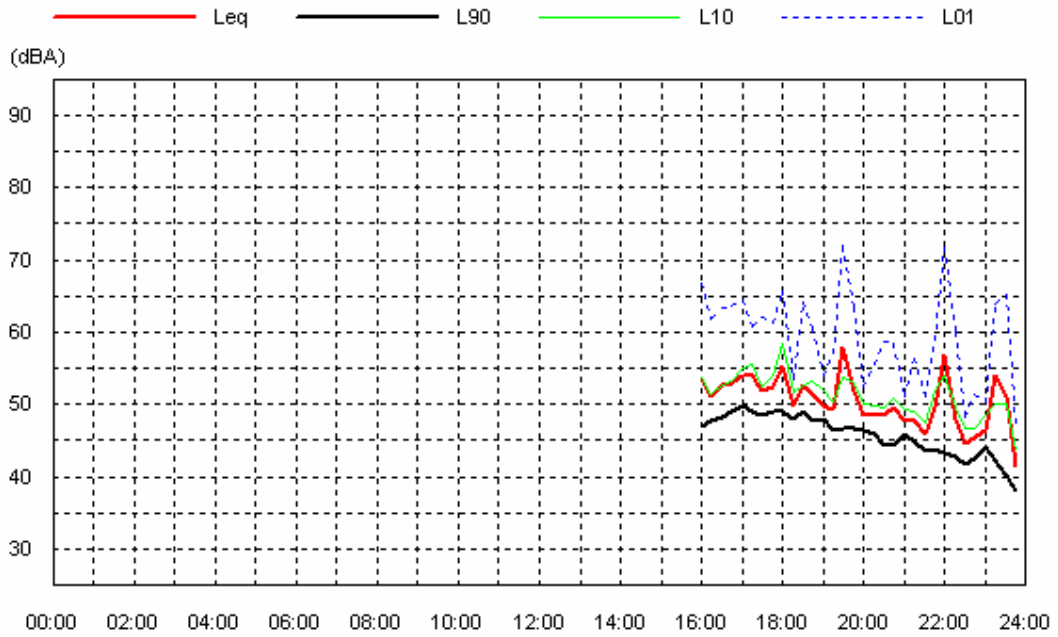
# APPENDIX B

## NOISE LOGGER GRAPHS

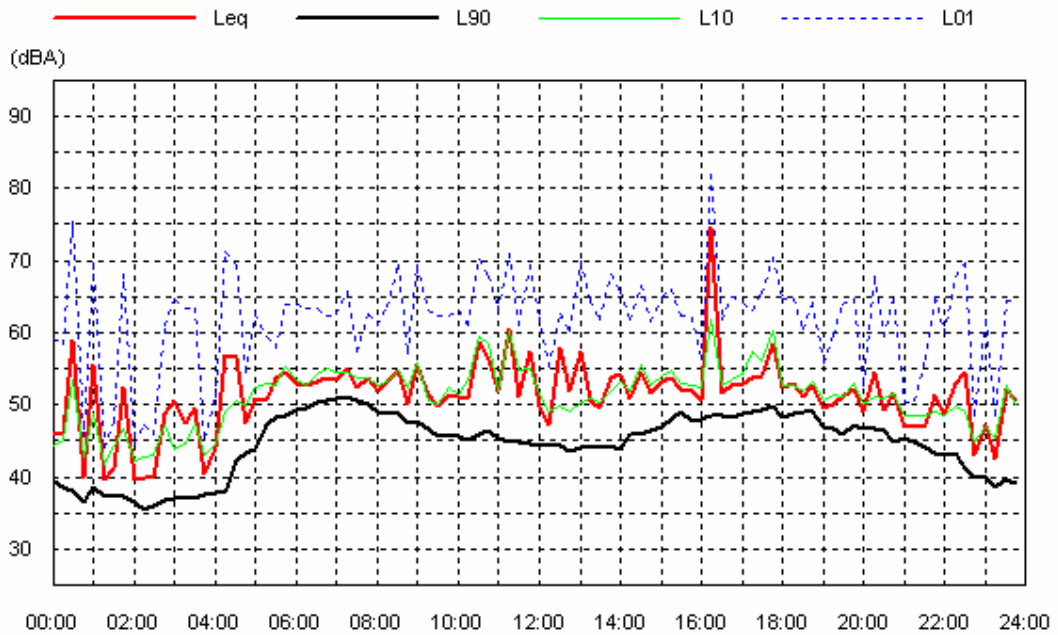
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Location: 22 Avoca Avenue, Emu Plains

Wed 08 Jun 05

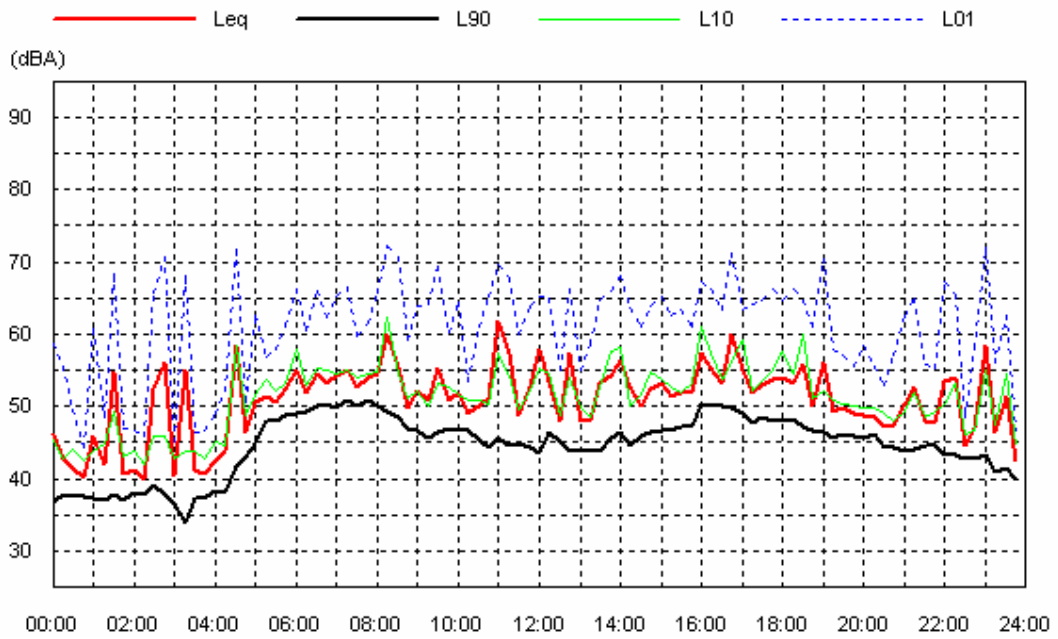


Thu 09 Jun 05

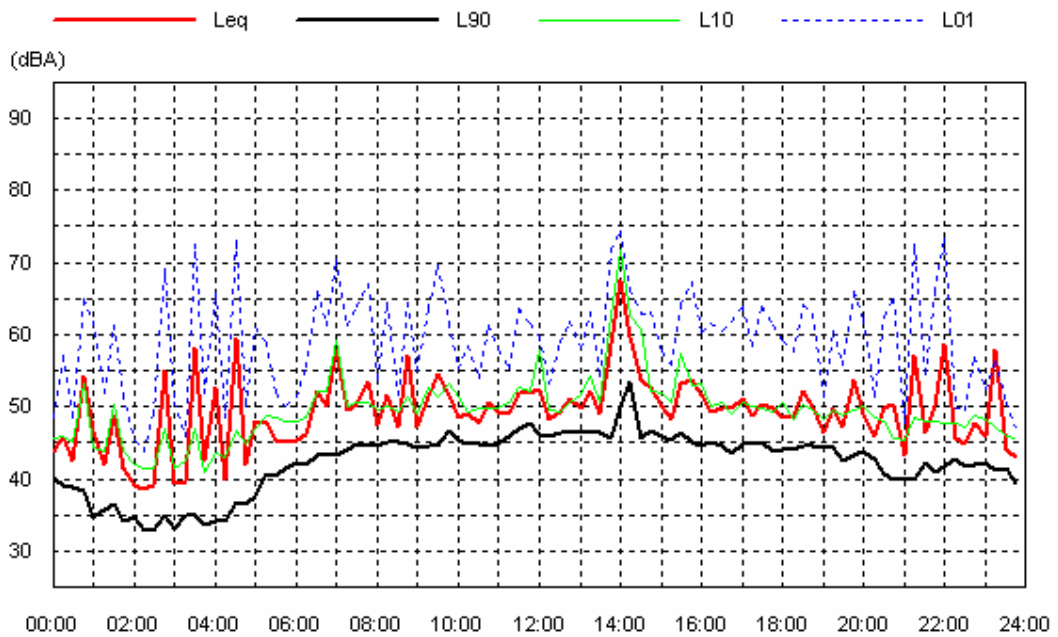


Location: 22 Avoca Avenue, Emu Plains

Fri 10 Jun 05

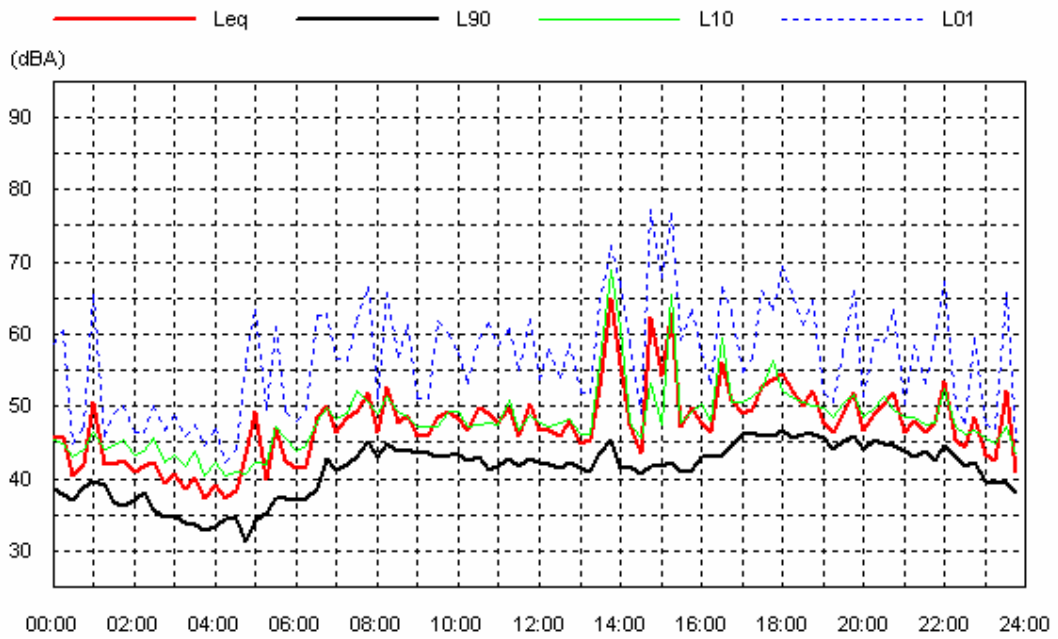


Sat 11 Jun 05

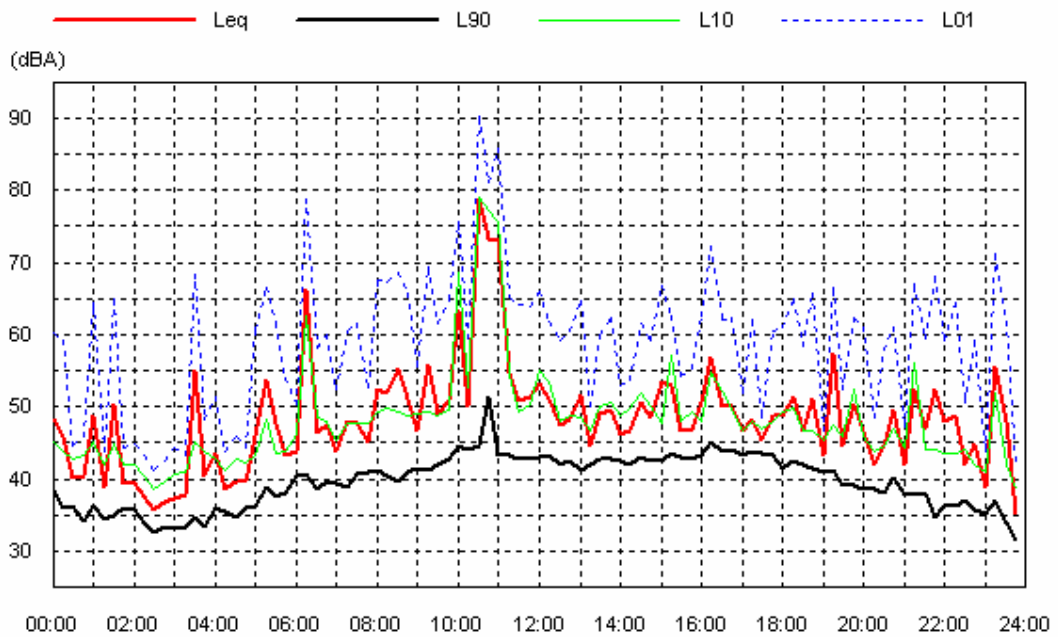


Location: 22 Avoca Avenue, Emu Plains

Sun 12 Jun 05

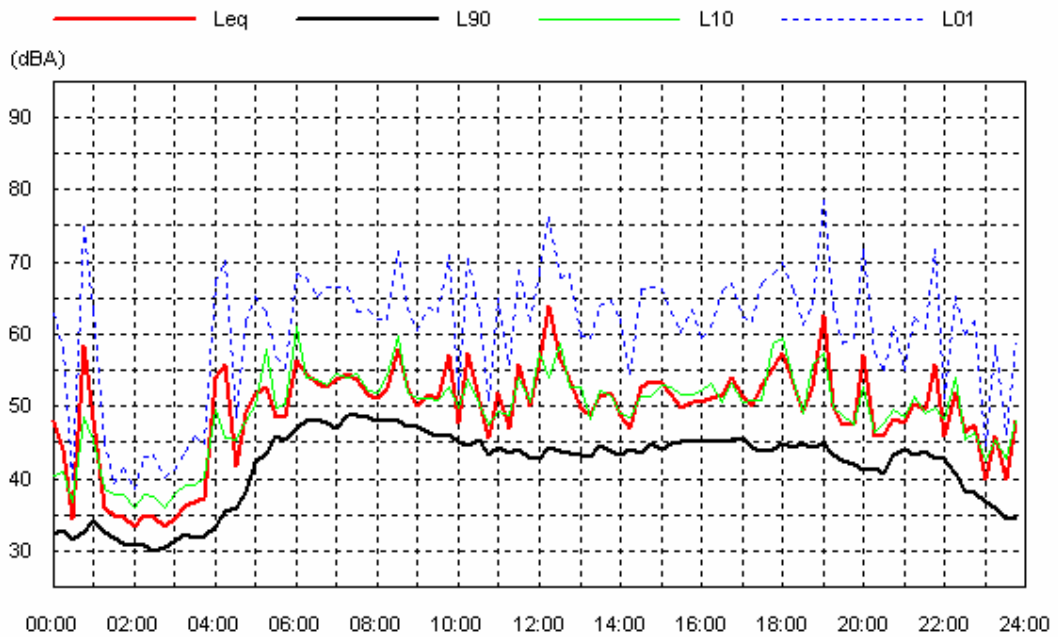


Mon 13 Jun 05

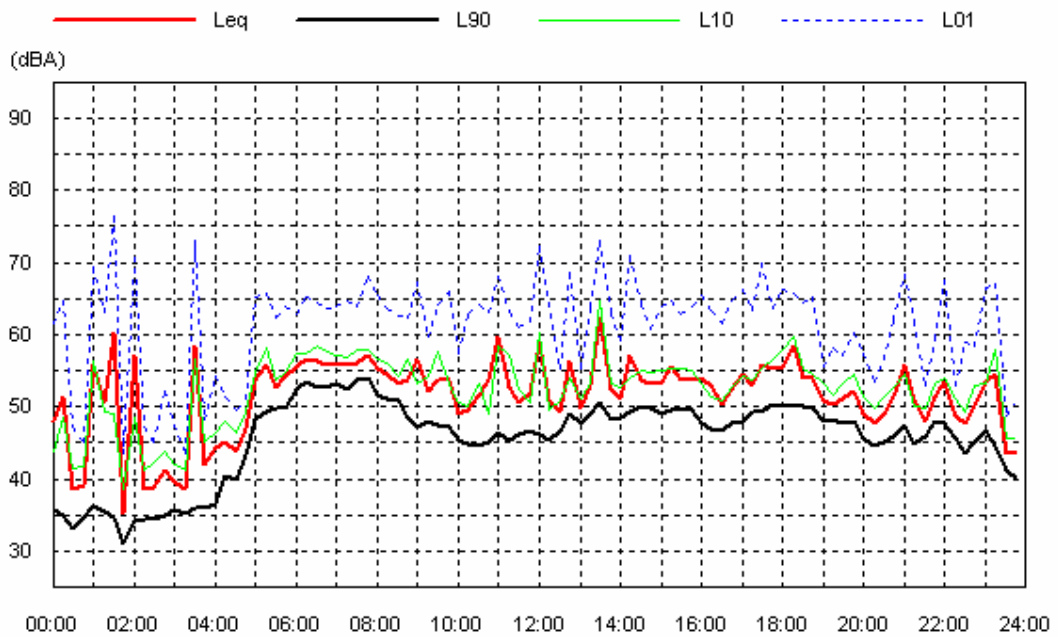


Location: 22 Avoca Avenue, Emu Plains

Tue 14 Jun 05

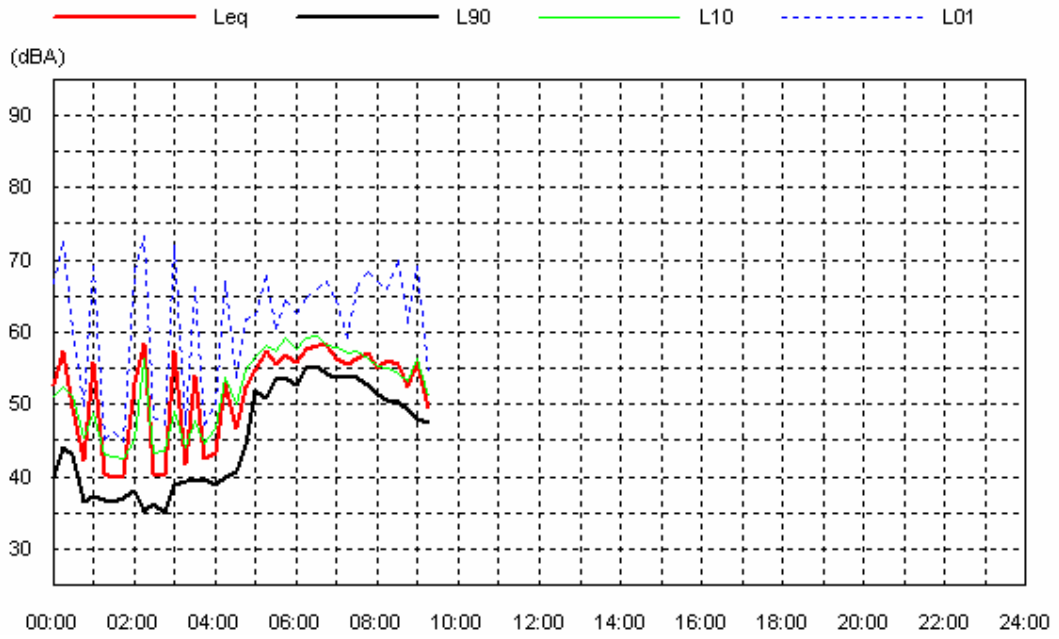


Wed 15 Jun 05



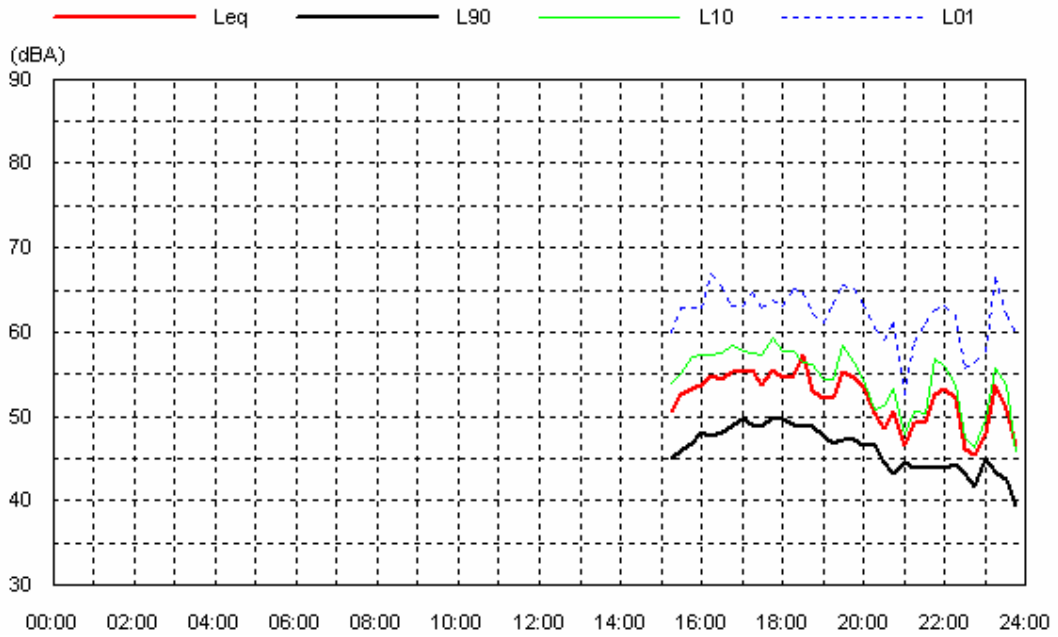
Location: 22 Avoca Avenue, Emu Plains

Thu 16 Jun 05

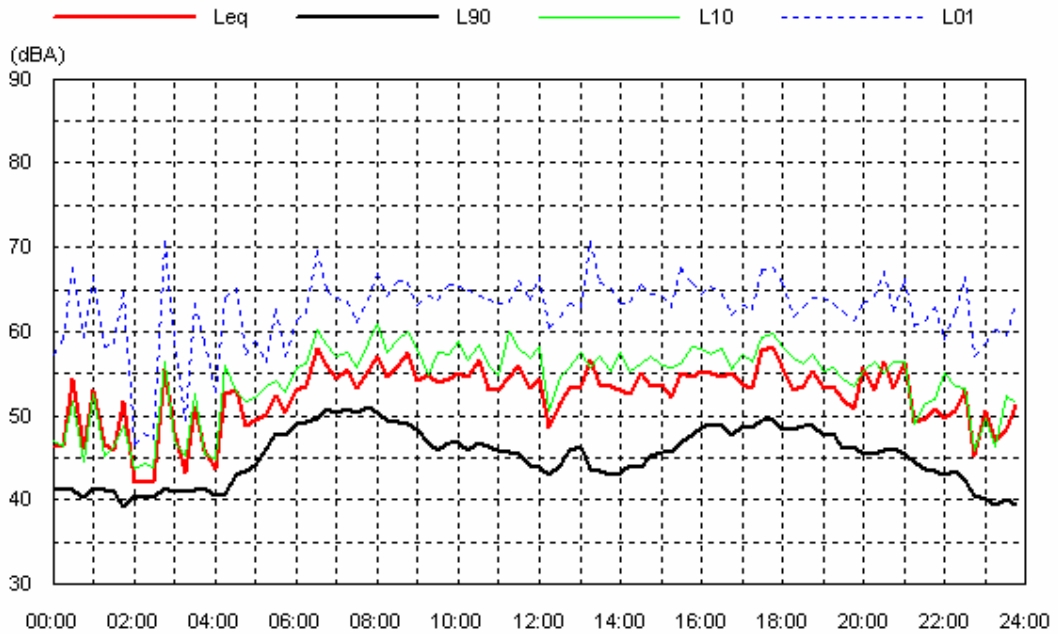


Location: Rowing Club, Penrith

Wed 08 Jun 05

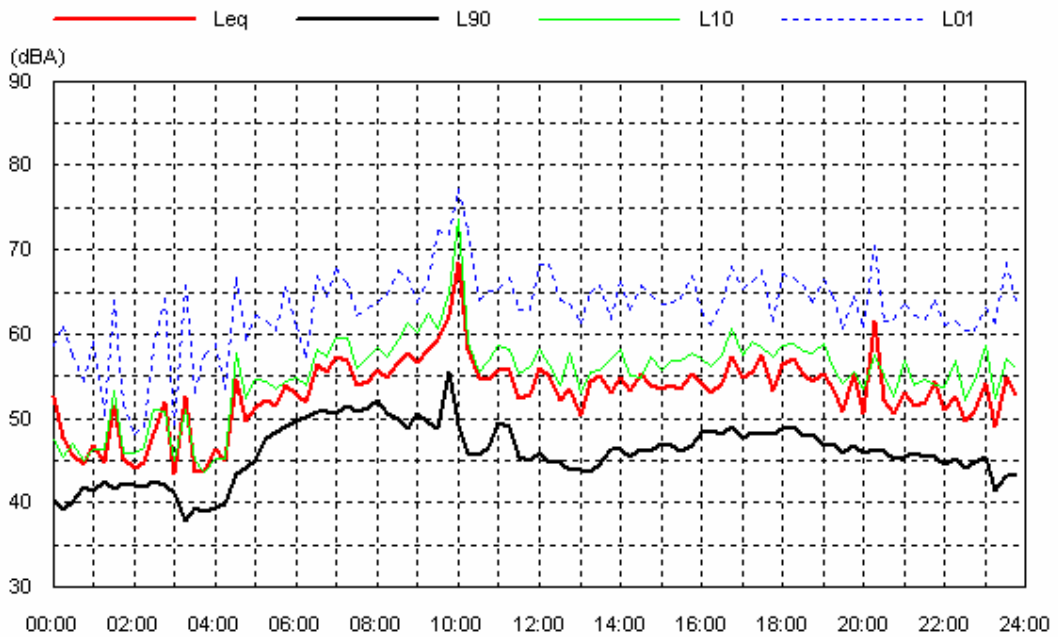


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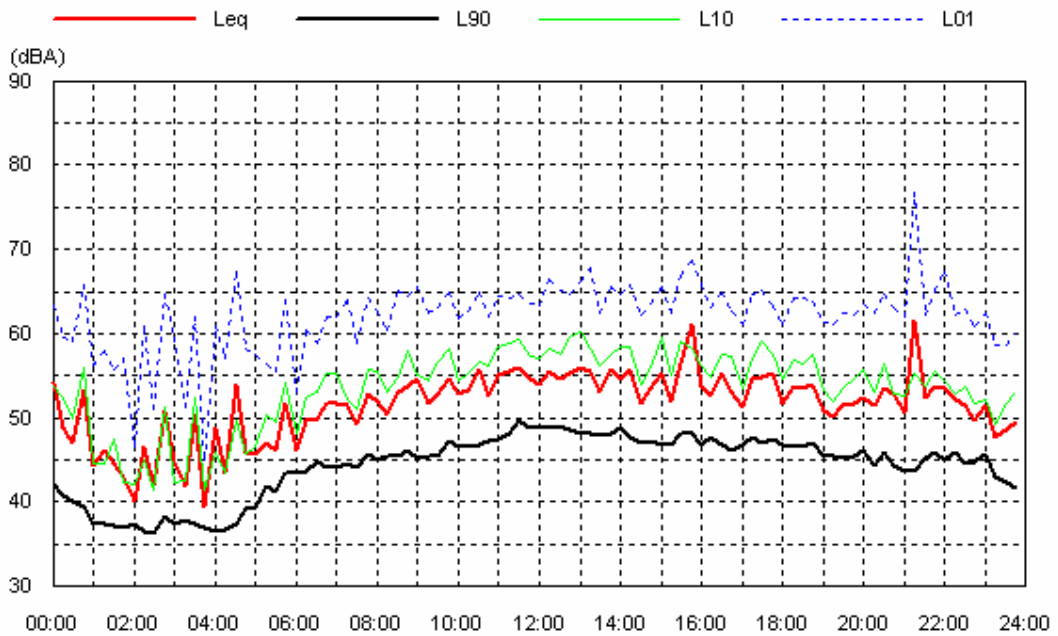


Location: Rowing Club, Penrith

Fri 10 Jun 05

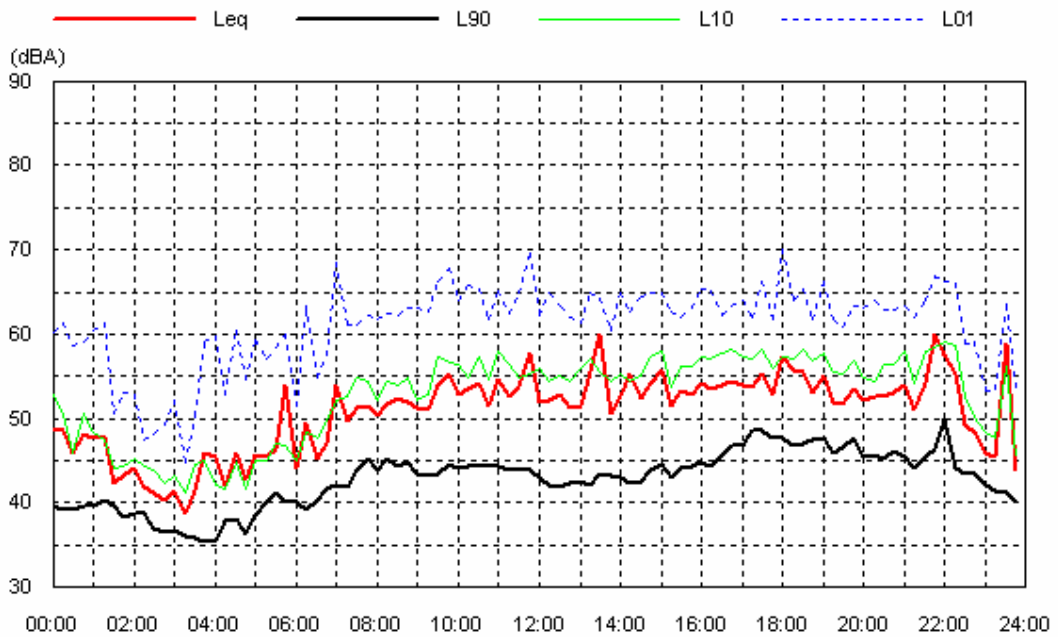


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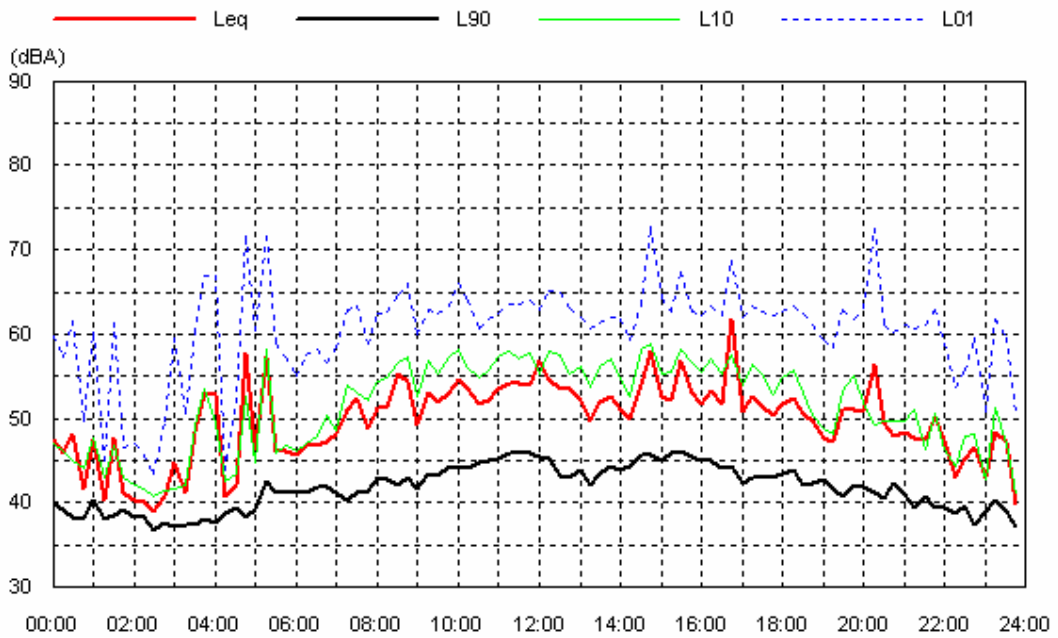


Location: Rowing Club, Penrith

Sun 12 Jun 05

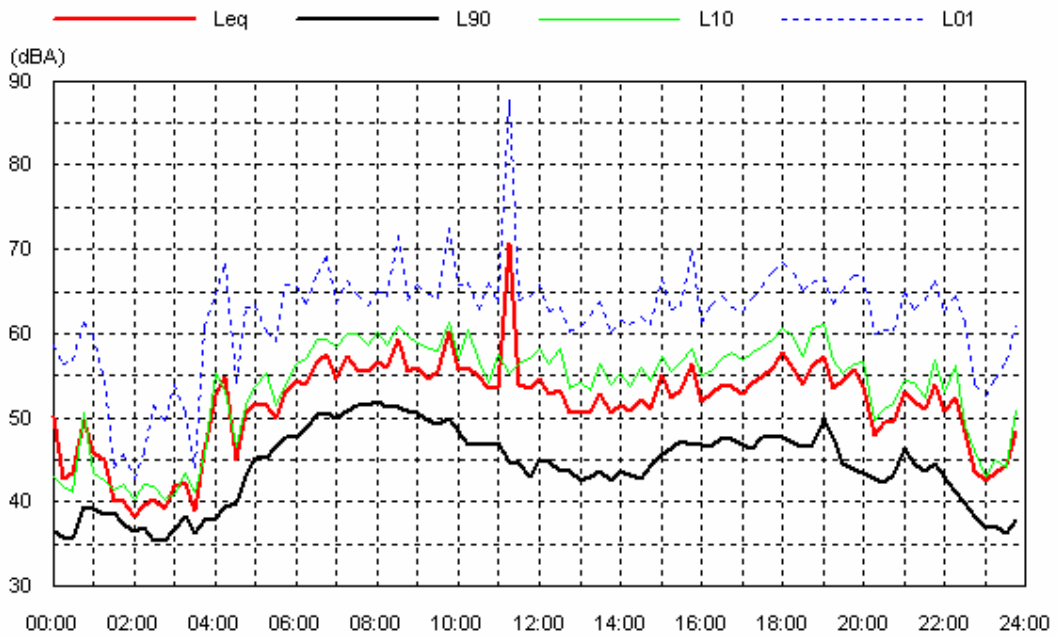


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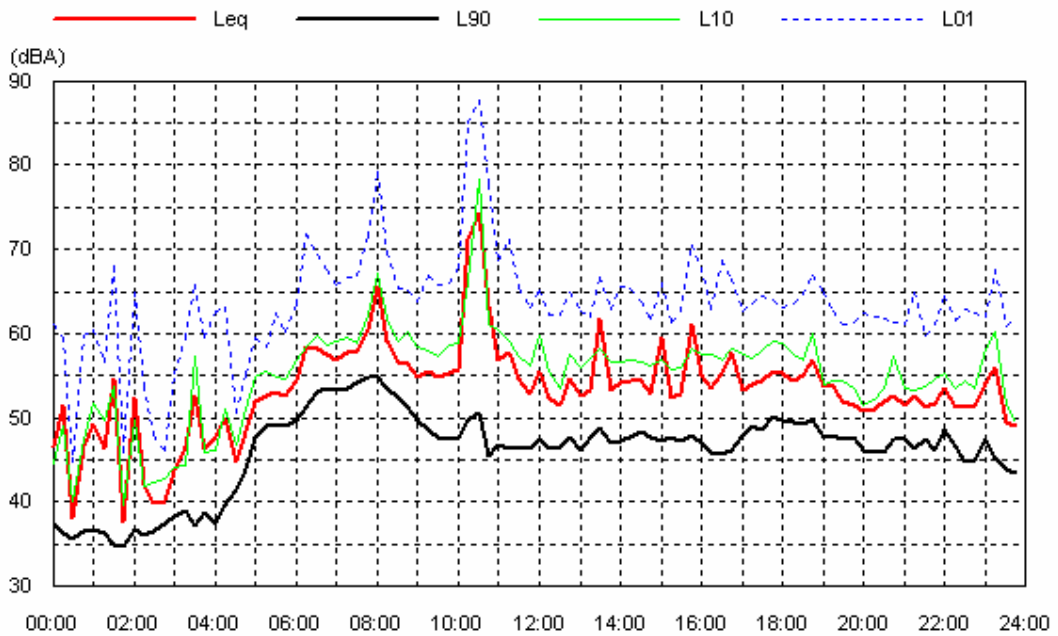


Location: Rowing Club, Penrith

Tue 14 Jun 05



Wed 15 Jun 05



Location: Rowing Club, Penrith

Thu 16 Jun 05

