

Environmental Assessment

Dolans Bay Marina

Appendix 14

**Acoustic Assessment for Extension to Dolans Bay
Marina by Renzo Tonin & Associates dated 1 April
2011**

**DOLANS BAY MARINA, 72 PARTHENIA ST, DOLANS BAY
ACOUSTIC ASSESSMENT FOR EXTENSION TO MARINA**

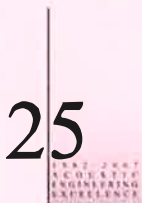
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1 APRIL 2011

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DOCUMENT CONTROL

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1 INTRODUCTION

Renzo Tonin & Associates was engaged to conduct an environmental noise impact assessment of the proposed extension to Dolans Bay Marina at 72 Parthenia Street, Dolans Bay.

The report addresses a request by the NSW Government Department of Planning (DoP) for additional information concerning noise impacts from Reference No. MP 10_0017 [ref: DoP Letter.pdf] dated 23rd December 2010.

The report addresses the concerns for potential noise impacts associated with construction works, operational activities and traffic generated by the proposal and assesses potential noise impacts on nearby residential receivers in accordance with the New South Wales (NSW) Department of Environment, Climate Change and Water (DECCW) Interim Construction Noise Guideline (ICNG), Industrial Noise Policy (INP) and Environmental Criteria for Road Traffic (ECRTN), where applicable.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 PROJECT DESCRIPTION

2.1 Proposed Development

The application seeks to expand the Dolans Bay Marina as follows:

- Relinquishing all of the existing 22 swing moorings principally around the entrance to Dolans Bay,
- Extending the existing Dolans Bay Marina from 29 marina berths to 82 (an additional 53 marina berths), and
- Extending the existing marina building to include a ground floor spare parts storage area and a first floor deck extension located directly above the spare parts store.

The proposed changes will result in a net increase in the number of boats being moored by 31 boats but will cover a much smaller area of Dolans Bay. The additional 53 marina berths proposed are located on two separate north/south parallel walkways providing 20 metres minimum clear water between the piles for manoeuvring of boats to and from the berths between the two walkways.

Access to the Dolans Bay Marina from the land side is from Parthenia Street to a 10 space car park at the top of the site. Access to the waterfront marina buildings and berths from the car park is then provided by a walkway, steps and inclinator (elevator). Access is not proposed to change.

The existing land-based facilities include:

- Slipways for two vessels,
- A two storey building comprising a boat maintenance workshop, toilets, an office and a small shop,
- A fuel tank – connected to two bowsers on the marina,
- A car park comprising 10 spaces, and
- An inclinator (elevator) and pedestrian path and steps connecting the car park and the marina facilities.

The existing water based facilities are located within the area of water of Dolans Bay and include:

- A series of marina pontoons with 29 permanent berths,
- Two fuel bowsers located on the pontoons, and
- 22 swing moorings in Dolans Bay.

The land based development in the surrounding area is primarily single detached housing set within a low density, residential environment consisting of predominately large contemporary dwelling houses, many with private aquatic facilities at the foreshore.

2.2 Hours of Operation

The hours of operation of the marina are not proposed to change. The existing hours are 7am to 6pm for fuel services, slipway and maintenance. The marina berths and swing moorings are accessible 24 hours and seven days per week via swipe card through a security gate.

2.3 Noise Issues

It is noted that there will be no significant changes to the operation of the marina as a result of this proposal. It is understood that there have been no significant or ongoing complaints from nearby residents regarding noise from the facility as set out in the Environmental Audit conducted in 2009 by Simmat & Associates Pty Ltd.

The noise emission sources potentially affecting nearby receivers are:

- *Construction noise* during the marina refurbishment and additions work.
- *Operational noise* from general operations at the site, including:
 - Intermittent noise from car parking activities on the car park; and
 - Intermittent noise from activities on the slipways and the marine maintenance workshop.
- *Traffic noise* generated by the additional vehicle movements.

2.3.1 Vibration

Vibration generated by proposed construction activity, in particular from piling activity, will only occur over the water and is not anticipated to be of significant impact due to the distance between the source and the nearest residential receiver, and is not assessed further in this report.

2.3.2 Slipways

Based on discussion with the client, it is understood that the existing slipways can only manage 2 boats per day and are currently at maximum capacity. Additional boats berthing on the marina as a result of the expansion therefore does not correlate to increase service in the slipways. Current activity associated with the slipways and the marine maintenance workshop are cleaning and repair work. Cleaning of boats involves water blasting and may take around half a day each. Occasionally if a boat needs a repair, it may stay on the slipway for up to a week while work is in progress. It is mainly power tools such as angle grinders and buffers used for boat repairs. Noise impact of a new project has been considered according to the change it causes in the existing noise environment. As the slipways are not forecast to increase service capacity, the proposal will not result in additional noise impacts.

2.3.3 On Boat Activities

Recreational activities on board boats can include social gatherings and BBQs etc. The majority of clients visit their boats on weekends with sailing generally limited to daylight hours usually between 10:00am and 5:00pm. In respect to the activities such as motor boat noise levels, social activities on board boats, on board maintenance activities and noise from halyards slapping against masts, any noise generation is intermittent and irregular. It is not considered that the additional berths will directly relate to an increase in noise impact from these types of activity.

We note that to date there is no record of any complaint received by management and thus conclude that the noise amenity is not expected to change as a result of the proposed development. Undue noise as a result of on boat activities is currently addressed through management measures and therefore we expect this to be effective and appropriate for continued operation.

2.3.4 Traffic Impacts

The Traffic and Parking Impact Assessment prepared by Christopher Hallam & Associates Pty Ltd has revealed that the peak summer weekend parking demand is expected to increase from 10 to 15 cars. This additional parking is to be accommodated on the local street as capacity is reached within the current car park.

Acoustically this relates to a potential noise level increase of just 1.8dB. In accordance with the Environmental Criteria for Road Traffic Noise, this is below the allowable 2dB(A) increase in existing noise. It is noted that the total peak traffic flow of 15 cars would be well below the relevant noise criteria. On this basis the additional activities associated with the car parking and the traffic generation will have no significant impact to the existing noise environment.

2.4 Assessment Methodology

Further to the above, it is considered that the primary acoustic impacts from the development, relate to the construction activities. In order to assess the potential noise impact from the construction activities the following methodology was used;

- Identify nearest most potentially affected receiver locations to the subject site;
- Determine existing background noise levels at the nearest most potentially affected receiver locations;
- Use measured ambient and background noise levels to establish noise goals in accordance with the standard noise criteria issued by NSW DECCW ICNG;
- Using predictive noise modelling, determine the extent of noise impacts from the proposed construction activities on nearby residential premises;
- Identify where noise emission from the site may exceed the relevant criteria; and
- Where noise emission from the site may exceed the relevant criteria provide recommendations to reduce noise impacts from the site.

3 ASSESSMENT LOCATIONS

The nearest most potentially affected receiver locations were identified as:

- Location A1 72A Parthenia Street, Dolans Bay
A three-storey residential dwelling located to the west of the subject development. The property is accessed via the pedestrian walkway between the car parking and the Marina. Despite of the location, this dwelling is not associated with the Marina.
- Location A2 84 Parthenia Street, Dolans Bay
A two-storey residential dwelling identified as the closest habitable building to the proposed Western Walkway. The eastern boundary of the dwelling is located approximately 75m to the centre of the proposed walkway.
- Location A3 243 Gannons Road, Caringbah South
A one-storey residential dwelling identified as the closest habitable building to the proposed Eastern Walkway. The western boundary of the dwelling is located approximately 100m to the centre of the proposed walkway.
- Location A4 750 & 755 Port Hacking Road South, Dolans Bay
Single and double-storey residential dwellings identified as the closest habitable building to the proposed location of the crane. The nearest boundary of each dwelling is located approximately 20m to the centre of the car-park.

The assessment locations are identified as 'A1', 'A2', 'A3' and 'A4' in Appendix B.

4 EXISTING ACOUSTIC ENVIRONMENT

Noise impacts at the residential premises are assessed against noise goals established from the existing noise environment of the area without the subject premise in operation. Appendix B of the NSW DECCW's Industrial Noise Policy (INP) presents two methods of determining the background noise levels of an area being 'B1 – Long-term background noise method' and 'B2 – Short-term background noise method'. For the subject assessment, both long-term and short-term noise levels monitoring were utilised to establish the existing acoustic environment.

4.1 Long-Term Unattended Noise Monitoring

Noise measurements are to be taken at the nearest or potentially most affected premise/s. In this case the nearest and potentially most affected premise with respect to the subject development was residential dwellings on Parthenia Street and Gannons Road with a direct line of sight to the Marina. The following location was used for long-term noise monitoring purpose:

- Location L1 74 Parthenia Street, Dolans Bay – Eastern Balcony on the lower level having unrestricted view to Dolans Bay and the Marina.

Noise monitor was positioned at 1.5m above the floor level approximately 2.8m from the facade. Noise data is considered representative of the ambient and background noise for residences surrounding the Marina.

The noise monitor was installed on the location between Wednesday 23rd and Tuesday 29th March 2011. Appendix B shows the long-term monitoring location marked as 'L1'.

The graphical recorded outputs from the long-term noise monitoring were analysed to determine a single assessment background level (ABL) for each day, evening and night period in each 24 hour period of noise monitoring, and based on the median of the individual ABLs, an overall single Rating Background Level (RBL) for the day, evening and night period is determined over the entire monitoring period in accordance with the INP.

Table 1 – Long-Term Noise Monitoring Results

Monitoring Location	L ₉₀ Background Noise Levels			L _{eq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
L1 – 74 Parthenia Street	39	36	36	50	49	41

Notes: Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays.
Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays.

4.2 Short-Term Attended Noise Monitoring

Short-term attended noise level measurements were conducted on Friday 18th March 2011 at the following location:

- Location S1 Dolans Bay Public Boat Ramp at the End of Port Hacking Road South, Dolans Bay
Sound level meter at 1.5m above the ground level, in the free field, adjacent to the boat ramp.

Ambient and background noise levels were undertaken at this location as it is proposed that a maximum 50 tonne crane will be situated within the car-park of the boat ramp to assist in launching the pre-manufactured pontoon units.

Sound level measurements were conducted in general accordance with AS1055.1-1997 "Acoustics – Description and Measurement of Environmental Noise" using a Brüel & Kjær Type 2250 precision sound level meter. Statistical noise levels were acquired in both overall and octave band frequencies. This instrument complies with AS IEC 61672.1 2004 "Electroacoustics – Sound Level Meters" and is designated as a Type 1 instrument having an accuracy suitable for field and laboratory use.

The calibration of the meter was checked in the field immediately before and after the noise measurements using a Brüel & Kjær Type 4231 calibrator and no drift in calibration was observed. Appendix B shows the short-term monitoring location marked as 'S1'.

A summary of the short-term measurement results are presented in Table 2 below.

Table 2 – Short-Term Noise Measurement Results

Period	L _{eq}	L ₉₀	Notes
Location S1 – Dolans Bay Public Boat Ramp			
11:26am – 11:36am	57	47	Includes unloading of boats and cargo at wharf. Trucks and cars idling.
11:41am – 11:44am	63	52	Affected by the creaking of Wally's Wharf due to the waves and boats.
11:47am – 12:02 pm	51	44	Ambient L _{eq} determined by aircraft flyovers

As described in Table 3.1 of the NSW INP, where only short-term measurements have been made, the lowest L_{A90, 15 minute} value shall be utilised for assessment.

5 CONSTRUCTION NOISE CRITERIA

5.1 Construction Schedule

The overall construction period is estimated as follows:

- Piling 6 weeks
- Floating marina installation 10 weeks
- Electrical works 3 weeks
- Water & fire systems 5 weeks
- Removal of swing moorings 2 weeks

In general terms these works will be carried out consecutively providing for a total construction period of 26 weeks.

Construction works will be limited to standard construction hours as follows:

- Monday to Friday 7:00 am to 6:00 pm
- Saturday 8:00 am to 1:00pm
- No work on Sundays or Public Holidays

In summary, the construction works involved are:

- All berths will be constructed by driving piles into the seabed.
- All pontoon will be manufactured offsite. They will be transported by semi-trailer to the boat ramp at the end of Port Hacking Road which is 400 metres from the site by water, launched into the water by a crane from the public ramp and floated into position.
- The floating modules will be bolted together and attached to the pile using hand tools. Minimal fabrication work will be conducted on-site.
- A maximum 50 tonne crane to unload the trucks will be situated within the car park of the boat ramp.

At this stage, the exact pile driver to be utilised is unknown, however two types of piles have been suggested being hollow reinforced steel piers and timber piers. No piling will take place prior to 8:00 am on any day or on Sundays or Public Holidays. Most of the construction activity will be over water during the 6 month period of construction.

5.2 Construction Noise Guideline

Chapter 171 of the NSW *Environmental Noise Control Manual* (ENCM, Environment Protection Authority 1994) provides guideline for assessing noise generated during the construction phase. However, the Department of Environment Climate Change (DECC – now DECCW) recently released its *Interim Construction Noise Guideline* (ICNG) in July 2009. This document is currently only issued as an interim guideline, although it is being referred to as DECCW's

standard policy for assessing construction noise on new projects. It is intended that this new guideline supersede Chapter 171 of the ENCM.

The key components of the ICNG that can be incorporated into this assessment include:

1. Use of L_{Aeq} as the descriptor for measuring and assessing construction noise

In recent years NSW noise policies including DECCW's NSW Industrial Noise Policy (INP) and the NSW Environmental Criteria for Road Traffic Noise (ECRTN) have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor. Consistent with the latest guideline (ICNG) the use of L_{Aeq} as the key descriptor for measuring and assessing construction noise may follow a 'best practice' approach.

2. Application of feasible and reasonable noise mitigation measures

As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints. Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects, including the cost of the measure.

3. Quantitative and qualitative assessment

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment.

A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria.

A qualitative assessment is recommended for small projects with a short-term duration where works are not likely to affect an individual or sensitive land use for more than three weeks in total. It focuses on minimising noise disturbance through the implementation of feasible and reasonable work practices, and community notification.

Given the significant scale of the construction works proposed for this Project, a quantitative assessment is carried out herein, consistent with the ICNG's requirements.

4. Management Levels

Residences

Table 3 below (reproduced from Table 2 of the ICNG) sets out the noise management levels and how they are to be applied. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without

undue constraints. The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 3 – Noise at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq(15\ min)}^*$	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. <ul style="list-style-type: none"> Where the predicted or measured $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. 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 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. <ul style="list-style-type: none"> Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ol style="list-style-type: none"> times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Sensitive Land Use

Table 4 below (reproduced from Table 3 of the ICNG) sets out the noise management levels for various sensitive land use developments.

Table 4 – Noise at Other Sensitive Land Uses Using Quantitative Assessment

Land use	Management level, $L_{Aeq(15\ min)}$ – applies when land use is being utilised
Classrooms at schools and other educational institutions	Internal noise level – 45 dB(A)
Hospital wards and operating theatres	Internal noise level – 45 dB(A)

Land use	Management level, L_{Aeq} (15 min) – applies when land use is being utilised
Places of worship	Internal noise level – 45 dB(A)
Active recreation areas	External noise level – 65 dB(A)
Passive recreation areas	External noise level – 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the 'maximum' internal levels in AS2107 for specific uses.

5.2.1 Construction Noise Goals

Table 5 below sets out the construction noise goals, above which residential receivers may be noise affected.

Table 5 – DECCW's Construction Noise Criteria, dB(A)

Assessment Location	Standard Construction Hours	
	Noise Affected	Highly Noise Affected
A1, A2 & A3	50	75
A4	54	75

5.3 Construction Equipment Noise Levels

Table 6 lists construction plant and equipment likely to be used by the contractor to carry out the necessary construction work for this project.

Table 6 – Typical Construction Equipment & Sound Power Levels, dB(A)

Plant Item	Plant Description	Sound Power Levels (re: 10^{-12} Watts)	
		Range	Typical L_{eq}
Dolans Bay Boat Ramp at the End of Port Hacking Road South			
1	Mobile Crane	110 – 115	110
Dolans Bay Marina			
2	Piling	105 – 130	115
3	Hand Tools (general)	90 – 100	95
Total Sound Power at Dolans Bay Marina			115

Notes: The sound power data within the column marked "Typical (Mid-Point)" has been used in this study to calculate typical noise levels at the nominated assessment locations.

The sound power levels for the majority of activities presented in the above table are based on maximum levels given in Table A1 of Australian Standard 2436 – 2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites", DECCW's Interim 'Construction Noise Guideline', information from past projects and information held in our library files.

5.4 Construction Noise Predictions

Noise levels at any given residential receivers resulting from construction would vary dependant upon the location of the residence with respect to the construction site, shielding from intervening topography and structures, the type of and duration of operation being undertaken as well as the number of items of equipment and their locations.

The main source of noise at Dolans Bay Marina is associated with the piling stage. Noise during the later construction stages is expected to be lower at the neighbouring buildings due to quieter equipment being used, the intermittent nature of the works being done.

The only construction activity occurring at the Dolans Bay Boat Ramp at the end of Port Hacking Road South is the launching of pre-manufactured pontoon units into the water with the crane. The crane, which will be situated within the car-park of the boat ramp, will be utilised to unload the units from the trucks.

There may be various tools utilised during the installation of the floating marina, electrical works and water & fire systems; however, for the purpose of prediction, only one individual operation of equipment will be shown in Table 7 below due to their intermittent operation. The noise level predictions were based on the distance from;

- Dolans Bay Boat Ramp – Approximate centre of the car-park, where the crane will be located, to the nearest respective residential boundary.
- Dolans Bay Marina – Approximate centre of each walkway to the nearest respective residential boundaries.

It is acknowledged that at any given time, multiple activities may be occurring, and the location of each plant may be spread out over the construction site.

Table 7 – Construction Noise Predictions, dB(A)

Location	Activity	Predicted L _{Aeq} Noise Levels	Standard Hours Criteria	
			Noise Affected	Highly Noise Affected
A1 – 72A Parthenia Street	Piling	68	50	75
	Pneumatic Hand Tools	48	50	75
A2 – 84 Parthenia Street	Piling	70	50	75
	Pneumatic Hand Tools	50	50	75
A3 – 243 Gannons Road	Piling	67	50	75
	Pneumatic Hand Tools	47	50	75
A4 – 750 & 755 Port Hacking Road South	Mobile Crane	76	54	75

Notes: *Bold indicates criteria that have been exceeded.*

The noise level predictions indicated that for individual equipment, use of the crane is the only item to exceed the DECCW's ICNG 'highly noise affected' goal during standard hours of operation. Furthermore, this is to occur at Location A4 only. The crane is expected to be operated intermittently (not continuously) throughout the construction period due to the nature of the works.

All items of construction plant are likely to exceed the 'noise affected' targets of 50dB(A) and 54dB(A). On the basis of the noise level predictions, it will be required to implement all feasible but reasonable mitigation measures relevant to each operation, as set out in the Section below.

5.5 Recommendations

The following recommendations provide in-principle noise control solutions to reduce noise impacts to residential receivers during standard hours. Where actual construction activities differ from those assessed in this report, more detailed design of noise control measures may be required once specific items of plant and construction methods have been chosen and assessed on site. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

With respect to the standard construction hours, construction activities were predicted to exceed the ICNG 'noise affected' criteria and noise emission from the crane use has the potential to exceed the 'highly noise affected' criteria by up to 1dB(A) due to its close proximity to residential premises.

Implementation of noise control measures, such as those suggested in Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-1981, Appendix E, and Table E1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table E2 in Appendix E presents typical examples of noise reductions achievable after treatment of various noise sources. Table E3 in Appendix E presents the relative effectiveness of various forms of noise control treatment.

5.5.1 Crane

It is recommended that the crane be located as far from the residential premises as practical. Due to the intermittent nature of the crane operation it is likely that limited impact will occur.

If the crane needs to be situated closer than 25m to a residential boundary it is recommended that screening of the crane engine be implemented. This could be provided by solid particle board hoarding, typical on construction sites.

5.5.2 Piling

There are limited opportunities for the implementation of noise mitigation measures for the piling operations. It is noted that piling is not to commence until after 8:00am. It is likely that respite will be provided at breaks in construction work and therefore will not be continuous throughout the allowable construction time period.

5.5.3 General Management Measures

Table 8 below outlines a number of techniques and options for managing construction noise, where considered reasonable and feasible.

Table 8 – Construction Noise Management Options

Construction Noise Management Options	
Source Controls	
Time constraints	Limit work to within the approved construction hours. Consider implementing respite periods for high noise/vibration-producing construction activities.
Equipment restrictions	Select low-noise plant and equipment. Ensure equipment has quality mufflers installed.
Emission restrictions	Establish stringent noise emission limits for specified plant and equipment. Implement noise monitoring audit program where specific activities are identified to impact upon residential receiver locations.
Substitute methods	Use quieter and less vibration emitting construction methods where possible.
Limit equipment on site	Only have necessary equipment on site.
Limit activity duration	Where possible, concentrate noisy activities at one location and move to another as quickly as possible. Any equipment not in use for extended periods during construction work should be switched off.
Equipment Location	Noisy plant and equipment should be located as far as possible from noise sensitive areas, optimising attenuation effects from topography, natural and purpose built barriers and materials stockpiles.
Site access	Vehicle movements outside construction hours, including loading and unloading operations, should be minimised and avoided where possible.
Equipment maintenance	Ensure equipment is well maintained and fitted with adequately maintained silencers which meet the design specifications.
Reduced equipment power	Use only necessary size and power.
Quieter work practices	For example, implement worksite induction training, educating staff on noise sensitive issues and the need to make as little noise as possible. For example loading and unloading of materials shall be done in a manner so as to reduce impact noise from materials being dropped from a height.
Reversing Alarms	Consider alternatives, such as manually adjustable or ambient noise sensitive types ("smart" reversing alarms). Practicality of implementing alternative reversing alarms will be based upon equipment supply. Alternative site management strategies can be developed, in accordance with the <i>Occupational Health and Safety Plan</i> , with the concurrence of the Occupational Health and Safety Officer.
Path controls	
Noise Barriers and Enclosures	Whilst construction of temporary barriers and enclosures may be feasible in some areas of the site, the time, cost and noise associated with constructing the temporary barriers is deemed unreasonable given the length of the construction phase.
Increased Distance	Locate noisy plant as far away from noise-sensitive receptors as possible.
Site Access	Select and locate site access roads as far away as possible from noise-sensitive areas.
Receptor Controls	
Consultation	Community consultation, information, participation and complaint responses are essential aspects of all construction noise management programs. They typically involve: A community information programmes before construction and/or high risk activities are commenced. This usually involves a leaflet distribution and direct discussions and negotiations with affected residents, explaining the type, time and duration of expected noise emissions. The involvement of affected residents in the development of acceptable noise management strategies.

A nominated community liaison officer with a contact telephone number.
Timely responses to complaints, providing information on planned actions and progress towards the resolution of concerns.

Local residents should be informed by direct mail of a direct 24-hour telephone line where any noise complaints related to the operation of the demolition activities will be recorded.

All noise complaints shall be investigated by the site in accordance with the Noise Complaint Management Procedure identified in Appendix E of this report.

6 CONCLUSION

Renzo Tonin & Associates has completed an acoustic assessment of environmental noise impact from the proposed extension to Dolans Bay Marina at 72 Parthenia Street, Dolans Bay.

From our review of the proposed development it is considered that noise from the operation of the development will be insignificant when compared with existing operations of the site. Consideration was given to potential impact of mooring of boats, repair activities and car park operation.

The focus of the quantitative impact assessment is with regard to noise impact during the construction works. The assessment of noise emission from construction equipment and activities has been carried out in accordance with the DECCW's Interim Construction Noise Guideline at potentially affected neighbouring residential premises. The study has relied upon existing ambient noise levels in the surrounding area, established through both long-term and short-term noise monitoring undertaken at the nearest most potentially affected residential receiver locations. The overall noise impact has been determined and recommendations are provided in Section 5.5 to minimise impact. Noise impacts are proposed to be addressed through a combination of physical noise controls and noise management measures. Detailed design of noise control measures can only be implemented once specific items of plant and construction methods have been chosen.

APPENDIX A - GLOSSARY OF ACOUSTIC TERMS

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse Weather Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

Ambient Noise The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

Assessment Period The period in a day over which assessments are made.

Assessment Point A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.

Background Noise Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).

Decibel [dB] The units that sound is measured in. The following are examples of the decibel readings of every day sounds:

0dB The faintest sound we can hear

30dB A quiet library or in a quiet location in the country

45dB Typical office space. Ambience in the city at night

60dB Martin Place at lunch time

70dB The sound of a car passing on the street

80dB Loud music played at home

90dB The sound of a truck passing on the street

100dB The sound of a rock band

115dB Limit of sound permitted in industry

120dB Deafening

<i>dB(A)</i>	A-weighted decibels. The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
<i>Frequency</i>	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
<i>Impulsive noise</i>	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
<i>Intermittent noise</i>	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
<i>L_{max}</i>	The maximum sound pressure level measured over a given period.
<i>L_{min}</i>	The minimum sound pressure level measured over a given period.
<i>L₁</i>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
<i>L₁₀</i>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
<i>L₉₀</i>	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L ₉₀ noise level expressed in units of dB(A).
<i>L_{eq}</i>	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
<i>Reflection</i>	Sound wave changed in direction of propagation due to a solid object obscuring its path.
<i>SEL</i>	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L _{eq} sound levels over any period of time and can be used for predicting noise at various locations.

<i>Sound</i>	A fluctuation of air pressure which is propagated as a wave through air.
<i>Sound Absorption</i>	The ability of a material to absorb sound energy through its conversion into thermal energy.
<i>Sound Level Meter</i>	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
<i>Sound Pressure Level</i>	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
<i>Sound Power Level</i>	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
<i>Tonal noise</i>	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B - SITE AND MEASUREMENT LOCATIONS



APPENDIX C - NOISE MONITORING METHODOLOGY

C.1 Noise Monitoring Equipment

Long term noise monitoring was conducted using a RTA Technology 04 noise logger. The noise monitoring equipment used here complies with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and is designated as a Type 1 instrument suitable for field use.

A noise monitor consists of a sound level meter and a computer housed in a weather resistant enclosure. Ambient noise levels were recorded at a rate of 10 samples per second. Every 15 minutes, the data is processed statistically and stored in memory. The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4230 calibrator. No significant drift in calibration was observed.

C.2 Meteorology during Monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the INP. The Bureau of Meteorology (BOM) provided meteorological data, which is considered representative of the site, for the duration of the noise monitoring period. The data was modified to allow for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is at 1.5m above ground level. The correction factor applied to the data was taken from *Australian Standard AS1170.2 1989 Section 4.2.5.1*.

C.3 Noise vs Time Graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the L_{10} , L_{90} , and L_{eq} levels. The statistical descriptors L_{10} and L_{90} measure the noise level exceeded for 10% and 90% of the sample measurement time. The L_{eq} level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the noise monitoring location in Appendix D illustrate these concepts.

Noise levels are commonly measured in units of A-weighted decibels or dB(A). The "A-weighting" refers to a standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low pitch sound than it is to high pitch sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample time period. This is represented as the L_{90} noise level.

APPENDIX D - LONG-TERM NOISE MONITORING RESULTS

74 Parthenia Street, Dolans Bay

**BACKGROUND & AMBIENT NOISE MONITORING RESULTS
NSW DECCW's 'INDUSTRIAL NOISE POLICY', 2000**

Day	L _{A90} Background Noise Levels ⁵			L _{Aeq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Wednesday-23-March-2011	-	40	38	-	50	40
Thursday-24-March-2011	-	36	32	-	46	37
Friday-25-March-2011	38	36	-	49	49	-
Saturday-26-March-2011	-	-	-	-	-	-
Sunday-27-March-2011	40	37	-	52	47	-
Monday-28-March-2011	39	36	36	49	50	43
Tuesday-29-March-2011	-	-	-	-	-	-
Representative Level	39	36	36	50	49	41

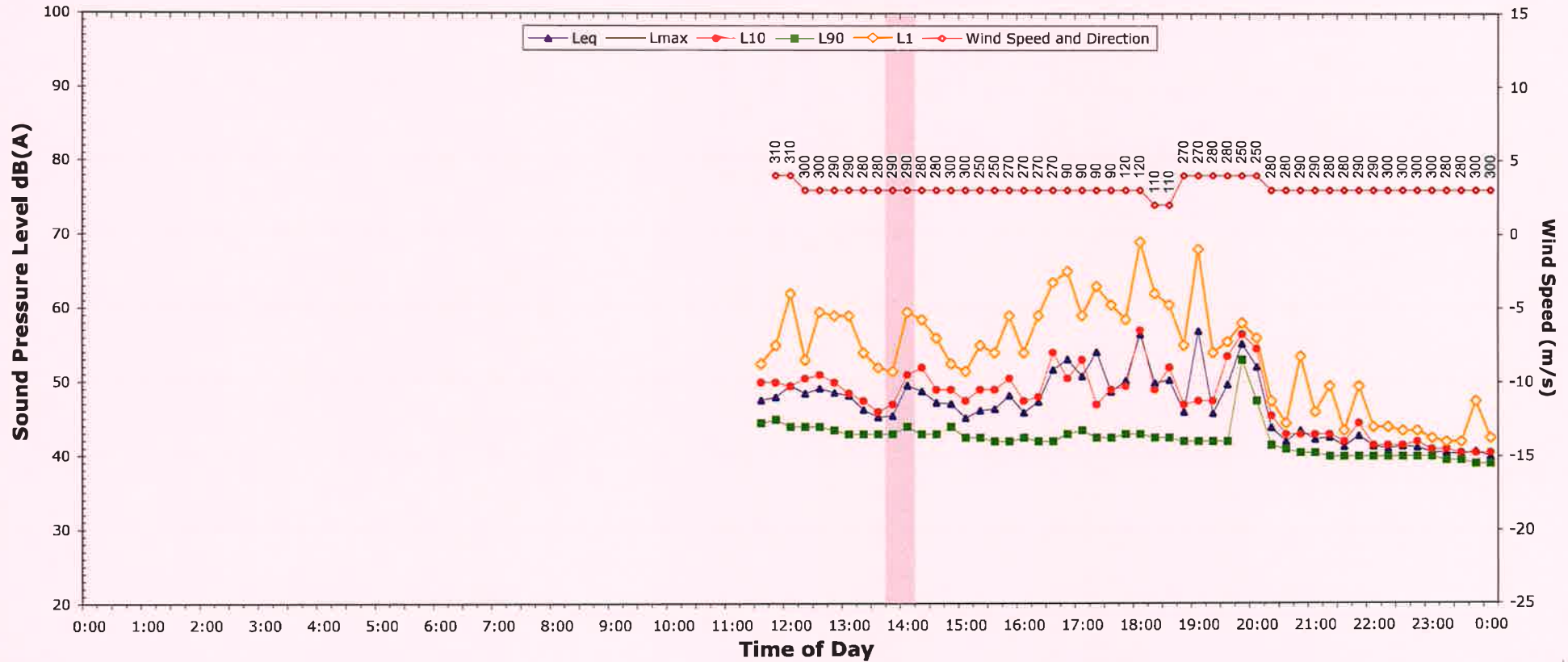
Notes:

- Day is taken to be 7:00am to 6:00pm
- Evening is taken to be 6:00pm to 10:00pm.
- Night is taken to be the remaining periods.
- Partial day's monitoring
- Assessment Background Level (ABL)
- Rating Background Level (RBL) for L90 and logarithmic average for Leq

**TRAFFIC NOISE MONITORING RESULTS
NSW DECCW 'ENVIRONMENTAL CRITERIA FOR ROAD TRAFFIC NOISE', 1999**

Day	L _{Aeq} Noise Levels			L _{Aeq 1hr} Noise Levels		
	Day	Night	Day - Up	Day - Low	Night - Up	Night - Low
Wednesday-23-March-2011	52	43	56	45	45	42
Thursday-24-March-2011	52	39	58	41	43	36
Friday-25-March-2011	52	47	55	47	50	41
Saturday-26-March-2011	53	48	54	49	54	41
Sunday-27-March-2011	53	40	57	47	44	38
Monday-28-March-2011	52	46	56	48	53	40
Tuesday-29-March-2011	51	-	54	47	-	-
Representative Weekday	52	45	56	46	49	40
Representative Weekend	53	46	56	48	51	40
Representative Week	52	45	56	47	50	40

EXISTING AMBIENT NOISE LEVELS
74 Parthenia Street, Dolans Bay
Wednesday, 23 March 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	-	40.0	38.0
Leq (see note 3)	-	49.7	40.4

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

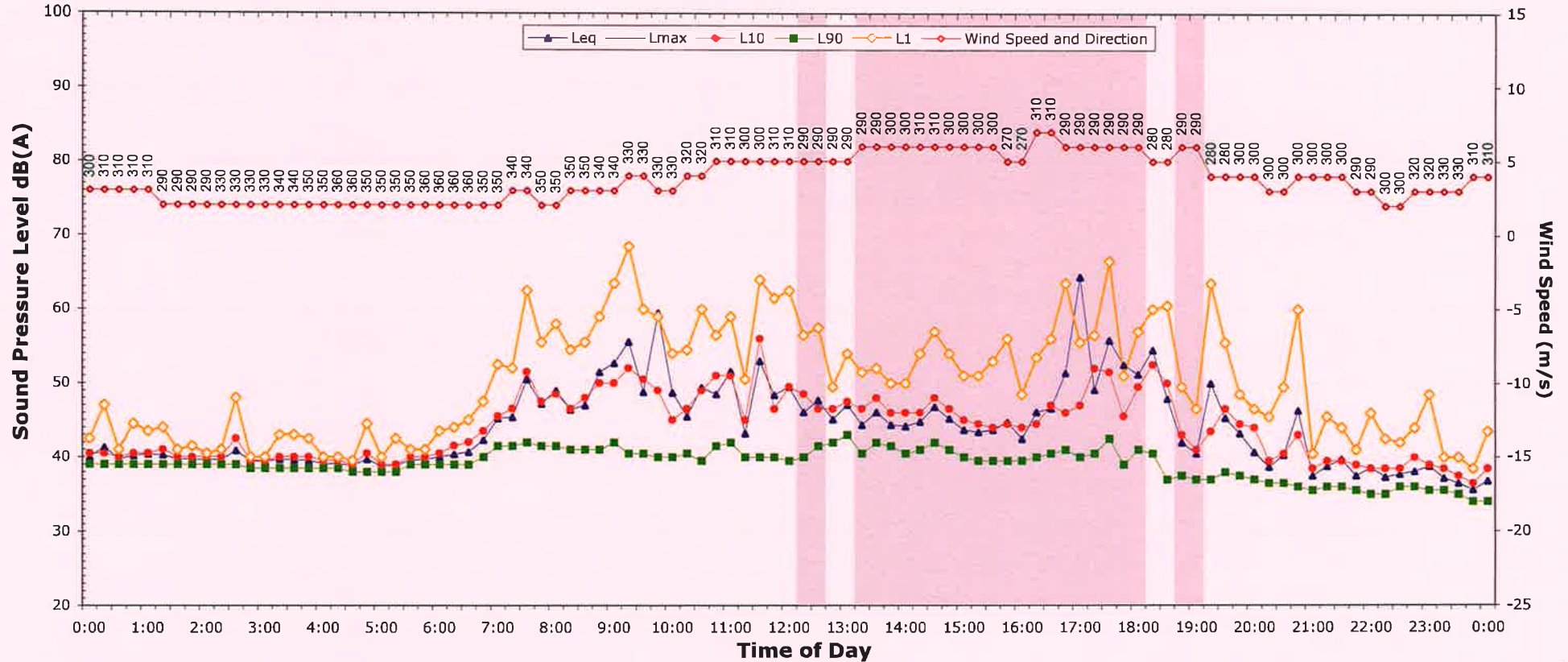
NSW ECRTN Policy (1m from facade)		
Descriptor	Day	Night ²
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	52.3	42.9
L _{eq} 1hr upper 10 percentile	55.9	45.1
L _{eq} 1hr lower 10 percentile	44.7	41.6

Night Time Maximum Noise Levels			
(see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

EXISTING AMBIENT NOISE LEVELS

74 Parthenia Street, Dolans Bay

Thursday, 24 March 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	-	35.5	32.0
Leq (see note 3)	-	46.4	36.6

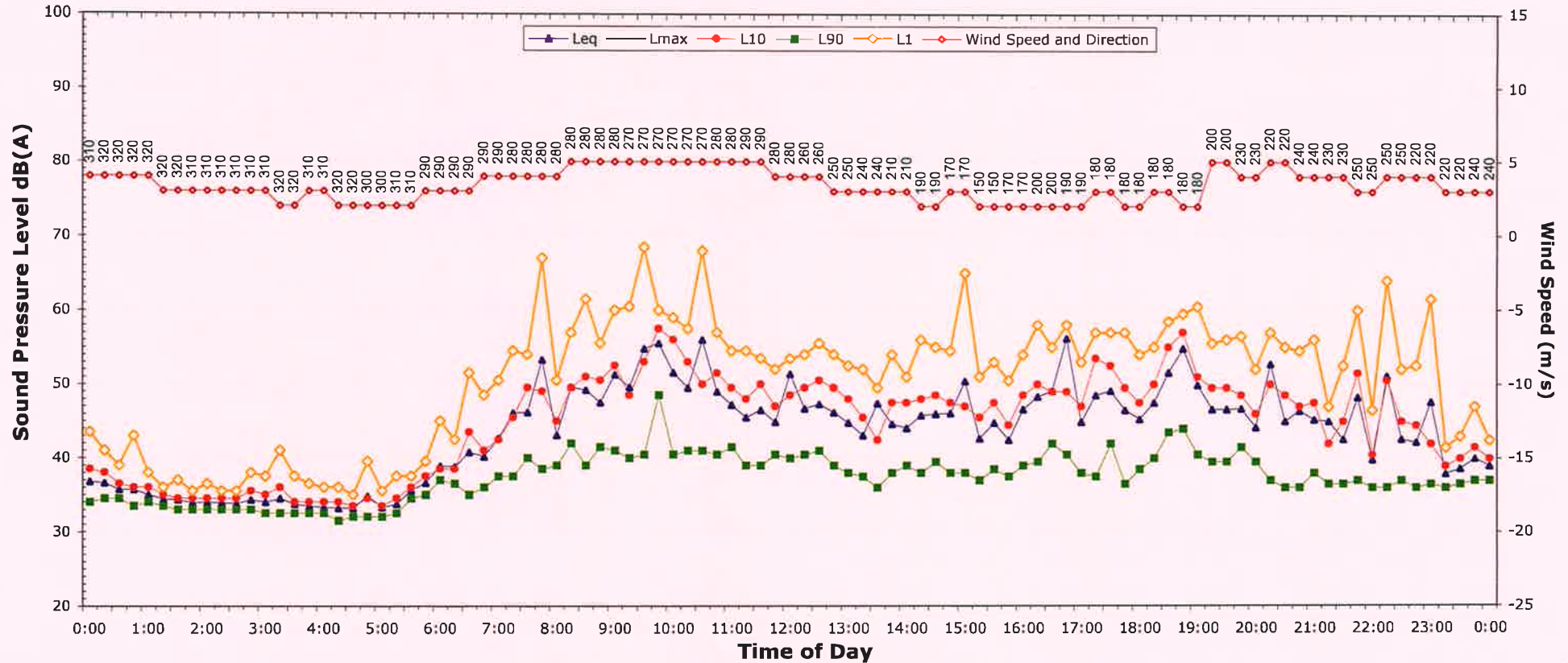
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note 3)		
Descriptor	Day	Night ²
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	52.4	39.1
L _{eq} 1hr upper 10 percentile	58.0	43.4
L _{eq} 1hr lower 10 percentile	41.2	36.2

Night Time Maximum Noise Levels (see note 4)		
Descriptor	Day	Night
Lmax (Range)	-	to -
Lmax - Leq (Range)	-	to -

EXISTING AMBIENT NOISE LEVELS
74 Parthenia Street, Dolans Bay
Friday, 25 March 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	37.5	36.0	-
Leq (see note 3)	49.5	48.7	-

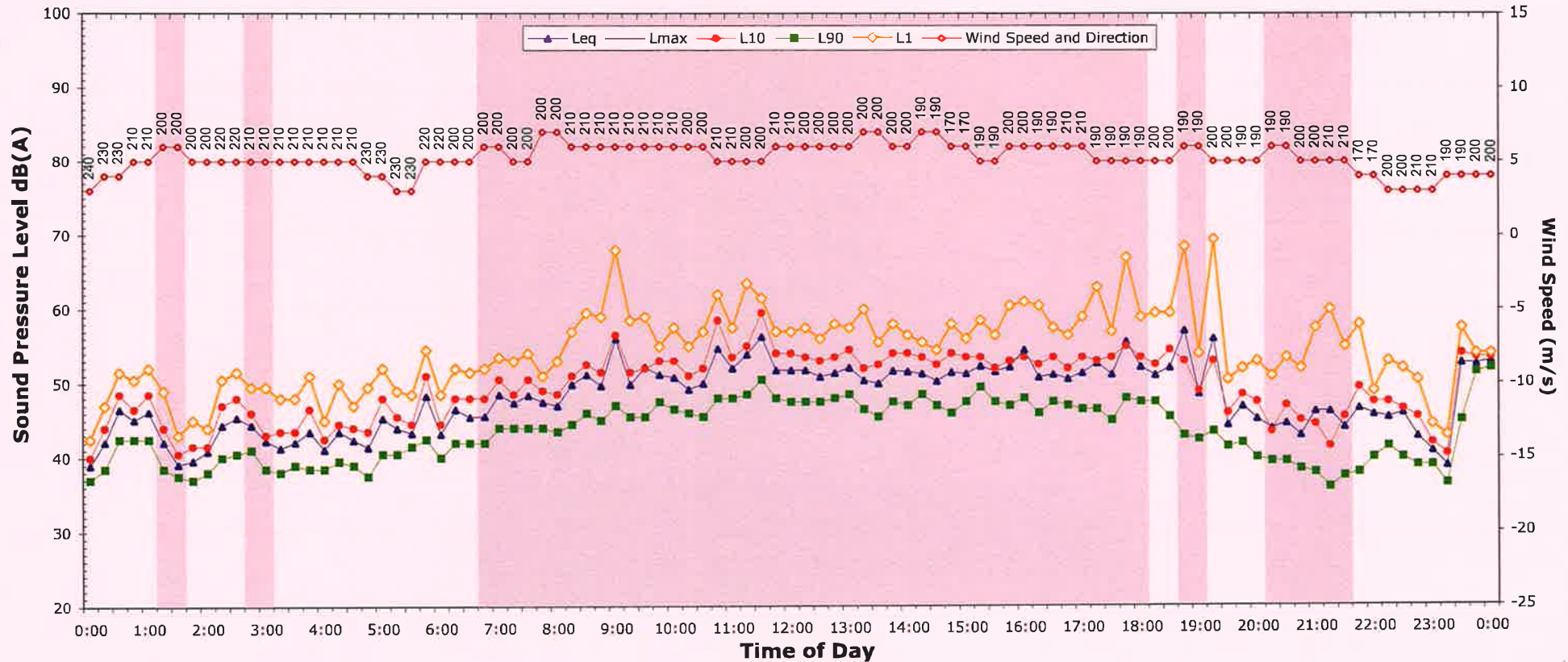
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time L_{max} values are shown only where L_{max} > 65dB(A) and where L_{max} - Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade)			(see note3)
Descriptor	Day	Night ²	
	7am-10pm	10pm-7am	
L _{eq} 15 hr and L _{eq} 9 hr	51.8	47.0	
L _{eq} 1hr upper 10 percentile	55.3	49.9	
L _{eq} 1hr lower 10 percentile	47.2	41.4	

Night Time Maximum Noise Levels				(see note 4)
L _{max} (Range)	-	to	-	
L _{max} - Leq (Range)	-	to	-	

EXISTING AMBIENT NOISE LEVELS
74 Parthenia Street, Dolans Bay
Saturday, 26 March 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	-	-	-
Leq (see note 3)	-	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

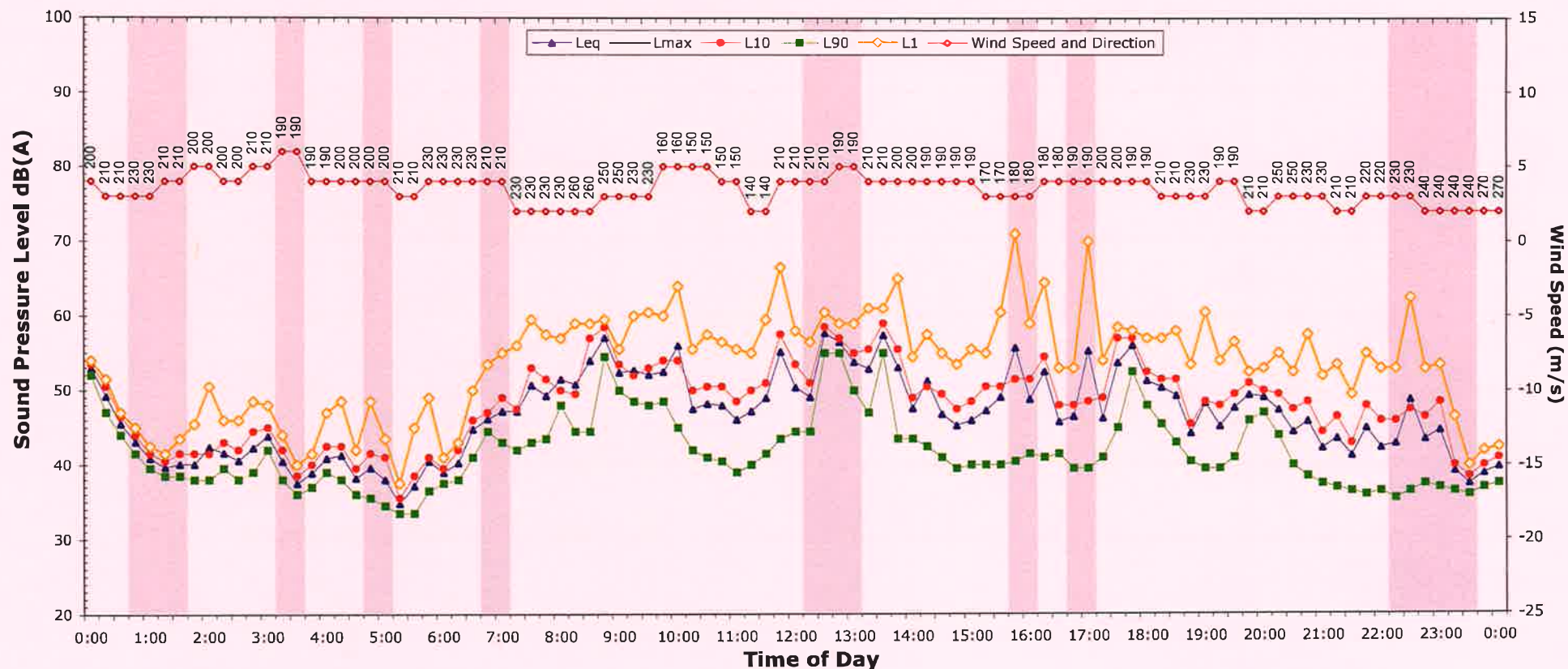
NSW ECRTN Policy (1m from facade) (see note 3)		
Descriptor	Day	Night ²
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	52.9	48.4
L _{eq} 1hr upper 10 percentile	54.1	54.1
L _{eq} 1hr lower 10 percentile	48.7	40.9

Night Time Maximum Noise Levels (see note 4)		
Descriptor	Day	Night
Lmax (Range)	-	to -
Lmax - Leq (Range)	-	to -

EXISTING AMBIENT NOISE LEVELS

74 Parthenia Street, Dolans Bay

Sunday, 27 March 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₅₀	40.0	36.5	-
Leq (see note 3)	51.9	46.8	-

NOTES:

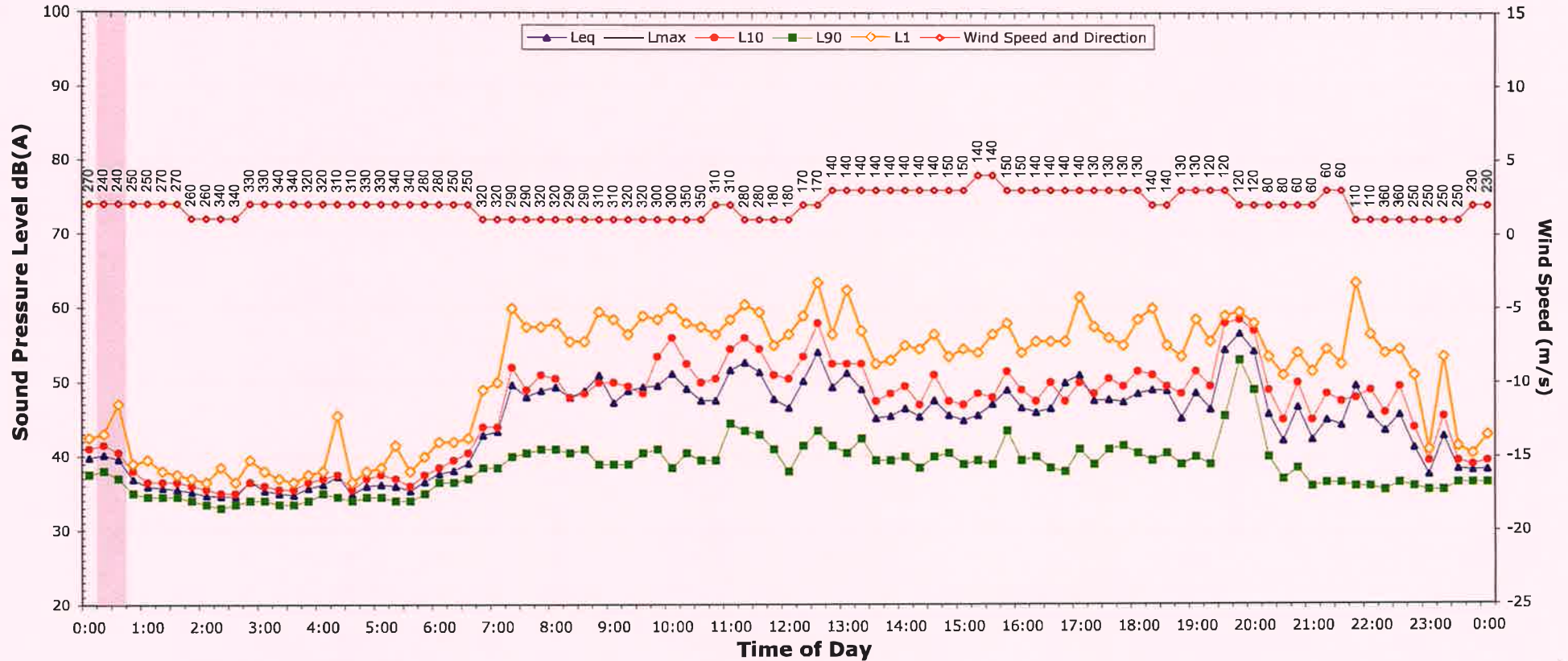
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade)			(see note 3)
Descriptor	Day	Night ²	
	7am-10pm	10pm-7am	
L _{eq} 15 hr and L _{eq} 9 hr	53.4	40.0	
L _{eq} 1hr upper 10 percentile	56.6	44.0	
L _{eq} 1hr lower 10 percentile	46.8	37.8	
Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

EXISTING AMBIENT NOISE LEVELS

74 Parthenia Street, Dolans Bay

Monday, 28 March 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	38.5	36.0	35.5
Leq (see note 3)	49.0	50.0	43.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

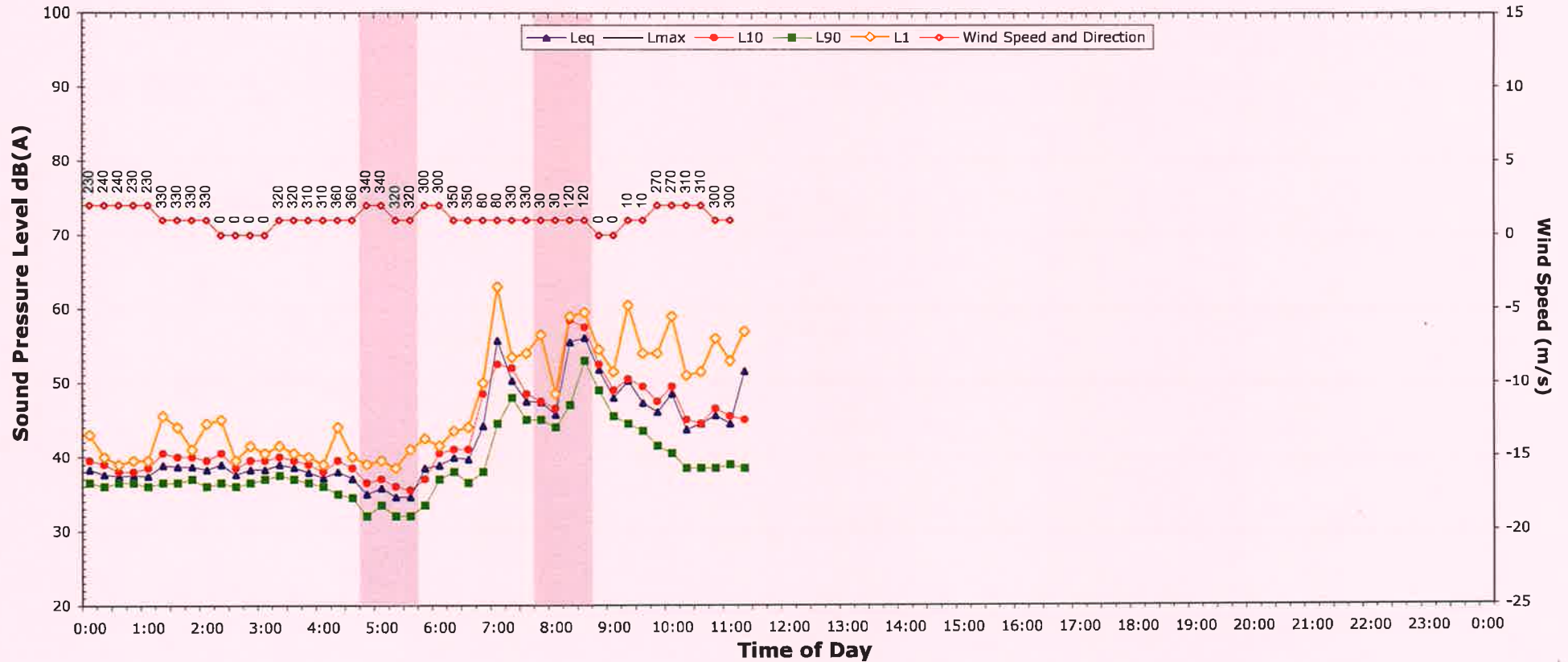
NSW ECRTN Policy (1m from facade) (see note 3)		
Descriptor	Day	Night ²
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	51.8	45.7
L _{eq} 1hr upper 10 percentile	55.6	52.7
L _{eq} 1hr lower 10 percentile	47.9	40.0

Night Time Maximum Noise Levels (see note 4)		
Lmax (Range)	-	to -
Lmax - Leq (Range)	-	to -

EXISTING AMBIENT NOISE LEVELS

74 Parthenia Street, Dolans Bay

Tuesday, 29 March 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	-	-	-
Leq (see note 3)	-	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note 3)		
Descriptor	Day	Night ²
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	51.0	-
L _{eq} 1hr upper 10 percentile	54.1	-
L _{eq} 1hr lower 10 percentile	47.1	-

Night Time Maximum Noise Levels (see note 4)		
Lmax (Range)	-	to -
Lmax - Leq (Range)	-	to -

APPENDIX E - NOISE COMPLAINT MANAGEMENT PROCEDURE

