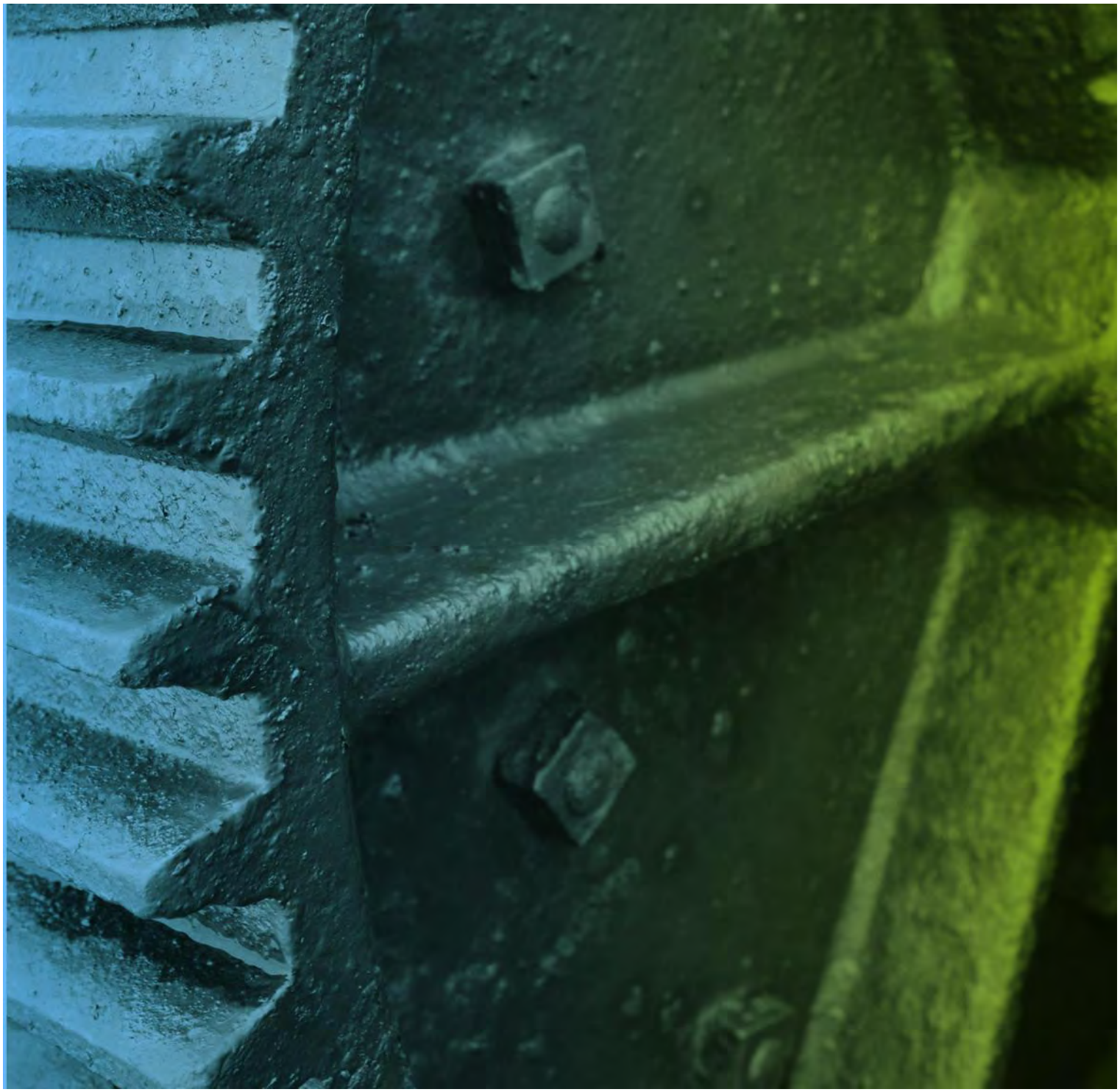
APPENDIX J

Noise and Vibration

Volume 6

Port Kembla Outer Harbour Development

Acoustic Assessment



Port Kembla Outer Harbour Development

Acoustic Assessment

Prepared for

Port Kembla Port Corporation

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00	14-Dec-2009	Draft Acoustic Assessment	Peter Sanderson Acoustic Engineer	
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1.0 Introduction

An acoustic assessment of the likely construction and operational activities associated with the proposed development of Port Kembla Outer Harbour (PKOH) has been carried out.

1.1 Background

Port Kembla Port Corporation is seeking concurrent Concept Plan approval for the total development and Major Project approval for Stage 1 of the development. The Major Project sits within, and is part of, the overarching Concept Plan framework. A description of the Concept Plan and Major Project is provided below. Further discussion on the framework of the Concept Plan and Major Project is presented in Sections 5 and 6 of the Environmental Assessment report.

Concept Plan Description

The Outer Harbour development is to be constructed in three discrete stages over the next 30 years with an anticipated completion date of 2037. Concept Plan approval is being sought for the total development. Construction of the Concept Plan would be staged to meet the needs of prospective customers, to cater for growing port needs and regional development, and to increase the potential to address the needs of new industry for 30 plus years into the future.

The Concept Plan provides a framework for the progressive completion of the Outer Harbour development and comprises creation of land dedicated to port activity. The reclaimed land would be divided into two main areas, one devoted to the import and export of dry bulk, break bulk and bulk liquid cargoes (multi-purpose terminals) and one devoted to container trade (container terminals).

Once the Concept Plan is completed, the reclamation footprint of the development would extend from the existing Port Kembla Gateway jetty in the north to Foreshore Road in the south, the boat harbour to the east and existing rail sidings to the west.

PKPC is seeking Concept Plan Approval for the total development of the Outer Harbour with the understanding that separate Major Project applications would be made for approval to construct and operate facilities on the site. PKPC would construct the reclamation, road and rail infrastructure and basic services for the site as a whole. Development of specific facilities may be undertaken by PKPC or third party operators who would lease part of the site from PKPC for a specific purpose. It is initially intended that the first stage of the multi-purpose terminals, including utilities and amenities, would be developed, operated and maintained by PKPC as a common user facility.

Stage 1 would be constructed between 2010 and 2018, Stage 2 between 2014 and 2025 and Stage 3 between 2026 and 2037.

Major Project Description

Major Project Approval is being sought to construct and operate Stage 1 of the Concept Plan. Construction of the Major Project would be divided into three sub-stages, identified as Stage 1a, Stage 1b and Stage 1c. Construction elements of Stage 1 comprise demolition of No.3 and No.4 Jetties, and reclamation and dredging for the footprint of the total development, with the following exceptions:

- An area in the vicinity of the Port Kembla Gateway.
- Expansion of the current swing basin area (ship turning circle).

At the completion of Stage 1 the central portion of the multi-purpose terminals would be operational. Road and rail infrastructure to support the first multi-purpose berth would also be constructed, and would comprise:

- Upgrade of rail infrastructure in the South Yard.
- A new road link from Christy Drive to the central portion of the multi-purpose terminals.
- A temporary road to facilitate construction of the container terminals.

The Major Project application sits within, and is part of, the overarching Concept Plan. Stage 1 is proposed to be constructed between 2010 and 2018. Major Project Approval would allow PKPC to commence reclamation and dredging for the multi-purpose and container terminals and construct and commence operations for the first multi-purpose berth. Major Project Approval for Stages 2 and 3 of the Concept Plan would be subject to separate applications for Project Approval made at a later date.

1.1 Scope of Acoustic Assessment

This assessment considers likely construction and operational scenarios associated with the Concept Plan and the Major Project. A detailed construction and operational assessment for the Major Project has been carried out. At this stage of the development detailed construction and operational methodology for the overall Concept Plan is not available. This assessment has therefore been carried out based on likely site activities that have been confirmed with Port Kembla Port Corporation (PKPC). The construction scenario modelled is considered to be representative of the likely worst case impacts associated with the Concept Plan and Major Project. Specific construction activities for each stage of the Concept Plan and Major Project have not been assessed but rather representative activities of both stages at the shortest distance between source and receivers. This is considered to be appropriate given the lack of construction methodology detail at the time of assessment.

Three potential locations for rail stabling activities associated with the Concept Plan and Major Project have been assessed. At this stage the impact resulting from the Major Project only has been assessed because the design and layout of rail infrastructure in Port Kembla is likely to change as a result of a review of rail infrastructure that is currently planned for 2010 (refer to Section 5.2.2).

It is understood that the construction phase is to include 24 hour dredging operations and that underwater blasting will take place to facilitate this procedure. Blasting locations have not yet been decided so a generic blasting assessment has been carried out to quantify the potential impact on nearby noise and vibration sensitive receivers.

AECOM has been advised that the construction works are to take place during standard working hours (Monday to Friday 0700 – 1800 and Saturday 0800 – 1200), with the exception of dredging pumps, which will be operational 24 hours a day.

Operational activities associated with the Concept Plan and the Major Project are understood to take place 24 hours a day, seven days a week.

2.0 Existing Noise Environment

2.1 Noise Logging

Three loggers were used to continuously measure background noise levels between Thursday 18th September 2008 and Wednesday 24th September 2008. The loggers were located at 7 Wentworth Road, 14 O'Donnell Street and 2 Reservoir Street, Port Kembla. These locations are considered to be representative of the sensitive receivers in the area. The data from the logger located at 2 Reservoir Street was not used as the logger experienced technical difficulties and only gathered reliable data for the period Thursday 18th Sept 2008 to 21st September 2008 (DECCW guidelines require a minimum of 7 consecutive days of logging). An additional logger was used to continuously measure road traffic noise levels between Thursday 18th September 2008 and Wednesday 24th September 2008. The logger was located at 43-57 Five Islands Road, adjacent to the carriageway. The loggers and receiver locations are shown on Figure 1.

A noise logger measures the noise level over the sample period and then determines L_{A1}, L_{A10}, L_{A90}, L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} is indicative of maximum noise levels due to individual noise events. The L_{A90} is taken as the background noise level.

The Assessment Background Level (ABL) is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or Rating Background Level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring duration.

The NSW Department of Environment, Climate Change and Water (DECCW) Industrial Noise Policy (INP) application notes recommends that when higher background noise levels (RBL) occur in the night time or evening assessment periods, that the criteria are generally set to the lower evening or daytime criteria in accordance with community expectations.

Measured ambient noise levels are shown in Table 1. Graphical representation of the logging results is shown in Appendix B.

Table 1 – Summary of ambient noise levels dB(A)

Logger Location	Day		Evening		Night	
7 Wentworth Road	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Thurs 18th September 2008			48	52	45	52
Fri 19th September 2008	50	56	47	56	49	53
Sat 20th September 2008	47	55	39	54	37	50
Sun 21st September 2008	43	67*	45	53	46	53
Mon 22nd September 2008	49	56	48	52	44	51
Tues 23rd September 2008	43	53	40	48	43	51
Wed 24th September 2008	47	54	46	51	48	53
RBL	**47**		**46**		**45**	
Log Average L_{Aeq}		**61**		**53**		**52**
14 O'Donnell Street	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Thurs 18th September 2008	-	-	40	44	37	44
Fri 19th September 2008	43	51	43	48	41	47
Sat 20th September 2008	39	50	38	43	26	45
Sun 21st September 2008	37	49	40	44	40	47
Mon 22nd September 2008	41	50	42	46	35	47
Tues 23rd September 2008	39	48	32	43	31	44
Wed 24th September 2008	38	54	38	45	41	48
RBL	**39**		**40**		**37**	
Amended RBL	**39**		**39**		**37**	
Log Average, L_{Aeq}		**51**		**45**		**46**

* Result of noisy afternoon activity

Table 2 – Summary of road traffic noise levels at 7m from Five Islands Road

Day Time - ECRTN Timebase			
15 hr Leq, (7am to 10pm)	70.9	1 hr Leq	72.8
Night Time - ECRTN Timebase			
9hr Leq, (10pm to 7am)	67.5	1 hr Leq	70.6

2.2 Noise Sensitive Receivers

The logger located at 7 Wentworth Road was affected by road traffic noise from the nearby Five Islands Road. This location has been assumed to be representative of residential properties adjacent to or in close proximity to the more heavily used roads in the area. This has been designated Sensitive Catchment Area 1 (SCA1).

The logger located at 14 O'Donnell Road is considered to be representative of residential properties located further away from the more heavily used roads in the area. This has been designated Sensitive Catchment Area 2 (SCA2).

Figure 1 – Sensitive receivers and noise logging locations

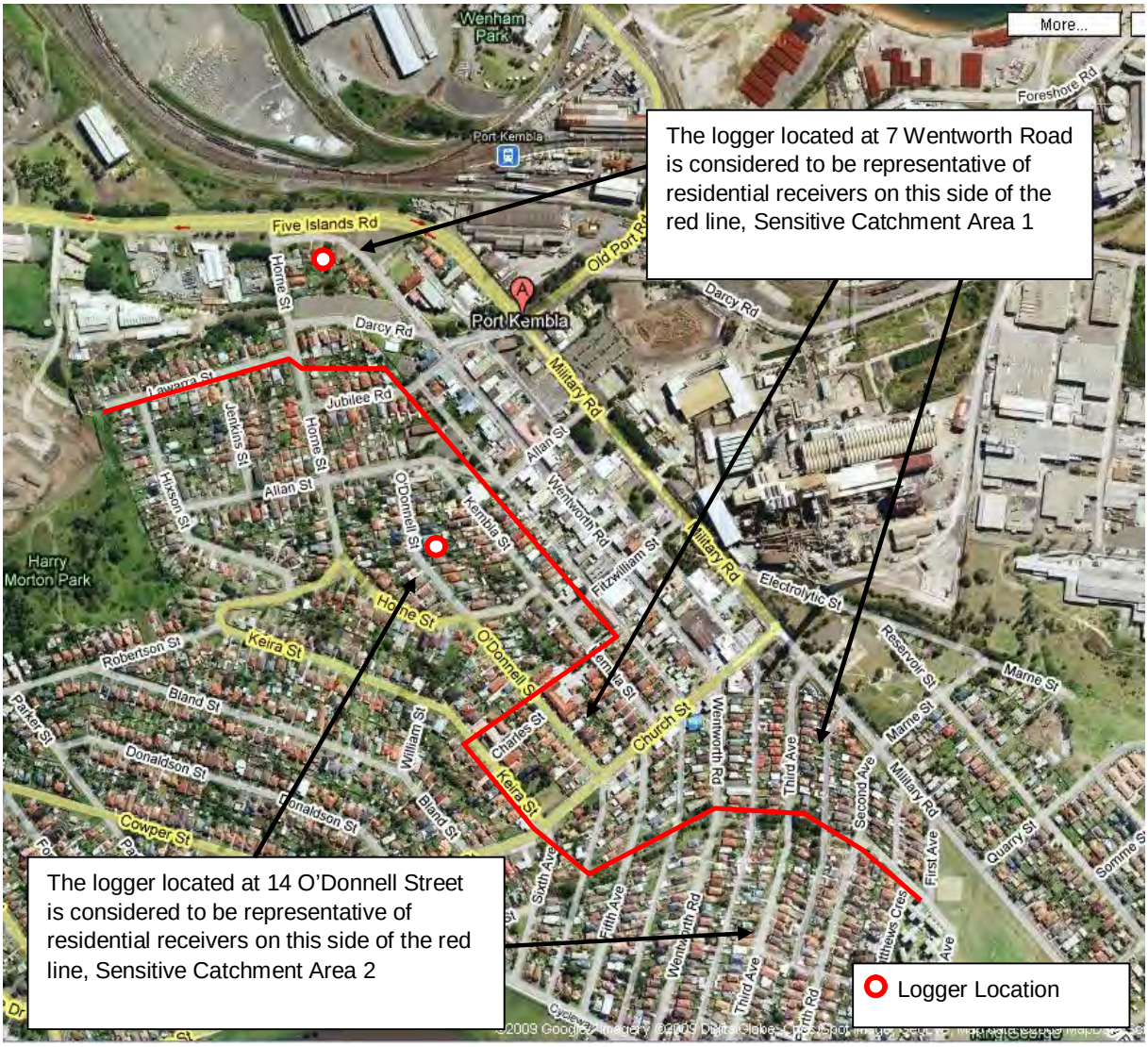


Figure 2 Five Islands Road noise logging location and most affected traffic noise receivers

Figure 3 Masters Road traffic noise receivers

3.0 Noise and vibration criteria

3.1 Construction noise criteria

In July 2009 the NSW Department of Environment, Climate Change and Water (DECCW) published their *Interim Construction Noise Guidelines (ICNG)* for use in construction noise assessment. This document supersedes their previous publication the *Environmental Noise Control Manual (ENCM)* and is used as the basis for establishing construction noise criteria.

Under the DECCW guidelines a construction noise management plan is required to be compiled by the Contractor, prior to construction commencing. Noise level objectives must be set for the daytime and evening periods, and must be complied with where reasonably practicable. Work that is proposed outside of standard working hours, as defined in the *ICNG*, generally requires strong justification.

The noise management plan should detail the "best practice" construction methods to be used, presenting a reasonable and feasible approach. The plan should identify the extent of the residential area affected and assess the impact on residents. The plan should detail any community relation programs that are planned e.g. prior notification for particularly noisy activities, letter box drop regarding out of hours construction work to be undertaken and a 24 hour contact phone number for residents to call should they have any complaints or questions.

The *ICNG* defines what is considered to be feasible and reasonable as follows:

Feasible

> *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*

Reasonable

> *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.*

The *ICNG* recommends that a quantitative assessment is carried out for all *'major construction projects that are typically subject to the EIA process'*. A quantitative assessment, based on a likely 'worst case' construction scenario associated with both the Concept Plan and Major Project, has been carried out using typical construction equipment likely to be used for both the Concept Plan and Major Project. Should the equipment used during construction differ greatly from that assumed for modelling purposes then it is likely the assessment will change.

Predicted noise levels at nearby noise sensitive receivers (residential, commercial and industrial premises) are compared to the levels provided in Section 4 of the *ICNG*. Where an exceedance of the criteria is predicted the *ICNG* advises that the proponent should apply all feasible and reasonable work practises to minimise the noise impact.

Criteria for residential receivers are set using the information in Table 3.

Table 3 – Construction noise at residences using quantitative assessment

Time of Day	Management Level L_{Aeq} (15min)*	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 + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise. • 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 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 relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - 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 + 5 dB	• 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 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2 (ICNG).

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m 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.

3.1.1 Construction noise management levels

It is assumed that the construction activities will take place during recommended standard working hours (07.00 am – 6.00 pm Monday to Friday and 8.00 am – 1.00 pm Saturday). However it is likely that dredging pumps/plant will be operational 24 hours a day.

Construction noise management levels for the most affected residential receivers are shown in Table 4.

Table 4 – Construction noise management levels – Residential receivers

Receivers	Background Noise Level, L_{A90} Day dB(A)	Daytime Noise Management Levels L_{Aeq} dB(A)	Background Noise Level, L_{A90} Evening dB(A)	Evening Noise Management Levels L_{Aeq} dB(A)	Background Noise Level, L_{A90} Night dB(A)	Night time Noise Management Limit L_{Aeq} dB(A)
Sensitive Receiver Catchment Area 1	47	57	46	51	45	50
Sensitive Receiver Catchment Area 2	39	49	39	44	37	42

Criteria for other sensitive land uses, such as schools, hospitals or places of worship are shown in Table 5.

Table 5 – Construction noise management levels – Sensitive land uses other than residential

Land Use	Management Level, L_{Aeq} (15 min) (applies when properties are in use)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas(characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses.

Criteria for industrial and commercial premises are shown below:

- Industrial premises: external $L_{Aeq\ (15min)}$ 75 dB(A)
- Offices, retail outlets: external $L_{Aeq\ (15min)}$ 70 dB(A)

3.2 Operational noise and vibration criteria

3.2.1 L_{Aeq} criteria

Any noise generated within the PKOH development site boundary, including noise from plant, truck movements, rail movements (including Stabling Yard activities), loading/unloading activities, mechanical services or associated with site buildings must be assessed in accordance with the INP.

The assessment procedure for industrial noise sources has two components, which are:

- controlling intrusive noise impacts in the short term for residences; and
- maintaining noise level amenity for particular land uses for residences and other land uses.

Intrusive noise impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average)

A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is termed the *Intrusiveness Criterion*. The *Rating Background Level* (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the INP. Adjustments are to be applied to the level of noise produced if the noise at the receiver contains annoying characteristics such as tonality or impulsiveness.

Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the acceptable noise levels specified in *Table 2.1* of the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is termed the *Amenity criterion*.

For a residential receiver in an urban area, the amenity criteria are shown in Table 6.

Table 6 Recommended L_{Aeq} noise levels from industrial noise sources

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50

Where there are high levels of existing industrial or transportation noise then noise from the new source must be controlled to preserve the amenity of the area. Table 2.2 in the INP provides modification factors for areas with existing high levels of industrial or transportation noise.

There is a significant contribution from existing industrial and traffic sources at all of the logging locations adjacent to the PKOH development site.

Due to this contribution from existing industrial noise sources the amenity criteria has been modified as per the recommendations in Table 2.2 of the INP.

Cumulative impact

Environmental noise criteria must consider the cumulative impact from all operational activities associated with the Major Project and the overall Concept Plan.

As the Major Project will be operating independently of the Concept Plan for a period of time, the operational activities associated with this phase have been assessed on both a standalone basis and as part of the Concept Plan.

The criteria for assessment of the Major Project and Concept Plan are consistent.

Final environmental noise criteria

A summary of the environmental noise criteria is given in Table 7.

Table 7 Environmental noise criteria

Receiver	Period	RBL (L_{A90})	Intrusive Criterion RBL + 5	Ambient (L_{Aeq})	Amenity Criterion	Final Environmental Criterion dB(A)
Sensitive Catchment Area 1	Day	47	52	61	52	52
	Evening	46	51	53	43	43
	Night	45	50	52	42	42
Sensitive Catchment Area 2	Day	39	44	51	60	44
	Evening	39	44	45	48	44
	Night	37	42	46	37	37

As the noise emissions from the Outer Harbour development would be dominated by relatively constant activities during the assessment periods, the $L_{Aeq,\ period}$ has been assumed to be equal to the assessed $L_{Aeq,\ 15\ min}$ for the

worst case operational scenario. This ensures compliance with both criteria at sensitive residential receivers and represents a conservative assumption.

The criteria above are applicable for all the operational noise sources within the multi-purpose terminal at the residential receivers most likely to be affected.

Meteorological Effects

Certain meteorological effects, such as source to receiver wind speeds of less than 3 m/s and thermal inversions, can increase the impact at noise sensitive receivers.

The INP states that temperature inversion are considered to be a feature of the area when they occur for more than 30% of the time during the winter months and between the hours of 6pm and 7am. Adverse wind conditions are considered to be a feature of the area when source to receiver wind speeds are below 3 m/s for more than 30% of the time during any assessment period.

Meteorological data sourced from the DECCW Wollongong monitoring station between July 2006 and June 2007, and summarised in the Air Quality report submitted as part of this EA, have been reviewed.

This data set indicates that F class temperature inversions occur for approximately 34% of the time, principally during the winter months. A screening test indicates that the occurrence of F-class temperature inversions has the potential to increase the noise impact at sensitive receivers by more than 3 dB(A). F-class temperature inversions have therefore been included in all night time modelling scenarios.

The data set indicates that source to receiver (i.e. north easterly) wind speeds of less than 3m/s occur for approximately 17% of the time. This is below the 30% requirement specified by the INP to indicate that adverse wind conditions are a feature of the area, however, in order to produce a worst case assessment adverse wind conditions have been included in the daytime modelling.

3.2.2 Sleep disturbance criteria

The DECCW's INP has been updated with application notes which discuss sleep disturbance. The INP application notes consider it appropriate that $\mathbf{L_{Amax} \leq L_{A90} + 15}$ be used as a screening criterion to assess the likelihood of sleep disturbance.

If this screening criterion is found to be exceeded then a more detailed analysis must be undertaken and include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

The sleep disturbance criteria for Sensitive Catchment Area 1 is L_{Amax}<60 dB(A).

The sleep disturbance criteria for Sensitive Catchment Area 2 is L_{Amax} <52 dB(A).

3.3 Rail Noise Criteria

The noise and vibration emission from rail vehicles movements generated by but not actually within the proposed site should be considered against the advice given in the DECCW publication '*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects'* (IGANRIP). The rail movements generated by the proposed development would be assessed in accordance with the guidance for *'Redevelopment of existing rail lines'*.

The IGANRIP recommends that rail infrastructure projects with the potential for noise and vibration impacts should be compared against the airborne and ground borne noise trigger levels to decide whether assessments of impacts and feasible and reasonable mitigation measures are necessary. The airborne noise criteria for *Redevelopment of Existing Rail Line* near to residential receivers are given below in Table 8.

The airborne noise criteria for *Redevelopment of Existing Rail Line* near to receivers other than residential are given in Table 9. The ground borne noise criteria for residential and other receivers are given in Table 10.

Table 8. Airborne rail traffic noise trigger levels for residential and educational receivers

Receiver	Noise trigger levels dB(A)		
	Day (7am -10 pm)	Night (10 pm – 7 am)	Comment
Residential	Development increases existing rail noise levels **and** resulting rail noise levels exceed:		These numbers represent external levels of noise that trigger the need for an assessment of the potential noise impacts from a rail infrastructure project. An 'increase' in existing rail noise levels is taken to be an increase of 2 dB(A) or more in L_{Aeq} in any hour or an increase of 3 dB(A) or more in L_{Amax}.
	65 $L_{Aeq(15h)}$ 85 L_{Amax}	60 $L_{Aeq(9h)}$ 85 L_{Amax}	

Table 9 – Airborne rail traffic noise trigger levels for sensitive land uses other than residential

Sensitive Land Use	Noise Trigger Levels dB(A)
	Redevelopment of existing rail line
	Development increase the existing rail noise levels by 2 dB(A) or more in L_{Aeq} in any hour ***and*** resulting rail noise levels exceed:
Schools, educational institutions – internal	45 $L_{Aeq(1hr)}$
Places of worship – internal	45 $L_{Aeq(1hr)}$
Hospitals	60 $L_{Aeq(1hr)}$
Hospitals – internal	35 $L_{Aeq(1hr)}$
Passive recreation	L_{Aeq} as per residential noise level values in Table 1* (does not include maximum noise level component)
Active recreation (e.g. golf course)	65 $L_{Aeq(24hr)}$

* Refers to Table 1 in IGANRIP i.e.Table 8 in this report

Table 10. Ground-borne rail traffic noise trigger levels for residential and educational receivers

Receiver	Time of day	Noise trigger levels dB(A)	Comment
Residential	Day (7 am – 10 pm)	40 L_{Amax} (slow)	Development increases existing rail noise levels by 3 dB(A) or more ***and*** resulting rail noise levels exceed:
	Night (10 pm – 7 am)	35 L_{Amax} (slow)	
Schools, educational institutions, places of worship	When in use	40 – 45 L_{Amax} (slow	

3.4 Road Traffic Noise Criteria

The proposed facility will generate truck and light vehicle movements on Five Islands Road, Flinders Road and Old Port Road. The potential noise impact resulting from additional truck and light vehicle movement is greatest as a result of movements on these roads.

The impact of noise from the movements has been assessed using the Department of Environment, Climate Change and Water (DECCW) document 'Environmental Criteria for Road Traffic Noise' (ECRTN).

The two primary roads in the study area that the development may impact are Five Islands Road and Old Port Road. Roads are classified depending on how they function within the surrounding road network. In this case Five Islands Road would be classified as an arterial road and Old Port Road as a sub arterial road.

Road traffic noise criteria for arterial, collector and local roads are presented in Table 11.

Table 11 Road traffic noise criteria – Arterial, collector and local roads

Period	Parameter	Criterion
Day (7.00 am – 10.00pm)	$L_{Aeq, 15hr}$	60
Night (10.00 pm – 7.00am)	$L_{Aeq, 9hr}$	55

In cases where noise from an existing road already exceeds the above criteria, Table 1 of the ECRTN recommends that "*Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access road; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB"*.

Table 12 shows the existing impact from traffic noise adjacent to Five Islands Road. The measured levels are in excess of the ECRTN criteria for daytime and night-time. The road traffic noise criteria have therefore been set to existing noise levels +2 dB(A).

Table 12 – Daytime and Night time existing ECRTN noise levels

Day Time - ECRTN Timebase	
Existing 15 hr Leq, (7am to 10pm)	71
Night Time - ECRTN Timebase	
Existing 9hr Leq, (10pm to 7am)	68

3.5 Vibration criteria

3.5.1 Construction blasting criteria

Construction blasting can result in two adverse environmental effects – airblast and ground vibration. The airblast and ground vibration produced may cause human discomfort and may have the potential to cause damage to structures, architectural elements and services.

Airblast will have no impact during the construction stage of the Major Project or Concept Plan as all blasting is to take place under a minimum water depth of 5 m. The acoustic impedance mismatch between air and water means that the vast majority of acoustic energy from an underwater blast will be reflected at the water surface. The minimal amount of energy that is not reflected is likely to be at a low sound pressure level at infrasound frequencies, and as such would not be perceptible by the nearest receivers.

The Australian and New Zealand Environment Conservation Council (ANZECC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* has been adopted by the DECCW as comfort criteria. The guidelines are not intended to be structural damage criteria; however they do provide a conservative approach to assessing blasting impacts.

3.5.2 Ground vibration

- The ANZECC recommended maximum level for ground vibration is 5 mm/s (Peak Particle Velocity, PPV);
- The PPV of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time; and
- Experience has shown that for almost all sites a PPV of less than 1 mm/s is generally achieved. It is recognised that it is not practicable to achieve a PPV of this level at all sites and hence a recommended maximum level of 5 mm/s has been selected. However, it is recommended that a level of 2 mm/s (PPV) be considered as the long term regulatory goal for the control of ground vibration.

3.5.3 Times and frequency of blasting

- Blasting should generally only be permitted during the hours of 9.00 am – 3.00 pm Monday to Friday and 9.00 am – 12.00 pm on Saturday. Blasting should not take place on Sundays or Public Holidays;
- Blasting should generally take place no more than once per day. (This requirement would not apply to minor blasts such as for clearing crushers, feed chutes etc); and
- The restrictions on times and frequency of blasting do not apply to:

- Those premises where the effects of the blasting are not perceived at noise sensitive sites; and
- Major underground metalliferous mining operations.

The ANZECC guidelines criteria are summarised in Table 13.

Table 13 - ANZECC guideline blast criteria summary

	ANZECC Guidelines
Noise	≤ 115 dB(linear) peak for 95% of total number of blasts in 12 months ≤ 120 dB(linear) peak for any blast
Vibration	≤ 5 mm/sec PPV for 95% of total number of blasts in 12 months ≤ 10 mm/sec PPV for any blast

Australian Standard 2187.2 'Explosives – Storage and use Part 2: Use of explosives' notes that damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133 dB(lin peak).

3.5.1 Building exposure to vibration

DIN Standard 4150 - Part 3 - Structural Vibration in Buildings - Effects on Structures provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration. The long term criteria, which produces the most conservative assessment, are shown in Table 14. It should also be noted that these levels are "safe limits", up to which no damage due to vibration effects has been observed for the particular class of building. "Damage" is defined by DIN 4150 to include even minor non-structural effects such as superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls.

DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits will not necessarily result in damage, the limits are generally recognised as being conservative.

Table 14- DIN 4150: Structural damage safe limits for building vibration

Type of Structure	Guideline values for Peal Particle Velocity (PPV) in mm/s in horizontal plane of highest floor at all frequencies
Dwellings and buildings of similar design and/or occupancy	5
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	10
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5

British Standard 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings quantifies three different levels of damage to structures:

- **Cosmetic** – The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction;
- **Minor –** The formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks; and
- **Major** – Damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks, etc.

BS 7385 provides guidance on assessing the possibility of vibration-induced damage in buildings due to a variety of sources and sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The standard states that there is a major difference between the sensitivity of people in feeling vibration and the onset of levels of vibration which may damage the structure. The levels of vibration at which people are likely to comment are below levels of vibration which damage buildings, except at lower frequencies.

The full assessment method presented takes into account the magnitude, frequency and duration of recorded vibration together with consideration of the type of building which is exposed.

Although the criteria contained within BS7385 are useful when appraising the relative severity of structural vibration, it is important to note that they are not intended to be adopted as acceptable or non-acceptable limits for vibration. The criteria in BS7385 are shown Table 15 below.

Table 15 - Transient vibration guide values for cosmetic damage

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz Increasing to 50 mm/s at 40 Hz and above
NOTE 1 Values referred to are at the base of the building. NOTE 2 For unreinforced or light framed structures at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.		

Note where the dynamic loading caused by continuous vibration results in dynamic magnification due to resonance, the guide values in Table 15 may need to be reduced by up to 50 %, especially at the lower frequencies where lower guide values apply.

BS 7385 asserts that minor damage is possible at vibration magnitudes that are greater than twice those given in Table 15 above, and that major damage to a building structure may occur at values greater than four times the stated values.

3.5.2 Human exposure to vibration

Long term exposure to vibration in buildings may cause annoyance. The levels at which annoyance occurs are much lower than the structural damage criteria in buildings. Blasting is not to be used in the long term as part of the dredging works associated with the Major Project or Concept Plan.

British Standard 6472-1992 Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) and NSW DECC publication 'Assessing Vibration – A Technical Guideline' provides guidance on human response to vibration. *BS 6472* defines levels of building vibration associated with a "low probability of adverse comment" from occupants, and the applicable levels for daytime activities are presented in Table 16 below.

Table 16 - Vibration (PPV) with "low probability of adverse comment" (1 Hz to 80 Hz)

Building Type	Peak Floor Vibration (X, Y Horizontal)	Peak Floor Vibration (Z Vertical)
Residential	0.8 mm/s to 1.6 mm/s	0.3 mm/s to 0.6 mm/s

Note: Daily monitoring can be performed with single axis instrumentation, in the z-axis (i.e. vertically). If problematic vibration levels are discovered then full tri-axial measurements should be obtained.

Vibration Dose Values (VDV) may also be used to assess the likelihood of complaints of intermittent vibration. The values and corresponding likelihood of response is presented in Table 17 below. For example, a VDV of between 0.8 to 1.6 would be likely to generate adverse comments or complaints. The VDV should be determined from a measurement obtained over the full exposure to vibration.

Table 17 - Vibration Dose Values (m/s$^{1.75}$) and the various degrees of adverse comment expected

Location	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential buildings 16 hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6

4.0 Noise and Vibration Assessment

4.1 Modelling

Construction and operational noise activities were modelled using SoundPLAN v7.0 modelling software. The environmental noise impact at the sensitive receivers was assessed using an implementation of the CONCAWE algorithms.

As stated in section3.2, F-class temperature inversions (2m/s drainage flow) have been included in all night time modelling scenarios and source to receiver wind speeds of less than 3 m/s have been included in all daytime and evening modelling scenarios.

Noise contours for the day and night time periods generated by the assessment of both the Major Project and Concept Plan are included in Appendix A. Daytime noise contours are also representative of evening noise contours.

4.2 Assumptions

In determining the noise impact assessment for construction and operational noise it has been assumed that the scenarios modelled accurately represent activities that will take place on site. Changes to the modelled scenarios may result in changes to the predicted noise impact levels.

4.3 Construction noise and vibration assessment

The acoustic impact at noise sensitive receivers resulting from construction activities has been assessed based on a likely construction scenario. The scenario is considered to be representative of likely site activities and the impact has been assessed based on the 'worst case' conditions i.e. the shortest distance between source and receivers and the noisiest activities occurring concurrently.

A detailed construction programme has not yet been confirmed and the predicted noise impact may change if the assumed construction scenario is altered.

Plant included in the assessment is shown in Table 18.

Table 18 – Assumed construction equipment and indicative sound power levels

Activity	Plant	% On-time in typical 15 min period	Number of Plant Items/Movements	L_w dB
Reclamation and Berth Construction	Trucks – Delivering Fill Material	20	6	77 per metre
	Train – Delivering Fill Material	100	1	106 per metre
	Asphalt Paver	20	1 (2 movements)	83 per metre
	12T Vibratory Roller	100	1 (20 movements)	80 per metre
	Graders	100	2 (15 movements each)	91 per metre
	40T Excavator	100	1	105
	Front End Loaders	60	2 (3 movements each)	78 per metre
	D9 Bulldozers	100	2	110
	Sheet Piling (power included)	40 (impact time)	3	101
	110T Rotary Bore Piling Rig	100	2	111
	Grab Hopper Dredge Ship	100	2	110

Fill material is to be sourced from dredging activities and imported to site from various external earthworks projects. It has been assumed for assessment purposes that the fill material is to be delivered from external sources or the dredging sites.

Some fill material will be transported to site by rail. A single train per day will transport fill material to the site during the Major Project. The impact of the rail movement on nearby receivers has been included in the assessment of construction noise and found to comply with the construction noise management levels at the closest residential receivers.

AECOM has been advised that, with the exception of dredging activities, construction activities will not operate outside of standard daytime working hours. The assessment for the evening and night time periods therefore assumes that only the dredging ship is operational.

The construction noise impact is predicted to comply with the daytime, evening and night time construction noise management levels at all nearby sensitive residential and commercial receivers.

4.3.1 Construction Road Traffic Noise Assessment

It is understood that the road traffic associated with the construction phase will add an additional 23 heavy vehicles per hour during the peak flow period. All of this additional traffic will pass the worst affected receivers near Lake Avenue (adjacent to Five Island Road) and along Gladstone Avenue (adjacent to Masters Road) at Cringila. The predicted increase in noise level at the worst affected receivers resulting from construction traffic is shown in Table 19.

Table 19 Construction Traffic - predicted increase in noise levels

	Major Project		
	2016 'Do Nothing' Heavy Vehicle Traffic Flow (peak hour)	Maximum Peak Hourly Construction Traffic Flow	Predicted Increase in Noise Levels dB(A)
AM			
Cringila Receivers	258	23	0.4
PM			
Cringila Receivers	228	23	0.4

The increase in noise levels resulting from construction traffic is predicted to comply with the road traffic noise criteria for the worst peak hour flow rate at the worst affected receivers.

4.3.2 Stabling Yard Construction Works

The noise impact resulting from a typical construction scenario for the addition of one rail siding to an existing stabling yard has been assessed. The Stabling Yards are part of the 'rail balloon loop' to the west of the proposed development.

It has been assumed that construction activities will take place during the day time period only. The plant included in the construction assessment is shown in Table 20.

Table 20 Assumed construction equipment and indicative sound power levels

Activity	Plant	% On-time in typical 15 min period	Number of Plant Items/Movements	L_w dB(A)
Siding Construction	30T Excavator	100	2	97
	25T Dump Truck	100	2	109
	D9 Dozer	100	1	98
	Rail Tamping Machine	100	1	100
	30T Mobile Crane	100	1	96
	Demolition Saw	100	1	116

The predicted noise impact at nearby noise sensitive receivers resulting from construction activities at each of the potential yard locations is shown in Table 21

Table 21 Predicted Stabling Yard Construction Noise Levels

Receivers	Daytime Construction Noise Management Levels dB(A)	Conditions	South Yard	North Yard	North-West Yard
Wentworth Road	57	Neutral	**68 (11)**	40	35
		Wind 3 m/s	**70 (13)**	42	37
Military Road	57	Neutral	**63 (6)**	37	22
		Wind 3 m/s	**65 (8)**	40	25
Jubilee Road	49	Neutral	**50 (1)**	36	31
		Wind 3 m/s	**52 (3)**	39	33

The assumed construction scenario is predicted to comply with the daytime construction noise criteria at the North Yard and North-West Yard. At the South Yard, the daytime construction noise management level is predicted to be exceeded by up to 13 dB(A) at the closest residential receivers (Wentworth Road) under adverse weather conditions. This is a worst case assessment i.e. the shortest distance between source and receivers and the noisiest activities occurring concurrently.

4.4 Operational noise and vibration assessment

An assessment of operational noise impact from the Major Project and the Concept Plan has been carried out. Both assessments are based on likely operational scenarios that were arrived at following discussion with AECOM maritime engineers, PKPC and DECCW.

The impact assessed in each case is based on the 'worst case' scenario i.e. the shortest likely distance between source and receivers. AECOM has been advised that the facility is to operate 24 hours a day, but that operations will be less extensive during the night-time period. For assessment purposes daytime, evening and night time operations have been assumed to be the same. This ensures that the worst case 15-minute will be assessed for each time period.

4.4.1 Major Project

The noise impact at noise sensitive receivers resulting from operations associated with the Major Project has been assessed. Should operational activities vary from those used for modelling purposes it is likely that the assessment will change.

Operational activity associated with the Major Project relates to the operation of one berth at the multi-purpose terminal and can be broadly split into two categories:

Materials Exporting -

- Export material will arrive by train and be unloaded directly to a mobile conveyor system that feeds stockpiles.
- Material from the stockpiles is transferred by wheeled loader onto another mobile conveyor system which feeds directly to the ships hold.

Materials Importing -

- Material is unloaded by ship cranes/occasional quayside crane and loaded directly into either:
    - o Hoppers which feed directly into trucks (up to 21 two way peak hour movements)
    - o A mobile hopper connected to a conveyor system taking materials directly to the cement production facility.
- Finished product from the cement plant has been assumed to leave site via truck.

Operational activities within the cement production facility building envelope have not been assessed. This facility will be subject to a separate planning approval process which will include an acoustic assessment.

It has been advised that the moored ships, operating using only auxiliary power units, will not be a significant source of noise. Ventilation systems associated with the engine rooms and crew quarters will result in some noise but this is considered to be insignificant when considered alongside other port activities and is unlikely to run at night.

Sound power levels (L_W) for the plant included in the Major Project operational noise model are shown in Table 22.

Table 22 Plant sound power levels (L_w), dB

Plant/Operation	Octave Band Sound Power Levels (L_W)						
	63 Hz	*125Hz*	*250Hz*	*500Hz*	*1kHz*	*2kHz*	*4kHz*
Truck moving	80	90	96	101	101	101	97
Trucks filling (gravel)	84	86	93	90	89	88	85
Conveyor belt	90	88	81	93	87	84	75
Train Idling	107	104	101	98	93	89	88
Train Moving	126	113	99	91	86	83	80
Stockpile Feeder	111	104	97	96	93	89	87
Quayside Crane	98	97	91	92	91	91	82
Ship Crane	100	95	98	94	84	84	74

Moving and linear noise sources have been modelled as line sources, with the sound power expressed as power per metre. This has been derived from the sound power of the plant and adjusted to account for:

- The number of plant items traversing the line source path in the assessment period;
- The proportion of the assessment period that the source is operational/moving; and
- The length of the line source.

The adjustment has been applied using the following equation:

$$SWL_{metre} = SWL_{truck} + (10 \log_{10}(t_{event}/t_{assessment}) + (10 \log_{10} n_{sources}) - (10 \log_{10} l_{line}))$$

Where:

- SWL = Sound Power in dB (or dB(A))
- tevent = duration of the event in seconds (s)
- tassessment = duration of the assessment period in seconds (s)
- nsources = number of sources
- lline = length of the line source in metres (m)

The purpose of the adjustment is to capture all the noise energy from all the noise events during the assessment period (including any breaks in activity if appropriate) and spread the energy equally over the length of the line source/vehicle route.

Plant details as used in the SoundPLAN model are summarised in Table 23.

Table 23 – Operational plant data used for modelling purposes

Project Phase	Plant	Source Type	Source Height (mAOD)	% On-time in typical 15 min period	Number of plant	L_W dB(A)
Major Project	Trucks on site access road	Line	3.6	10	5	77 per metre
	Trucks accessing/leaving Major Project area	Line	3.6	20	4	76 per metre

Project Phase	Plant	Source Type	Source Height (mAOD)	% On-time in typical 15 min period	Number of plant	L_w dB(A)
	Trucks direct filling from ship hoppers	Point	4.6	100	2	97
	Trucks accessing/leaving cement plant	Line	3.6	10	3	84 per metre
	Cement plant conveyor system	Line	3.5	100	1	75 per metre
	Train Idling/Unloading	Point	4.5	100	3	111
	Train Leaving Site	Line	4.5	15	1	106 per metre
	Stockpile Conveyor 1	Line	Varies – 0-5m	100	1	74 per metre
	Stockpile Conveyor 2	Line	Varies - 3.5 – 22m	100	1	80 per metre
	Stockpile Conveyor 3	Line	3.5	100	1	77 per metre
	Stockpile Conveyor 4	Line	Varies 3.5 – 23.5	100	1	80 per metre
	Stockpiler Feeders	Point	3.5	100	2	112
	Mobile Quayside Crane	Point	3.5	100	1	102
	Ship Crane	Point	25	100	3	104

The predicted noise levels at sensitive receivers in Sensitive Catchment Areas 1 and 2, as a result of operations associated with the Major Project have been assessed.

There are no predicted exceedances of the daytime, evening or night time environmental criteria in Sensitive Catchment Area 1 as a result of Major Project operations.

There are no predicted exceedances of the daytime, evening or night time environmental criteria in Sensitive Catchment Area 2 as a result of Major Project operations.

There are no predicted exceedances of the noise management criteria for commercial and industrial premises as a result of Major Project operations.

4.4.2 Concept Plan

The impact at noise sensitive receivers resulting from operations associated with the overall Concept Plan has been assessed.

In addition to the operation of one berth for the multi-purpose terminal associated with the Major Project, the operations associated with the Concept Plan include the balance of the multi-purpose terminal (two existing berths relocated from Port Kembla Gateway) and the container terminal (4 berths).

Operations at the multi-purpose terminal will comprise offloading using ship and occasional quayside cranes, transportation of offloaded goods to internal or external storage areas by forklift and then transportation of goods off site by truck.

Operational activity associated with the Container Terminal can be broadly summarised as follows:

Goods Importing:

- Full containers arriving on ship are unloaded by quayside rail mounted quayside cranes. Containers are then transferred across the terminal by shuttle carriers and placed in stacks by rail mounted gantry cranes (RMGs).
- The stacks are transferred onto waiting trains by RMGs.

Goods exporting:

- Trains arriving on site with full/empty containers are unloaded by the RMGs. Containers are then transferred either directly to be loaded onto ship or to a 'buffer' stack area by shuttle carrier.
- Containers transferred to the buffer zone are stacked/unstacked by RMG.

It is understood that approximately 90% of containers will be moved by rail and 10% by road.

Sound power levels (L_W) for the plant included in the Concept Plan operational noise model are shown in Table 24. These activities are in addition to the activities specified in Table 23, which were also included in the modelling assessment.

Table 24 Plant sound power levels (L_w), dB(A)

Plant/Operation	Octave Band Sound Power Levels (Lw)						
	63 Hz	*125Hz*	*250Hz*	*500Hz*	*1kHz*	*2kHz*	*4kHz*
Multi-purpose Terminal							
Truck Moving	80	90	96	101	101	101	97
Forklift moving/loading	101	98	98	111	93	90	86
Quayside Crane	98	97	91	92	91	91	82
Ship mounted cranes	100	95	98	94	84	84	74
Container Terminal							
Rail Mounted Gantry Cranes	110	107	103	105	101	97	96
Train Moving	126	113	99	91	86	83	80
Train Idling	107	104	101	98	93	89	88
Mobile Stackers	110	107	103	105	101	97	96
Quayside Crane	98	97	91	92	91	91	82
Truck Moving	80	90	96	101	101	101	97
Forklift moving/loading	101	98	98	111	93	90	86

The linear noise source adjustment outlined in Section 4.4.1 has also been applied to linear noise sources included as a part of the Concept Plan assessment.

Plant details as used in the SoundPLAN model are summarised in Table 25.

Table 25 – Operational plant data used for modelling purposes

Project Phase	Plant	Source Type	Source Height (mAOD)	% On-time in typical 15 min period	Number of plant	L_W dB(A)
Multi-purpose	Truck on site	Line	3.6	10	5 per 15	107

Project Phase	Plant	Source Type	Source Height (mAOD)	% On-time in typical 15 min period	Number of plant	L_W dB(A)
Terminal	access road				mins	per metre
	Trucks accessing warehousing	Line	3.6	10	3 per 15 mins	107 per metre
	Trucks accessing outside storage areas	Point	3.6	10	2 per 15 mins	107 per metre
	Forklift moving offloaded goods	Line	2	10-20	5 (each with 3 movements in 15 mins)	82 per metre
	Forklift loading goods	Line	2	5	2 (each with 3 movements in 15 mins)	82 per metre
	Quayside Crane	Point	3.5	100	1	102
	Ship mounted cranes	Point	25	100	4	104
Container Terminal	Rail Mounted Gantry Cranes	Point	2	100	10	115
	Quayside Cranes (rail Mounted)	Point	2	100	8	115
	Mobile Stackers	Line	3	5	20	84 per metre
	Train Moving	Line	4.5	25	1	106 per metre
	Train Idling	Point	4.5	100	3	111
	Trucks Accessing Site	Line	3.6	10	5	76 per metre
	Forklift Loading Goods	Line	2	10	2 (each with 3 movements per 15 min)	82 per metre

The predicted noise levels at sensitive receivers in Sensitive Catchment Areas 1 and 2, as a result of operations associated with the Concept Plan have been assessed.

The operational noise assessment for the Concept Plan is predicted to comply with the daytime and evening environmental noise criteria at all noise sensitive receivers. The model predicts exceedance of the night time environmental noise criteria of:

- 1 dB(A) at the four closest noise sensitive receivers, located on Military Road, in Sensitive Catchment Area 1

- Between 1-4 dB(A) at a large number of noise sensitive receivers in Sensitive Catchment Area 2.

The extent of the modelled exceedances is shown on the *Concept Plan – Night* noise contour plan included in Appendix A. The vast majority of the modelled exceedances are in the 1-2 dB(A) range, with less than fifteen modelled exceedances of 3 dB(A) and four modelled exceedances of 4 dB(A).

It is important to note that the assessment represents the results of modelling a worst case scenario and assumes all three terminals are working at maximum capacity at the same time with peak traffic flow rates for each terminal occurring coincidentally while there is an F-class temperature inversion in effect. Furthermore, the modelled exceedances are not the result of any large individual impacts but rather the cumulative impact of a large number of relatively low noise impacts.

It is recommended that the ground-borne noise impact resulting from rail movements at the South Yard associated with the Concept Plan is assessed following the rail infrastructure planning study scheduled for 2010.

There are no predicted exceedances of the noise management criteria for commercial and industrial premises as a result of Concept Plan operations.

4.4.3 On Site Rail Noise Assessment

The impact at noise sensitive receivers resulting from Major Project operations at the proposed Stabling Yard locations has been assessed. Assessment of Concept Plan operational rail impacts has not been undertaken as details of future rail infrastructure design and layout is not known and given regional rail infrastructure is being reviewed in 2010. Assessment of Stage 2 and 3 rail impacts can be undertaken when details of rail infrastructure are known. At this stage the proposed operations at each yard are indicative only and have been assessed based on a likely operational scenario.

It is important to consider that the proposed Stabling Yard sites are all currently operational. The Southern Yard comprises eleven sidings and is currently operated by Pacific National on a 24/7 basis. It is understood that use of this yard for the Major Project of the development would not add any additional rail movements, rather that some existing Pacific National movements would be utilised by PKPC. The existing operational situation in terms of number of trains and number of movements within the Stabling Yard will not be altered by the Major Project operations.

For the Major Project it is understood that one train (utilising an existing rail movement) per day will use the South Stabling Yard and that this could occur at any point during the day, evening or night. The impact of a single train has been assessed against the night time environmental noise criteria.

The predicted noise levels during the Major Project operation at the closest noise sensitive receivers are shown in Table 26.

The predicted noise impact at nearby noise sensitive receivers resulting from the assumed operational scenario complies with the night time environmental noise criteria for the North Yard and North-West Yard options.

The predicted noise impact at nearby noise sensitive receivers resulting for the assumed operational scenario exceeds the night time environmental noise criteria by up to 4 dB(A) for receivers in Wentworth Road and Military Road under adverse meteorological conditions for the South Yard option.

Assessment of the impact of rail noise against the overall environmental criteria, which is controlled at night by the more stringent amenity criteria, is considered to be excessively conservative as it is unlikely that any of the Stabling Yard activities will persist for an extended period. Shunting and decoupling activities are likely to occur for only a fraction of the time that the train is within the Stabling Yard and the locomotives will be switched off for extended periods. Assessment against the amenity criteria assumes that the noise source being assessed is continuous for the entire nine hour night time period. When this is not the case, as with the Stabling Yard activities associated with the Major Project, it is more appropriate to assess the impact against the intrusiveness criterion.

Assessment of Stabling Yard activities against the night time intrusiveness criterion results in compliance at all nearby noise sensitive receivers.

Table 26 Predicted Rail Siding Major Project Operational Noise Levels

Receivers	Night time Intrusiveness Noise Criteria dB(A)	Conditions	South Yard	North Yard	North-West Yard
Wentworth Road	50	Neutral	45	28	25
		F-class 2m/s	46	30	28
Military Road	50	Neutral	43	29	18
		F-class 2m/s	45	31	21
Jubilee Road	42	Neutral	32	25	19
		F-Class 2 m/s	34	27	22

4.5 Sleep disturbance assessment

An assessment against the INP (application notes) sleep disturbance criteria, and with consideration of the ECRTN sleep disturbance research, has been undertaken. The assessment is applicable to the Concept Plan and Major Project as it relates to loud noises which would be common to all stages of Concept Plan development, such as metal clangs and the sounding of train horns.

The Industrial Noise Policy Application Notes state the following:

> *"Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development.*
>
> *DECC reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*
>
> *From the research, DECC recognised that current sleep disturbance criterion of an L_{A1}, (1 minute) not exceeding the L_{A90}, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, DECC will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.*
>
> *The detailed analysis should cover the maximum noise level or L_{A1}, (1 minute), that is, the extent to which the maximum noise level exceeds background noise level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN."*

This indicates that where the L_{A1} (1 minute), exceeds the background noise level, L_{A90} (15 minute) by more than 15 dB(A) further analysis is recommended.

The ECRTN concludes as a result of the review of research that:

> *Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions; and*
>
> *One or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly.*

An open bedroom window generally provides an approximate attenuation of about 10 dB(A), which, given that internal levels below 50-55 dB(A) are unlikely to cause awakening reactions, means external levels of 60-65 dB(A) are unlikely to cause awakening reactions.

Metal 'clangs' and noise from train horns are likely to provide the greatest L_{A1} values. The predicted impact of metal 'clangs' from the 'non-weather sensitive' container stacks and train horns being sounded at the northern end of the Southern Stabling Yard option at the closest noise sensitive receivers is shown in Table 27.

Table 27 Predicted Sleep Disturbance – Including Train Horns

Receiver	Background L_{A90} dB(A)	Sleep Disturbance Screening Criterion dB(A)	Predicted night time impact at receivers dB(A)	Predicted Exceedance dB(A)
5-7 Military Road	45	60	67	7
15 Wentworth Avenue	45	60	71	11
1 Jubilee Road	37	52	60	8

In each case the predicted exceedance shown in Table 27 is the result of the train horn being sounded at the northern end of the Southern Stabling Yard option. The predicted impact without the train horns sounding, but with the worst case container 'clang' is shown in Table 28.

Table 28 Predicted Sleep Disturbance – without train horns

Receiver	Background L_{A90} dB(A)	Sleep Disturbance Screening Criterion dB(A)	Predicted night time impact at receivers dB(A)	Predicted Exceedance dB(A)
5-7 Military Road	45	60	50	-
15 Wentworth Avenue	45	60	47	-
1 Jubilee Road	37	52	47	-

As the sounding of train horns is predicted to result in significant exceedance of the sleep disturbance screening criterion it is recommended that an alternative to sounding horns be sought in the Stabling Yard area. Use of a visual signalling system would eliminate the noise source and the predicted sleep disturbance exceedances.

4.6 Road traffic noise assessment

The road traffic assessment has provided data on the number of vehicle movements associated with the site. Figures for 2016 without the development and with the development (Major Project) and 2036 without the development and with the development (Concept Plan) have been assessed.

$$\text{Increase in Noise Level} = 10\log_{10} (\text{Future Vehicles/Existing Vehicles})$$

One hundred percent of the operational traffic generated by the Major Project and Concept Plan will travel along Flinders Street and Five Islands Road towards the Southern Freeway. The most potentially affected receivers will be located at Cringila, situated around Lake Avenue, adjacent to Five Islands Road (Figure 2) and along Gladstone Avenue, adjacent to Masters Road (Figure 3).

The predicted increase in noise level resulting from the increase in heavy vehicle movements associated with the Major Project and Concept Plan is shown in Table 29.

The maximum predicted increase in noise level resulting from increased traffic flow associated with the Major Project is 0.3 dB(A).

The maximum predicted increase in noise level resulting from increased traffic flow associated with the Concept Plan is 0.6 dB(A). Both noise levels are well within the relevant criteria for road traffic noise.

Table 29 Predicted Traffic Noise Level Increases

	Major Project			Concept Plan Approval		
	2016 'Do Nothing' Heavy Vehicle Traffic Flows	2016 with Development Heavy Vehicle Traffic Flows	Predicted Increase in Noise Levels dB(A)	2036 'Do Nothing' Heavy Vehicle Traffic Flows	2036 with Development Heavy Vehicle Traffic Flows	Predicted Increase in Noise Levels dB(A)
	AM					
Cringila Receivers	258	272	0.2	315	356	0.5
Masters Road Receivers	200	209	0.2	245	265	0.3
	PM					
Cringila Receivers	228	242	0.3	275	315	0.6
Masters Road Receivers	217	225	0.2	243	263	0.3

4.7 Blasting and Operational Vibration assessment

4.7.1 Blasting Assessment

The blasting impact at nearby residential and industrial/commercial receivers has been assessed. As no trial blasts have yet taken place the assessment uses generic values recommended in *AS 2187.2:2006 Explosives – Storage and use – Use of explosives*. The values used are considered to be conservative.

The ground vibration arriving at a point remote from a blast is a function of many factors, including:

- charge mass of explosive per delay;
- explosive type and coupling;
- distance from blast;
- ground transmission characteristics;
- firing sequence;
- origin of the rock mass;
- presence of bedding and joints; and
- degree and depth of weathering of surface at the point.

Some of these factors are difficult to accurately quantify without specific site knowledge. Many site factors will affect the transmission of vibration through the ground, the most accurate predication graph for a site will be that generated from vibration measurements taken at the site. However, in the absence of such site data, ground vibration can be estimated using the following equation:

$$PPV = K_g \left(\frac{R}{\sqrt{Q}} \right)^{-B}$$

where: PPV = peak particle velocity (mm/s)

Q = Maximum instantaneous charge(kg)

R = distance (m)

K_g, B = Constants related to site and rock properties for estimation purposes

Ground vibration levels depend on the maximum instantaneous charge (effective charge weight per delay), and not the total charge weight, provided the effective delay interval is appropriate.

Constants of K_g 1140 and 5000 and B 1.6 will provide an estimate of vibration levels in 'average' conditions. In practice, due to variations in ground conditions and other factors, the resulting ground vibration levels can vary from two fifths to four times that estimated. In cases where the site parameters have not been reliably determined from prior experience, advice should be obtained from suitably qualified and experienced persons, who may recommend initial trial blasts with conservative charge quantities.

Predicted vibration levels at locations in SCA 1 and SCA 2 are shown in Table 30 and Table 31, respectively.

Table 30 – Predicted vibration at Sensitive Catchment Area 1with a K_g value = 5000

Site Number	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)						
		1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
5-7 Military Road	630	0.2	0.6	1.0	1.4	1.8	2.5	4.4
9 Military Road	635	0.2	0.6	1.0	1.4	1.8	2.5	4.3
11 Military Road	645	0.2	0.6	1.0	1.4	1.8	2.4	4.2
15 Military Road	650	0.2	0.6	1.0	1.4	1.7	2.4	4.2
3 Wentworth Rd	715	0.1	0.5	0.9	1.2	1.5	2.1	3.6
5 Wentworth Rd	705	0.1	0.5	0.9	1.2	1.5	2.1	3.7
7 Wentworth Rd	695	0.1	0.5	0.9	1.2	1.6	2.2	3.8
9 Wentworth Rd	690	0.1	0.5	0.9	1.3	1.6	2.2	3.8
11 Wentworth Road	690	0.1	0.5	0.9	1.3	1.6	2.2	3.8
13 Wentworth Road	700	0.1	0.5	0.9	1.2	1.5	2.1	3.7
15 Wentworth Road	705	0.1	0.5	0.9	1.2	1.5	2.1	3.7
17 Wentworth Road	710	0.1	0.5	0.9	1.2	1.5	2.1	3.6
19 Wentworth Road	720	0.1	0.5	0.8	1.2	1.5	2.0	3.5
1 Third Avenue	1305	0.1	0.2	0.3	0.5	0.6	0.8	1.4
2 Third Avenue	1325	0.1	0.2	0.3	0.4	0.6	0.8	1.3
160 Wentworth Road	1315	0.1	0.2	0.3	0.4	0.6	0.8	1.4
2 Reservoir Street	1305	0.1	0.2	0.3	0.5	0.6	0.8	1.4

Table 31 – Predicted vibration at Sensitive Catchment Area 2 with a K_g =5000

Site Number	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)						
		1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
1 Jubilee Road	825	0.1	0.4	0.7	0.9	1.2	1.6	2.9
2 Jubilee Road	840	0.1	0.4	0.7	0.9	1.2	1.6	2.8
3 Jubilee Road	830	0.1	0.4	0.7	0.9	1.2	1.6	2.8
4Jubilee Road	855	0.1	0.4	0.6	0.9	1.1	1.5	2.7
5 Jubilee Road	840	0.1	0.4	0.7	0.9	1.2	1.6	2.8
6 Jubilee Road	865	0.1	0.4	0.6	0.9	1.1	1.5	2.6
7 Jubilee Road	845	0.1	0.4	0.7	0.9	1.1	1.6	2.7
8 Jubilee Road	870	0.1	0.4	0.6	0.9	1.1	1.5	2.6
9 Jubilee Road	850	0.1	0.4	0.6	0.9	1.1	1.6	2.7
10 Jubilee Road	875	0.1	0.4	0.6	0.9	1.1	1.5	2.6
11 Jubilee Road	860	0.1	0.4	0.6	0.9	1.1	1.5	2.7
12 Jubilee Road	880	0.1	0.4	0.6	0.8	1.1	1.5	2.6
14 Jubilee Road	885	0.1	0.3	0.6	0.8	1.1	1.5	2.5
16 Jubilee Road	890	0.1	0.3	0.6	0.8	1.0	1.5	2.5
14 Horne Street	850	0.1	0.4	0.6	0.9	1.1	1.6	2.7
16 Horne Street	870	0.1	0.4	0.6	0.9	1.1	1.5	2.6
18 Horne Street	880	0.1	0.4	0.6	0.8	1.1	1.5	2.6

The vibration levels predicted for receivers in both Sensitive Catchment Areas comply with the vibration criteria (DIN Standard 4150 – Structural Vibration in Buildings; Table 14).

Predicted vibration levels at the closest industrial and commercial receivers are shown in Table 32.

Assuming a dominant blast frequency of 15 Hz, the vibration levels predicted for the closest industrial/commercial receiver comply with the criteria vibration criteria (DIN Standard 4150 – Structural Vibration in Buildings; Table 14), with the exception of the 60kg charge, which exceeds the criteria by 7.5 mm/s.

Table 32 – Predicted vibration at closest industrial/commercial receiver with a K_g =5000

Site Number	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)						
		1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
Closest Industrial/Commercial Receiver	200	1.0	3.8	6.6	9.1	11.4	15.8	27.5

4.7.2 Operational Vibration

It is considered unlikely that there will be any vibration impact at nearby sensitive receivers as a result of operations (other than rail movements) within the site boundary due to the nature of the activities and the distance to the closest receivers.

The likely impact as a result of rail movements in the South Yard associated with the Major Project has been assessed.

VDVs accumulate the vibration energy of a receiver over a certain period and are suited for assessing intermittent vibration such as train pass-bys.

Since the alignment of the rail line and train speeds are unlikely to change for operations associated with the Major Project, the increase in Vibration Dose Values at affected receivers will primarily be driven by an increase in train movement.

The relationship between increase in train movements and concomitant increase in VDVs is non-linear. VDVs increase with the 4^{th}-root of the train movement increase, i.e. a sixteen-fold increase in train movement will only double the VDV. Table 33 gives results for 5% and 10% increases in train movements.

Table 33 Correlation between train movement increase and increase in VDV.

Increase in train movements	Increase in VDV
5% increase	1% increase
10% increase	2.4% increase

If rail movements at the South Yard increased by up to 10% it would be expected to see a corresponding increase in VDVs of 2.4%. This very modest increase in VDVs is deemed inconsequential. In view of the large ranges of VDV generally accepted and shown in Table 17 and the fact the Major Project is not actually adding any additional rail movements, adverse comment is considered unlikely.

It is recommended that the impact of operational vibration resulting from rail movements associated with the Concept Plan is assessed following the rail infrastructure planning study scheduled for 2010.

5.0 Discussion and Recommendations

5.1 Construction noise impact

The construction noise impact is predicted to comply with the construction noise management levels for the daytime, evening and night time periods at all noise sensitive residential and commercial receivers.

The construction noise impact associated with the South Stabling Yard is predicted to exceed the daytime construction noise management level by up to 13 dB(A) at the closest residential receivers. This is a worst case assessment and it is likely that the predicted impact can be reduced with careful consideration of the construction schedule at the construction management plan stage.

If the number and type of plant involved in construction varies from that in Table 18 it is recommended that an additional noise assessment be carried out in order to gauge the likely impact at nearby receivers.

The DECCW "*Draft Construction Noise Guidelines"* recommend that the contractor demonstrates best practicable means and include noise mitigation measures in the construction management plan to minimise the noise impact at sensitive receivers. It is recommended that a Construction Noise Management Plan is compiled by the Contractor. This may include the work practices described below.

Community notification

- Contact potentially noise-affected neighbours at the earliest possible time before any site work begins;
- Inform potentially noise-affected neighbours about the nature of the construction stages and the noisier activities – for example excavation and rock-breaking;
- Give clear indication to potentially noise-affected neighbours of how long noisy activities will take;
- Describe any noise controls, such as walls to be built first that will reduce noise, temporary noise walls, or use of silenced equipment;
- Keep potentially noise-affected neighbours up to date on progress;
- Provide contact details on a site board at the front of the site, and keep a complaints register suited to the scale of works;
- Ask about any concerns that potentially noise-affected neighbours may have and discuss possible solutions;
- Provide a copy of the noise management plan to potentially noise-affected neighbours.

Operate plant in a quiet and efficient manner

- Turn off plant that is not being used;
- Examine, and implement where feasible and reasonable, alternative work practices which generate less noise – for example use hydraulic rock splitters instead of rockbreakers, or electric equipment instead of diesel or petrol powered equipment;
- Examine, and implement where feasible and reasonable, the option of using silenced equipment.
- Ensure plant is regularly maintained;
- Locate noisy plant away from potentially noise-affected neighbours or behind barriers, such as sheds or walls; and
- Where reasonable, provide respite periods for very noisy activities.

Involve workers in minimising noise

- Avoid dropping materials from a height;
- Talk to workers about noise from the works and how it can be reduced; and
- Use radios and stereos indoors rather than outdoors.

Handle complaints

- Review, and implement where feasible and reasonable, work practices to minimise noise from construction that are the subject of noise complaints.

5.2 Operational noise impact

5.2.1 Major Project

Operations

The Major Project operational scenario is predicted to comply with the daytime, evening and night time environmental noise criteria at all noise sensitive receivers. The noise assessment was undertaken assuming 'worst case' operational conditions and adverse weather conditions; 3m/s source to receiver wind speed during the daytime and evening periods and an f-class thermal inversion during the night time.

Rail Noise

Due to the likely limited number of trains (only one) and limited duration of noisy activities, such as shunting, decoupling and idling locomotives, it is considered more appropriate to assess the impact from the Southern Stabling Yard against the intrusiveness criterion. The predicted noise impact resulting from one train movement at the Southern Stabling Yard complies with the night time intrusiveness criterion at all noise sensitive receivers.

The measured existing background noise level at night at the closest receivers (shown in Table 7) is 45 dB(A), which is exactly the same as the predicted impact resulting from Major Project rail operations under neutral weather conditions (Table 26). It is important to consider that trains are currently operational in the South Stabling Yard twenty four hours per day and that the proposed Major Project development would not increase the number of rail movements. Given that this is an existing situation and that the proposed activities would not result in increased noise levels at nearby receivers the impact is considered to be negligible.

As the number of train movements at the South Yard would not increase due to Major Project operations the ground-borne noise impact at nearby receivers would be unchanged.

Sleep Disturbance

The noise impact from train horns sounding in the South Stabling Yard is predicted to exceed the sleep disturbance criteria by up to 11 dB(A) at receivers on Wentworth Avenue, up to 8 dB(A) at receivers on Jubilee Road and by up to 7 dB(A) at receivers on Military Road(Table 27).

As stated in Section 4.5 research has shown that one or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly. An open bedroom window generally provides an approximate attenuation of about 10 dB(A), meaning that one or two noise events with a maximum external noise level of 75-80 dB(A) are not likely to affect health and wellbeing significantly.

As there is only one train movement every 24 hours associated with the Major Project and the maximum predicted external noise level at a noise sensitive receiver is 71 dB(A) (Table 27) it is unlikely that train horn noise resulting from Major Project operations will affect health and well being significantly.

It is considered appropriate that an alternative to sounding of train horns in the South Yard, such as visual signalling, is sought to ensure compliance with the sleep disturbance criteria.

5.2.2 Concept Plan

Operations

The Concept Plan operational scenario used in the noise modelling includes activities associated with the planned multi-purpose terminal and container terminals.

The Concept Plan operational scenario is predicted to comply with the daytime and evening environmental noise criteria at all noise sensitive receivers. There are predicted exceedances of up to 1 dB(A) at four noise sensitive receivers in SCA1. There are predicted exceedances of 1-4 dB(A) at sixty seven noise sensitive receivers in SCA2.

As a result of existing industrial noise in the area, the night time environmental noise criterion in each case is controlled by the more stringent Amenity Criterion (Table 7). The existing ambient L_{Aeq} noise levels in SCA2 are 46 dB(A). The worst predicted exceedance of 4 dB(A) at four receivers would result in this L_{Aeq} increasing by an estimated 1.2 dB(A). At fifty of the potentially affected receivers the increase in the L_{Aeq} would likely be less than 1 dB(A).

It is important to consider that this assessment represents a worst case scenario and to look at how likely this scenario is to occur and how often that occurrence is likely to happen.

The assessment assumes that all berths at the multi-purpose terminal and container terminals are working at maximum capacity) at the same time, with the peak traffic flow rates for each terminal occurring coincidentally while there is an F-class temperature inversion in effect.

Based on the unloading times and annual throughput it has been calculated that the average occupancy of each terminal is as shown in Table 34. This corresponds to one ship at each of the multi-purpose terminals and two ships at the container terminals.

Table 34 Likely Berth Occupancy Rate

Terminal	Number of Ships	Berth Occupancy Time (annual)	Assumed Night-time Berth Occupancy Time (annual)
1 – Multi-purpose terminal	1	64%	32%
2 – Multi-purpose terminal	1	33%	17%
3 – Container terminals	2	47%	24%

Based on the occupancy rates shown in Table 34 it is unlikely that all terminals (four ships total) will be occupied and working during the night time period for more than 1% of the time.

In order to realise the worst case this would have to coincide with the 34% chance of an F-class temperature inversion and the coincidental occurrence of peak truck arrival at each terminal. This situation is likely to occur on only one or two days of the year and can be further assessed during the detailed design assessment of the General Goods Terminal and Container Terminal.

Furthermore, the predicted exceedances are not the result of any large individual impacts but rather the cumulative impact of a large number of relatively low noise impacts. For example, at one of the worst affected receivers located at 17A Kembla Street, a noise level of 41 dB(A) is predicted, which is an exceedance of 4 dB(A). However, the single largest contributor at this location only results in a level of 32 dB(A). The predicted level of 41 dB(A) is the result of many noise sources combined, all with predicted impacts at the receiver of 25-31 dB(A).

An exceedance of this nature can be difficult to mitigate using standard mitigation measures such as acoustic barriers. While it may be feasible to reduce the predicted impact level by constructing barriers and screens, the environmental and economic cost associated with this approach is often not reasonable. For example, construction of a 220 m long acoustic barrier 7.5m height along the multi-purpose terminal access road reduces the predicted impact at the receiver by only 0.3 dB(A). Given the environmental and economic cost associated with such a mitigation measure this cannot be seen to be a reasonable approach to noise control.

It is likely that the opportunity to reduce the predicted operational noise exceedances will present itself at several stages of the Concept Plan when subsequent project approvals are required. At this time an additional noise assessment will look at operations in greater detail and allow targeted management controls to be put in place with a view to reducing noise emissions at night.

PKPC are committed to the selection of acoustically considerate plant where possible and the use of noise reducing measures such as silencers, multi frequency reversing alarms, visual system reversing warnings, enclosures and shrouds. It is also likely that emerging technologies over the next 25 years will present the opportunity to further reduce the predicted noise impact.

Sleep Disturbance

The noise impact from container ‘clang’ associated with operations at the container terminal are predicted to comply with the sleep disturbance criteria at all receivers.

It is understood that a major rail infrastructure planning study for Port Kembla Outer Harbour is to be undertaken in 2010. An assessment of the acoustic impact arising from changes to the rail infrastructure associated with the Concept Plan should be carried out to compliment this planning study. It is recommended that sleep disturbance impacts arising from increased rail movements associated with the Concept Plan be investigated further as part of applications for planning approval for Stages 2 and 3, and once the rail infrastructure planning study has been carried out.

Stabling Yard Noise

It is recommended that a full assessment of the acoustic impact arising from changes to the rail infrastructure associated with the Concept Plan be carried out to complement the major rail infrastructure planning study to be undertaken in 2010.

5.3 Rail Traffic Noise

The noise impact resulting from rail movements on the main Illawarra line (i.e. not within the South Yard), as a result of one train movement per day arising from operations associated with the Major Project, is predicted to be less than 2 dB(A). This complies with the IGANRIP criteria outlined in Table 8.

The potential impact resulting from increased rail movements associated with the Concept Plan should be addressed following the rail infrastructure planning study, which is due to take place in 2010.

5.4 Road Traffic Noise

The predicted impact from increased heavy vehicles passing the worst affected residences at Cringila (Figure 2) is less than 2 dB(A).

This complies with the ECRTN criteria outlined in Section 3.4.

5.5 Blasting and Operational Vibration

The vibration levels resulting from blasting associated with the works have been calculated.

The vibration levels have been predicted at receivers in Sensitive Catchments Area 1 and Area 2 for charges ranging from 1 kg to 60 kg. The results have been assessed against the long term structural damage safe limits in DIN 4150. This assessment is considered to be appropriate as the structural resonance frequency of the potentially affected receivers is not known. It is likely that the results are conservative.

The predicted vibration levels comply with the criteria at all receivers in Sensitive Catchments Area 1 and Area 2.

The predicted vibration level at the closest industrial/commercial facility on Old Port Road exceeds the criteria when a 60 kg charge is assumed.

These values have been calculated using non site-specific data. They also assume the shortest possible distance between the site and the receivers. It is recommended that site specific data gathered during trail blasts is used to refine and calibrate the calculations prior to any blasting taking place.

6.0 Conclusion

The impact of noise emissions from plant associated with the construction and operation of the Concept Plan and Major Project have been assessed. Construction and operational impact assessments have been carried out based on plant that is likely to be associated with each phase.

Further assessment of the noise impact associated with the Concept Plan is recommended prior to development in conjunction with subsequent project approvals.

The modelled construction scenario is considered to be representative of the likely worst case impacts associated with Concept Plan and Major Project. Specific construction activities for each stage of the Concept Plan and Major Project have not been assessed but rather representative activities of both stages at the shortest distance between source and receivers. This is considered to be appropriate given the lack of construction methodology detail at the time of assessment.

The impact of construction noise on the receivers in SCA1 has been assessed. The noise levels at all receivers in SCA1 are predicted to comply with the daytime, evening and night-time noise management levels.

The impact of the port facility construction noise on the receivers in SCA2 has been assessed. The noise levels at all receivers in SCA2 are predicted to comply with the daytime, evening and night-time noise management levels.

The impact of increased traffic associated with construction works has been assessed at the worst affected receivers located at Cringila. The increase in noise levels due to construction traffic is predicted to comply with the road traffic noise criteria for the worst peak hour flow rate.

The impact of the Stabling Yard construction noise on the closest receivers in SCA1 has been assessed. The noise levels are predicted to comply with the daytime construction noise management levels for activities taking place at the North Yard and North-West Yard options. The noise levels resulting from construction activities at the South Yard option are predicted to exceed the daytime construction noise management levels by up to 13 dB(A) at the closest noise sensitive receivers. This is considered to be a worst case assessment and it is unlikely that this level of exceedance would persist. It is likely that the predicted noise level will reduce following careful consideration of the construction methodology at the construction management plan stage.

It is recommended that an additional noise impact assessment be carried out should the construction methodology on site differ from that assumed for modelling purposes. The guidelines set out in the DECCW guidance document *'Interim Construction Noise Guideline'* should be implemented to ensure that the impact at receivers from construction noise is minimised as far as is reasonable and feasible.

The operational noise assessment for the Major Project multi-purpose terminal, has been carried out based on a likely operational scenario.

The impacts of operational noise generated by the Major Project are predicted to comply with the daytime, evening and night time environmental noise criteria at all sensitive receivers in SCA1 and SCA 2.

The operational noise assessment for the Concept Plan has been carried out based on a likely operational scenario.

The impacts of the operational noise generated by the Concept Plan are predicted to comply with the daytime and evening environmental noise criteria at all receivers in SCA1 and SCA2.

The impacts of the operational noise generated by the Concept Plan are predicted to exceed the night time environmental noise criteria by 1 dB(A) at the four closest noise sensitive receivers in SCA1.There are also predicted exceedances of 1-4 dB(A) at a large number of receivers in SCA2. The majority of exceedances are predicted in the 1-2 dB(A) range and are the result of the cumulative impact of a large number of individually compliant sources. The operational scenario modelled to produce the predicted noise levels is considered to be extremely conservative and likely to occur on only 1 or 2 days a year.

It is likely that the predicted noise impact resulting from operations associated with Concept Plan will be lower than modelling at this stage. PKPCs commitment to use acoustically considerate equipment where possible and to consider the acoustic impact of operations at detailed design stage is likely to result in lower noise levels at receivers than those predicted in this assessment.

When assessed against the overall night time environmental noise criteria, which is controlled by the more stringent amenity criterion, the impact of assumed operations at the South Stabling Yard during the Major Project is predicted to result in exceedances of up to 4 dB(A) at the closest noise sensitive receivers under adverse

weather conditions. As there is only one rail movement associated with the Major Project in any 24 hour period and associated Stabling Yard activities are likely to be of limited duration the impact has been assessed against the more appropriate intrusiveness criterion. Stabling Yard activities associated with the Major Project are predicted to comply with the night time intrusiveness criterion at all nearby noise sensitive receivers. The predicted noise level at the closest receivers matches the measured existing background noise levels, which are affected by existing rail operations in the South Yard. The impact of development of the South Stabling Yard for the Major Project is therefore considered to be minimal.

It is understood that a major planning study with regard the rail infrastructure around the Outer Harbour is to be carried out in 2010. It is recommended that a full assessment of the acoustic impact arising from changes to the rail infrastructure associated with the Concept Plan be carried out to complement this planning study.

The predicted impact arising from increased heavy vehicle movements associated with the Major Project and Concept Plan has been shown to be insignificant. The worst case predicted increase in noise level is 0.6 dB(A), which complies with the ECRTN criteria.

The sounding of one train horn per day associated with the Major Project is considered unlikely to affect health and wellbeing significantly at the closest noise sensitive receivers. Consideration of this impact in conjunction with other Stabling Yard rail movements suggests that it would be appropriate to investigate alternatives to sounding train horns, such as a visual signalling system.

Sleep disturbance as a result of activities associated with the Concept Plan and Major Project has been assessed. Noise generated by container ‘clang’ occurring at the shortest distance between site and receiver has been shown to comply with the sleep disturbance criteria. It is recommended that the issue of sleep disturbance arising from increased rail movements associated with the Concept Plan be investigated further as part of the Port Kembla rail infrastructure planning study to be carried out in 2010.The predicted vibration levels associated with blasting have been shown to comply with the criteria at all receivers in Sensitive Catchment Areas 1 and 2.

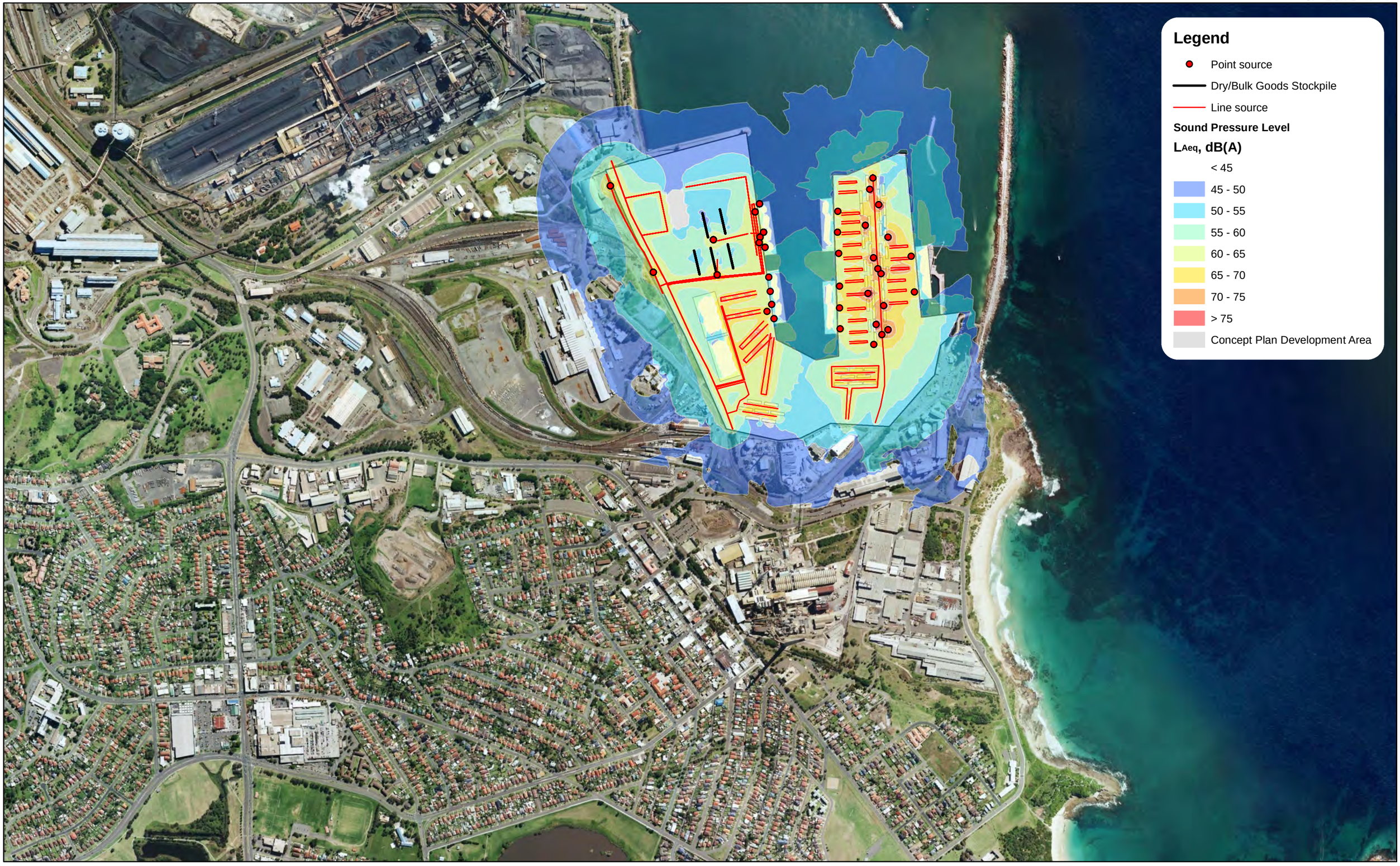
The predicted vibration level at the closest industrial/commercial receiver exceeds the criteria when a 60 kg charge is assumed. It is recommended that the impact from blasting be calculated from site specific data gathered during trial blasting.

It is recommended that Noise Management Plans (NMP) be included as part of the CEMPs and OEMPs prepared for the Concept Plan and Major Project to minimise the noise impact at sensitive receivers. The NMPs should best practice mitigation measures and be prepared in accordance with the DECCW “*Draft Construction Noise Guidelines*” .

Appendix A

Appendix A - Noise Contours

AECOM



Port Kembla Outer Harbour Development

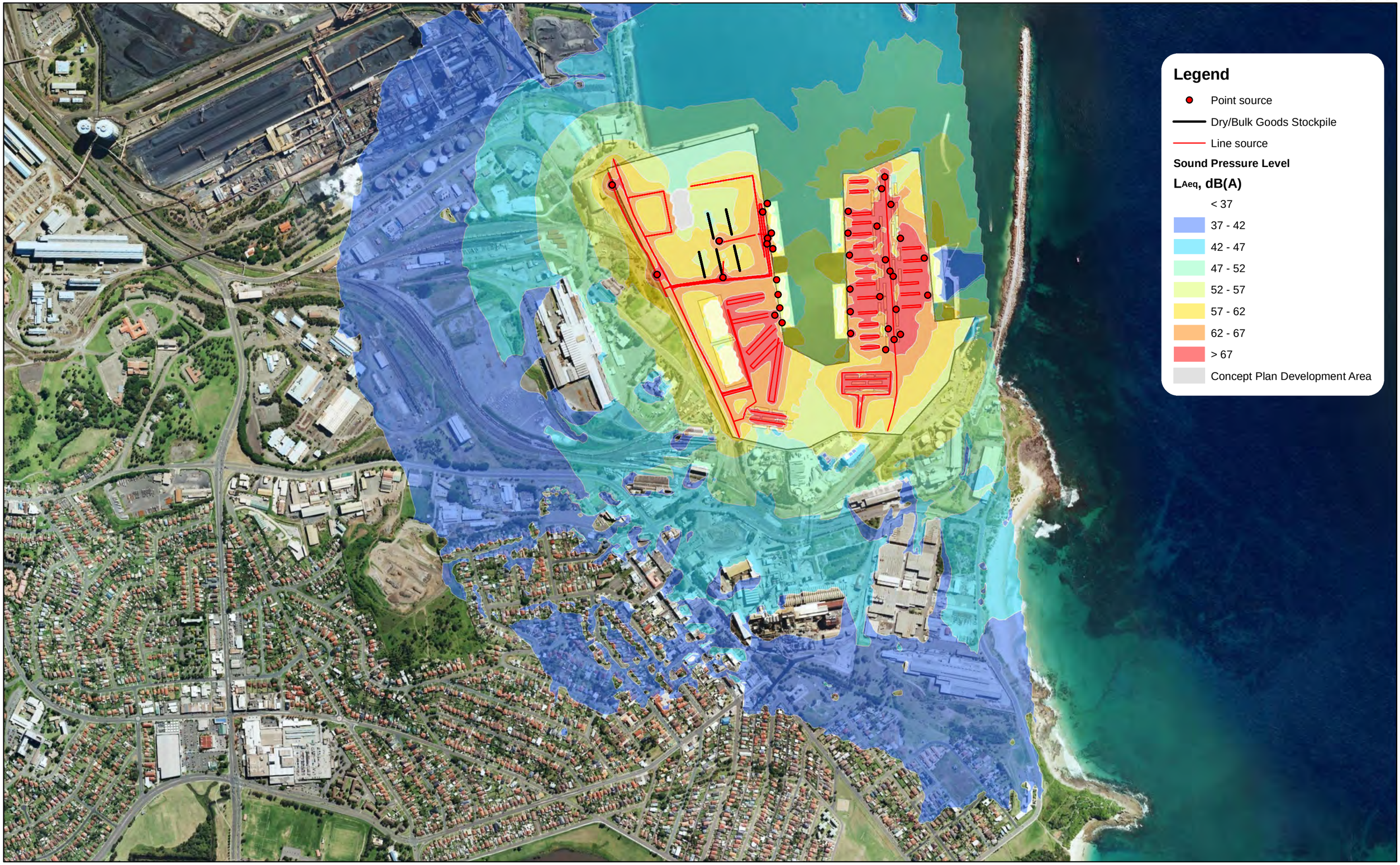
Concept Plan - Day

60039301

0 250 500 1,000 m

Dwg **3**

AECOM



Port Kembla Outer Harbour Development
Concept Plan - Night

60039301

0 250 500 1,000 m

Dwg. **4**

AECOM

Port Kembla Outer Harbour Development

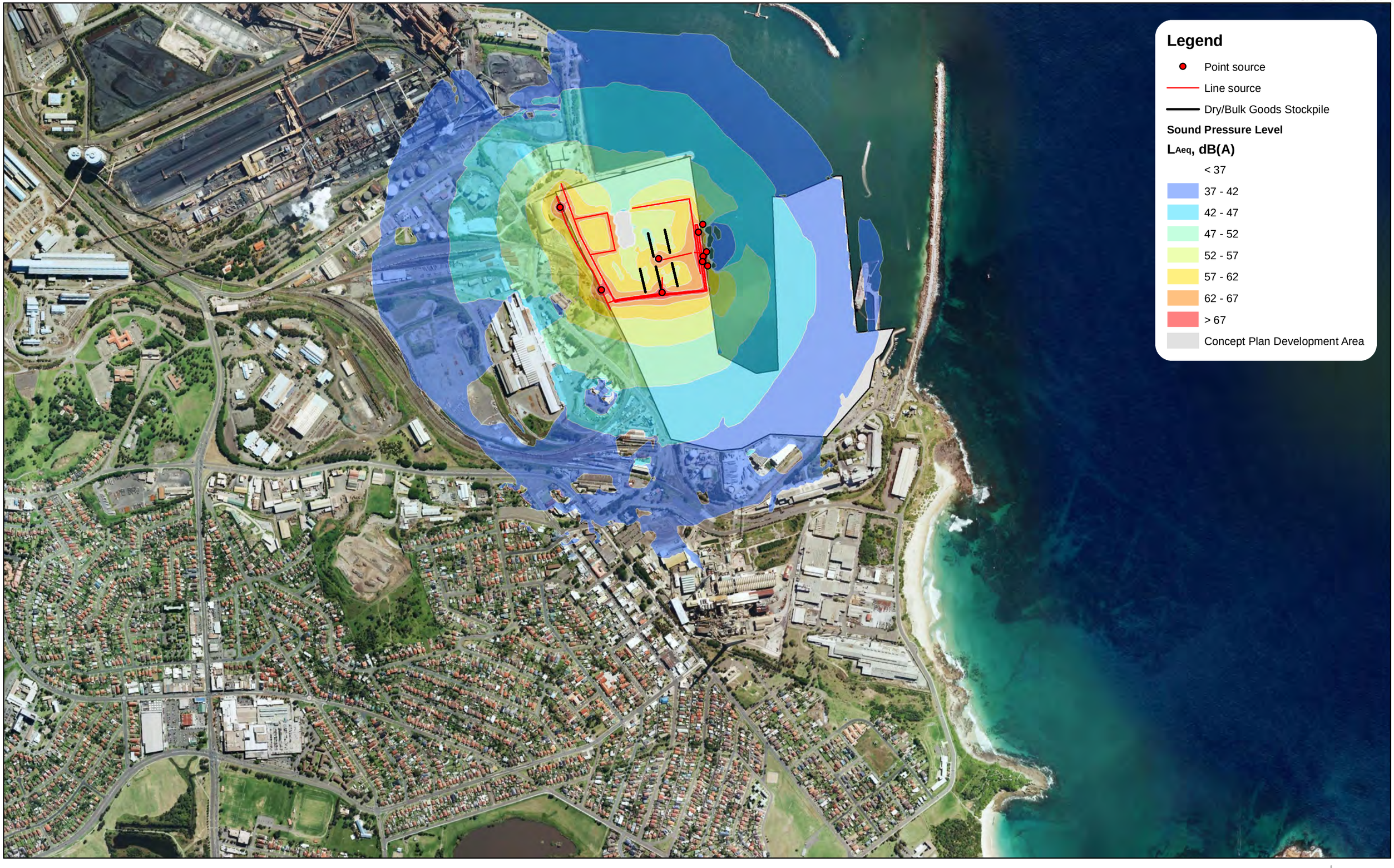
Major Project Approval - Day

60039301

0 250 500 1,000 m

Dwg **1**

AECOM



Port Kembla Outer Harbour Development

Major Project Approval - Night

60039301

0 250 500 1,000 m

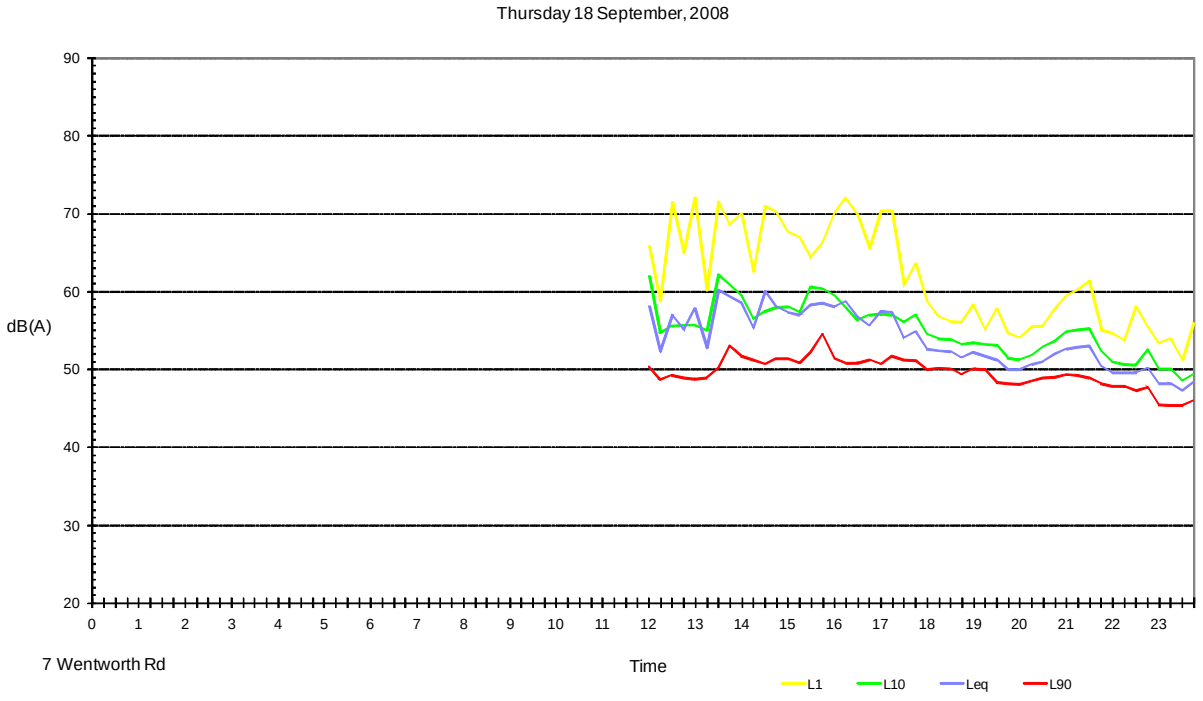
Dwg **2**

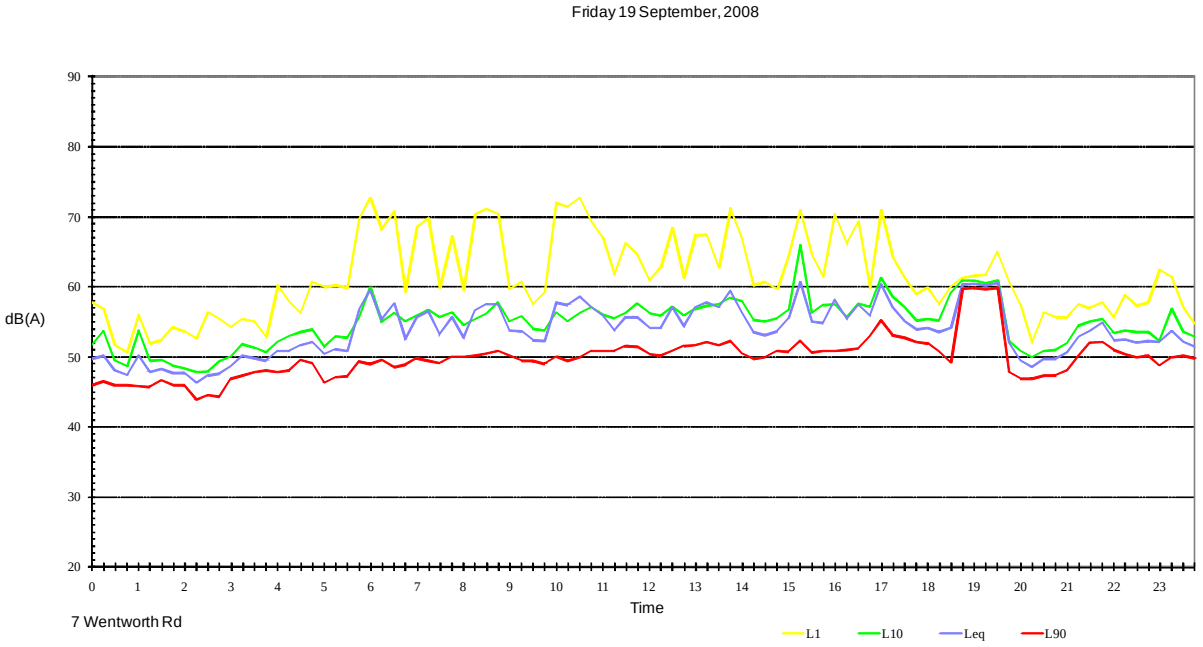
Appendix B

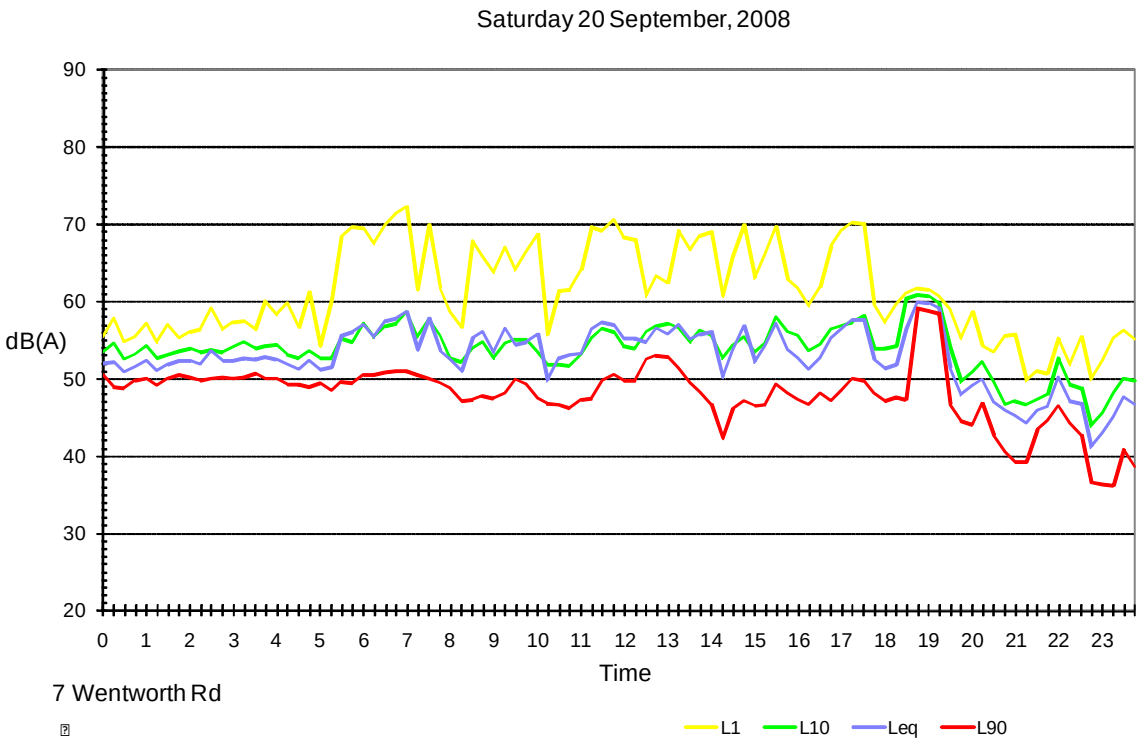
Appendix B - Noise Logging Graphs

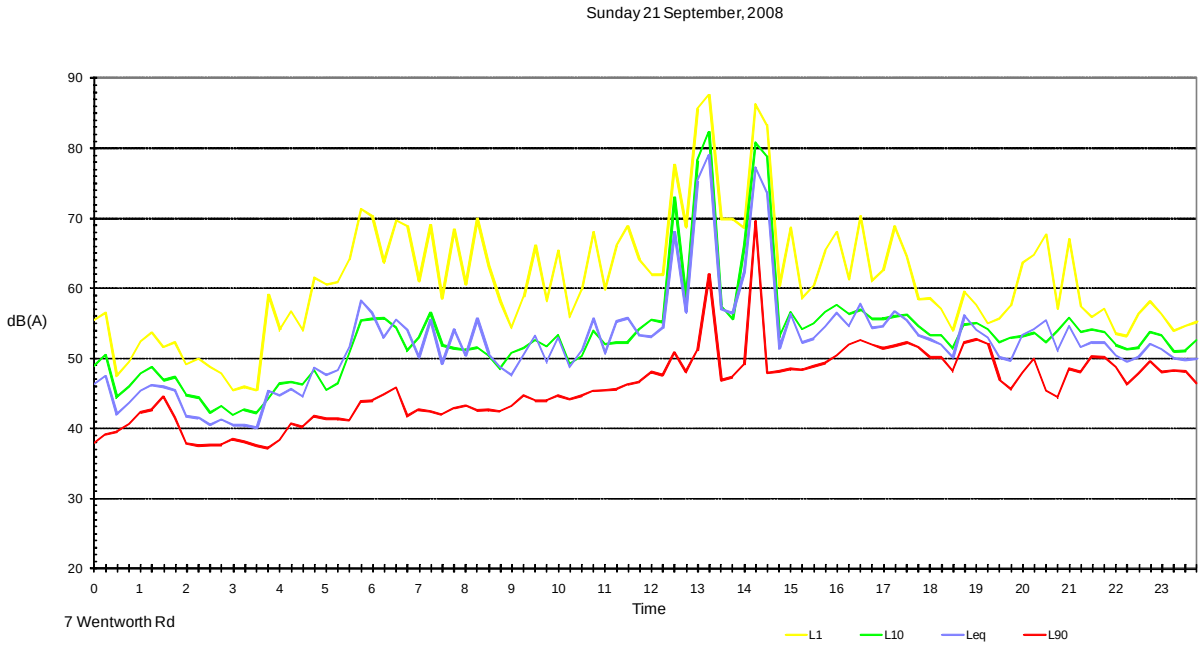
Appendix B Appendix B - Noise Logging Graphs

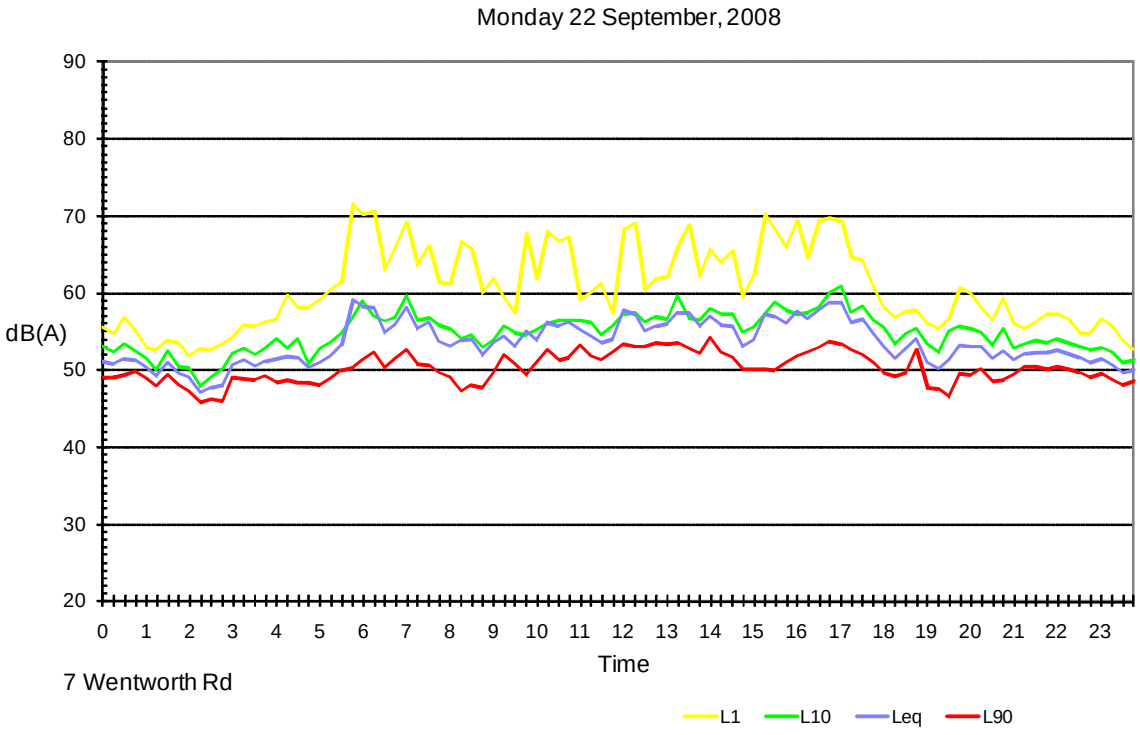
Wentworth Road






Saturday 20 September, 2008
dB(A)
Time
7 Wentworth Rd
L1
L10
Leq
L90


Sunday 21 September, 2008
dB(A)
Time
7 Wentworth Rd
L1
L10
Leq
L90


Monday 22 September, 2008
dB(A)
90
80
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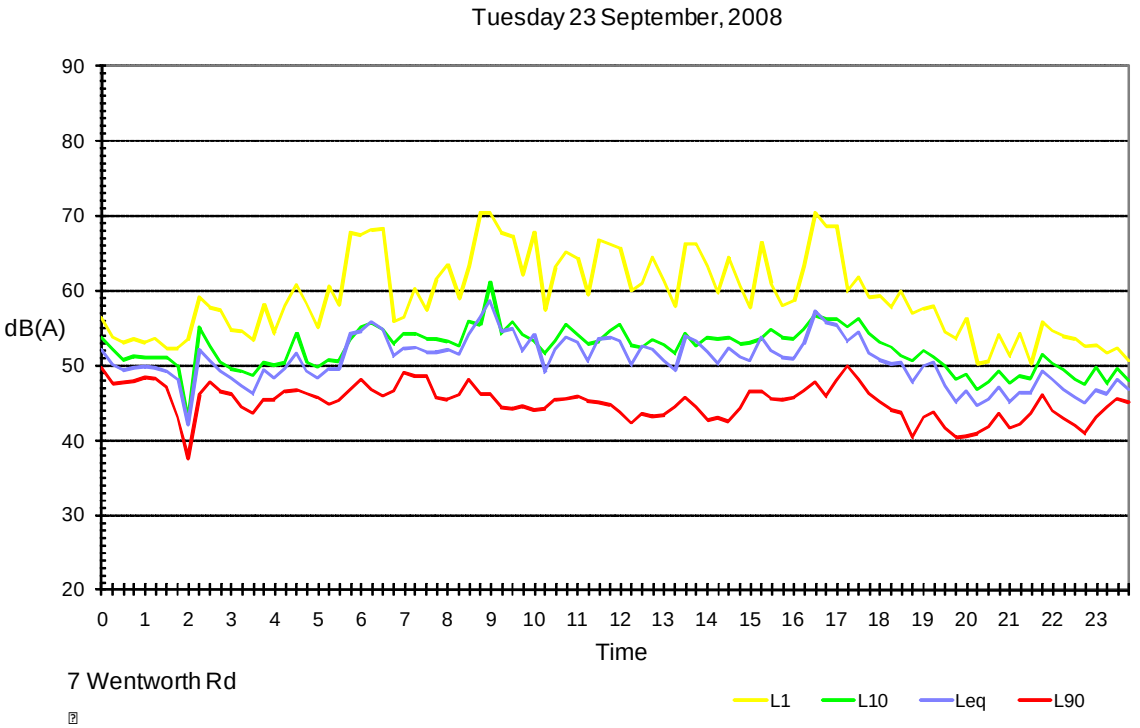
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
7 Wentworth Rd
L1
L10
Leq
L90


Tuesday 23 September, 2008
dB(A)
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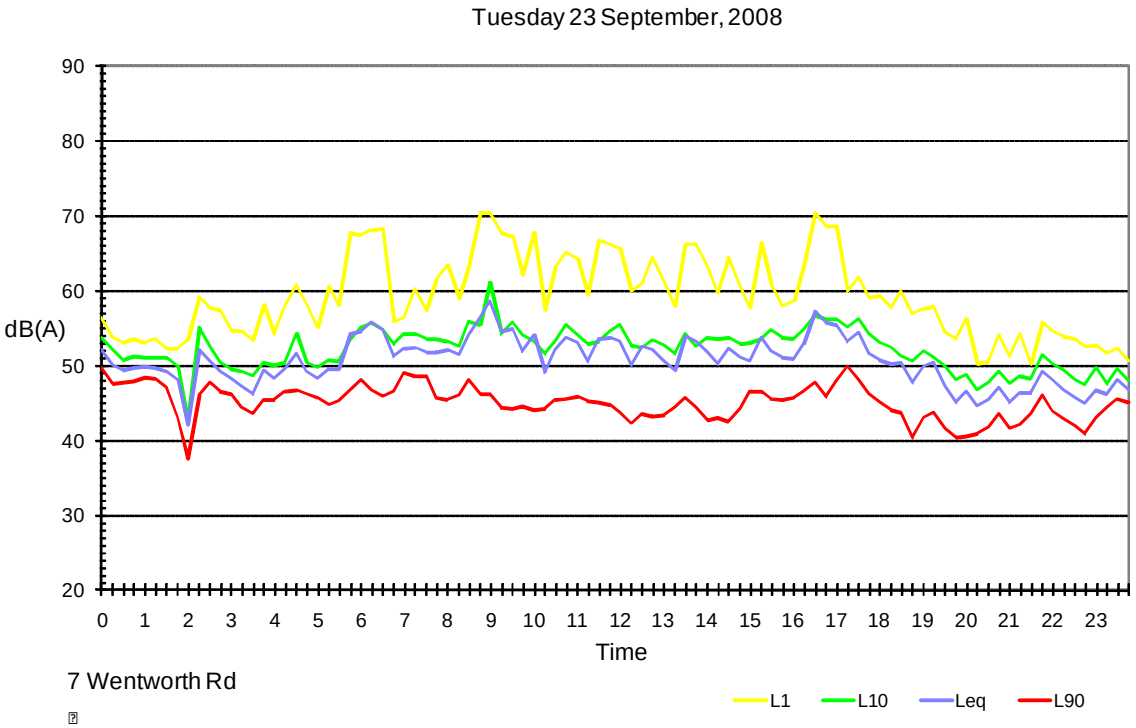
Time
7 Wentworth Rd
L1
L10
Leq
L90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dB(A)
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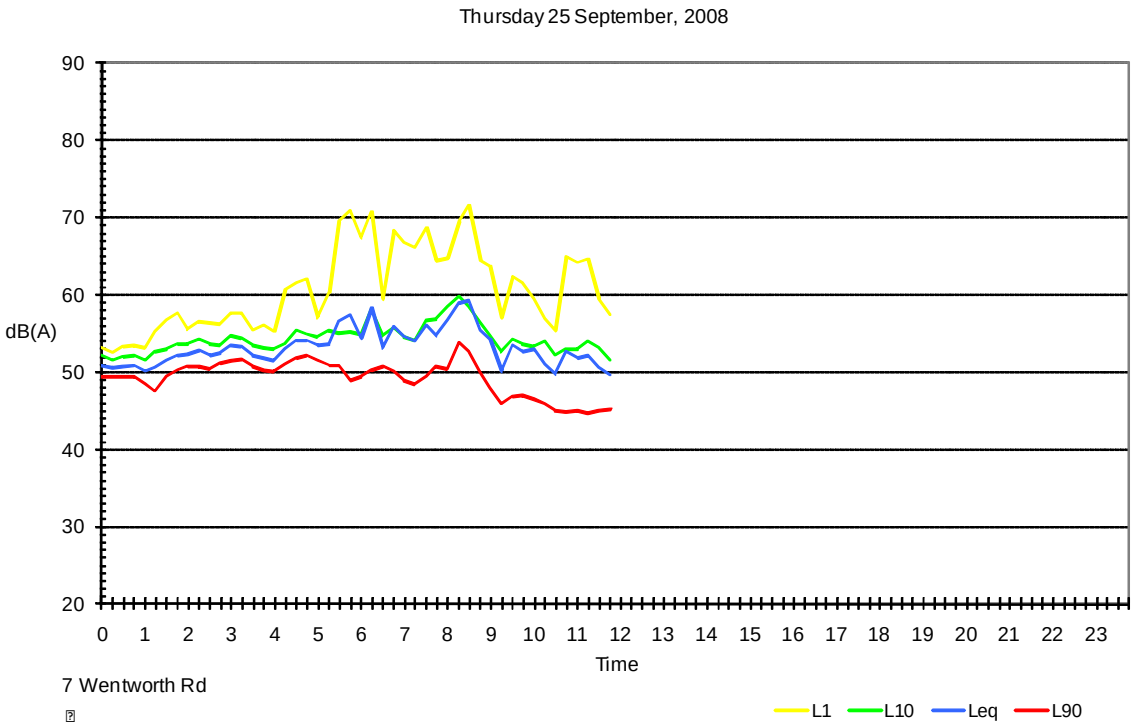
Time
7 Wentworth Rd
L1
L10
Leq
L90


Thursday 25 September, 2008
dB(A)
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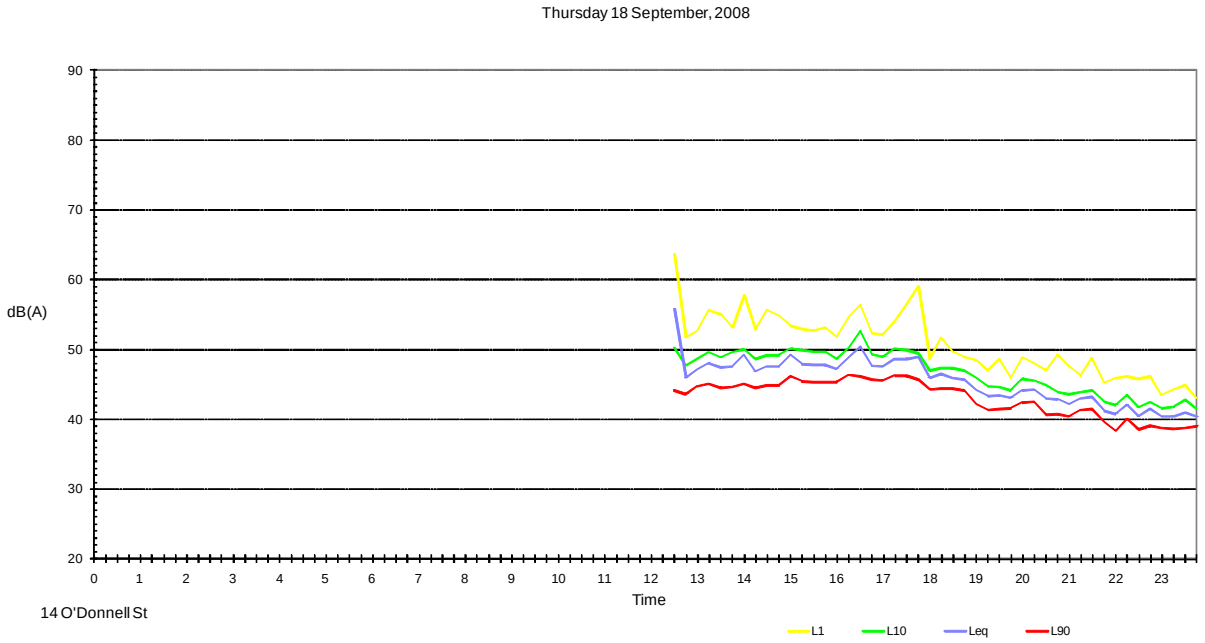
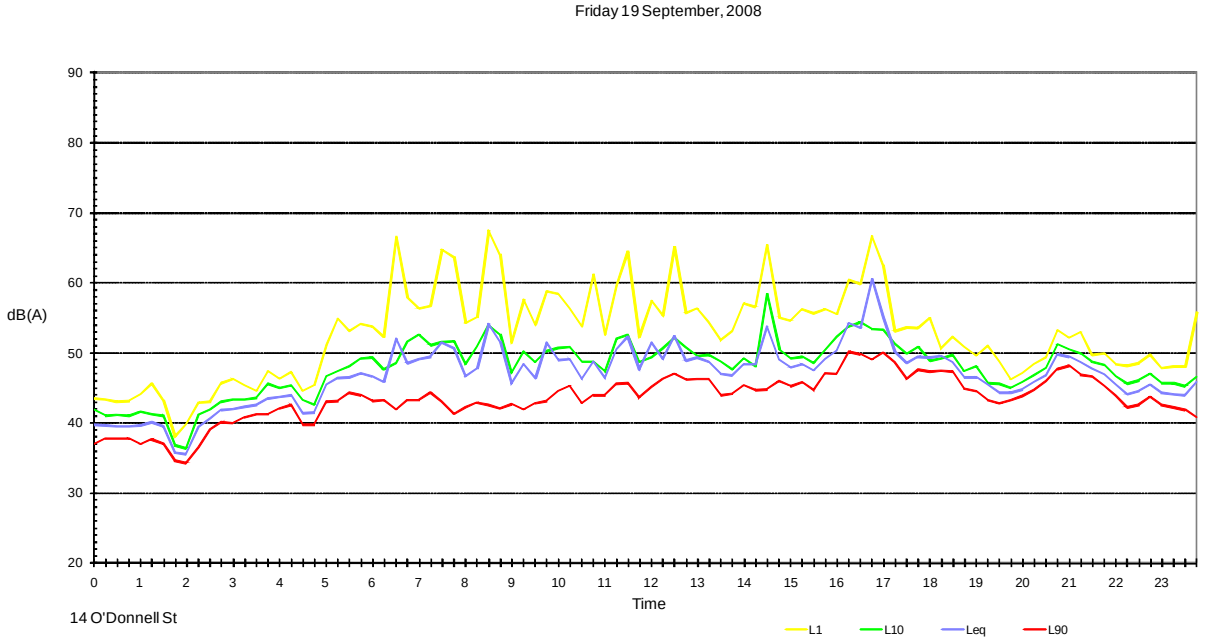
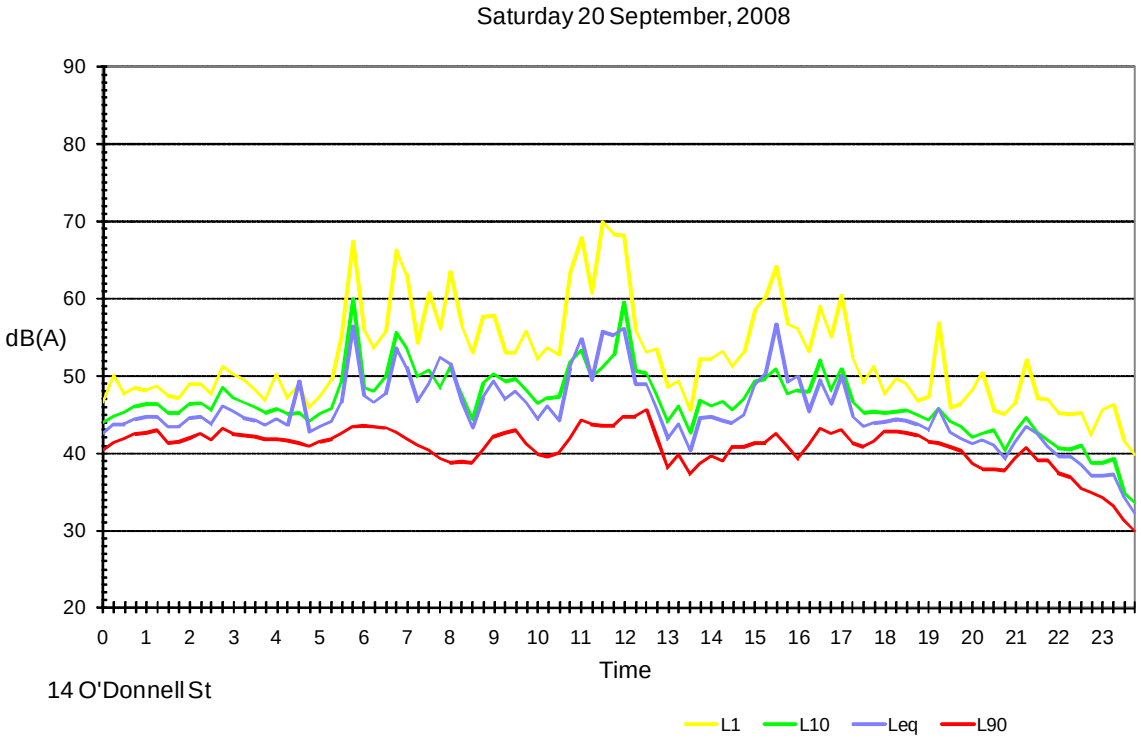
Time
7 Wentworth Rd
L1
L10
Leq
L90

O'Donnell Street






Saturday 20 September, 2008
dB(A)
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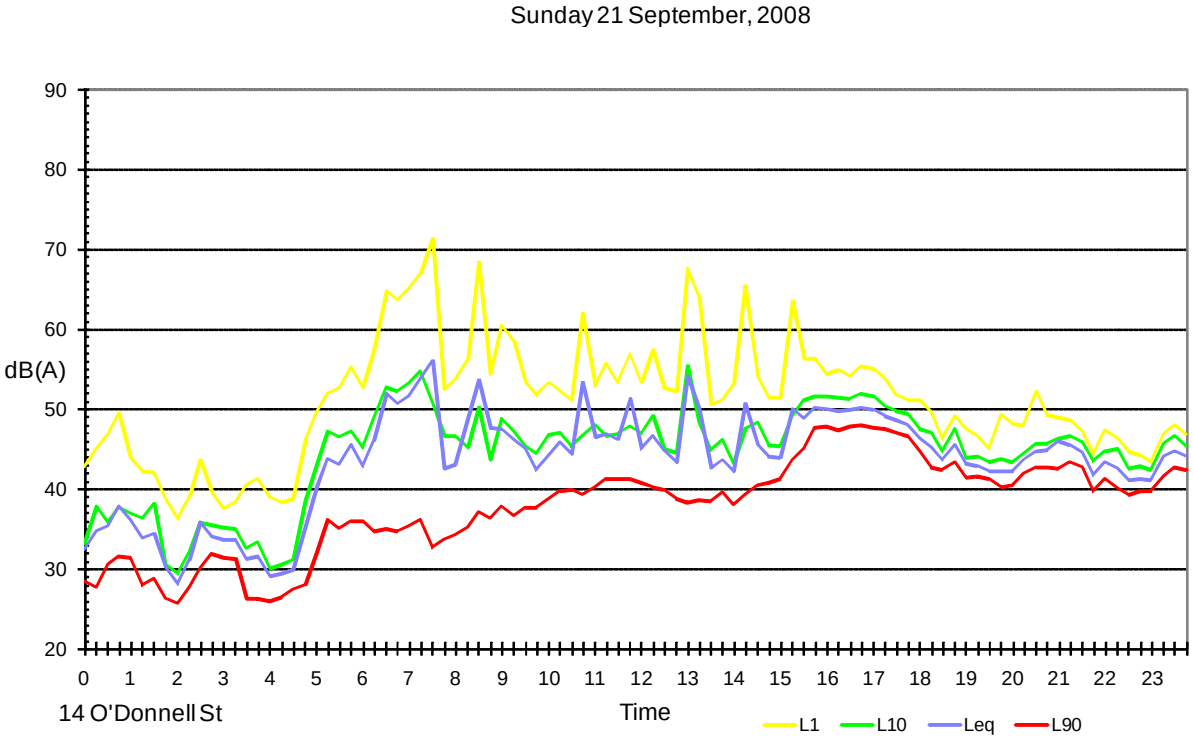
Time
14 O'Donnell St
L1
L10
Leq
L90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dB(A)
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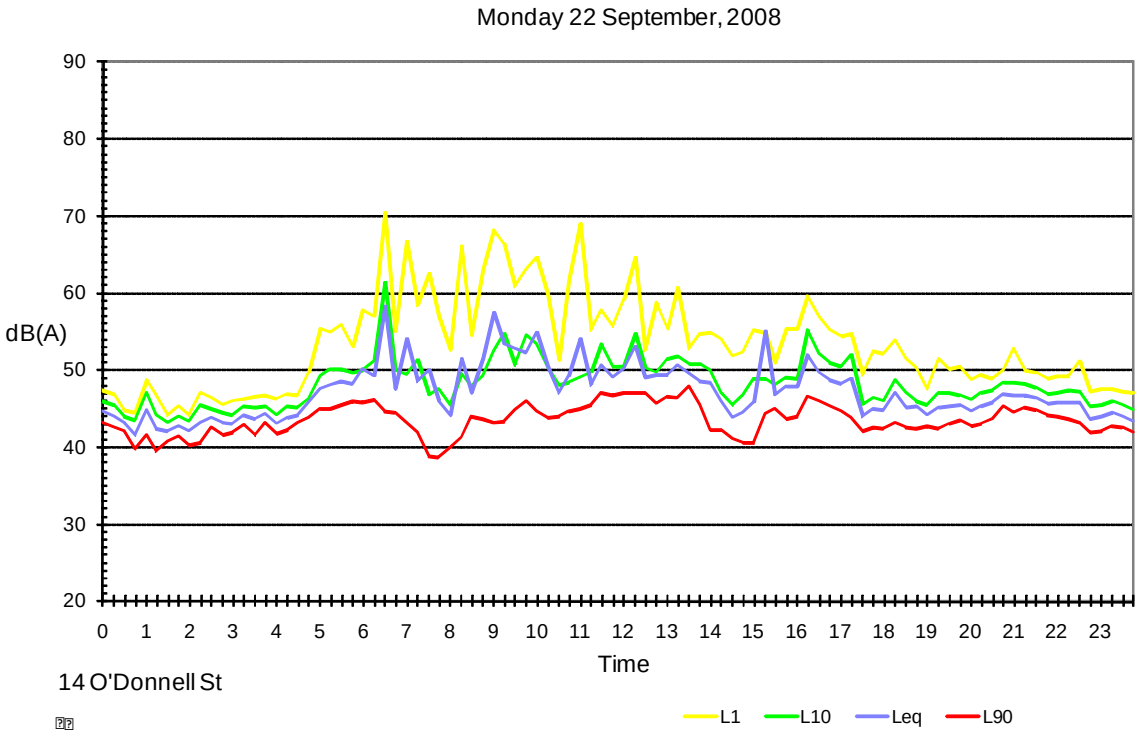
Time
14 O'Donnell St
L1
L10
Leq
L90


Monday 22 September, 2008
dB(A)
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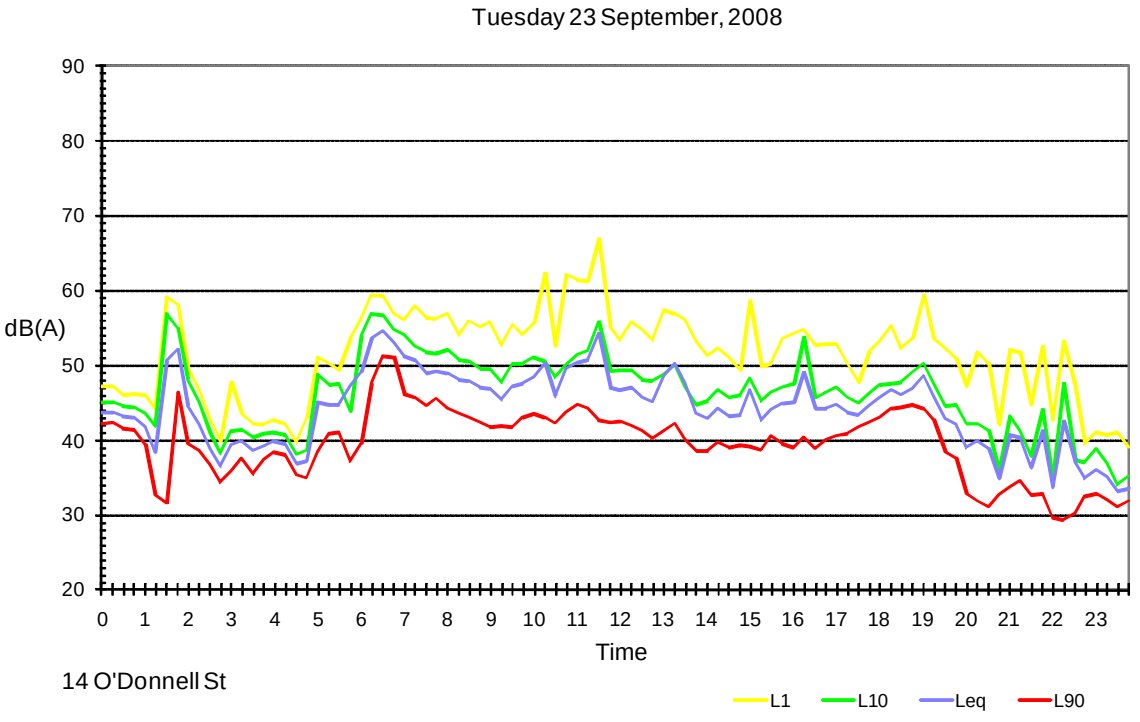
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
14 O'Donnell St
L1
L10
Leq
L90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dB(A)
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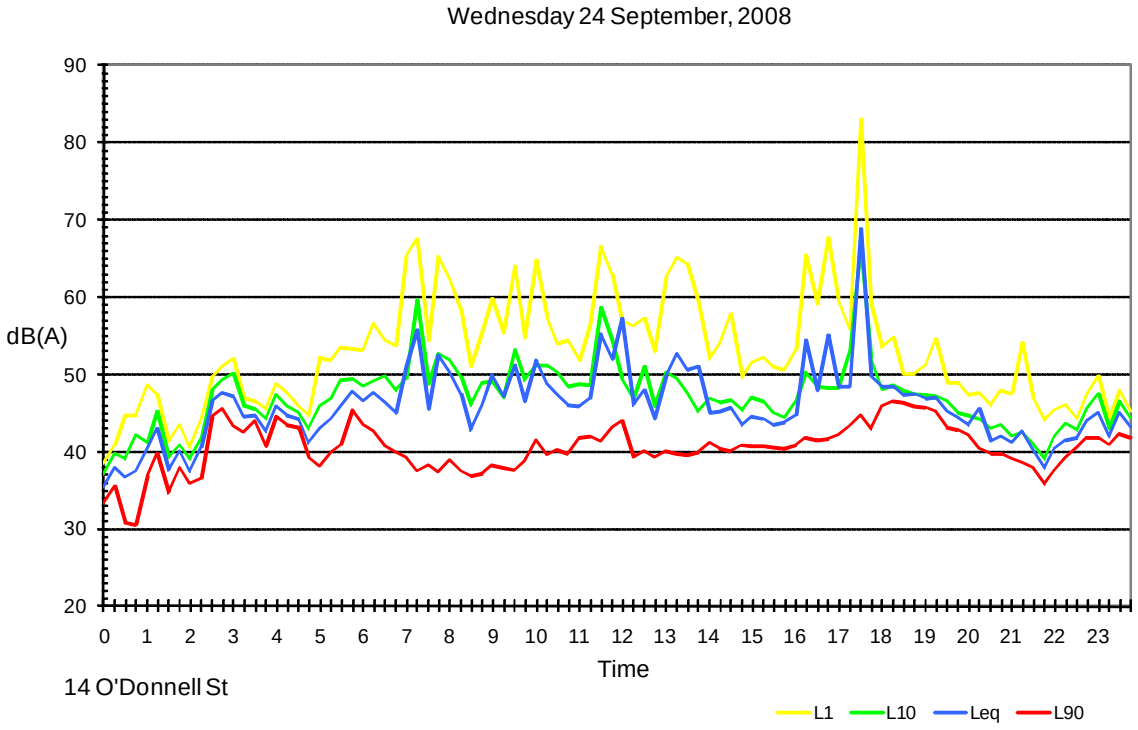
Time
14 O'Donnell St
L1
L10
Leq
L90


Wednesday 24 September, 2008
dB(A)
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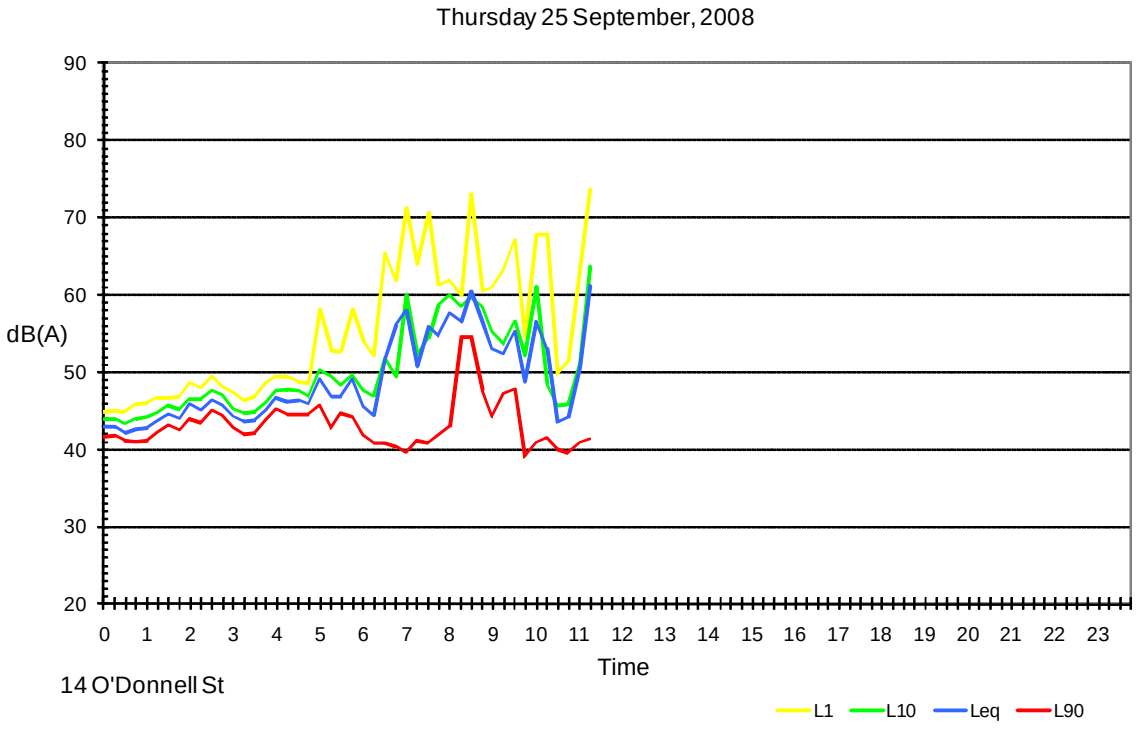
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
14 O'Donnell St
L1 L10 Leq L90


Thursday 25 September, 2008
dB(A)
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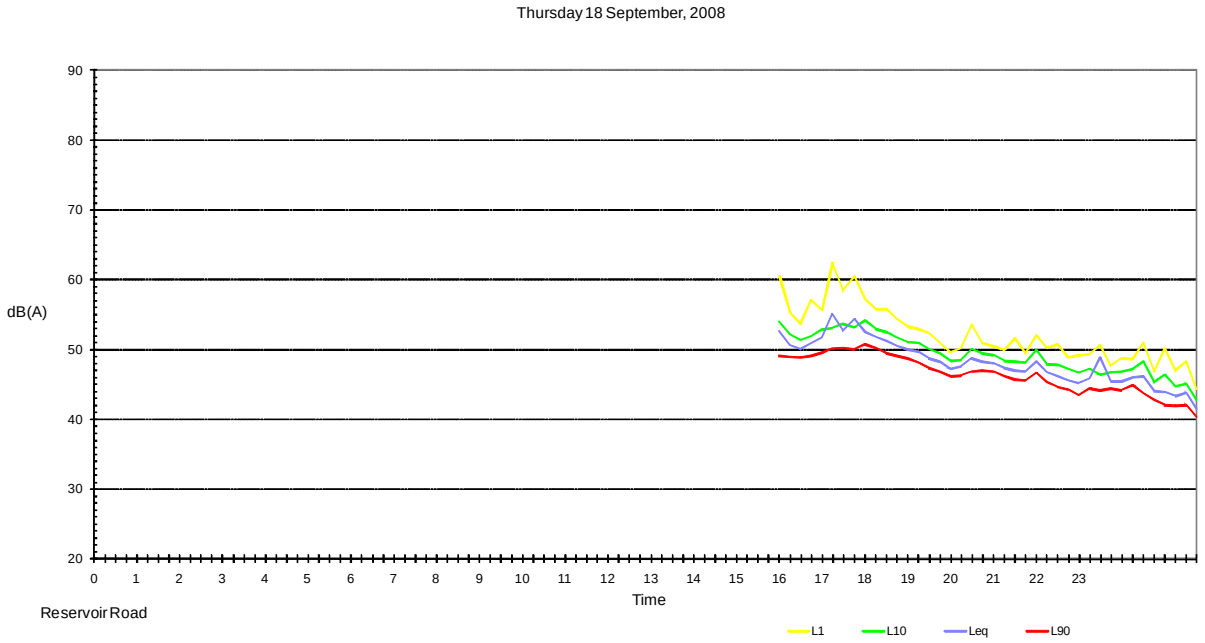
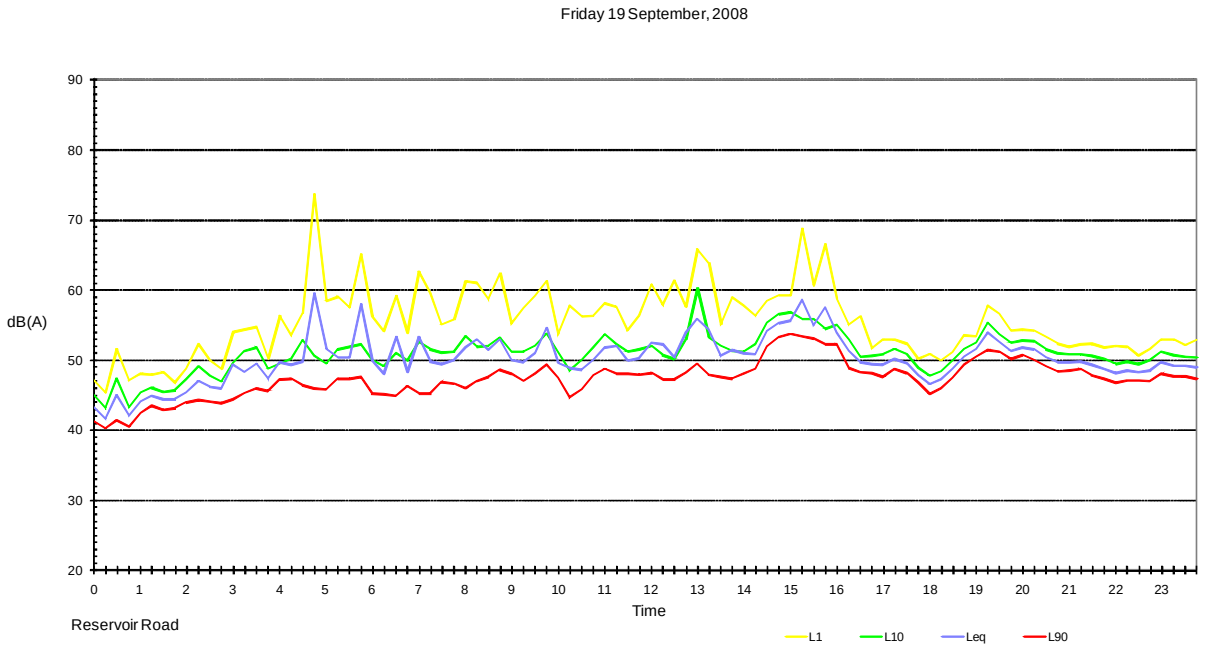
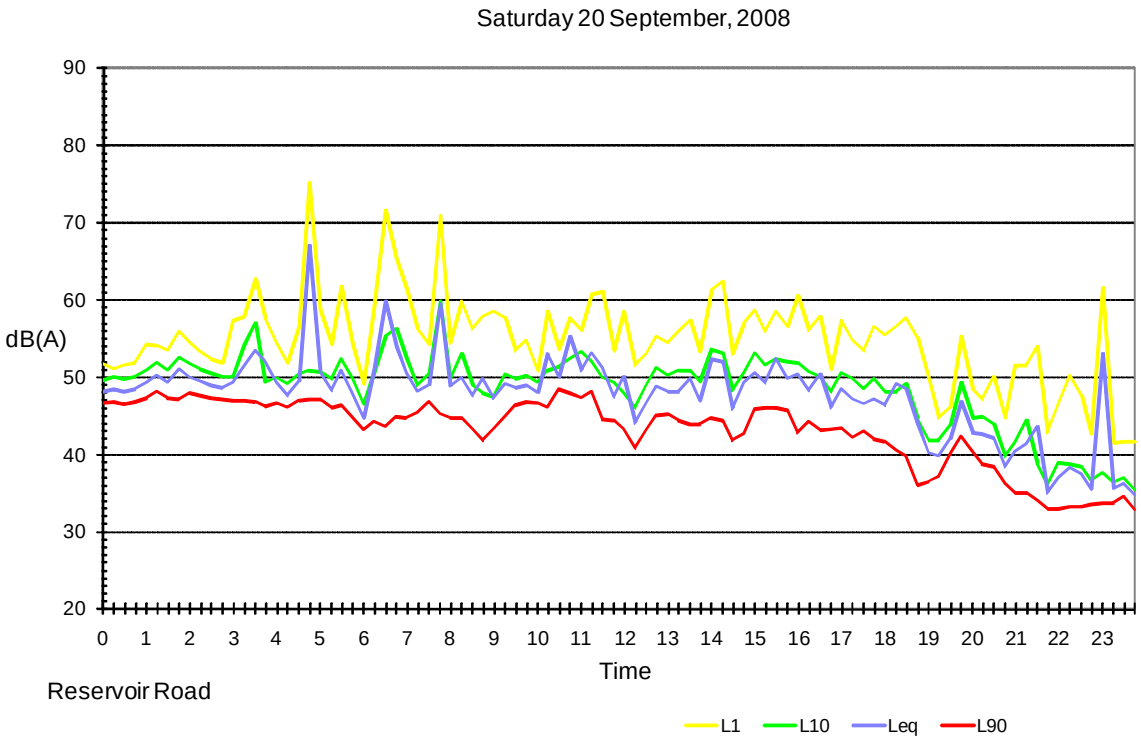
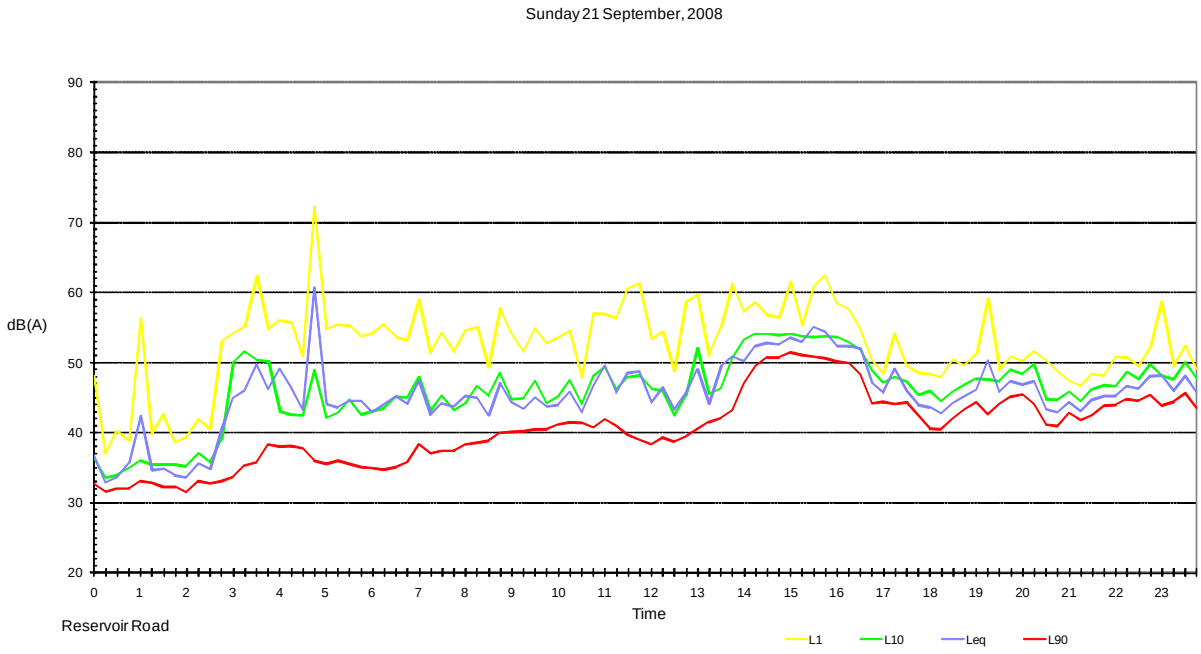
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
14 O'Donnell St
L1 L10 Leq L90

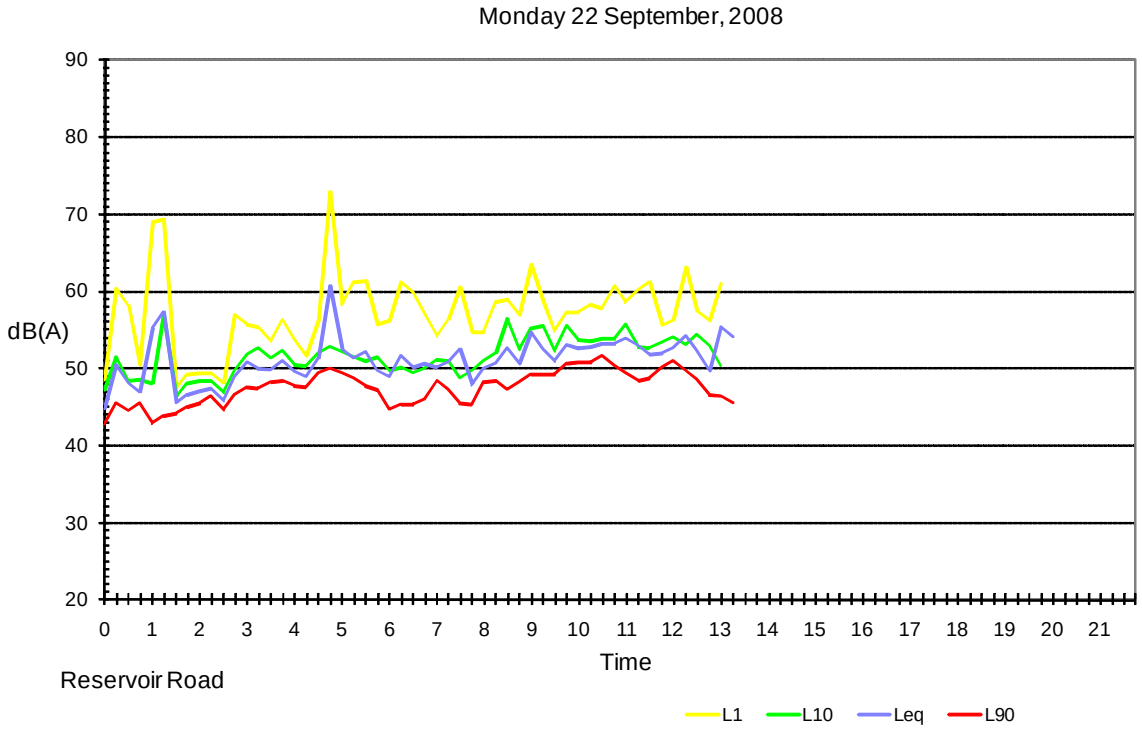
Reservoir Road



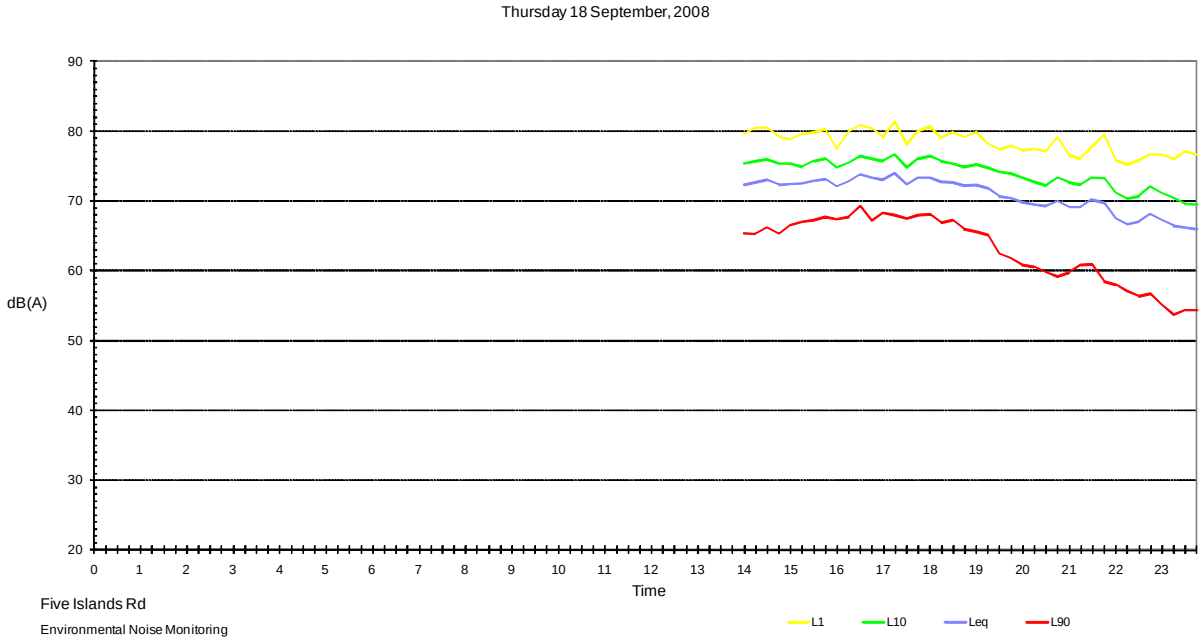


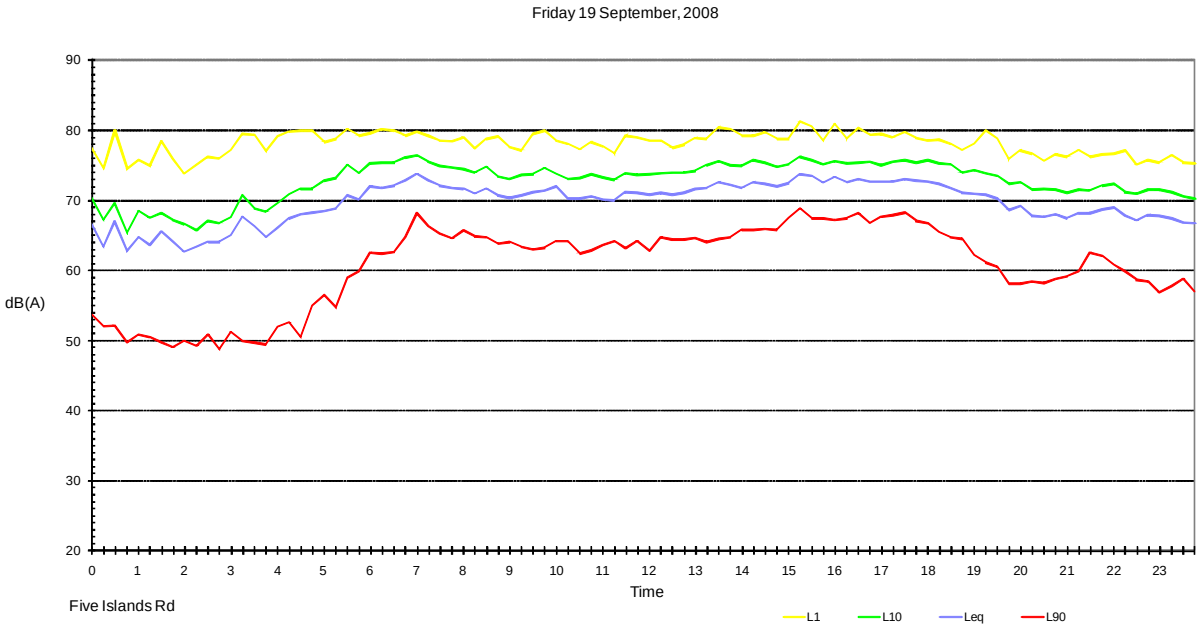

Saturday 20 September, 2008
dB(A)
Time
Reservoir Road
L1
L10
Leq
L90


Sunday 21 September, 2008
dB(A)
Time
Reservoir Road
L1
L10
Leq
L90



Five Islands Road – Traffic Noise




Friday 19 September, 2008
dB(A)
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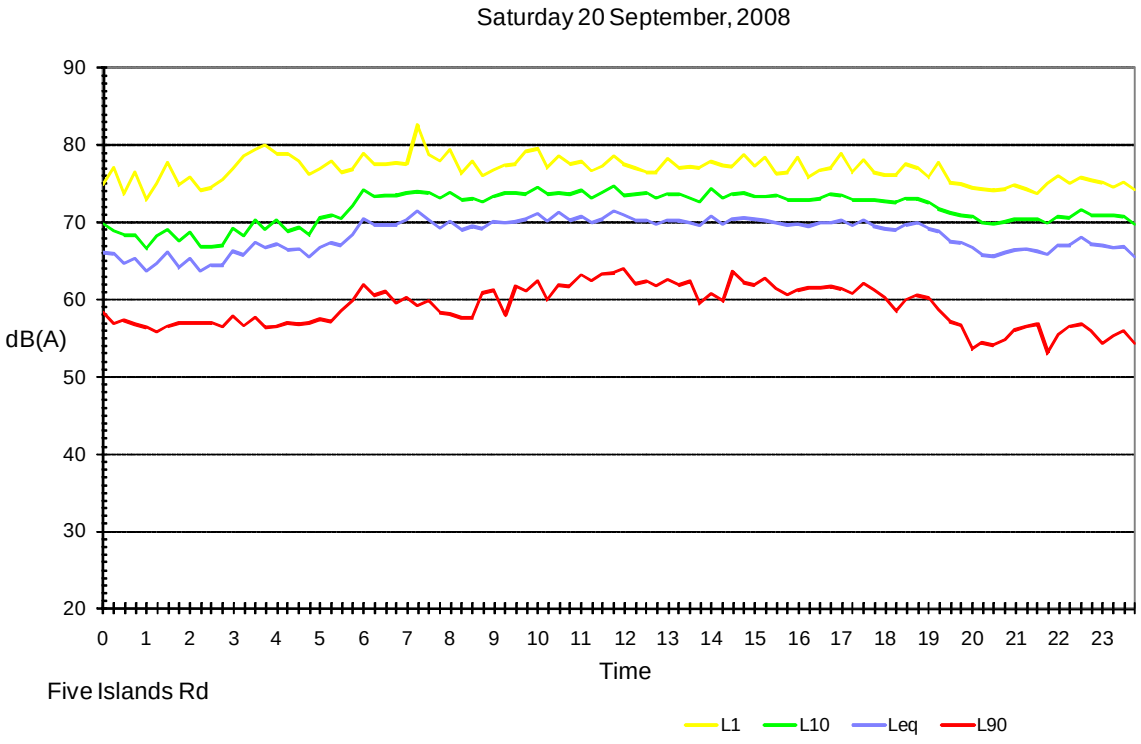
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90


Saturday 20 September, 2008
dB(A)
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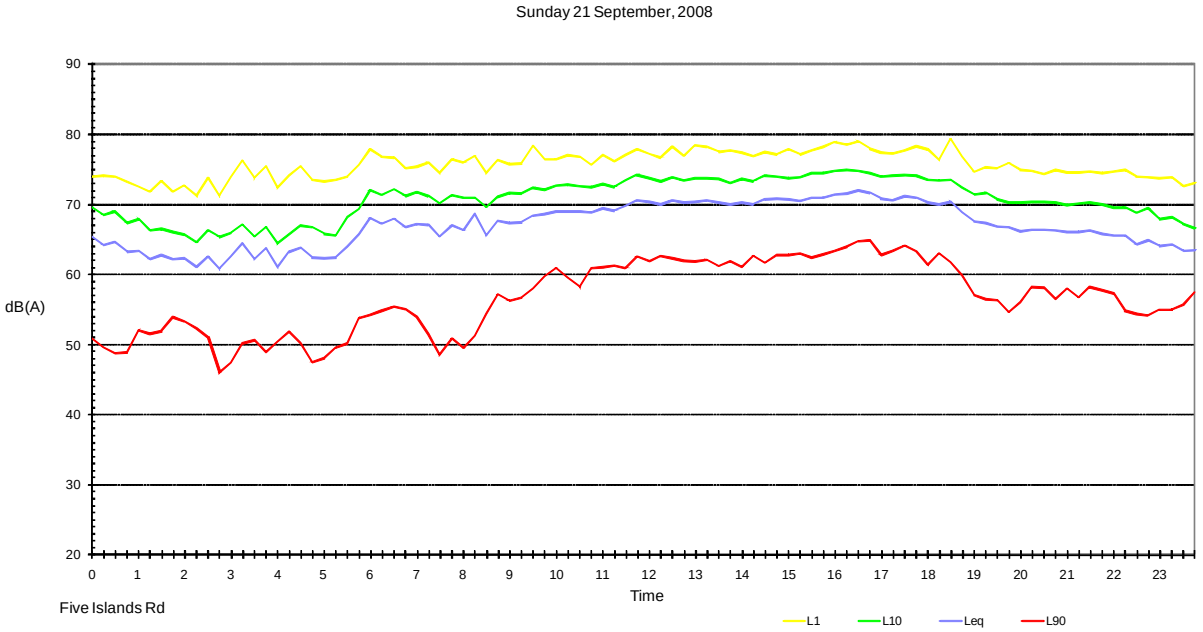
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90


Sunday 21 September, 2008
dB(A)
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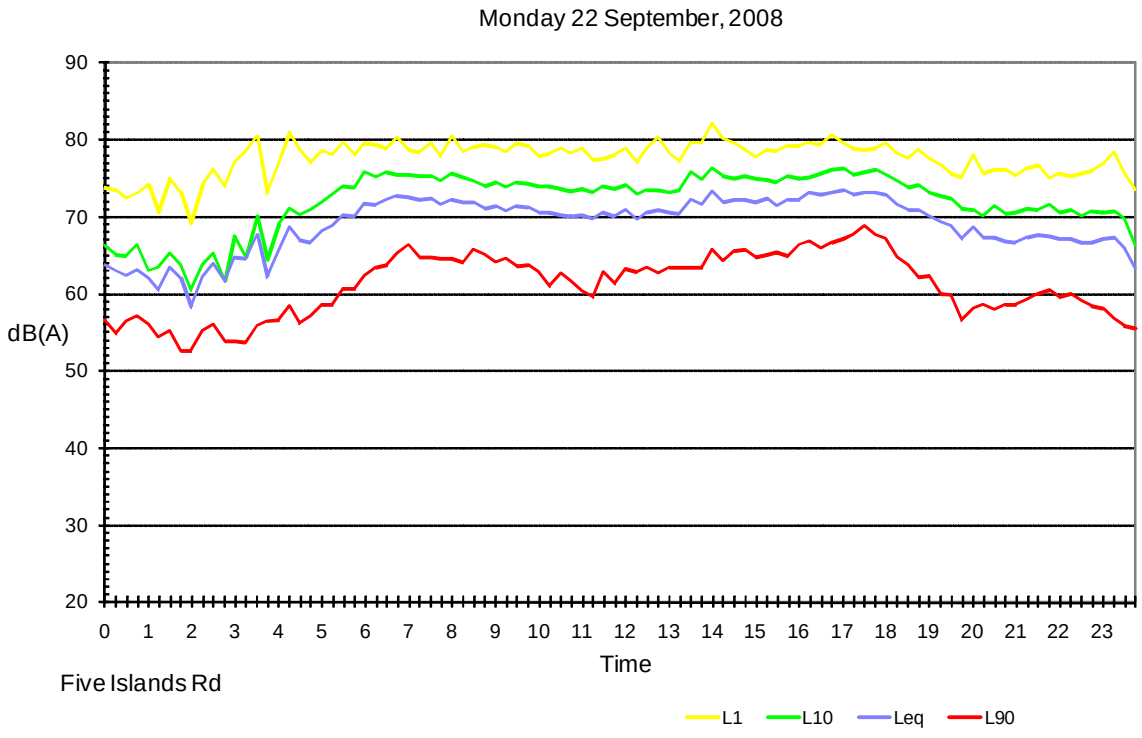
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90


Monday 22 September, 2008
dB(A)
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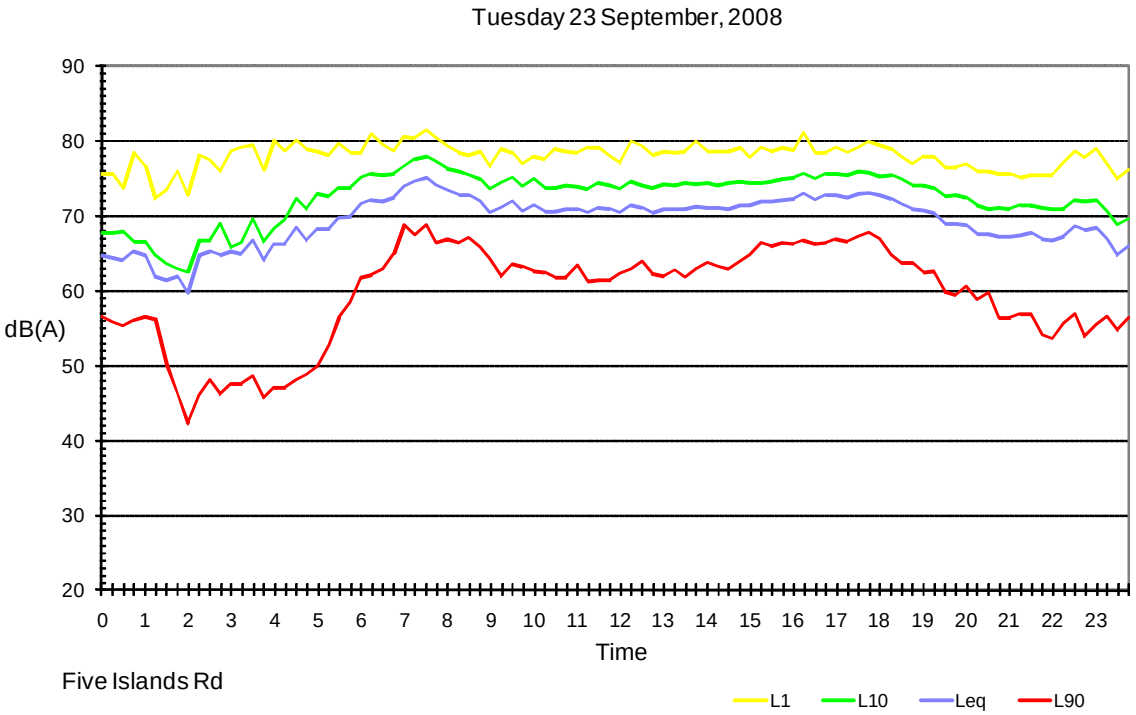
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90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dB(A)
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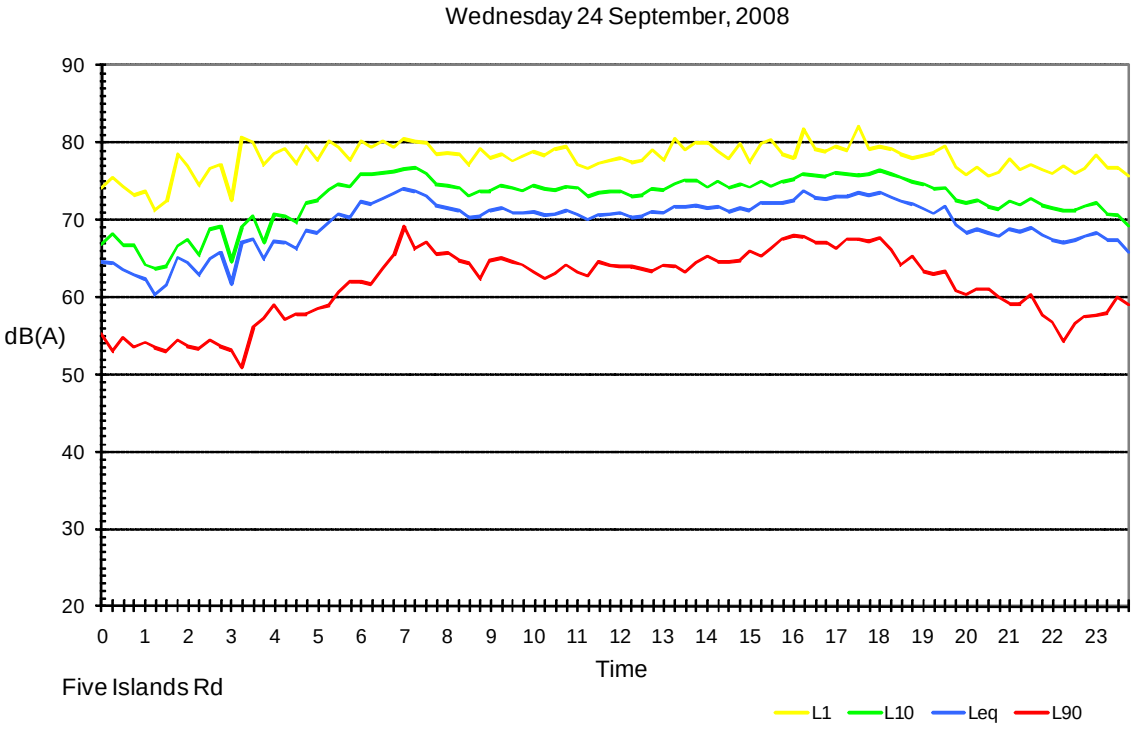
Time
Five Islands Rd
L1
L10
Leq
L90


Wednesday 24 September, 2008
dB(A)
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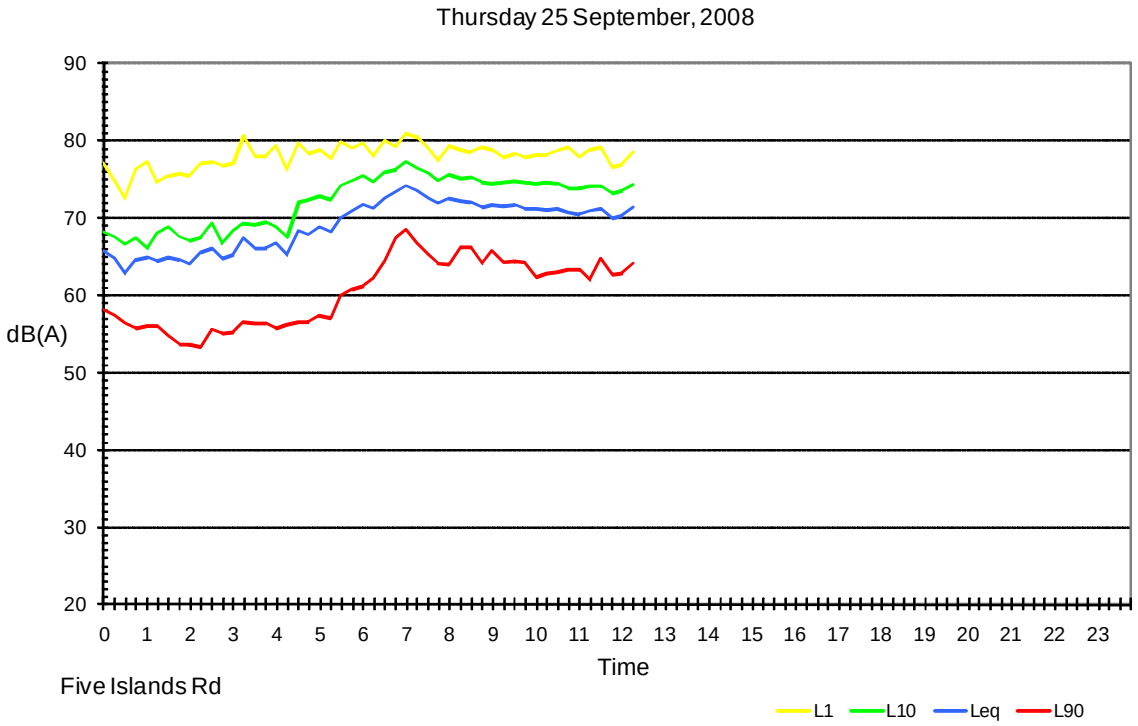
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90


Thursday 25 September, 2008
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dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90