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Environmental Assessment

Ventilation Shaft No.6 Project

Project Number: 110060-02 Report 001 Rev 1

Prepared for: BHP Billiton Illawarra Coal

October 2010

Annex D – Noise Assessment

BHPBIC VENT SHAFT #6 AT DOUGLAS PARK

NOISE ASSESSMENT AND MONITORING PLAN

ACOUSTICS AND AIR

REPORT NO. 10112
VERSION A

WILKINSON MURRAY

BHPBIC VENT SHAFT #6 AT DOUGLAS PARK

NOISE ASSESSMENT AND MONITORING PLAN

REPORT NO. 10112
VERSION A

AUGUST 2010

PREPARED FOR

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TABLE OF CONTENTS

1 INTRODUCTION

BHP Billiton Illawarra Coal Pty Limited (BHPBIC) operates in the Southern Coalfield of NSW, approximately 25km north-west of Wollongong. BHPBIC has made an application for approval under Part 3A of the Environmental Planning & Assessment Act 1979 (EP&A Act) to continue to mine the Bulli Seam at its Appin Mine and West Cliff Collieries for the next 30 years.

To implement ventilation to the new mining domains, BHPBIC proposes to construct a new upcast ventilation shaft to be known as Ventilation Shaft No. 6 (VS#6). A separate Part 3A application is necessary for the VS#6 project. The location of VS#6 is on BHPBIC owned land near the township of Douglas Park in New South Wales.

Noise assessment is included in the Director-General's Requirements (DGR's) for the Appin Ventilation Shaft Project (Department of Planning reference 10_0079). The requirements include the following as a key issue:

> *Noise - including on-site construction and operational noise and off-site road noise and vibration impacts particularly within the township of Douglas Park.*

The purpose of this report is to satisfy the DGR's concerning noise and vibration from this project. The report presents an assessment of potential noise and vibration from construction and operation of the VS#6. Aspects covered include:

- daytime construction noise (consisting of but not limited to): earthmoving, upgrading of Douglas North Substation, drilling of the shaft, shaft liner construction, underground and overhead powerline construction, construction of service boreholes and ancillary activities;
- night time construction noise: drilling of the shaft;
- operational noise from the project; and
- vibration from construction and operation of the project.

As well as an assessment of potential impacts, this report presents Management Plans for both operational and construction noise.

2 PROJECT DESCRIPTION

The proposal is for a new upcast ventilation shaft, known as VS#6, near the town of Douglas Park in NSW. There would be associated surface infrastructure and a series of service boreholes as part of the VS#6 proposals.

The vent shaft would be approximately 6m in diameter and 530m deep. The shaft would take approximately 21 months to build.

Following completion of the construction of the vent shaft, installation of the ventilation fans commences. Installation of the fans would take an additional 6 months. Once operational, the only significant noise source from the project would be the operation of the ventilation fans. There would be three ventilation fans, two of which would operate continuously and the other fan on standby duty. One backup diesel powered fan will be used for emergency purposes.

The vent shaft would be drilled from the surface down using the "blind boring" technique. In this technique a drill head is attached to a pipe drill string that is rotated at the surface. At all times the shaft is full of water. Rock fragments are transported to the surface using compressed air and water. All boring equipment is mains powered.

Included in the two-year construction period would be:

- Access road construction ~5 months
- Switch yard construction and underbore/overhead line to DNS ~3 months
- Vent shaft site construction ~3 months
- Shaft drilling & liner fabrication ~10 months
- Fan installation ~6 months

One option for noise mitigation is the construction of an earth mound or noise wall between the fan site and the town of Douglas Park.

Drilling of the shaft will be on a 24-hour basis.

3 SITE DESCRIPTION AND BACKGROUND NOISE LEVELS

3.1 Site Location

The site is located near the South Western Freeway (Hume Highway) at Douglas Park as shown on the Project Area Layout Plan for the Construction Phase on Figure 3-1.

Residences in Douglas Park are located approximately 500m to the west of the surface site. The next nearest residences are located 1200m to the south, and 800m to the northeast.

For noise assessment the residential areas near the site have been considered in four noise catchments, representing areas where potential noise impact is considered similar. Noise has been assessed for those catchments, as well as for individual residences within those catchments where appropriate. The catchments are described in Table 3-1 and shown on Figure 3-2. Catchment A extends to the north to encompass receivers potentially impacted by construction traffic utilising the proposed new access road and construction of the actual road itself.

Table 3-1 Noise Catchments and Measurement Addresses

Noise Catchment	Locality
A	North Douglas Park
B	South Douglas Park
C	South of Douglas Park
D	East of Douglas Park

Figure 3-1 Site Location

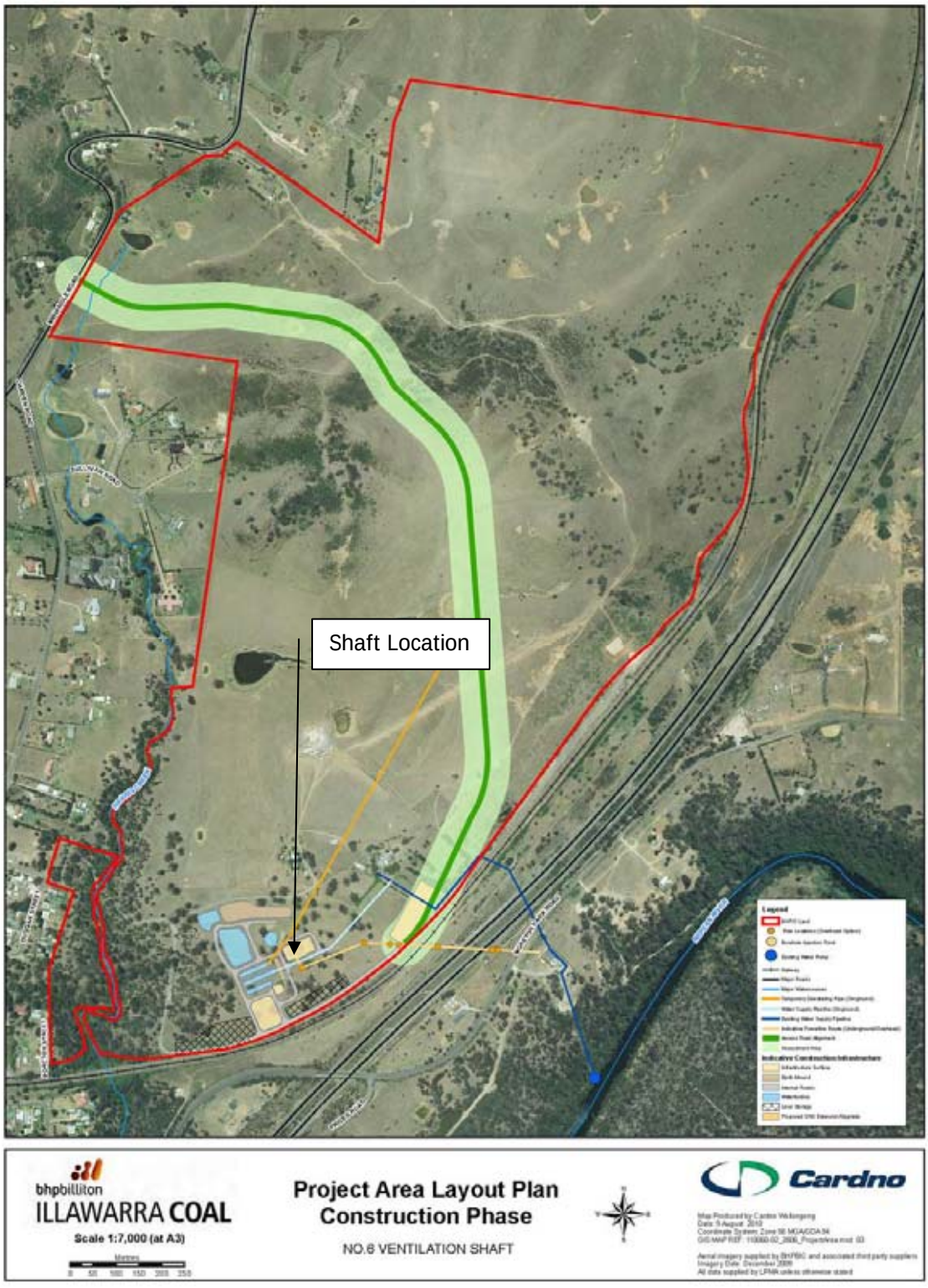
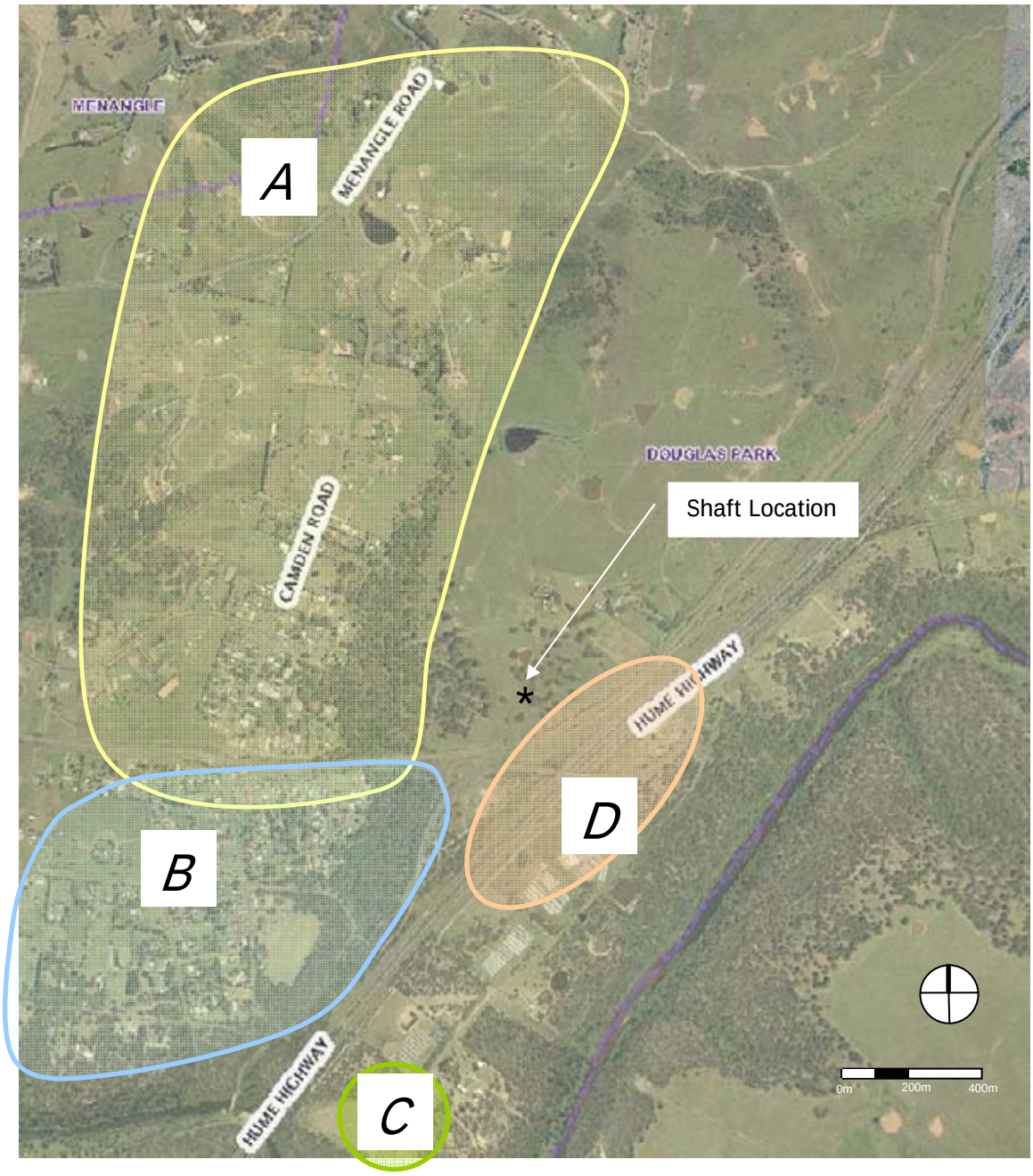


Figure 3-2 Site Location and Noise Catchments



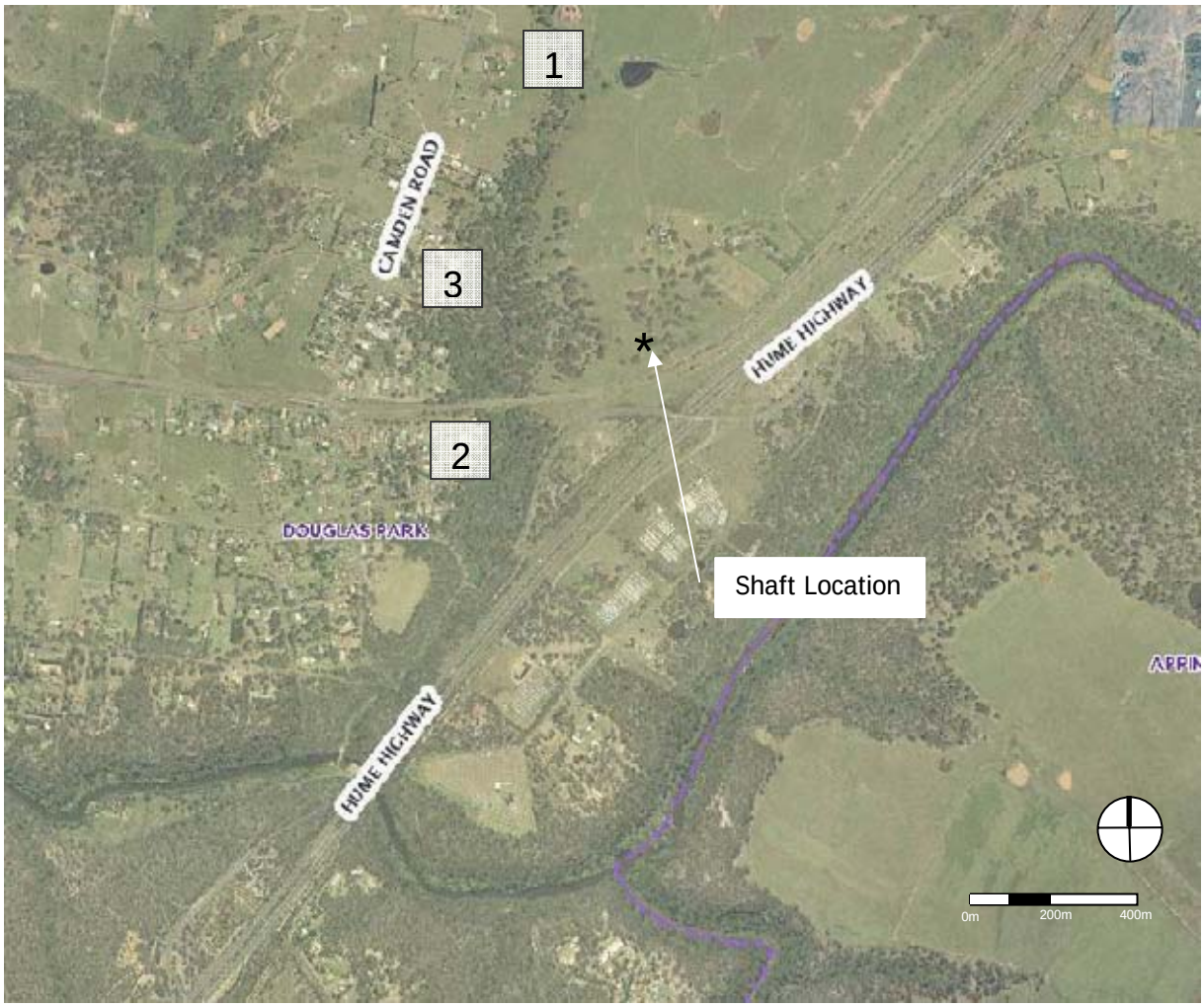
Unattended monitoring was carried out in May and June, 2010 at the three locations shown on Figure 3-3.

The locations of the noise monitors are given in Table 3-2.

Table 3-2 Monitoring Locations

Rec. No.	Location	Noise Catchment
1	Camden Road	A
2	Moreton Street	B
3	Cnr Duggan/Hopson Street	A

Figure 3-3 Site and Monitoring Locations



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

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Appendix A for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. This is used for the assessment of sleep disturbance. The L_{A90} level is normally taken as the background noise level during the relevant period. The Rating Background Level (RBL) is a summary of measured background noise levels and is defined in the DECCW's *Industrial Noise Policy* (*INP*).

The measured RBL values are given in Table 3-3. As required by the *INP*, measurements recorded during times of inappropriate meteorological conditions (such as during rainfall) were excluded from the calculation.

Table 3-3 Background Noise Levels

Rec. No.	Location	RBL (dBA)		
		Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
1	Camden Road	42	44	40
2	Moreton Street	40	41	35
3	Cnr Duggan/Hopson Street	40	40	34

4 OPERATIONAL NOISE CRITERIA

4.1 Industrial Noise Criteria

The *INP* is designed to assess industrial noise using the more stringent of the following two approaches:

- intrusive noise impacts in the short term for residences; and
- amenity for particular land uses such as residences.

The *INP's* intrusive goal is set 5dBA above the RBL for each time period (daytime, evening or night time) of interest.

The amenity goal sets an upper limit to the total noise level (L_{Aeq}) in an area from all industrial noise (existing and future). The criterion depends on the time of day, area classifications and the total measured L_{Aeq} (and contribution from existing industrial noise) to determine the Acceptable Noise Level (ANL) for the development.

Residences in Douglas Park would be considered "suburban" for noise assessment, and isolated residences outside Douglas Park would be considered "rural". The acceptable and maximum amenity criteria for the noise catchments are given in Table 4-1.

Table 4-1 Amenity Criteria for Residences

Location	Acceptable Amenity criteria, $L_{Aeq,period}$ dBA			Maximum Amenity Criteria $L_{Aeq,,period}$ dBA		
	Day	Evening	Night	Day	Evening	Night
Suburban (Catchments A and B)	55	45	40	60	50	45
Rural (Catchments C and D)	50	45	40	55	50	45

Table 4-2 presents a summary of the project specific noise criteria for the residential receivers surrounding the site. While the measured background levels show slightly higher (1dBA) levels at night time at Catchment A than Catchment B, the lowest background level has been used to set a conservative criterion at all locations.

Table 4-2 Operational Noise Criteria

Noise Catchment	Locality	Intrusive criteria, $L_{Aeq,15min}$ dBA			Amenity Criteria $L_{Aeq,,period}$ dBA		
		Day	Evening	Night	Day	Evening	Night
A	North Douglas Park	45	45	39	55	45	40
B	South Douglas Park	45	45	39	55	45	40
C	South of Douglas Park	45	45	39	50	45	40
D	East of Douglas Park	45	45	39	50	45	40

The *INP* discusses setting a "project specific noise criteria": that is the intrusive or amenity criterion that is most limiting on operations. At all locations the project specific criterion is the night time intrusive criterion of $L_{Aeq,15min}$ 39dBA.

4.2 Criteria for Douglas Park Public School

The *INP*s "acceptable" amenity criteria for schools are:

- classrooms: L_{Aeq} 35dBA in noisiest 1-hour period when school is in use; and
- playgrounds: L_{Aeq} 55dBA.

To assess noise inside the classrooms it is necessary to predict the noise reduction provided by the school façade. If it is assumed that the school classrooms may have open windows, then the expected noise reduction from outside to inside would be approximately 10dBA. Hence a suitable criterion for the school is that the noise level at the façade should not exceed $L_{Aeq,1hour}$ 45dBA. If this is satisfied then the playground criterion will also be satisfied.

Because operational noise from VS#6 will be constant, and the night time criterion for residences is lower than the criterion for the school, compliance with the residential criteria will lead to compliance with the school criterion.

5 OPERATIONAL NOISE PREDICTION

5.1 Modelling

A noise model was used to predict noise from both operation and construction of the project. Noise modelling was performed using the Environmental Noise Model (ENM) software which has been approved for use by the DECCW.

The noise model takes into account:

- topography;
- distance from source to receiver;
- characteristics of the source, such as spectrum and directionalities; and
- meteorological factors which could influence the propagation of noise.

5.2 Meteorology

The *INP* requires analysis of the effects of meteorological conditions that could enhance propagation of noise. Such conditions are typically night time temperature inversions, or low speed winds from source to receiver. The *INP* suggests adding the effect of those conditions if they occur for a significant period, in particular if they occur for more than 30% of any day/evening/night period in any season.

The approach taken in our assessment is more rigorous and has been accepted previously by the DECCW as a valid method for determining noise impact. The noise impact is considered acceptable if the noise does not exceed the criterion for more than 10 percent of the time in any season. To determine if this occurs requires analysis of noise propagation during all meteorological conditions that occur at the site, and the probability of those conditions occurring.

Meteorological data for Douglas Park was provided by PAE Holmes who are using the same data for the air impact assessment aspects of the environmental assessment for this project. The data includes hourly values for wind speed, wind direction, and atmospheric stability (which correlates to the probability of temperature inversions). Our analysis involves predicting noise from the project for each combination of wind speed, direction and temperature inversion that occurs at the site. Then, using the probability that these conditions occur as derived from the yearly data set, the probability of noise levels occurring at each residence is determined.

5.3 Noise Sources

During operation, the noise sources will consist of two shaft ventilation fans. A view of a computer model of the site is shown in Figure 5-1. The figure shows the proposed three ventilation fan layout connected by ductwork. The location of the shaft itself is at the intersection of the “T” sections.

Figure 5-1 Artists impression of operational stage from south-east

The discharge of the three fans will be toward the northeast, away from Douglas Park township. The discharges will be oriented 45° toward the vertical.

Two of the ventilation fans will be in operation at any one time, with another fan being on standby. A fourth low flow fan, to be diesel powered, is proposed to be installed for use during emergency situations where mains power is not available. The emergency fan would be used to facilitate a safe evacuation of the mine and would not be in operation for longer than 24 hours. The emergency fan would be periodically tested for about 1 hour per month during day time hours.

A sound power level of 100dBA has been specified for each fan design to the fan manufacturers. The specification includes all noise sources associated with the fan, including noise from the air discharge and casing radiated noise. This noise level has been assumed in the noise model and a specification has been provided to BHPBIC.

It is acknowledged that this specification represents best practice for practical noise mitigation of fans with the required performance. This study therefore includes analysis of noise mitigation by use of noise walls or noise mounds or a combination of both, to be used in conjunction with fans of higher noise level than those specified. The top of the noise wall or mound should be 1m higher than the highest point of the fan discharges. Options for the design of the wall are discussed in Section 5.4. Using one of these wall options the sound power level for each fan can be increased to 104dBA.

5.4 Options for Noise Control

The vent shaft evase have been oriented to direct noise in a north easterly direction along the existing infrastructure corridor and away from Douglas Park.

There are two practical strategies for noise control of VS#6 operation: control of noise at the source, and building a barrier between the source and the receivers.

Control of noise at the source requires sourcing quiet fans, or applying controls to the fans so that they do not exceed a maximum source sound power level. The controls could include fan

discharge attenuators, acoustic lining of ductwork, and enclosure (cladding) of ductwork and fan casings.

A noise barrier could take the form of an earth mound or a wall. The earth mound option is shown in Figure 5-2. Due to the required height, up to 8m, the base of an earth mound would be very wide, so that the top of the mound would be 30-40m away from the noise source. The closer the top of the wall or barrier is to the noise source, the better it performs acoustically. A noise wall could be placed closer to the source, as shown in Figure 5-3, however the community has expressed preference for an earth mound. An alternative is to have a 6m earth mound with a 2m wall along the top, as shown in Figure 5-3, however this would result in the top of the wall being further away from the noise source compared to using a full 8m high noise wall only.

Figure 5-2 Barrier Option 1 – 8m High Noise Mound

Figure 5-3 Barrier Option 2 – 8m High Noise Wall

Figure 5-4 Barrier Option 3 – 6m High Noise Mound, 2m Wall

5.5 Results at Residences

Noise was predicted to the monitoring locations described previously, and four other residential properties considered to be most potentially impacted. The locations are listed in Table 5-1 and shown on Figure 5-5. The location called "School" represents residences near the Douglas Park Public School in Duggan Street. Further residences in Noise Catchment A are assessed in Section 7, Construction Noise Assessment, as they are potentially impacted by a proposed access road to the project site. As they are further from the site than Location 1, compliance at Location 1 will ensure operational noise compliance at Noise Catchment A residences north of Location 1.

Table 5-1 gives predicted night time noise levels with and without the noise mitigation mound (or wall). The table shows that noise levels are predicted to comply with the criterion of 39 dBA at all locations, under either of the two noise mitigation scenarios considered.

Table 5-2 gives predicted noise levels for daytime operation. Daytime noise levels are lower than night time due to the less frequent occurrence of temperature inversions. The noise is predicted to comply with the criterion of 45 dBA at all locations, under either noise mitigation scenario.

Table 5-1 Predicted Night Time Operational Noise Levels – 10th percentile $L_{Aeq,15min}$

Rec. No.	Location	Noise Catchment	Predicted $L_{Aeq,15min}$ Noise Level, dBA	
			Sound Power Level 100 dBA Per Fan, No Noise Wall	Sound Power Level 104 dBA Per Fan, Noise Wall
1	73 Camden Road	A	37	38
2	6 Moreton Street	B	37	37
3	Cnr Duggan/Hopson Street	A	38	37
4	School	A	38	37
5	Moreton Street (closest receiver to west)	A	38	37
6	Prices Road	C	24	28
7	125 Moreton Park Road	D	28	32
8	20 Moreton Park Road	D	30	34
9	670 Menangle Road	D	26	28
10	660 Menangle Road	D	27	31
11	575 Menangle Road	D	22	26
12	Blades Place (group of houses at eastern end)	D	31	34
13	40 Sullivan Road	D	36	39

Figure 5-5 Assessment Locations

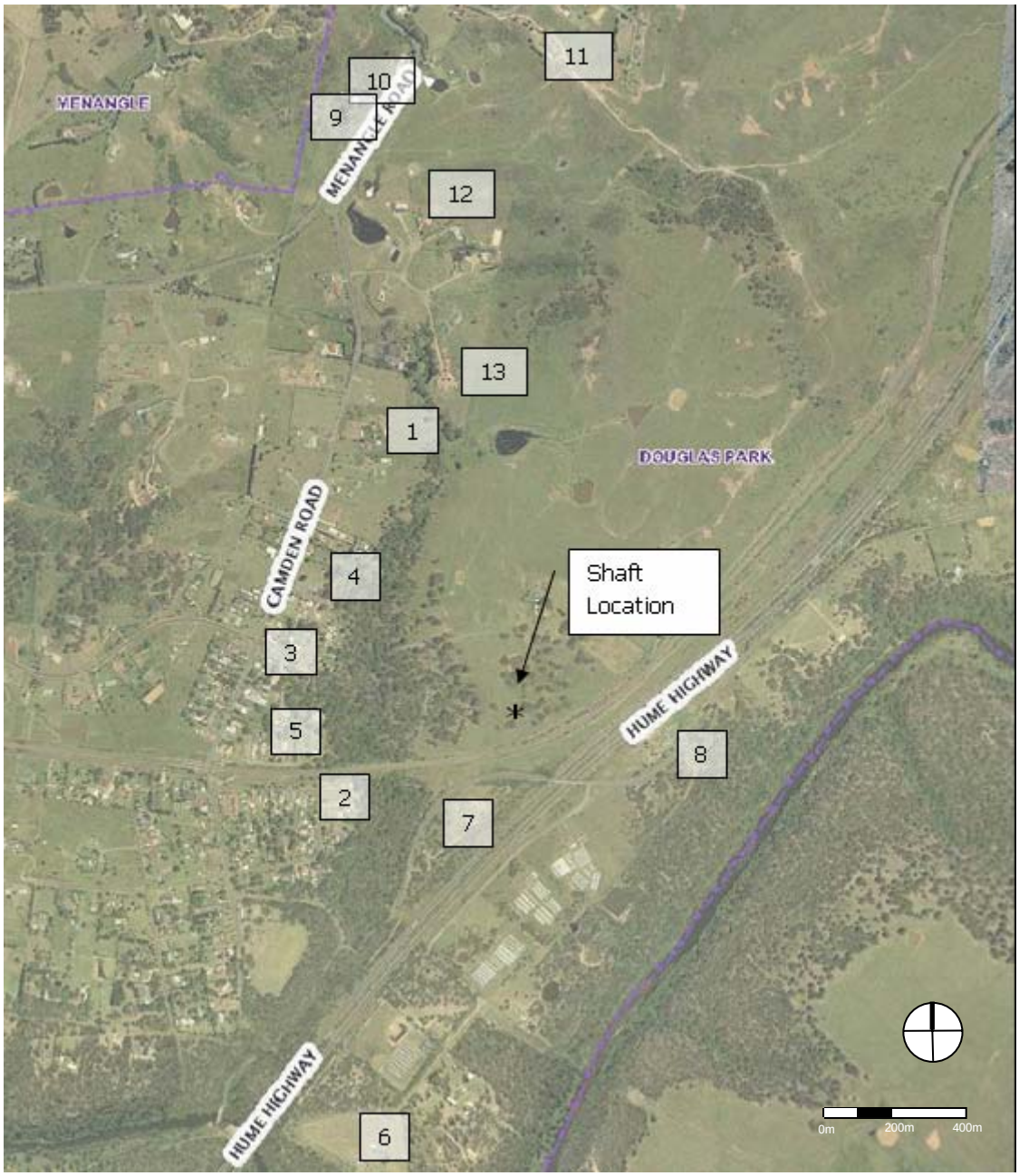


Table 5-2 Predicted Daytime Operational Noise Levels – 10th percentile $L_{Aeq,15min}$

Rec. No.	Location	Noise Catchment	Predicted $L_{Aeq,15min}$ Noise Level, dBA	
			Sound Power Level 100 dBA Per Fan, No Noise Wall	Sound Power Level 104 dBA Per Fan, Noise Wall
1	73 Camden Road	A	35	35
2	6 Moreton Street	B	35	37
3	Cnr Duggan/Hopson Street	A	38	37
4	School	A	38	37
5	Moreton Street (closest receiver to west)	A	38	36
6	Prices Road	C	24	28
7	125 Moreton Park Road	D	23	27
8	20 Moreton Park Road	D	29	33
9	670 Menangle Road	D	24	28
10	660 Menangle Road	D	24	28
11	575 Menangle Road	D	17	20
12	Blades Place (group of houses at eastern end)	D	29	32
13	40 Sullivan Road	D	33	33

6 OPERATIONAL NOISE MANAGEMENT PLAN

6.1 Overview of the Plan

The Operational Noise Management Plan includes:

- specification of appropriate noise limits at residential receivers (night time noise level L_{Aeq}, 15min criteria is 39 dB_A) ;
- procedures for determination of compliance;
- procedures for handling non-compliance;
- procedures for community liaison (including complaints handling); and
- the person responsible for implementation of the Plan.

6.2 Noise Monitoring and Reporting Procedures

Measurements of the ventilation shaft noise levels will be undertaken every 3 months during the first two years of operation, then annually thereafter where compliance was demonstrated in the first two year period. The noise measurements will be performed by attended monitoring during the night time period (10.00pm to 7.00am), at each of the four locations shown in Table 6-1, over periods of at least 15-minutes.

Reporting of noise monitoring will include:

- equipment used;
- calibration results of the equipment;
- overall noise levels at the measurement site, including L_{Aeq}, $L_{1,}$ L_{10}, and L_{A90};
- measured or estimated noise level contribution of the ventilation shaft itself;
- record of other noise sources heard; and
- record of compliance or non-compliance.

In determining the noise level of the ventilation shaft it is expected that this will be reported as an estimated contribution of the noise from the ventilation shaft to the overall noise at the measurement site. As it has been predicted that the noise level from the ventilation shaft will be at or below the ambient background noise level at many measurement sites during some measurement periods, it is imperative that a measurement be performed by an experienced technician able to determine whether the ventilation shaft contributes significantly to the noise environment.

Table 6-1 Noise Catchments and Measurement Locations

Noise Catchment	Locality	Measurement Location
A	North Douglas Park	Corner of Hopson and Duggan Streets
B	South Douglas Park	Moreton Street
C	East of Douglas Park	Moreton Park Road Residence
D	South of Douglas Park	Prices Road Residence

6.3 Non-Compliance Procedures

At each receiver location, the measured or estimated $L_{Aeq,15min}$ noise level due to noise from the ventilation shaft will be compared with the criterion of 39 dBA. Any non-compliance will be reported to BHPBIC, who will be responsible for determining whether additional noise mitigation is required. Where additional noise mitigation may be required, BHPBIC will investigate and implement reasonable and practical measures such as, but not necessarily limited to:

- Additional noise barriers adjacent to the noise source;
- Attenuation of noisy equipment;
- Modification of works or timing of those works;
- Noise mitigation works at receiver locations.

Any non-compliance with the noise criteria will be reported in accordance with the requirements of the Project Approval. Similarly, any assessment of additional noise management actions and any noise mitigation works that arose from the assessment will be reported in the Annual Report,

6.4 Complaints Handling and Community Liaison

As well as the noise monitoring outlined in Section 6.2, monitoring may be an appropriate response to a noise complaint made by one of the neighbouring residences.

The Illawarra Coal Community Call Line telephone number (1800 102 210) will be displayed prominently on the site in a position visible by the public as well as on publications sent to the local community.

All complaints will be managed in accordance with the Illawarra Coal Handling Community Complaints and Enquiries Procedure. The Appin Area 9 Project Environment and Community Co-ordinator will be responsible for engaging the community in regard to site based community matters.

7 CONSTRUCTION NOISE ASSESSMENT

7.1 Construction Program

Construction will be in stages and is expected to take approximately two years. Indicative timeframes for significant works packages are described below, although some activities may occur concurrently.

Site access and establishment

This stage will take approximately two months. Noise from these activities is typically variable. For assessment it is assumed that there would be two excavators and two dump trucks operating on site.

Switchyard connection to Douglas North Substation

BHPBIC are proposing to upgrade the existing Douglas North Substation facility located on Moreton Park Road on the other side of the Hume Highway to the VS#6 site.

The connection from the Douglas North Substation to the VS#6 switchyard will require underboring under the highway and rail line and/or the installation of overhead powerlines.

Set up drilling rig and power supply

Construction of the drilling rig will take approximately two months. Noise sources would include cranes and delivery vehicles. Site establishment for internal roads and water quality ponds would take approximately three months.

Drilling of vent shaft

Drilling of the shaft will take approximately 10 months. The shaft will be constructed using the blind boring method. In this method the shaft remains full of water so noise emission from the drill face itself is limited. Surface equipment consists of electrically powered hydraulic motors and pumps located at the shaft surface. The drilling process itself is very quiet. The ancillary drilling equipment is also relatively quiet and will be further mitigated via acoustic treatment, either in the form of temporary noise barriers or silencing of the equipment. During the vent shaft drilling program, shaft liners are constructed on site. This involves welding steel liner sections together and lining them with concrete. This operation is relatively quiet. Completed liners will be moved to temporary storage areas using surface mobile equipment.

Lining and grouting of shaft

Lining with steel collars and grouting of the shaft will take approximately 2-3 months. Equipment to be used includes delivery vehicles and cranes.

Dewater shaft

Dewatering of the shaft will take approximately 3 weeks. Equipment to be used includes pumps at the shaft surface.

Installation of fan equipment

Installation of the fans, ductwork and ancillary equipment will take approximately 6 months. Equipment to be used would include cranes, delivery vehicles and hand tools.

Access Road and Vehicle Movements

A new access road is proposed to be built to the site from Menangle Road. Access through the Douglas Park township will no longer be required once the access road is completed.

- The location of the access road is shown on

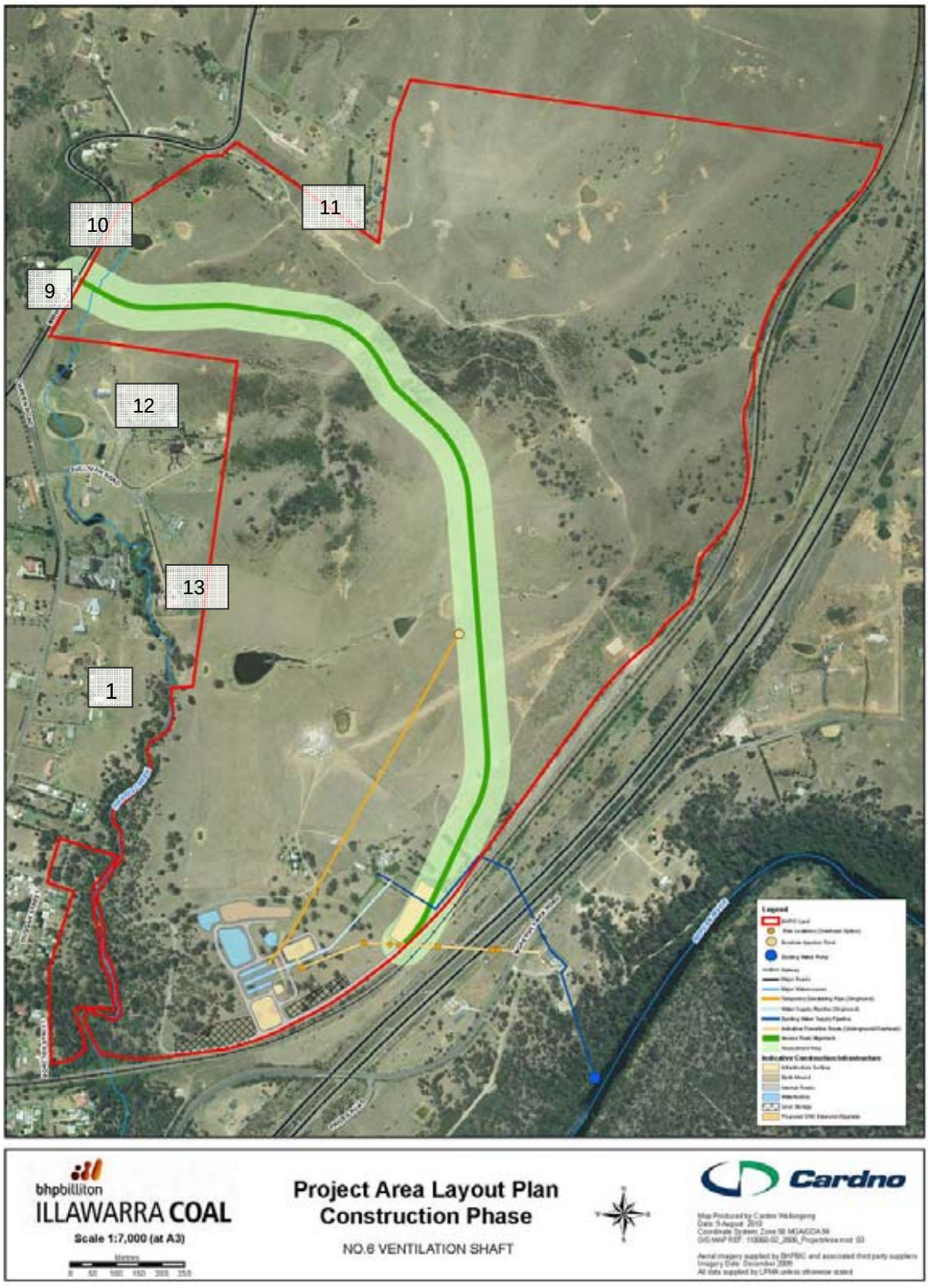
Figure 7-1. Construction of the access road is predicted to take approximately 4-6 months and equipment to be used may consist of excavators with hydraulic rock hammers (if required), dump trucks, dozer/s and grader/s.

Vehicle movements on the access road will vary throughout the shaft construction period. Light vehicle movements vary from 6 to 20 vehicles per day. Typical heavy vehicle movements are 10 vehicles per day, but may be up to 40 vehicles per day during busy periods. The maximum flow would continue for approximately 15 months. The maximum flow will coincide approximately with the drilling and shaft lining periods.

For predicting noise impact the following traffic flows will be assumed:

- during drilling and shaft lining periods – 20 light and 40 heavy vehicles per day; and
- during other periods – 10 light and 10 heavy vehicles per day.

Figure 7-1 Location of Access Road and Receivers



7.2 Construction Noise Criteria for Residences

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

Recommended standard hours of work

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

Management Noise Goals

Noise goals are detailed in Table 7-1.

Table 7-1 Noise at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,15min}$*	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dB(A)	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	• The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable ways to reduce noise to below this level. • If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended Standard hours	Noise affected RBL + 5dB(A	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.

The RBLs established for the intrusiveness criterion are used. The criteria specific to this project are shown in Table 7-2.

Table 7-2 L_{Aeq} Construction Noise Criteria

No.	Location	Construction Noise Criteria, L_{Aeq} dBA		
		Day	Evening[1]	Night[1]
1	All locations	50	45	39

Note: 1 These criteria apply for any necessary out of hours work

7.3 Construction Noise Criterion for Schools

For schools the guideline is that the noise should not exceed L_{Aeq} 45dBA inside the classroom. This is approximately equivalent to an external goal of 55dBA (assuming a façade with normally open windows).

7.4 Construction Noise Modelling

Source noise levels of typical construction equipment are shown in Table 7-3. These are maximum levels and useful for specification of equipment to be used. The L_{Aeq} operational noise level is typically 1 to 4dBA lower, depending on the equipment and duty. To predict construction noise from the site a total sound source level from all construction activity is determined from the expected mix of equipment for that activity. The site sound source level determined for each activity is shown in Table 7-4, along with the daily heavy vehicle flow assumed in the noise prediction.

Table 7-3 Source Sound Levels of Construction Equipment

Plant	Maximum Sound Power Level (dBA)	Maximum Sound Pressure Level at 7m (dBA)
Front End Loader	111	86
Grader	107	82
Smooth Drum Roller	107	82
Spoil, Materials or Concrete Truck	109	84
Truck-mounted Shotcrete Pump	106	81
Excavator or Bobcat	107	82
Concrete Pump	105	80
Large Bored Drilling Rig	112	87
Small Bored Drilling Rig	108	83
Powered Hand Tools	109	84
30t Excavator operating with hydraulic hammer	122	97
Water Cart	110	85
Articulated Dump Truck	113	88
Air Compressor (Power Tools)	98	73

Plant	Maximum Sound Power Level (dBA)	Maximum Sound Pressure Level at 7m (dBA)
Blind Boring Rig	103	78
Dozer	115	90

Table 7-4 Source Sound Levels of Construction Activities and Heavy Vehicle Schedule

Activity	Duration	Equipment	Site Sound Power Level, $L_{wAeq,15}$	Access Road Traffic, heavy vehicles per day
Site access and establishment	Five months	2 x excavator/grader 2 x dumptruck 2 x dozer 1 x water cart	119	10
Connection to Douglas North Substation	Less than one month	Trencher and underborer and/or cranes and trucks	112	10
Set up drilling rig and power supply	Two months	Cranes, trucks	110	10
Drilling vent shaft	10 months (24 hour operation)	Blind boring rig	103	40
Lining and grouting shaft	2-3 months	Cranes, trucks	110	40
Dewater shaft	3 weeks (24 hour)	Pumps	103	10
Installation of fan equipment	6 months	Cranes, trucks, hand tools	110	10

7.5 Construction Noise Assessment

As construction will continue for a number of months, the predicted noise levels are based on the 10th percentile of predicted noise levels, as for the operational noise, taking into account the statistical occurrence of meteorological conditions during daytime and night time hours. Noise from drilling and dewatering of the shaft was predicted for night time meteorological conditions, and all other activities were predicted for daytime meteorological conditions.

Table 7-5 shows predicted noise levels for daytime construction activities. The only predicted 1dBA exceedance at Location 1 during site establishment. This would have negligible impact and would only occur when all equipment is operating at full capacity..

Predicted night time construction noise levels are shown in Table 7-6. Noise is predicted to comply at all residences. In both cases, noise emission from all equipment above the ground surface should be limited to L_{Aw} 103dBA. Mitigation and management of construction noise is discussed in Section 8.

Table 7-5 Predicted Daytime Construction Noise Levels $L_{Aeq,15min}$ – Criterion is $L_{Aeq,15min}$ 50dBA

Rec. No.	Location	Noise Catchment	Site access and establishment, typical access road construction traffic	Connection to Douglas North Substation, typical access road traffic	Set up drilling rig and power supply, max. access road traffic	Drilling vent shaft, max. access road traffic	Lining and grouting shaft, typical access road traffic	Dewater shaft, typical access road traffic	Installation of fan equipment, typical access road traffic
1	73 Camden Road	A	51	44	35	35	35	35	42
2	6 Moreton Street	B	48	41	33	33	33	32	39
3	Cnr Duggan/Hopson Street	A	48	41	34	34	34	32	39
4	School	A	47	40	35	35	35	33	38
5	Moreton Street (closest receiver to west)	A	47	40	33	33	33	32	39
6	Prices Road	C	41	35	37	37	37	32	34
7	125 Moreton Park Road	D	39	32	26	26	26	24	30
8	20 Moreton Park Road	D	46	41	44	44	44	38	40
9	670 Menangle Road	D	43	39	44	44	44	38	38
10	660 Menangle Road	D	40	34	35	35	35	30	33
11	575 Menangle Road	D	42	39	45	45	45	39	39
12	Blades Place (group of houses at eastern end)	D	43	37	39	39	39	34	36
13	40 Sullivan Road	D	44	37	28	28	28	28	35

Table 7-6 Predicted Night Time Construction Noise Levels $L_{Aeq,15min}$ – Criterion is $L_{Aeq,15min}$ 39dBA

Rec. No.	Location	Noise Catchment	Drilling vent shaft, no construction traffic	Dewater shaft, no construction traffic
1	73 Camden Road	A	37	37
2	6 Moreton Street	B	37	37
3	Cnr Duggan/Hopson Street	A	38	38
4	School	A	38	38
5	Moreton Street (closest receiver to west)	A	38	38
6	Prices Road	C	28	28
7	125 Moreton Park Road	D	28	28
8	20 Moreton Park Road	D	30	30
9	670 Menangle Road	D	27	27
10	660 Menangle Road	D	27	27
11	575 Menangle Road	D	22	22
12	Blades Place (group of houses at eastern end)	D	30	30
13	40 Sullivan road	D	35	35

8 CONSTRUCTION NOISE MANAGEMENT

8.1 Overview of Construction Noise Management Plan

The Construction Noise Management Plan is summarised in Table 8-1.

Table 8-1 describes the management measures and responsibility for the procedures that are included in the plan. Possible management measures are described in detail after the table. These management measures are as recommended by the DECCW Interim Construction Noise Guideline (ICNG) and should be implemented where reasonable and feasible.

Table 8-1 Noise Management Measures

Activity	Summary of Management Measures	Responsibility
Induction	The employee and contractor induction shall inform all site personnel about noise management measures, construction hours and nearest sensitive receivers. All employees are responsible for managing noise from their work activities and working in a manner to minimise noise.	Field Safety & Environment & Community Coordinator / All Personnel
Hours	Limit construction works other than approved 24hr activities to 7.00am -6.00pm Monday to Friday and 8.00am-1.00pm Saturday. Quiet construction operations that are inaudible at any residential receiver are able to be undertaken outside this period.	Project Manager
Equipment	Ensure that plant and equipment is well maintained and carry out maintenance as required.	Project Manager
Site Design and Planning process	All reasonable and feasible noise source controls to reduce noise from plant and equipment during construction shall be investigated and applied during the site design and planning process.	Project Manager
Notification and Complaints handling	Notice of works will be provided to relevant affected residents at least 5 days prior to commencing construction activities. Complaints dealt with in accordance with Illawarra Coal's Community Complaints and Enquiries Procedure.	Project Manager Environment & Community Coordinator
Monitoring	Carry out quarterly environmental noise monitoring and keep records	Project Manager/ Environment & Community Coordinator /Acoustic Consultant
Reporting	Maintain a log of noise management practices and monitoring, and provide reports where necessary	Project Manage/ Environment & Community Coordinator /Acoustic Consultant

8.2 Induction, training and site behaviour

- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise.

- Ensure site managers periodically check the site and nearby residences and other sensitive land uses for noise problems so that solutions can be quickly applied.
- Include in tenders, employment contracts, subcontractor agreements and work method statements clauses that require minimisation of noise and compliance with directions from management to minimise noise.
- Avoid the use of radios or stereos outdoors where neighbours can be affected.
- Avoid the overuse of public address systems.
- Avoid shouting, and minimise talking loudly and slamming vehicle doors when near residential properties during night time hours.
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).

8.3 Hours of Construction

Limit construction works activities to 7.00am -6.00pm Monday to Friday and 8.00am-1.00pm Saturday except for approved out of hour activities such as shaft drilling. Quiet construction operations that are inaudible at any residential receiver are able to be undertaken outside this period.

8.4 Plant and equipment

In terms of both cost and results, controlling noise at the source is often the most effective method of minimising the noise impacts from any construction activities.

Use quieter methods

- Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fracture. The suitability of alternative methods should be considered on a case-by-case basis.
- Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units where feasible and reasonable. Note, the blind boring shaft drilling methods operates via electrically powered hydraulic pack.

Use quieter equipment

- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber wheeled tractors can be less noisy than steel tracked tractors.
- Noise labels are required by NSW legislation for pavement breakers, mobile compressors, chainsaws and mobile garbage compactors. These noise labels can be used to assist in selecting less noisy plant.
- Pneumatic equipment is traditionally a problem – select supersilenced compressors, silenced jackhammers and damped bits where possible.
- When renting, select quieter items of plant and equipment where feasible and reasonable.
- When purchasing, select, where feasible and reasonable, the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise.

Operate plant in a quiet and efficient manner

- Reduce throttle setting and turn off equipment when not being used.
- Examine and implement, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin.

Maintain equipment

- Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers.
- Equipment must not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified.
- For machines with enclosures, check that doors and door seals are in good working order and that the doors close properly against the seals.
- Return any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair.
- Ensure air lines on pneumatic equipment do not leak.

8.5 Site Design, Planning and Process

Barriers and acoustic sheds are most suited to longer-term fixed works, as in these cases the associated cost is typically outweighed by the overall time savings.

Location of plant

Place as much distance as possible between the plant or equipment and residences and other sensitive land uses.

Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times.

Locate site vehicle entrances away from residences and other sensitive land uses.

Carry out noisy fabrication work at another site (for example, within enclosed factory premises) and then transport to site.

Avoid use of reversing alarms by designing site layout to avoid reversing, such as by including drive through for parking and deliveries, or use low frequency reversing alarms.

Maximise shielding

Use temporary site buildings and materials stockpiles as noise barriers.

Schedule construction of permanent walls and noise mounds so that they can be used as early as possible as noise barriers.

Temporary barriers may be installed, for example hoarding around the site.

8.6 Consultation and notification

The community is more likely to be understanding and accepting of noise if the information provided is frank, does not attempt to understate the likely noise level, and if commitments are firmly adhered to.

Notification before and during construction

- Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur.
- Maintain good communication between the community and project staff.
- Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.

Illawarra Coal has appointed an Environment and Community Coordinator to facilitate interaction between the Project and the Douglas Park community

Complaints handling

- Provide a readily accessible contact point through the 24 hour toll-free Community Call Line.
- Respond to complaints in accordance with the Illawarra Coal Community Complaints and Enquiry Procedure.
- Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate.

8.7 Response to Complaints

- Where noise complaints are received, management of noise impact may be required. The response will depend on the nature of the activity that generated the complaint.

8.8 Monitoring

The need for construction noise monitoring could be triggered by receipt of noise complaints.

The procedure for monitoring the noise is as follows:

Measuring instrument: Monitoring should consist of attended monitoring carried out in accordance with AS1055: Acoustics – Measurement and Description of Environmental Noise.

Measurement conditions: Meteorological conditions must be obtained for the time of monitoring. This is to include wind speed and direction as well as data suitable for quantifying the presence or otherwise of temperature inversions.

Measurement Interval: The monitoring interval shall be a 15 minute period.

Measurement Parameters: For construction noise the measurement parameter is $L_{Aeq,15min}$.

Monitoring Records and Reporting: For each monitoring site, the following information shall be reported:

- Location, data and time;
- Instrument, calibration status and calibration level before and after measurements;
- Parameters measured and their results at each distance measured;
- Weather conditions;
- Background Noise Level; and

- Sound levels from specific identifiable sources.

Monitoring will be undertaken quarterly during the shaft construction period at the same locations specified in the Operational Noise Management Plan described in Section 6.

Monitoring may be performed as required - for example if monitoring is the appropriate response to a noise complaint.

8.9 Non-Compliance Procedures

At each receiver location, the measured or estimated $L_{Aeq,15min}$ noise level due to night time construction noise from the ventilation shaft will be compared with the criterion of 39 dBA. Any non-compliance will be reported to BHPBIC, who will be responsible for determining whether noise mitigation is required. Where additional noise mitigation may be required, BHPBIC will investigate and implement reasonable and practical measures such as, but not necessarily limited to:

- Additional noise barriers adjacent to the noise source;
- Noise attenuation of noisy equipment;
- Modification of works or timing of those works;

Any non-compliance with the noise criteria will be reported in accordance with the requirements of the Project Approval. Similarly, any assessment of additional noise management actions and any noise mitigation works that arose from the assessment will be reported in the Annual Report.

8.10 Reporting

Noise monitoring statements, and records of complaints and response, will be reported in accordance with the requirements of the Project Approval.

9 VIBRATION ASSESSMENT

9.1 Vibration Criteria

The *DECCW* publication *Assessing Vibration: A Technical Guideline* (February 2006) considers impacts from vibration in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). The guideline gives "preferred" and "maximum" vibration levels at buildings exposed to continuous and impulsive vibration. For construction noise the guideline is to apply the criteria for maximum continuous vibration. These levels are summarised in Table 9-1.

In relation to building damage from vibration, suitable levels are determined from German Standard DIN 4150 and BS 7385: Part 2 – 1993, and British Standard BS 6472. The limits interpreted from these Standards are included in Table 9-1.

Table 9-1 Vibration Criteria

Receiver	Vibration Criteria, Maximum Peak Velocity (mm/s)		
	Human Comfort, Preferred	Human Comfort, Maximum	Building Damage (typical structures)
Residential during daytime	0.28	0.56	10
Residential night time	0.20	0.40	10
Offices	0.56	1.1	10
Critical Areas (e.g. hospital operating theatres, precision laboratories)	0.14	0.28	10

9.2 Vibration Source Levels

Table 9-2 provides some estimated vibration levels at a range of distances from the various construction activities. The attenuation with distance is dependant on the nature of the rock strata at the site, so the levels are a guide only.

Table 9-2 Typical Vibration Emission Levels from Construction Plant

Source	PPV Vibration Level (mms^{-1}) at Distance					
	5m	10m	20m	30m	40m	50m
Heavy Rock Breaker (typical)	4.5	1.3	0.4	0.2	0.12	0.085
Heavy Rock Breaker (worst known)	4.5	2.5	0.5	-	-	-
Light Rock Hammer (e.g. 600kg)	0.2	0.06	0.02	0.01	-	-
Ripping (measured in Sydney sandstone)	0.7	0.15	0.03	-	-	-

9.3 Construction Vibration Assessment

9.3.1 Impact at Residences

The nearest residential premises to the project are approximately 500m from the shaft site. Construction equipment could approach to as close as 400m to the aforementioned residences during construction of the noise mound or wall.

Construction of the mound will use excavators, dump truck/s, dozer and roller. Though it is unlikely that excavator-mounted rock breakers would be used, for a conservative assessment it will be assumed that rock breakers could be used at the point closest to residences.

As shown in Table 9-2 the predicted vibration from rock-breakers at 50m complies with the lowest criterion for human comfort. At 400m distance the vibration would be much lower. It is unlikely that the vibration could be detectable or measurable. Vibration from other equipment would be even less.

Hence no impact from construction vibration is predicted.

9.3.2 Building Damage

The criterion for building damage is 10mm/s. This criterion will be met at all receivers for all project activities, and no building damage impact from the project is predicted.

9.4 Operational Vibration Assessment

The fans are designed to be balanced to minimise vibration. Similarly, fan foundations are designed to accommodate static and dynamic loads imparted by the operational fans. Given these designs, and the distance to the nearest residential premises, vibration will not be detectable and no impact is predicted.

10 ROAD TRAFFIC NOISE

10.1 Access to the Site

The Director General's Requirements include consideration of off-site traffic noise. Once the access road to the site is built there will be no further requirement for access to the site through the township of Douglas Park except in case of emergency

10.2 Operational Traffic Noise

Once operational there would be a small volume of regular traffic generated by the site. This traffic comprises heavy vehicle delivery of consumables such as ballast, stone dust etc to the service boreholes. These deliveries will be during day time periods.

Light vehicles will travel to the site, primarily during day time periods, for regular inspection and maintenance of the fans. Light vehicle travel may occur during night time periods for emergency maintenance or start up/shut down.

No traffic noise impact is predicted during the operational phase.

10.3 Construction Traffic Noise

There will be significant heavy vehicle traffic during the shaft construction phase. BHPBIC have recognised the impact of heavy vehicles through Douglas Park as a potential issue, and have proposed a new access road discussed in Section 7. Access to the site is proposed to be from Menangle Road through land owned by BHPBIC to the shaft site.

The current traffic flow on Menangle Road is approximately 6000 vehicles per day (Menangle Structure Plan, February 2010, AECOM Australia, for Menangle Pastoral). Menangle Road traverses semi-rural areas and most houses are well set back from the road.

Typical construction flows to the site are predicted to be 30 vehicles per day, of which approximately two thirds (or 20 heavy vehicles per day) would be considered heavy vehicles for noise purposes.

The addition of 30 vehicles onto the current daily 6000 vehicles that currently use Menangle Road would not cause a significant change in traffic noise, and no impact is predicted.

11 CONCLUSION

VS#6 is proposed by BHPBIC to provide ventilation to new mining domains.

Noise and vibration from construction and operation of VS#6 was assessed to satisfy the Director General's Requirements for the project's environmental assessment.

During operation there will be two large fans in continuous operation.

The construction phase will take approximately two years. Drilling of the shaft will take approximately 10 months and requires 24 hour operation of the drilling equipment.

Operational Noise

Operational noise was predicted at residences surrounding the site. The nearest residences, in Douglas Park, are approximately 500m from the site.

Noise was predicted taking into account meteorological conditions that occur in the area.

Compliance with noise requirements can be achieved by using fans of sufficiently low sound power level. An alternative is to use a noise wall/mound to the west and north of the fans, allowing a higher source noise level.

The noise wall could be an earth mound, a wall, or a combination of low mound plus wall. The height of the noise wall should be 1m above the top of the fan discharge.

An operational noise management plan has been developed. This plan includes the fan specification, measurement locations, measurement frequency, procedures for response to non-compliances and complaints, and reporting.

Construction Noise

Daytime construction noise is predicted to be within relevant noise goals at all residences, for all stages of the construction.

Night time construction is essential for the project. Night time construction noise is predicted to comply with relevant guidelines.

Construction traffic will access the site using a proposed new access road from Menangle Road. Noise from this road is predicted to meet relevant criteria under all usual construction conditions.

A construction noise management plan has been prepared to include requirements for noise sources, noise monitoring, and response to complaints.

Traffic Noise

Operational traffic noise will be insignificant and no impact is predicted.

Vibration

Vibration during construction and operation is predicted to comply with relevant guidelines. No impact is predicted from vibration.

Note

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Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

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

Version	Status	Date	Prepared by	Checked by
A	Draft	30 July 2010	George Jenner	Rob Bullen
A	Final	11 August 2010	George Jenner	Rob Bullen

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph on Figure A1, overleaf, are here defined.

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

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

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

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

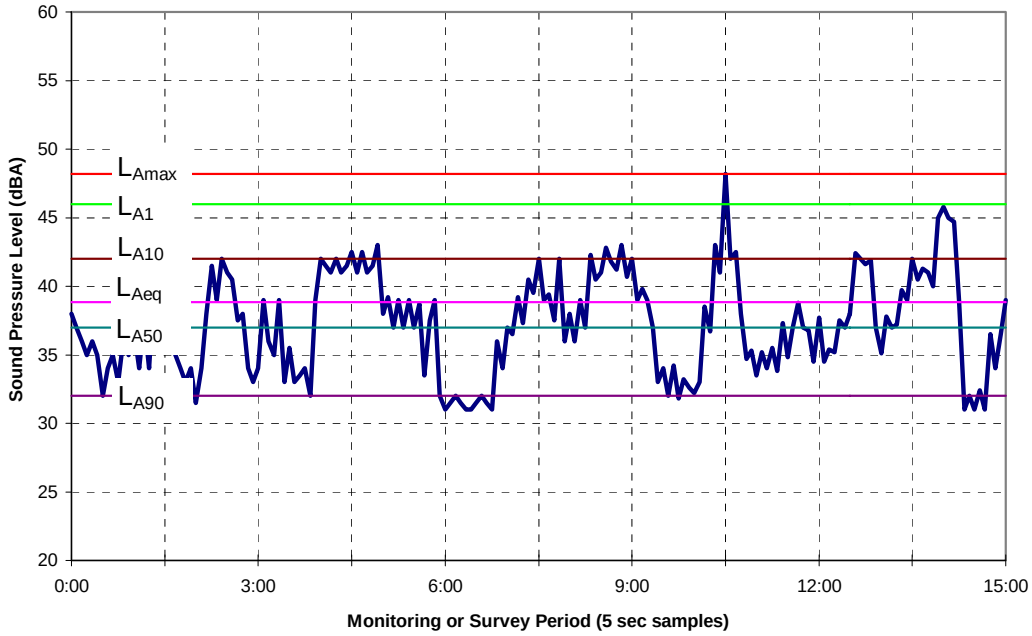
L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

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

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

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

Figure A1- Sound Level variation over time



APPENDIX B

NOISE MEASUREMENT RESULTS

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Data shaded: Met

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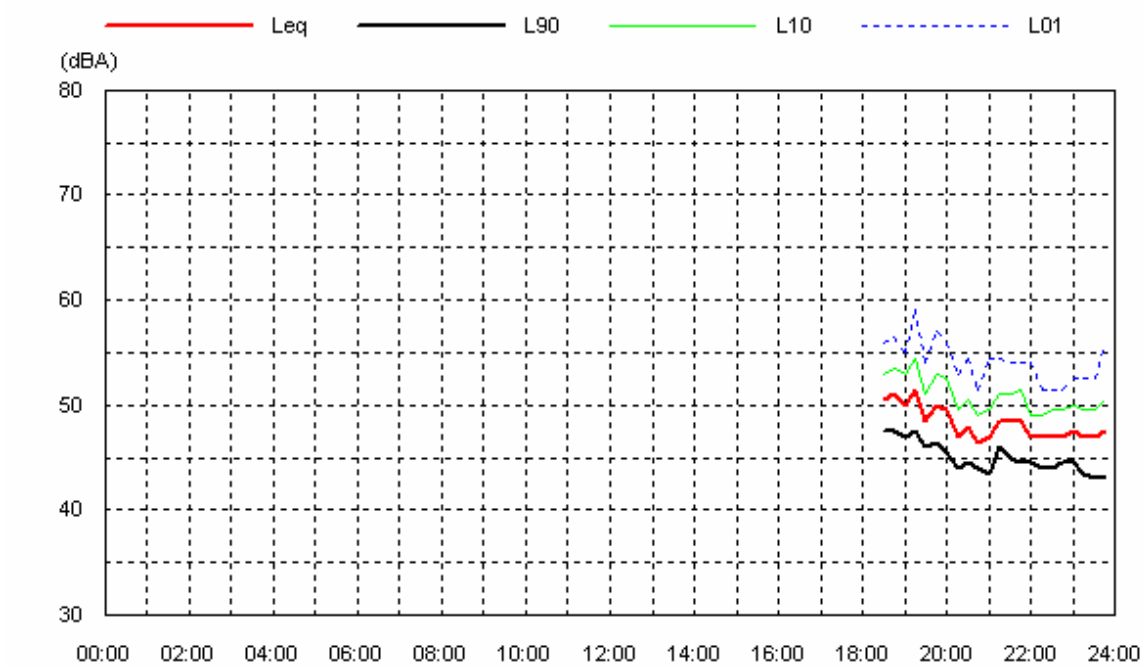

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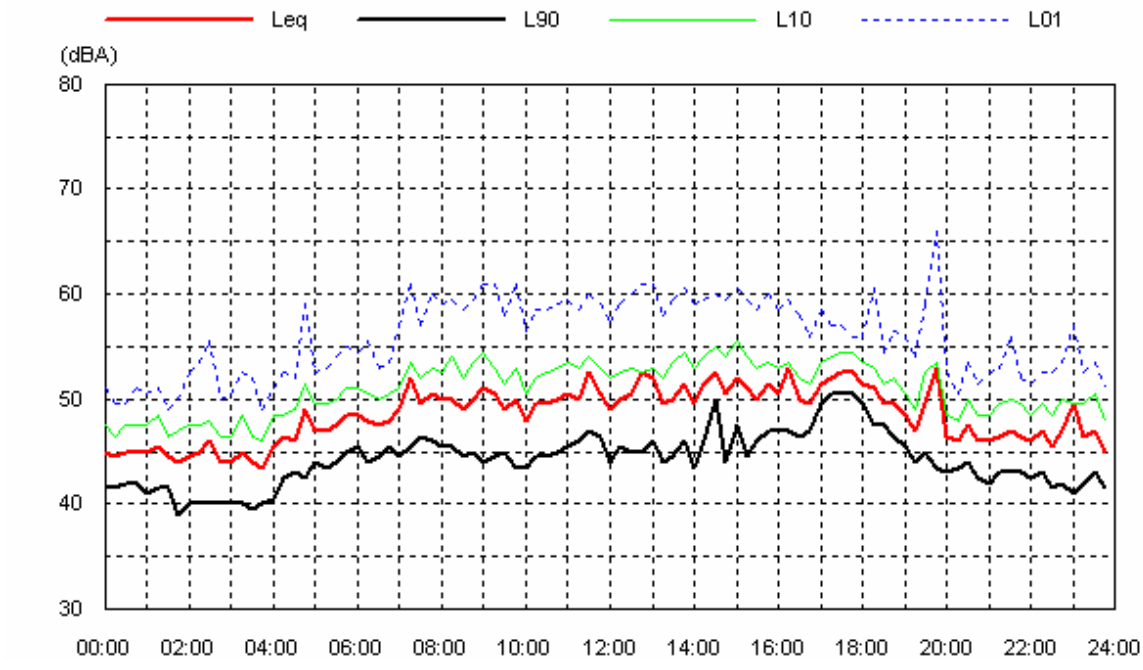

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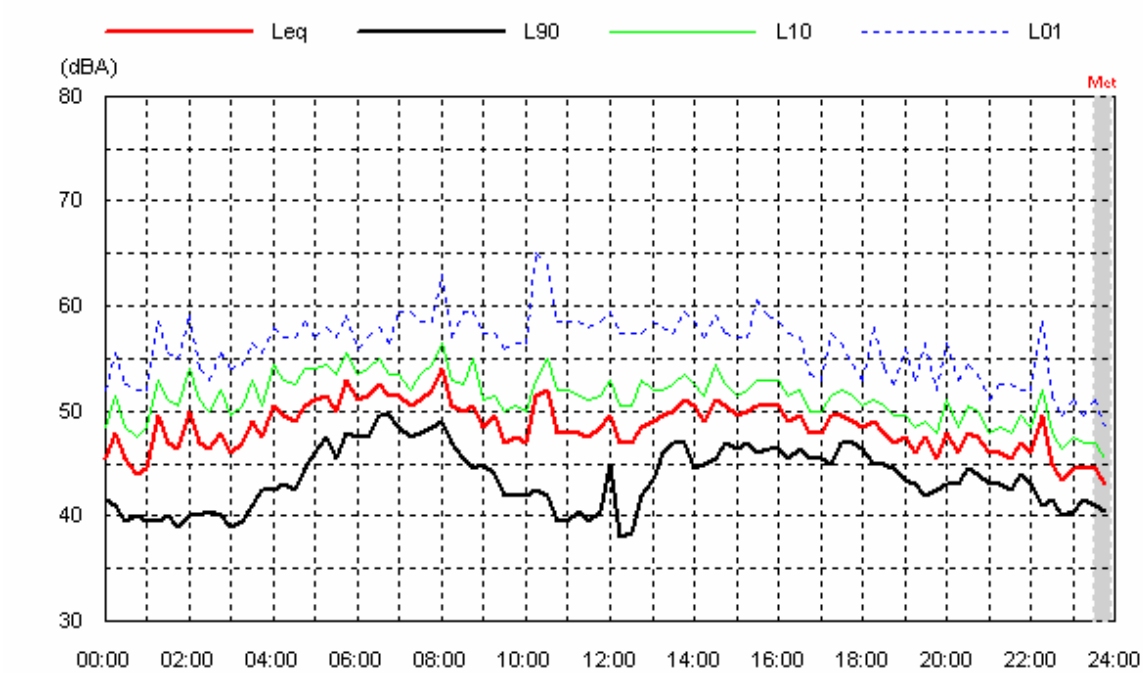

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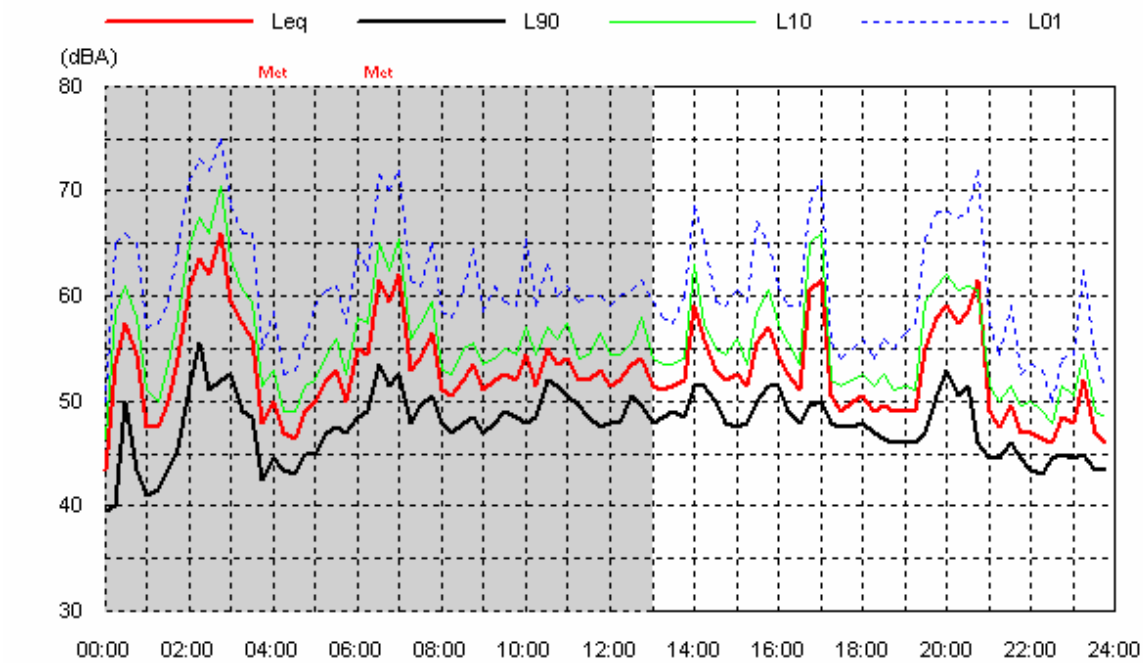

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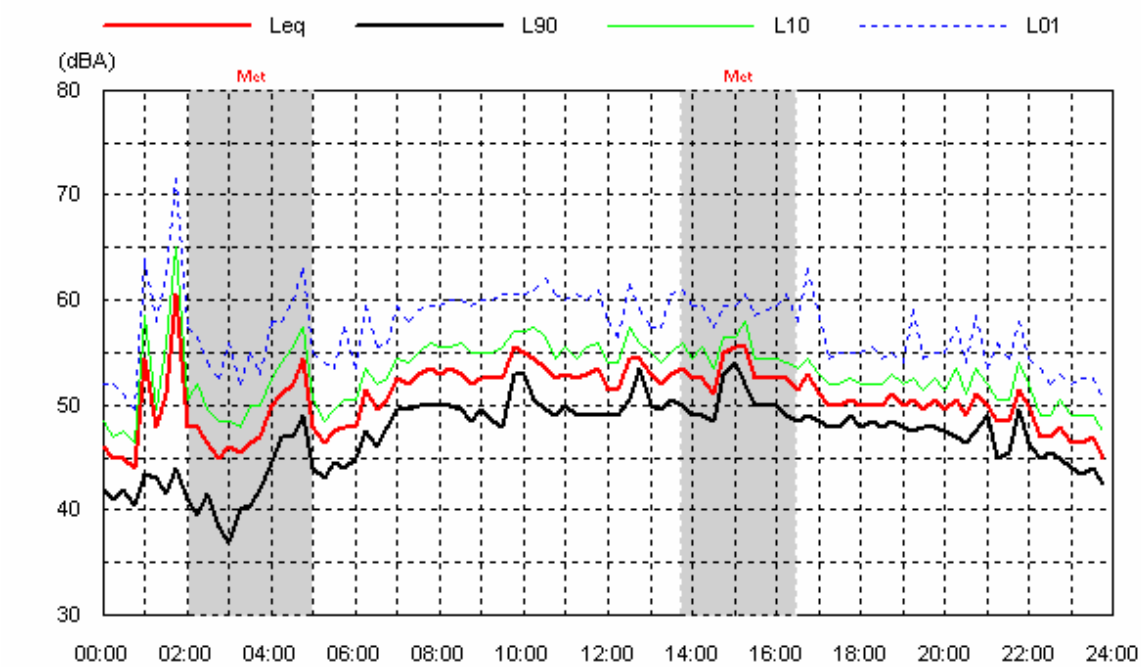

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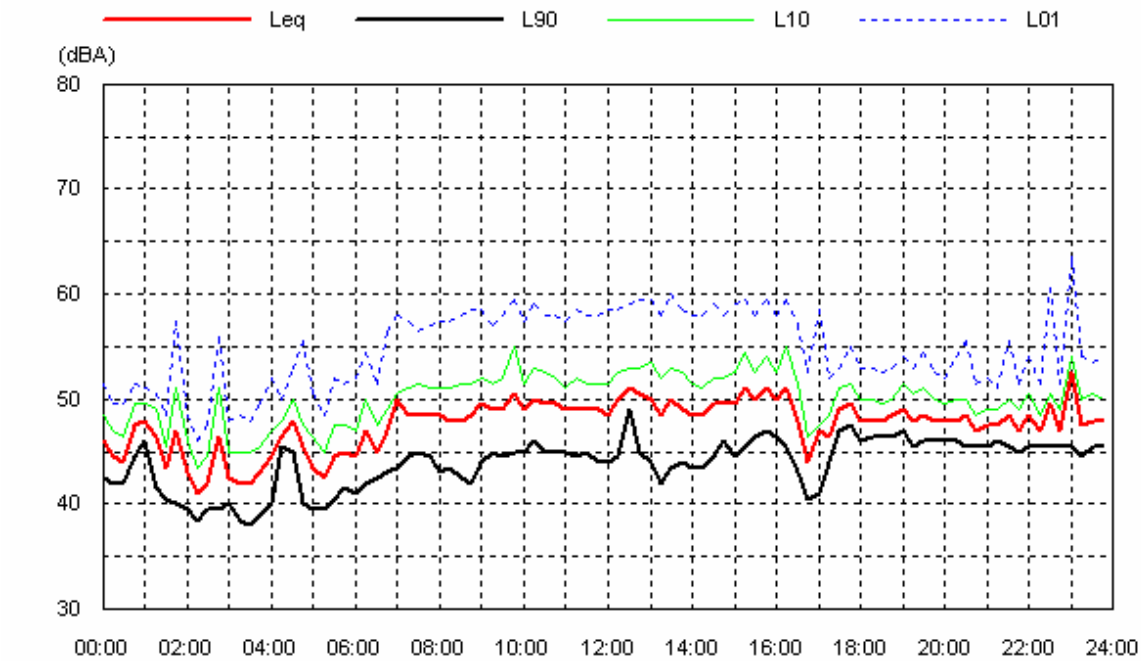

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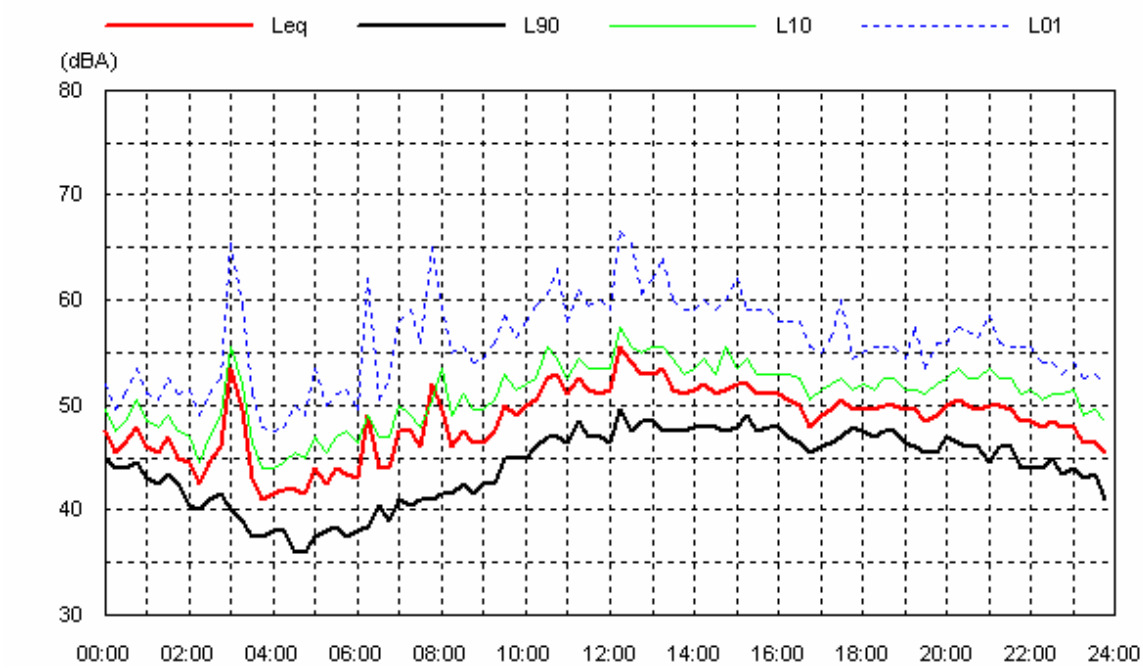

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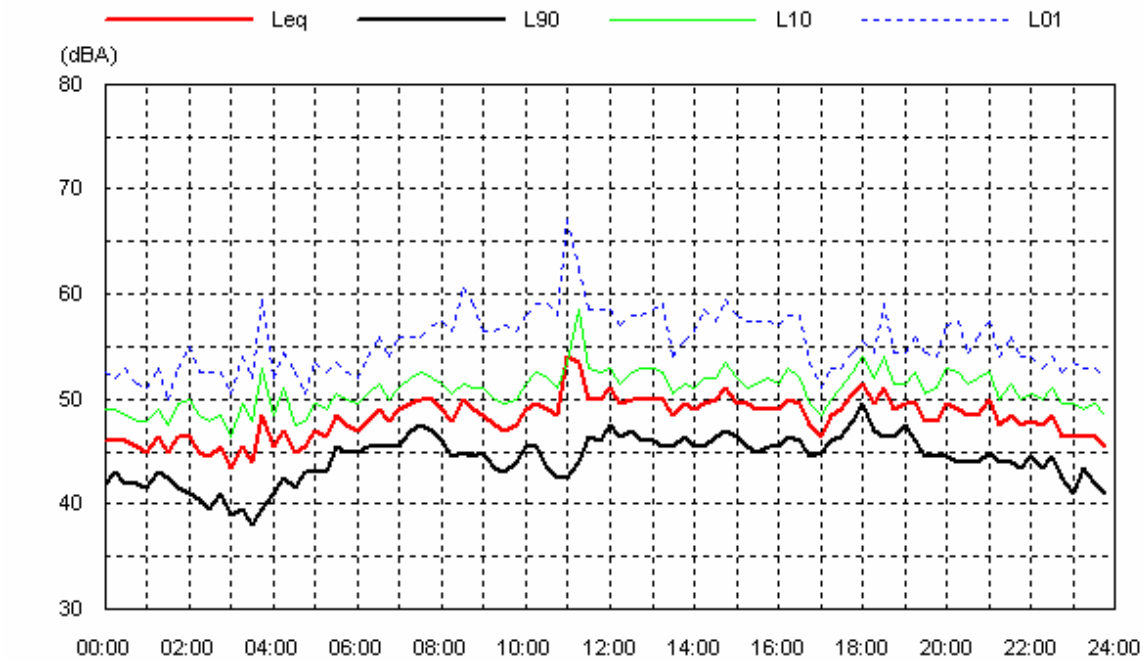

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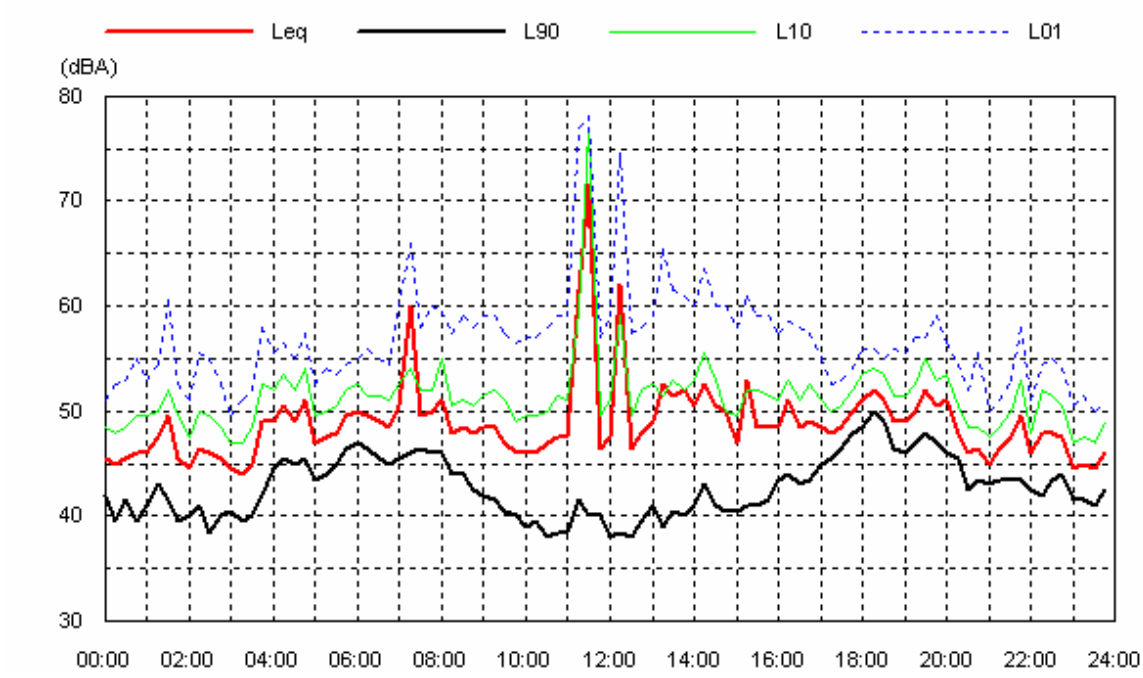

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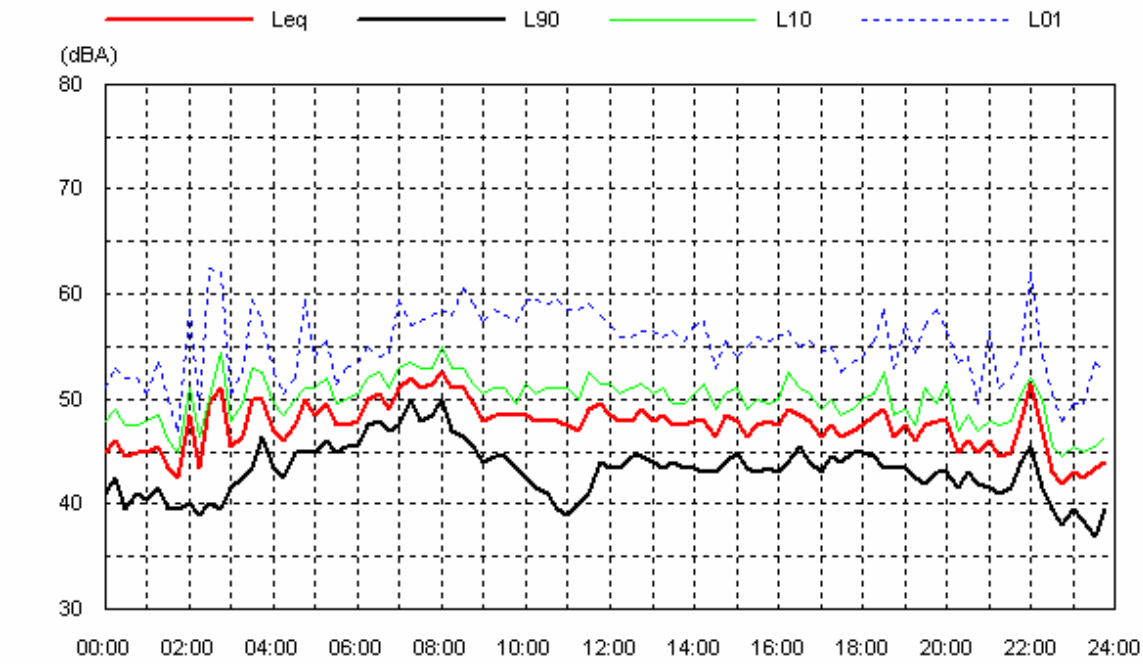

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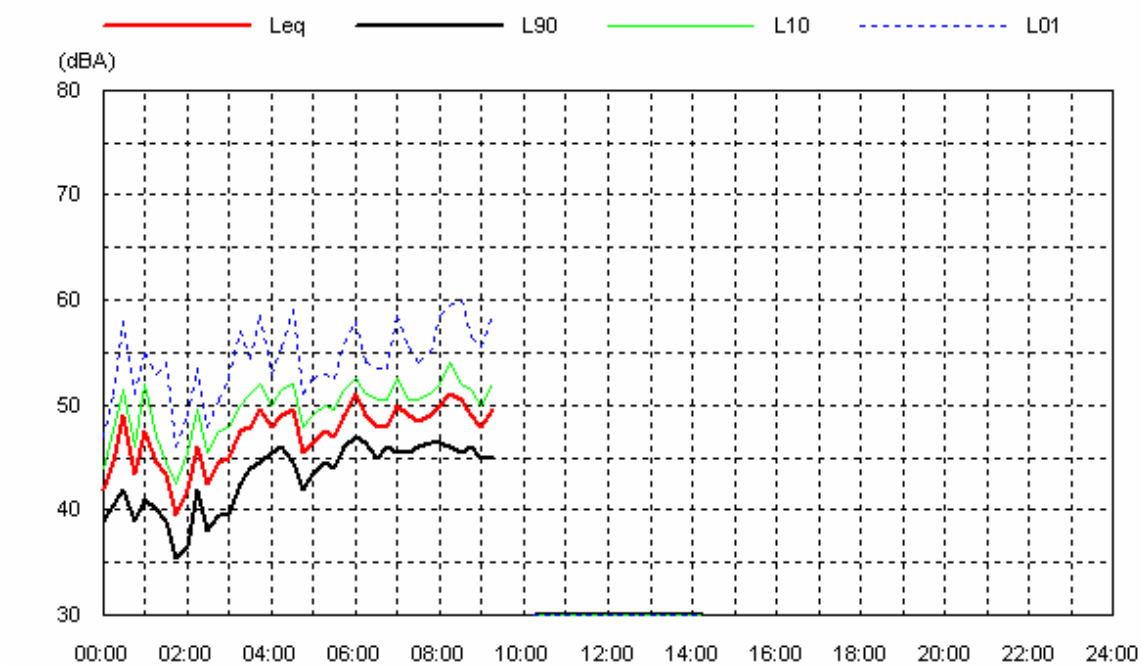

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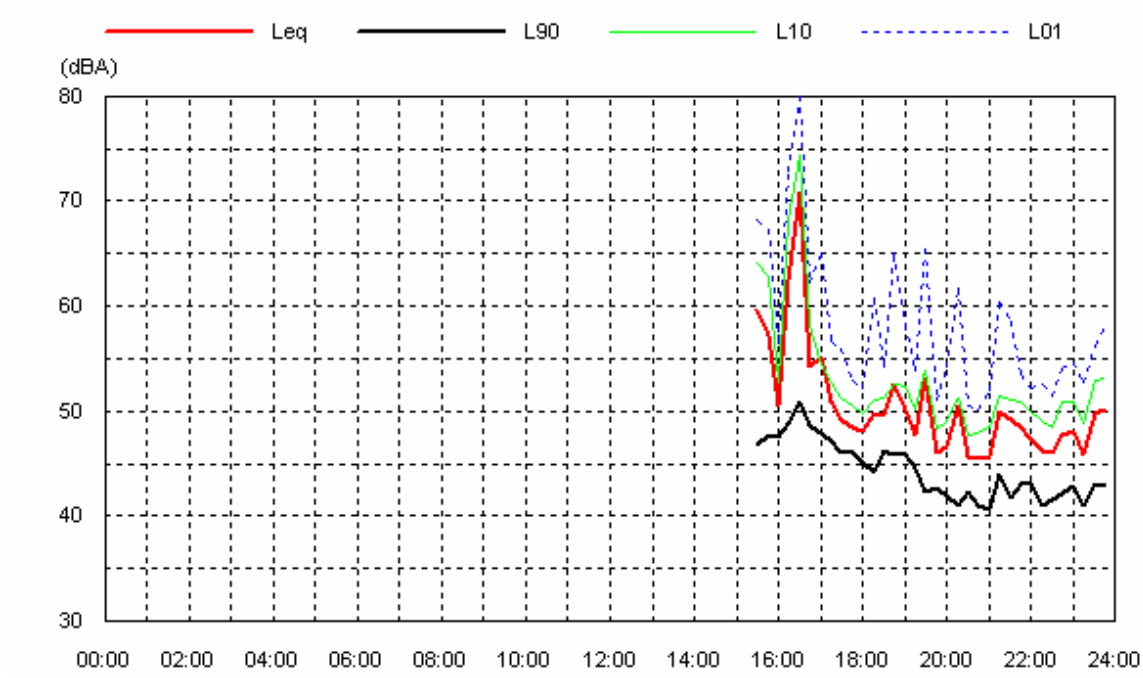

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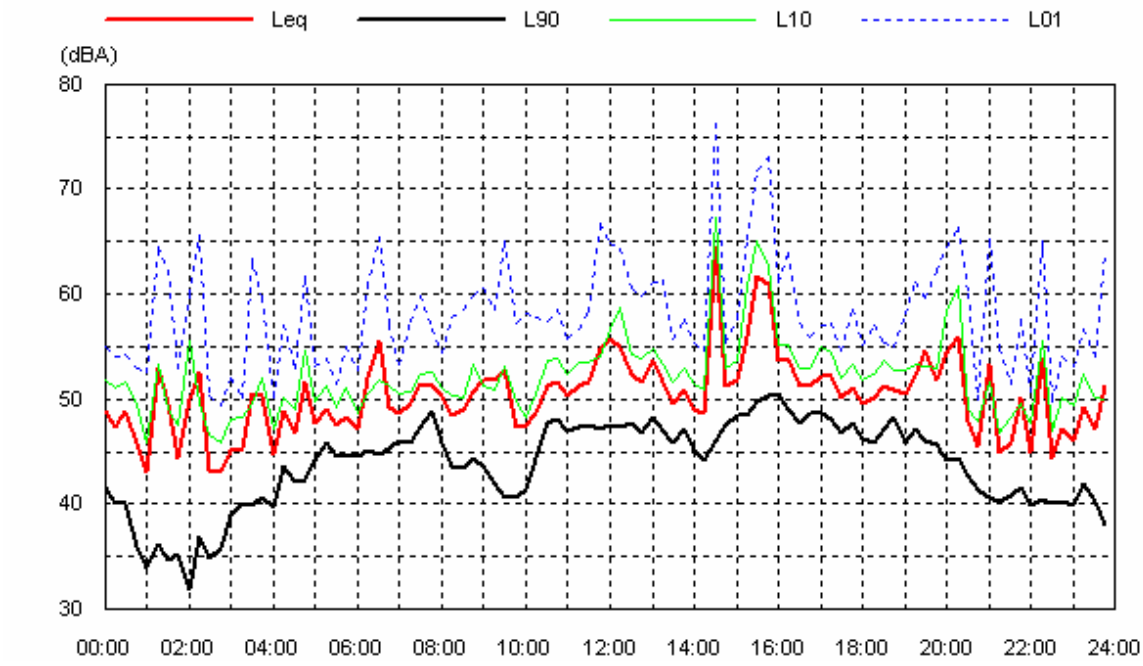

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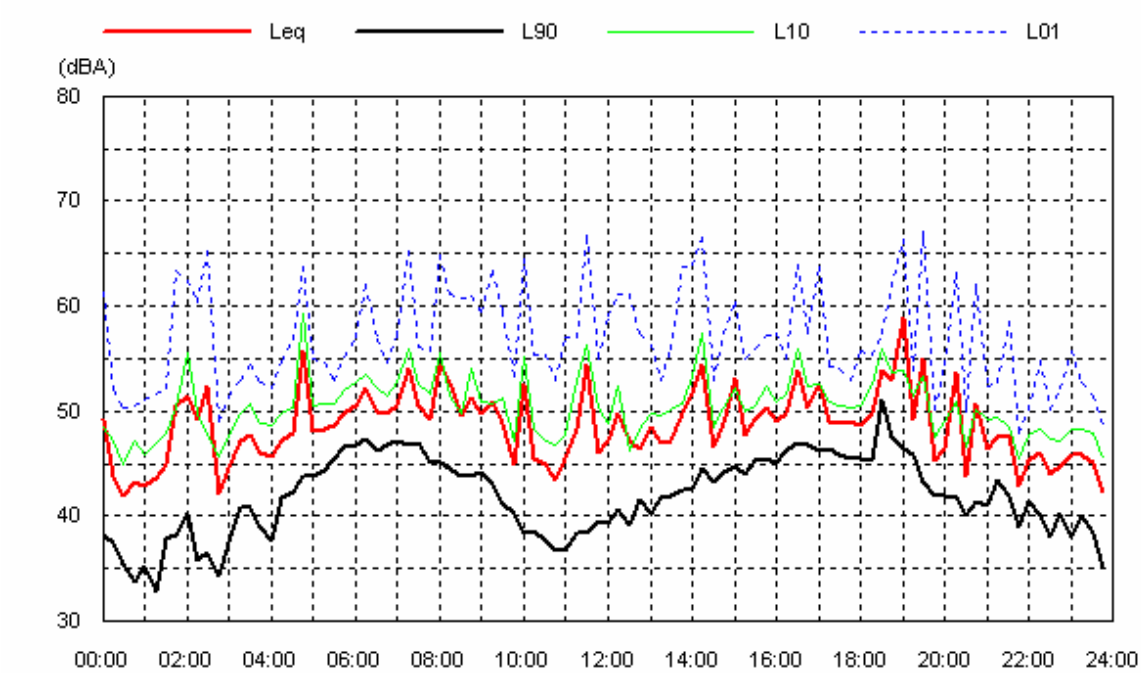
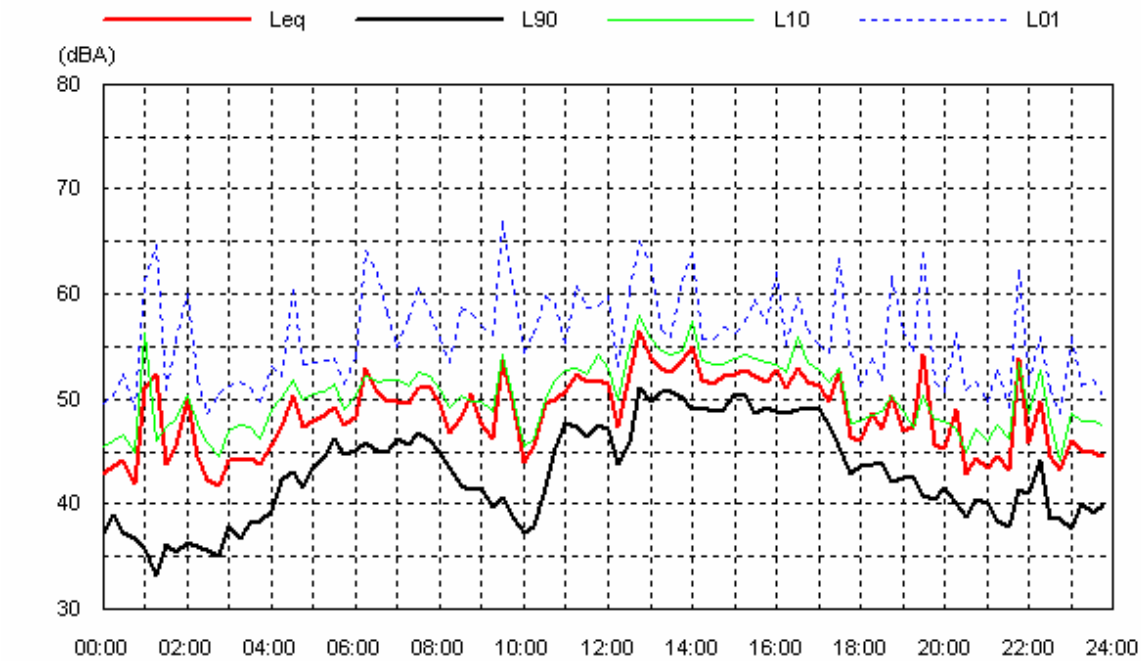
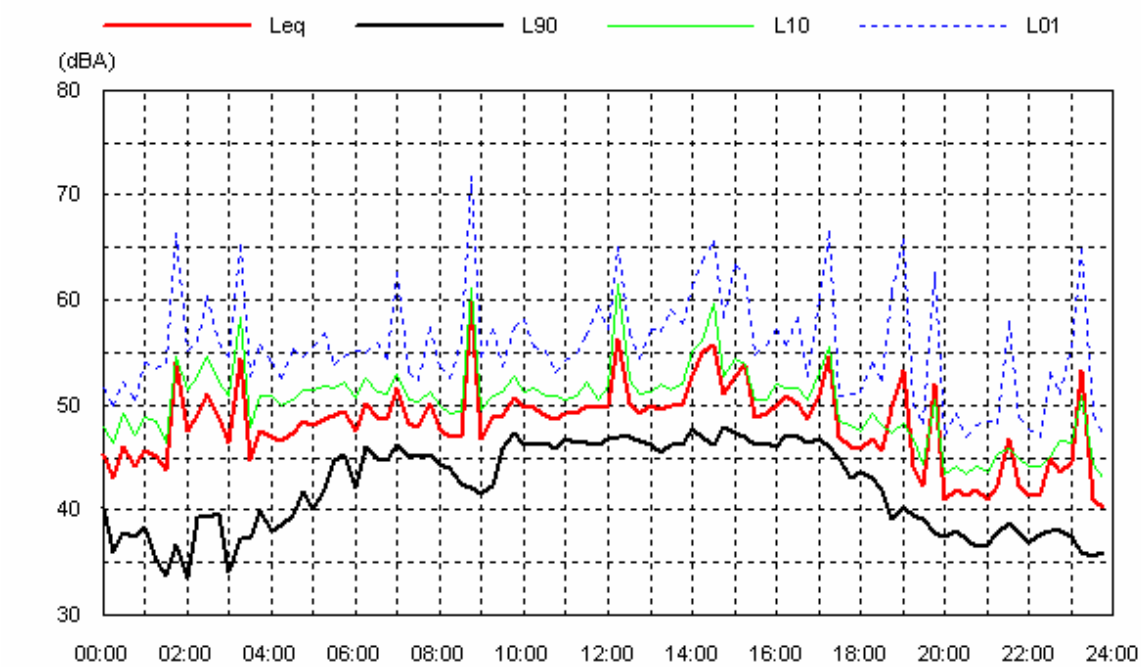


Fri 21 May 10

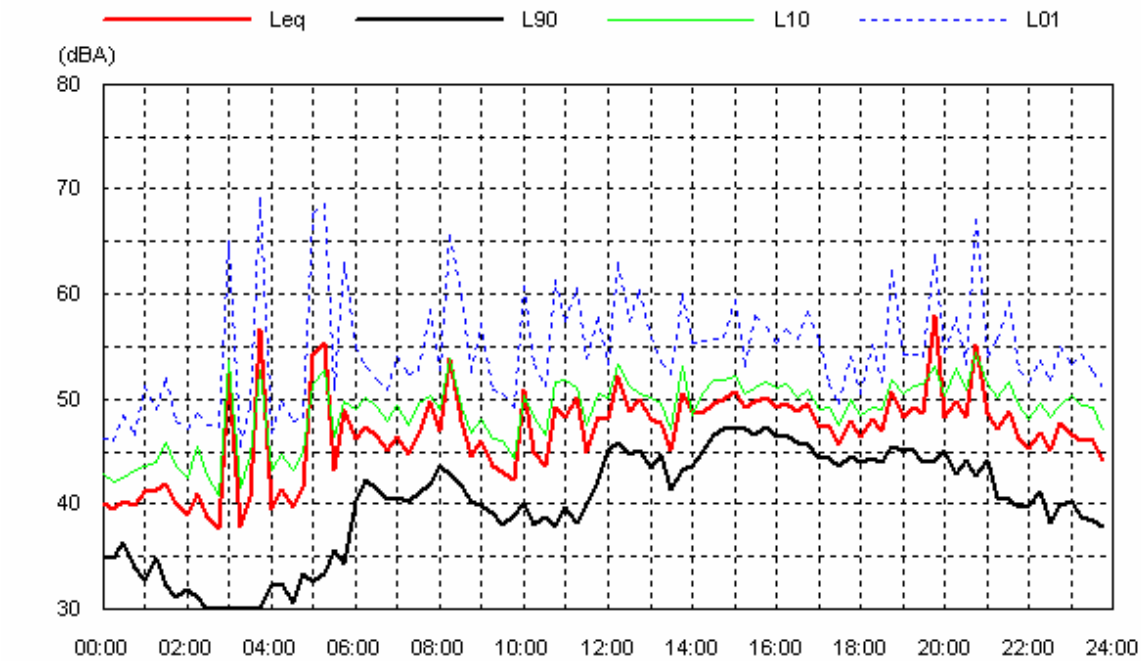


Location: 6 Moreton St

Sat 22 May 10

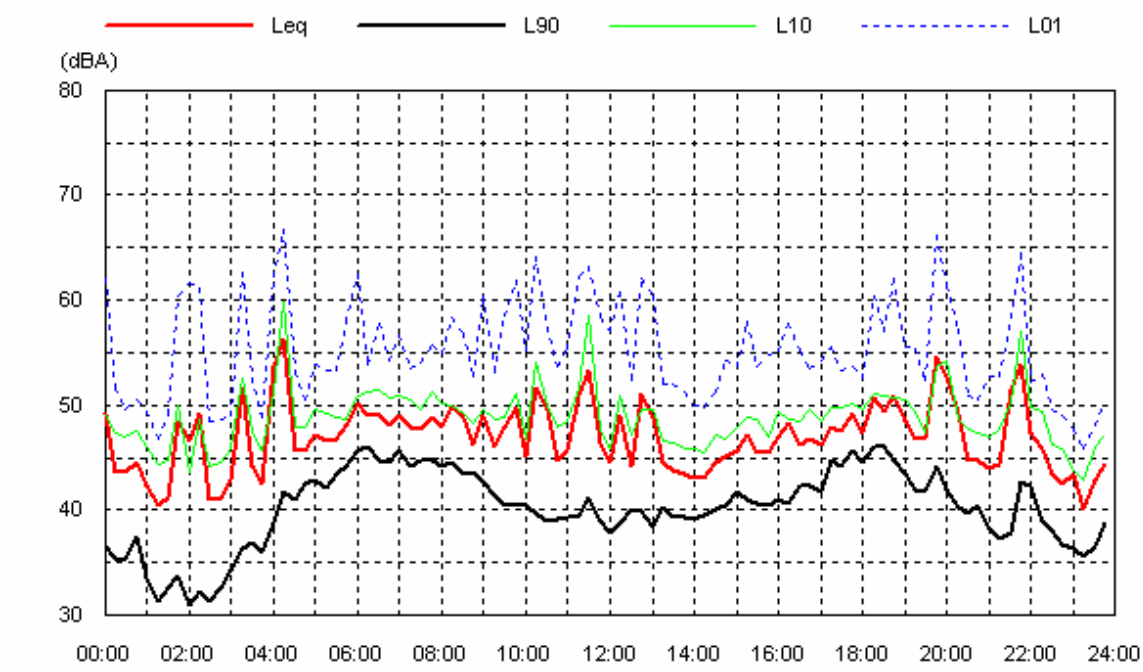


Sun 23 May 10

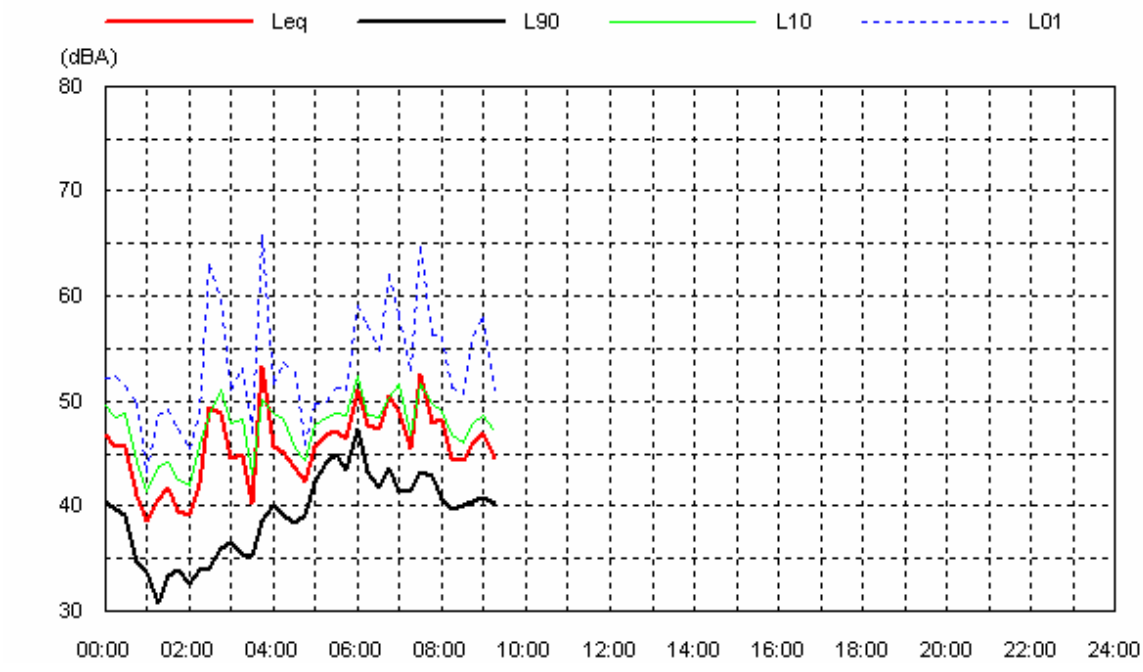


Location: 6 Moreton St

Mon 24 May 10

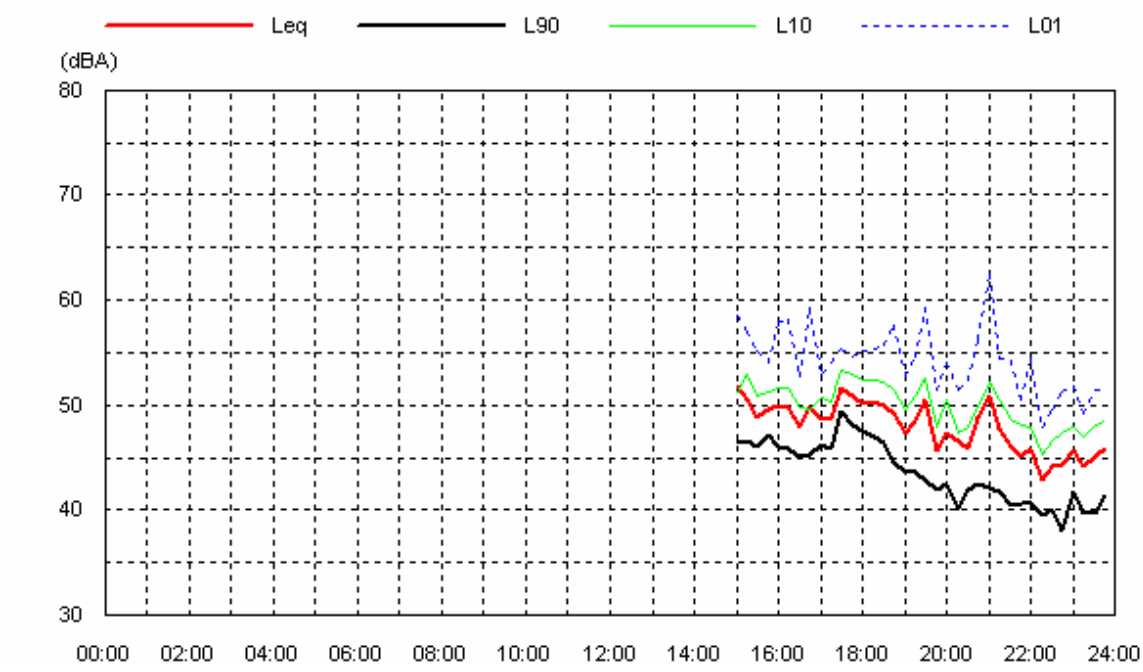


Tue 25 May 10

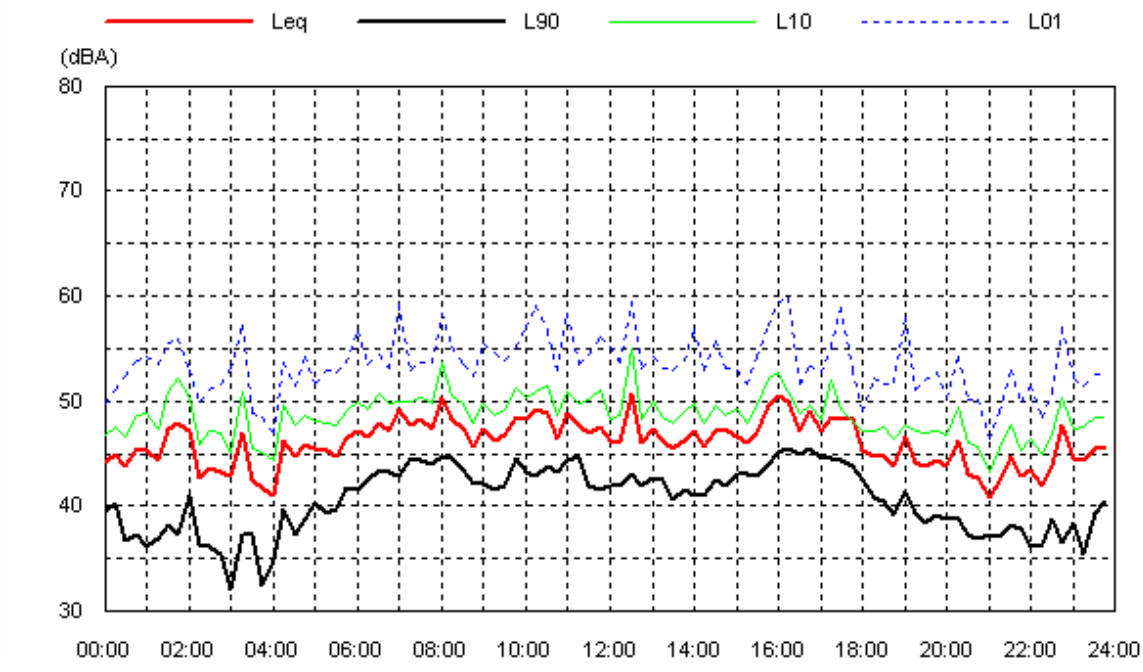


Location: Duggan St

Fri 14 May 10

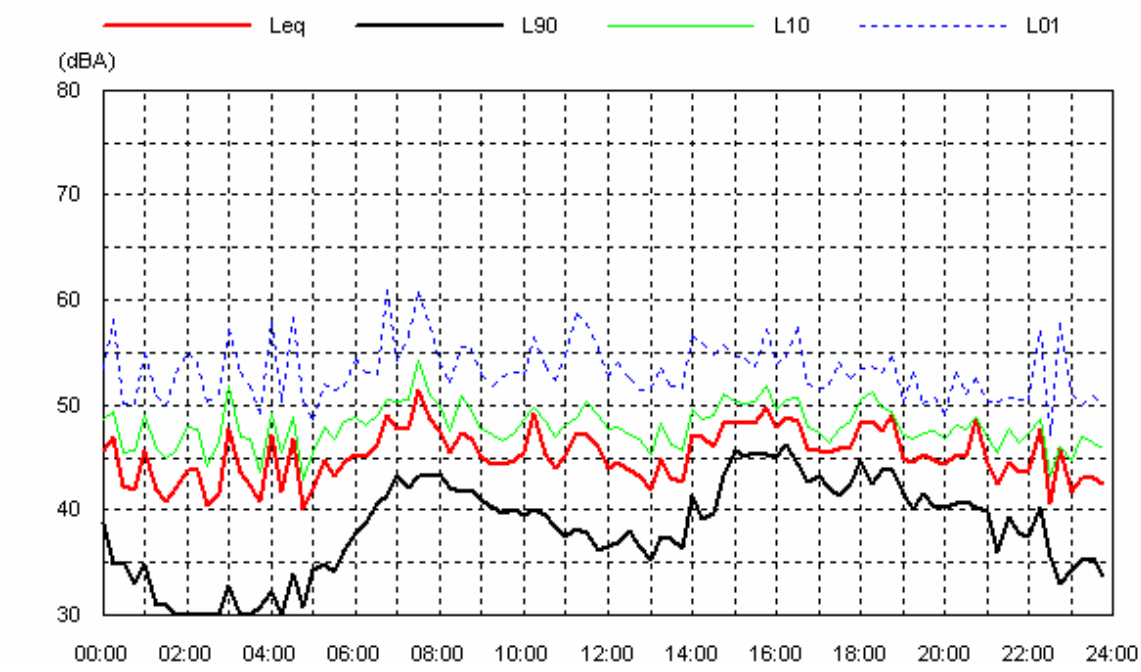


Sat 15 May 10

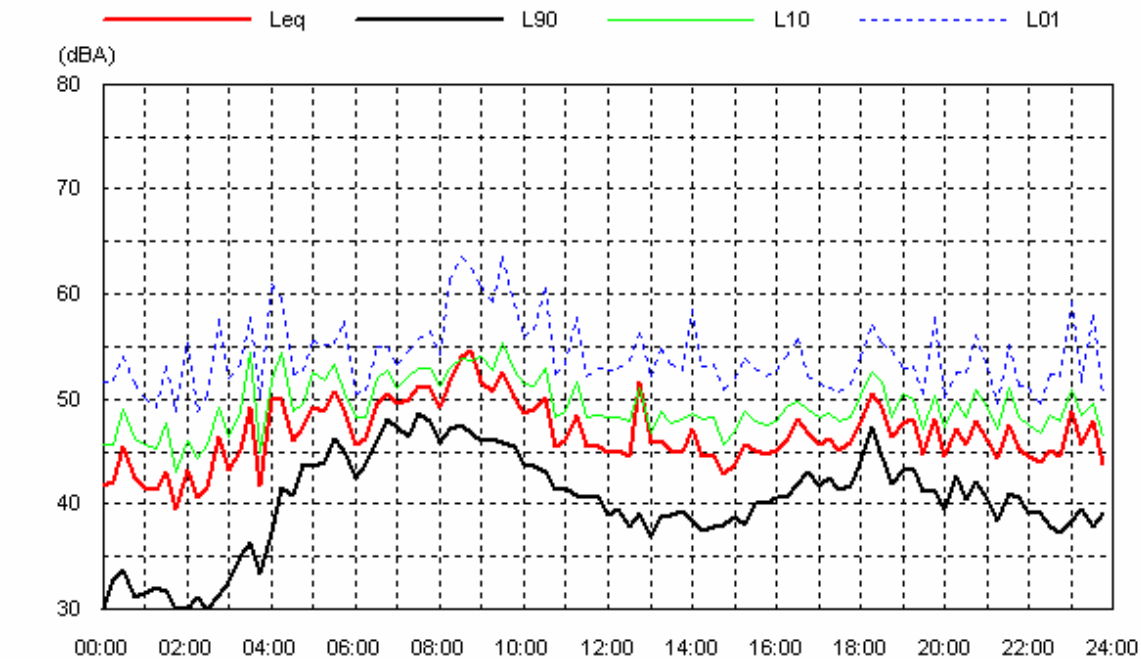


Location: Duggan St

Sun 16 May 10

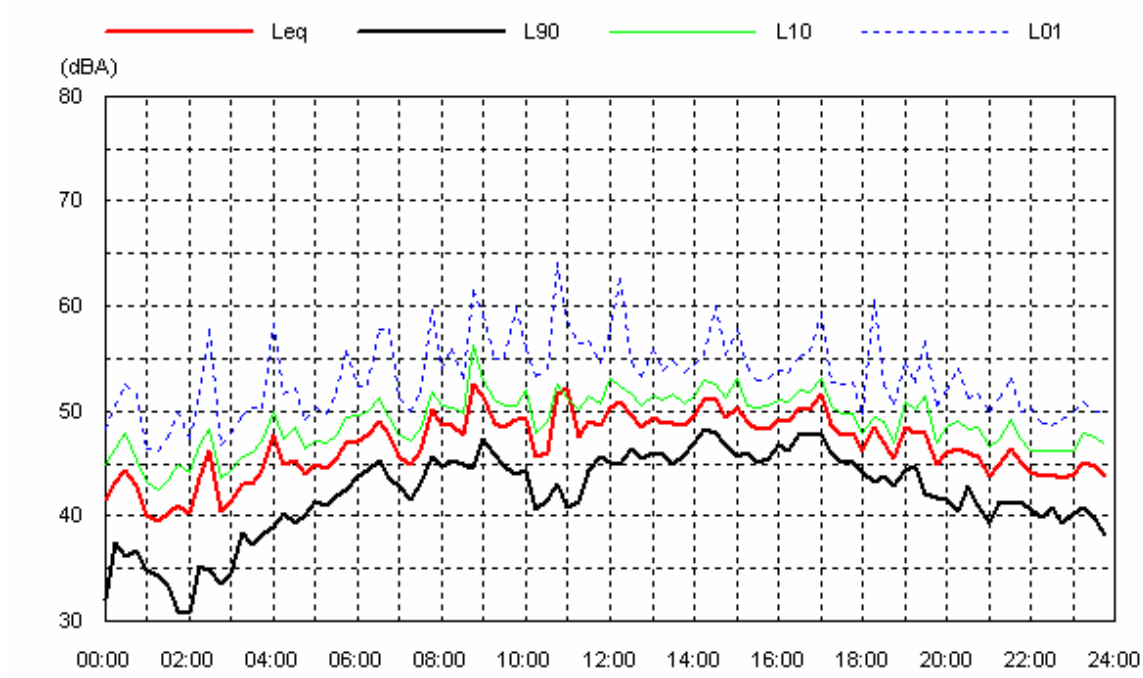


Mon 17 May 10

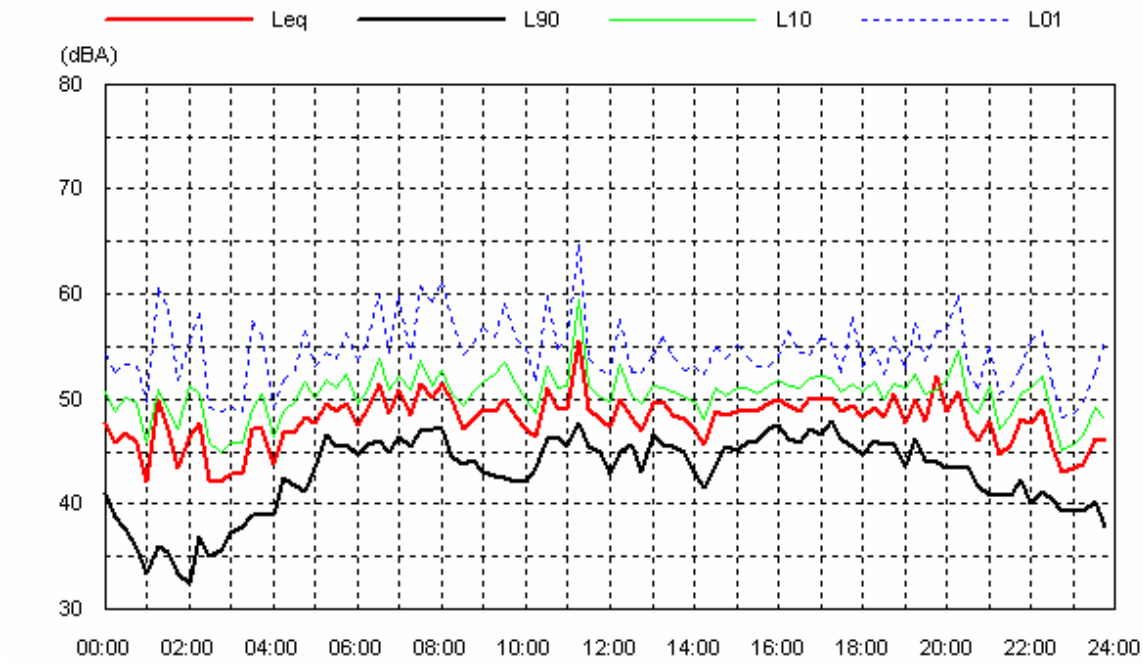


Location: Duggan St

Tue 18 May 10

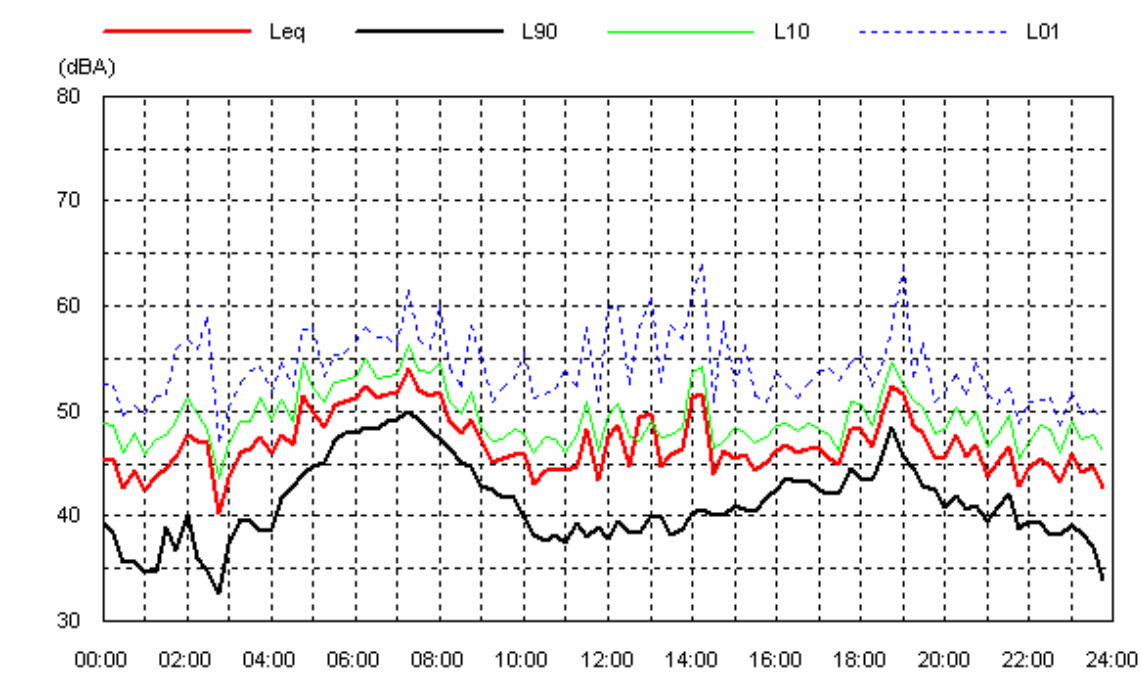


Wed 19 May 10

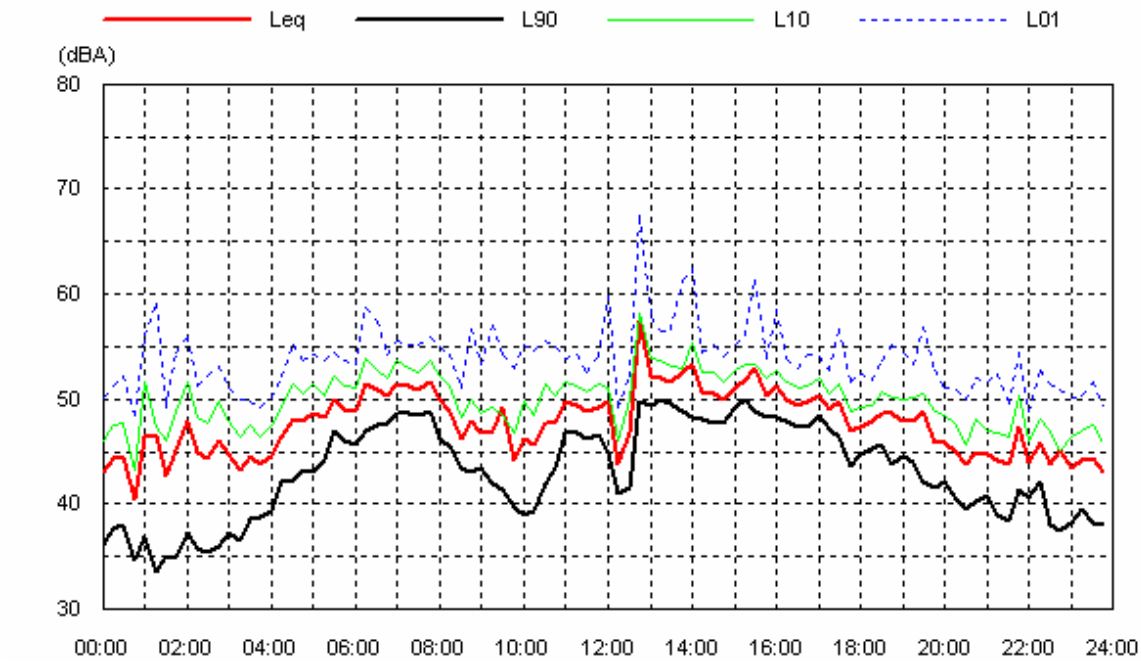


Location: Duggan St

Thu 20 May 10

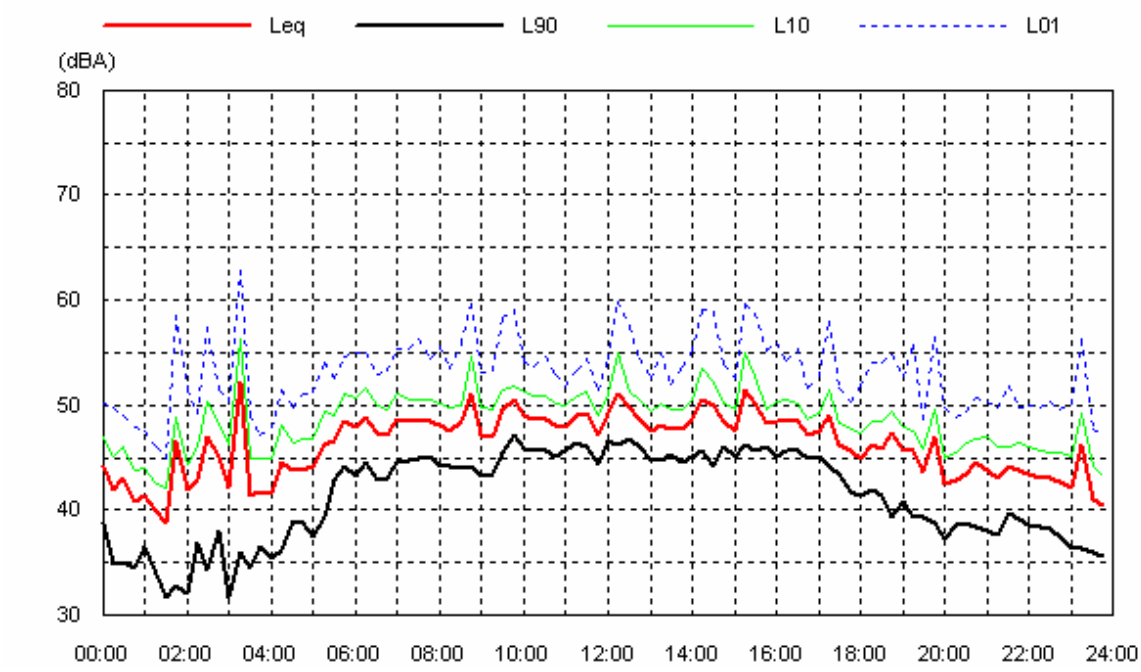


Fri 21 May 10

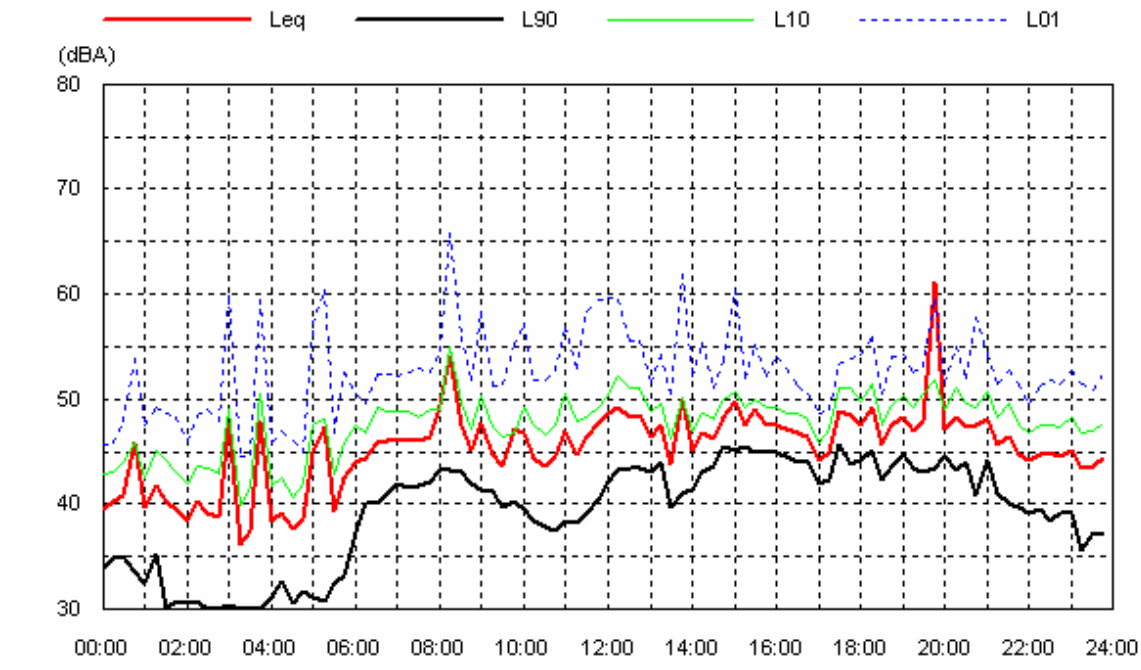


Location: Duggan St

Sat 22 May 10

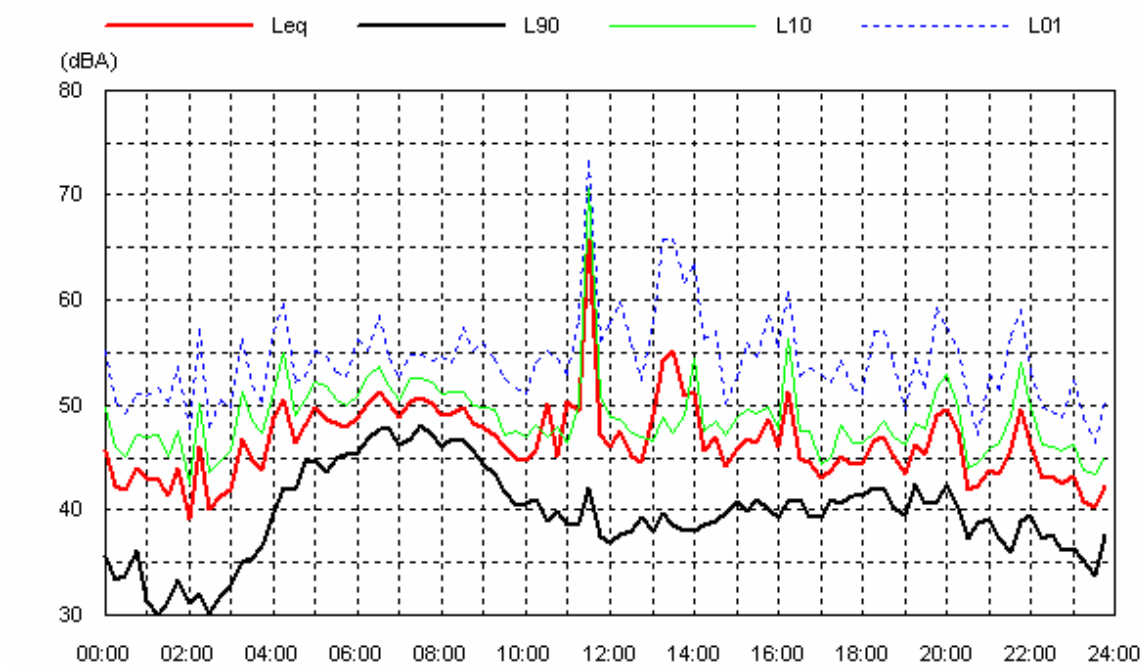


Sun 23 May 10



Location: Duggan St

Mon 24 May 10



Tue 25 May 10