Royal North Shore Hospital electrical substation noise impact assessment

July, 2008

Energy Australia

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Executive summary

This report has been prepared by Parsons Brinckerhoff (PB) on behalf of Energy Australia (EA) to assess the potential noise levels of the proposed 132/11 kV Transformer substation at Royal North Shore Hospital substation at Reserve Road, St Leonards, NSW.

Land use surrounding the proposed substation site includes private and public hospital buildings to the south, and south east, North Sydney TAFE to the west, a multi storey car park to the east and commercial buildings to the north.

To meet increased demand from the Royal North Shore Hospital redevelopment, EA propose to install an electrical substation with two 132/11 kV transformers and two kiosks and associated ancillary plant located in an open configuration within the hospital grounds.

Existing baseline noise levels were measured through attended and unattended monitoring at the nearest potentially affected receptors to characterise the ambient noise environment.

Based on *Environmental Noise Control Manual* (NSW EPA (ENCM), 1994) guidance, and measured noise levels a day time construction noise goal of 63 dB(A) L_{A10} was established.

Potential exceedance of the construction noise goal of up to 12 dB(A) L_{A10} at the nearest potentially affected receptors have been determined for peak demolition works. Peak construction noise levels are not expected to occur throughout the construction work programme and are indicative of short term intensive works.

Potential received construction ground borne vibration is expected to be compliant with the *Department of Environment and Climate Change, Environmental Noise Management Assessing Vibration* guidelines (2006).

A range of construction noise and vibration management measures, adopting principles of Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA), have been proposed to ensure feasible and reasonable measures are taken to reduce received noise levels.

For the operation of the proposed substation noise design objectives were established from the monitored existing baseline noise environment. The NSW Industrial Noise Policy (INP) guidance has been applied in determining an external hospital amenity noise design goal of 42 dB(A) $L_{Aeq,\ 15min}$ and an internal criteria of 35 dB(A) $L_{Aeq,\ 15min}$. An internal noise goal of 35 dB(A) $L_{Aeq,\ 15min}$ was established for North Sydney TAFE adjacent the substation site, for the nearest commercial receptor a noise goal of 65 dB(A) $L_{Aeq,\ 15min}$ was adopted.

An operational predictive noise impact model was established using SoundPLAN Version 6.5 software. Indicative worst case ODAF noise emissions were adopted. Received noise levels at the nearest potentially impacted hospital, TAFE and commercial receptors were within the adopted noise goals.

1. Introduction

Parsons Brinckerhoff (PB) has been commissioned by EnergyAustralia (EA) to assess noise impact potential from the proposed Royal North Shore Hospital substation at Reserve Road, St Leonards, NSW.

The Department of Health has obtained a concept approval for the Royal North Shore Hospital redevelopment under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). In accordance with this concept approval the Department of Health will do a Project Submission for the substation development (on behalf of EnergyAustralia) to the Department of Planning. This Project Submission includes an environmental assessment to identify the potential environmental impacts associated with the proposal.

This noise impact assessment has been prepared for inclusion in the environmental assessment.

1.1 Scope

The scope of works for this study was to undertake a noise assessment to determine potential noise impacts associated with the construction and operation of the Royal North Shore Hospital substation. The assessment included:

- identifying noise catchment areas, potentially affected receivers and existing noise generating activities
- undertaking attended (day time) and unattended noise monitoring at the nearest potentially affected receptors to the proposed construction and operational locations
- establishing project specific noise design objectives and construction noise goals based on monitored existing noise levels
- undertaking predictive construction and operational noise impact assessments for the nearest potentially affected receptors
- undertaking a qualitative road traffic noise impact assessment for proposed construction traffic and transport routes
- where construction and operational noise criteria are likely to be exceeded, environmental noise control options/management practises are recommended.

2. Site description and proposal details

2.1 Site description

As detailed in Figure 2-1, the proposed substation is located in St Leonards, North Sydney, NSW within the existing hospital complex, Reserve Road.

Land use surrounding the proposed substation site includes private and public hospital buildings to the south, and south east, North Sydney TAFE to the west, hospital multi storey car park to the east and commercial buildings to the north.

The existing noise environment is influenced primarily by hospital ventilation plant and local traffic within the hospital car park.

2.2 Operational proposal

EA propose to install an electrical substation with two 132/11 kV transformers and two auxiliary transformer kiosks (800 kVA) and associated ancillary plant located in an open configuration.

Figure 2-1 details the proposed substation development.

The substation is proposed to operate on a 24hr, 7 day a week basis where, dependent upon potential network demand, it is understood 3 operational performance scenarios would be required. Dependent upon the required transformer load, the scenarios require varying operation of plant for the purpose of cooling, summarised as follows:

- ONAN – oil natural, air natural (normal operation)
- ODAN – oil direct, air natural
- ODAF – oil direct, air forced (peak operation).

Oil cooling is delivered through the operation of an oil pump and the air cooling from a fan unit. The substation proposal provides one oil pump and one fan unit per transformer.

2.3 Construction proposal

The delivery of the infrastructure required for the proposed substation requires construction works in both fixed and temporary locations.

The construction of the substation is expected to include implementation of standard practises in the construction of building structures and installation of required infrastructure. The transformers will be delivered to the site and directly installed.

The construction programme is to be approximately 40 weeks in duration. Noise intensive works such as demolition of existing structures, civil works and infrastructure installation are likely to be less than 26 weeks in duration.

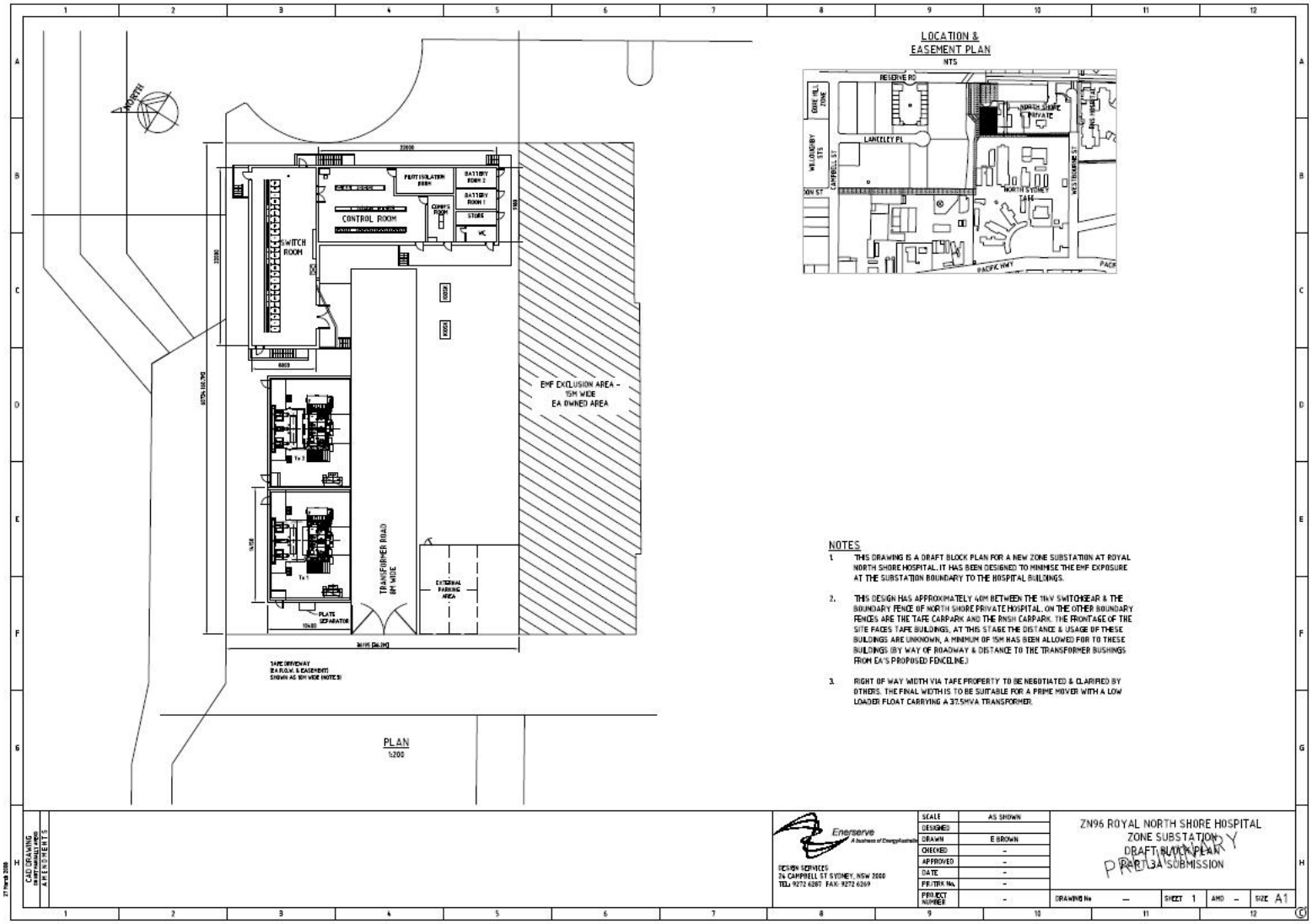


Figure 2-1 Schematic of proposed electrical substation

3. Existing noise environment

3.1 Noise monitoring methodology

This section presents the results of background noise measurements carried out in the study area. The results have been used to develop existing background noise profiles and establish project-specific noise emission design objectives.

Noise measurements were carried out using a RION NA27 Precision Sound Level Meter (operator attended noise monitoring) and Acoustic Research Laboratories statistical environmental noise loggers, type EL-316 (long-term unattended noise monitoring). The instrument sets comply with AS 1259.

Instrument sets were calibrated by a NATA accredited laboratory within two years of the measurement period. Copies of the instrument set calibration certificates have been included in Appendix C.

Microphones were positioned 1.2 metres above ground level and were fitted with windsocks. Each instrument was calibrated before and after the measurement period to ensure the reliability and accuracy of results. No significant variances were observed.

3.1.1 Unattended noise monitoring

The unattended noise monitor was established within the hospital grounds adjacent the boundary with North Sydney TAFE. Continuous 15 minute statistical measurements were obtained from Thursday 29 May to Tuesday 10 June 2008.

The measurement location was selected to be representative of the existing noise environment and to be secure and accessible.

Background noise levels measured with the environmental noise loggers are influenced by all local noise sources. The noise profiles should be viewed in conjunction with attended noise measurements and comments.

3.1.2 Attended noise monitoring

The instrument was set on A-weighted, fast response and statistical noise levels were logged over fifteen minute statistical intervals. Observations were recorded during the measurement interval during attended noise monitoring. Attended monitoring was undertaken at the noise logger location and within the hospital car park area to assist in the determination of existing industrial and road traffic noise influences.

Attended noise monitoring was carried out during the day time period on Tuesday 10 June 2008.

3.1.3 Noise monitoring locations

Noise monitoring locations were selected with respect to the proposed substation site; accounting for construction and operational phases of the proposal.

Location 1: western (TAFE) boundary

At the western site boundary adjacent North Sydney TAFE attended and unattended noise monitoring was undertaken. The location is indicative of ambient noise environment in proximity to the proposal site.

An ARL Type 1 noise logger (serial number 16-203-502) was established at this location.

Location 2: car park area

At this location attended noise monitoring was undertaken, the monitoring location was considered indicative of ambient noise profiles adjacent the northern façade (closest hospital receptor) of the private hospital complex.

3.2 Meteorological data

Hourly meteorological data was obtained from the nearest Bureau of Meteorology operated all-weather stations (Fort Denison, station number 066022 and Observatory Hill, station number 066062) to the noise monitoring location.

Review of meteorological data for the monitoring period indicated inclement conditions, as a result of precipitation and wind speeds above 5 m/s, were present approximately 37% of the time. Inclement meteorological conditions have been shown as shaded on the compiled daily noise logger graphs (Appendix B).

The presented unattended noise data in Section 4 has been filtered for adverse conditions.

Attended noise measurements, carried out on 10 June 2008, were undertaken during satisfactory meteorological conditions.

3.3 Measured Noise Levels

For the survey period 29 May to 10 June 2008, the results of the background noise monitoring are presented in Table 3-1.

The unattended monitoring should be considered in conjunction with operator observed noise influence during attended noise measurements, as detailed in Table 3-2.

Table 3-1 Unattended noise monitoring results (western site boundary adjacent North Sydney TAFE)

Date	Day (7 am – 6 pm)		Evening (6 pm – 10 pm)		Night (10 pm – 7 am)	
	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}
Median	**59**	**53**	**55**	**52**	**55.5**	**52**

Notes: Values expressed as dB(A); dB(A) = decibels, A-weighted;
L_{Aeq} = equivalent continuous (energy average) A-weighted sound pressure level;
L_{A90} = A-weighted sound pressure level exceeded for 90 percent of the time (background); All values rounded to nearest 0.5 dB(A)

The collected data indicated the local noise environment being primarily influenced by constant noise sources. The background L_{A90} noise descriptor did not vary significantly between day time, evening and night time periods. Median background noise levels varied by only 1 dB(A) between daytime and night time periods.

Noise data collected during inclement meteorological conditions has been excluded in the calculation of daily median L_{Aeq} and L_{A90} noise levels.

The median L_{Aeq} and L_{A90} noise levels have been adopted to determine project specific noise design goals, detailed in Section 4.

The results of the day time attended noise monitoring undertaken on 10 June 2008 are provided in Table 3-3.

Table 3-3 Attended measured noise levels (day time)

Location	Time	L_{Aeq}	L_{A90}	L_{A10}	Comments
Western Boundary (adjacent North Sydney TAFE)	12:00	55	52	57	local traffic in hospital car park 58 – 60 hospital ventilation plant 51 – 52 (SS)
car park South of proposed substation site	12:20	54.5	51	56	local traffic in car park 52 – 57 aircraft pass over 57 – 65 hospital ventilation plant 50 – 51 (SS)

Notes: Values expressed as dB(A), to nearest 0.5dB;
L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
L_{A90} Noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).
S.S. Steady state measurement made in the presence of minimal influences to noise levels.

Hospital ventilation plant operating continuously during attended noise monitoring was identified as the primary influence on background noise profiles. Local traffic within the hospital parking area was observed as sporadically influencing the L_{Aeq} descriptor.

Noise monitoring locations and the nearest potential affected receptors are indicated in Figure 3-1.

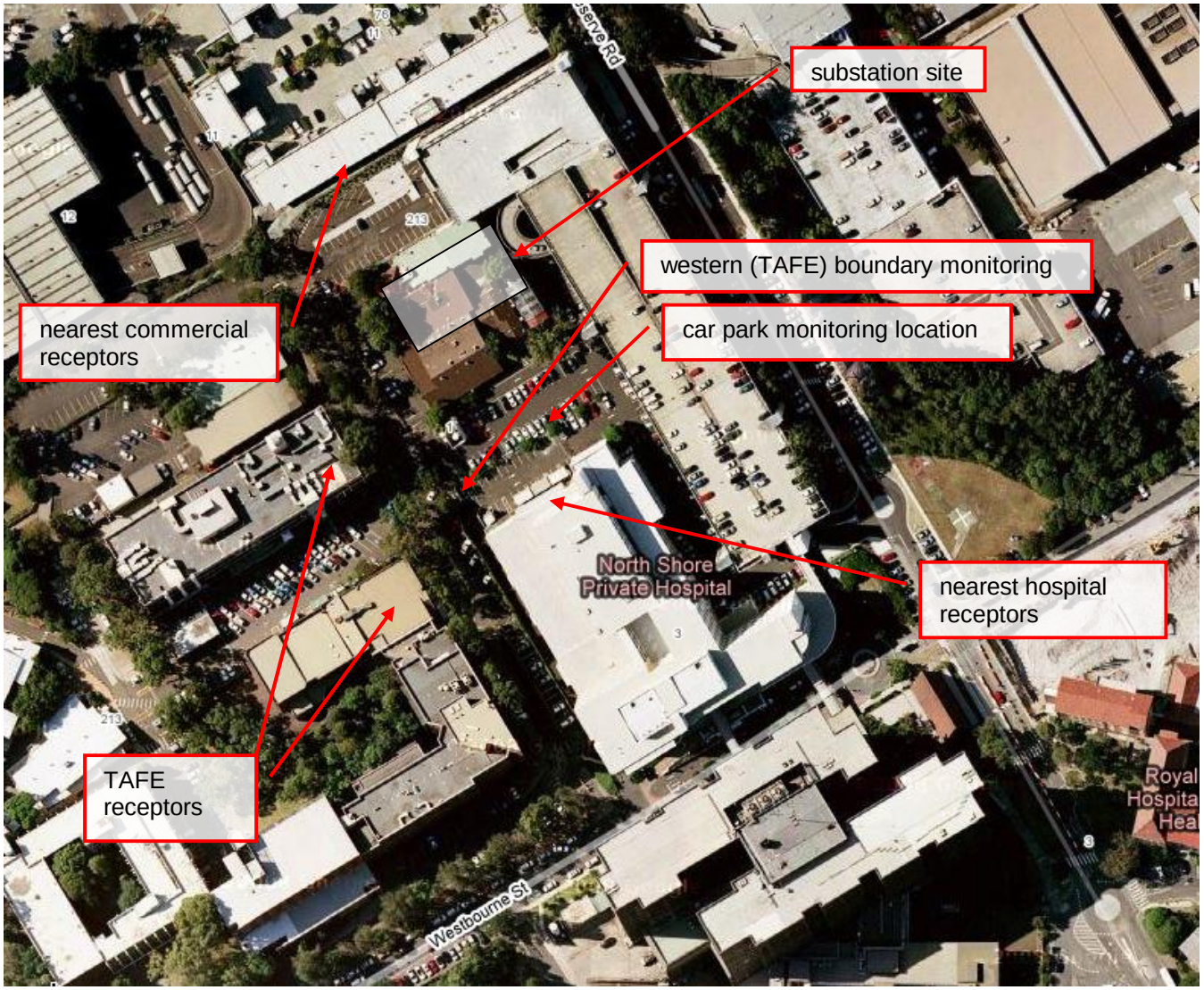


Figure 3-1 Noise monitoring and receptor locations

4. Adopted noise criteria and guidelines

4.1 Overview

The *Protection of the Environment Operations Act, 1997* (POEO Act) regulates noise generation and prohibits the generation of "offensive noise" as defined under the Act.

In addition to the regulatory requirements under the POEO Act, the Department of Environment and Climate Change (DECC) provides guidelines regarding acoustic criteria and noise controls.

4.2 Construction noise

Noise criteria for construction sites have been established in accordance with Chapter 171 of the *Environmental Noise Control Manual* (NSW EPA (ENCM), 1994). The acoustic design objectives for construction are presented in Table 4-1. The recommended criteria are planning goals only.

The potential noise impacts from construction works should be assessed with respect to additional factors such as the social benefits of the activity, economic constraints, and the nature and duration of the proposed construction program.

The DECC recognise that individuals accept higher perceived noise impacts for emission sources with a limited duration and an identified end date.

Table 4-1 Acoustic design objectives for construction activities

Construction period	Acoustic design objective
<4 weeks	Received $L_{A10} \leq L_{A90}$+ 20 dB(A)
>4 weeks and <26 weeks	Received $L_{A10} \leq L_{A90}$ + 10 dB(A)
>26 weeks	Received $L_{A10} \leq L_{A90}$ + 5 dB(A)

Note: L_{A10} = Noise level 10% of time

L_{A90} = Noise level 90% of time (background).

Source: EPA 1994.

The period for substation civil and installation noise generating construction works will each be approximately 26 weeks in duration, as such an adopted construction noise goal at the nearest potentially impacted receptors has been determined from the addition of 10 dB(A) to the measured day time L_{A90} noise level of 53 dB(A) at the TAFE Boundary. Construction works shall be subject to an adopted noise goal of **63 dB(A) L_{A10}**.

4.3 Operational noise

Noise emissions from the operation of the proposal would require adherence to the NSW *Industrial Noise Policy* (NSW EPA (INP), 2000).

The policy sets out two criteria that are used to assess potential off-site noise impacts. The first aims to control intrusive short-term noise impacts for residences (intrusive criterion), while the second aims to maintain the long-term amenity of particular land uses (amenity criterion). The more conservative of the two limits are established as project-specific operational noise goals.

The relevant intrusive criterion can be summarised as follows:

- $L_{Aeq\ (15\ min)} \leq$ rating background levels + 5 dB(A).

The rating background level is the background level representing the day, evening and night periods determined over the noise monitoring period.

The amenity criterion is determined based on guidelines presented in the INP (EPA 2000). The acceptable amenity limits for an urban area are listed in Table 4-2.

Table 4-2 NSW INP amenity criteria –urban environment

Type of receptor	Period of day/day of week	Acceptable noise level (L_{Aeq})
Hospital ward — internal	Noisiest one hour period	35 dB(A)
— external	Noisiest one hour period	50 dB(A)
School classroom — internal	Noisiest one hour period when in use	35 dB(A)
Commercial premises	When in use	65 dB(A)
Boundary	All periods	

Note: L_{Aeq} = Equivalent noise level (average).

Source: Table 2.1 NSW EPA INP.

The amenity criterion is established with reference to the L_{Aeq} noise levels for the area and the existing industrial noise influence. The amenity criterion is then corrected with reference to Table 2-2 of the INP (EPA 2000).

4.3.1 Adopted operational noise criteria

The rating background noise levels have been determined from the unattended noise monitoring carried out at the western site boundary. Industrial noise from ventilation plant was observed as the primary influence on existent noise levels. Table 4-3 details the adopted intrusive and amenity noise criteria. The noise design goals have been established to minimise potential degradation of the local ambient noise environment.

Table 4-3 Adopted noise criteria

Location	Period	Measured		Noise design goal L_{Aeq}		
		L_{Aeq}	L_{A90}	Intrusive limit	Amenity limit	Adopted criteria
Hospital ward — internal	Noisiest one hour period			40	35	**35**
Hospital ward — external	Noisiest one hour period	55	52	57	50	**42**
School classroom — internal	Noisiest one hour period when in use	59	53	58	35	**35**
Commercial premises	When in use			58	65	**58**

Note: Values expressed as dB(A)

The external hospital ward noise criteria has been adjust from a measured L_{A90} of 52 dB(A) in accordance with Table 2-2 of the INP.

The proposed substation is expect to operate a 24 hour per day schedule, as such the night time (10pm – 7am) period, when the noise environment is most sensitive, has been considered indicative of the worst case for hospital receptors. The operation of the substation shall be subject to an adopted hospital external amenity noise design goal of **42 dB(A) $L_{Aeq, 15min}$**.

Noise levels from operation of the substation at North Sydney TAFE should not exceed the adopted daytime noise goal of **35 dB(A) $L_{Aeq, 15min}$** for internal noise levels.

Substation boundary noise levels should not exceed 70 dB(A) and a noise design goal of 65 dB(A) $L_{Aeq15min}$ would apply at the nearest commercial premises to the proposed substation. It is considered that compliance with the adopted noise design goals would preserve the acoustic amenity of the surrounding environment.

4.4 Road traffic noise

The construction works associated with the proposed substation would require the use of vehicles to facilitate the removal of demolition material and the delivery of substation components, construction equipment and staffing throughout the construction programme.

Road traffic noise goals have been considered as part of the construction and operation noise impact assessment. The ECRTN (NSW EPA, 1999) recommends 'base' and 'allowance' goals.

The recommended 'base' goals for land use developments with the potential to create additional traffic on collector and arterial roads are base goals of daytime $L_{Aeq, 1hr}$ levels of **60 dB(A)**, and night-time $L_{Aeq, 1hr}$ levels of **55 dB(A)**.

The 'allowance' goals are generally established where the 'base' goals are already exceeded. In such circumstances, traffic arising from a development should not lead to an increase in existing noise levels of more than 2 dB.

4.5 Vibration

Two main issues can be present in relation to vibration levels from construction and operational activities: disturbance to residents from intermittent vibration resulting from activities such as heavy vehicle passage; and potential architectural/structural damage to off-site buildings.

Human comfort and structural damage limits vary across the frequency spectrum, although they are generally a constant level across the frequency range generated by most construction activities. Generally, if disturbance issues are controlled, there is limited potential for structural damage to buildings.

4.5.1 Annoyance/human comfort

The NSW Department of Environment and Conservation (now DECC) *Environmental Noise Management Assessing Vibration*: a technical guideline (2006) provides recommendations for vibration goals from continuous, impulsive and intermittent sources. Construction works associated with the proposal have potential vibration sources including the daytime movement of heavy vehicles, and operation of excavators. This type of vibration is assessed on the basis of vibration dose levels. Acceptable vibration levels are outlined in Table 4-4.

Table 4-4 Acceptable vibration dose levels for intermittent vibration ($m/s^{1.75}$)

Location	Daytime [!]	
	Preferred value	Maximum value
Residences	0.20	0.40
Offices	0.40	0.80

Notes: Daytime is the period between 7 am and 10 pm.

Sources: BS 6472-1992.

4.5.2 Structural damage

Although not specified by DECC, German Standard DIN 4150: Part 3-1986 provides guidance on vibration velocity for evaluating potential structural damage. Limits range from 5 millimetres per second (mm/s) (< 10 hertz (Hz)), 5-15 mm/s (10-50 Hz) and 15-20 mm/s (50-100 Hz) at the foundation for a residential dwelling. At the uppermost storey floor plane, a vibration limit of 15 mm/s is applicable for a residential dwelling.

5. Construction noise and vibration assessment

Assessment of potential noise and vibration impacts associated with the construction of the proposed substation has been undertaken.

At the time of assessment the full construction program had not been finalised. As such, where deemed necessary, experience and knowledge of construction practises and standard construction techniques and plant have been applied to the modelled scenarios.

5.1 Construction period

The complete construction programme for the substation is expected to take approximately 40 weeks, including civil work for site preparation, building demolition, ground clearance and foundation excavation and an installation phase for the substation infrastructure. It has been assumed that the nature of the works programme would facilitate civil and infrastructure works to occur concurrently following demolition works.

The noise intensive construction phases are expected to be approximately 26 weeks in duration; all works are proposed to be undertaken during daytime hours Monday to Friday (7 am – 6 pm) and Saturdays (7 am – 1 pm). No construction works would be undertaken at any time either on Sundays, Saturdays after 1 pm or public holidays.

Should the project require construction activities to be undertaken outside of standard construction hours, approval would be sought.

5.2 Construction source noise levels

Source noise levels for plant and equipment required for the construction phases have been directly applied to the noise prediction assessment. Table 5-1 details the sound power levels for typical equipment associated with the construction methodologies.

Table 5-1 Construction plant sound power levels

Generic plant			
Source	**SWL (L_{Aeq})**	**Source**	**SWL (L_{Aeq})**
Mobile crane[1]	98	Excavator with Rock breaker[2]	118
Front end loader[2]	86	Generator[1]	90
20T excavator[2]	100	Truck[1]	102
Backhoe[1]	85	Forklift[1]	98
Dump truck[3]	83	Hand tools[1]	98

Notes: Values expressed as dB(A), to nearest 0.5 dB(A)

1 Australian Standard AS 2436 – 1981

2 PB database

3 RTA Noise Management Manual (RTA 2001).

5.3 Construction noise catchment zones

To facilitate the prediction of potential noise impacts from construction works, receptors have been categorised in noise catchment zones:

- Hospital receptors 40 - 60 metres south of the proposed substation site
- TAFE receptors 30 – 80 metres west and south west of the site
- commercial receptors within 60 - 70 metres north of the site.

5.4 Construction noise assessment

Construction noise impact assessment has been undertaken for the worst case 15-minute period assuming dominant noise generating plant in cumulative operation.

Where concurrent civil works and infrastructure works are considered to occur the dominant noise generating activity has been considered to be the primary influence to received noise levels.

Given the nature of the local environment and distances between noise source and receiver, noise impact assessment can be undertaken through the application of the following noise propagation relationship:

- $SPLreceived = SWLsource - 20\log(r) - 8$

Where *SPL received* is the received sound pressure level, *SWL* is the source sound power level and *8 dB* is a constant, applied for the loss of acoustic energy resultant from hemi-spherical radiation of noise from a point source and atmospheric attenuation.

All construction plant and equipment has been treated as point noise sources where the intervening topography between source and receivers is uniform. A 3 dB addition has been applied to predicted noise levels to account for the variation between L_{Aeq} and L_{A10} noise descriptors.

The predicted construction noise levels are detailed in Table 5-2. Comparison with construction impact design goals has been undertaken. The predictive noise modelling is indicative of noise levels received during the most intensive period of construction works.

Table 5-2 Substation predicted construction noise impacts

Substation construction works	Noise catchment zone	Construction L_{A10} noise impact dB(A)		
		Predicted	Criterion	Compliance
Demolition	Hospital	51 – 73	63	+10
	TAFE	49 – 75	63	+12
	Commercial	49 – 67	63	+4
Civil works	Hospital	51 – 55	63	Yes
	TAFE	45 – 58	63	Yes
	Commercial	45 – 51	63	Yes
Infrastructure installation	Hospital	52 – 56	63	Yes
	TAFE	49 – 58	63	Yes
	Commercial	50 – 52	63	Yes

Note: noise levels to nearest 1 dB(A)

Demolition noise levels may exceed the adopted noise goal by up to 12 dB(A) at the nearest TAFE receptors. These worse case levels are associated with operation of a rock breaker. Similarly rock breaker levels would exceed the adopted goal by 10 dB(A) at the hospital and 4 dB(A) at the nearest commercial receptors.

Construction noise levels for the civil works and infrastructure installation works have been predicted to be compliant with the construction noise goal at all of the potentially impacted receptors.

Received noise levels are indicative worst case operations for periods of intensive activity where all feasible plant would be in cumulative operation. Noise impacts of this nature are likely to occur for short term durations only.

It should be noted that predicted construction levels do not account for potential barrier effects resultant from site fencing or screening effects from completed building structures, such as the Control room and Switch room. Reductions of 10 dB(A) to received noise levels could be expected where ground level works are screened by buildings.

Construction noise management and mitigation techniques to reduce receive noise impacts have been recommended in Section 7.

5.5 Construction road traffic

Road vehicle requirements for the substation civil and installation construction works have been estimated for indicative worst case hourly L_{A10} levels from light vehicle and truck movements. Vehicle speeds of 50 km/h and hourly flows of 6 light vehicles and 4 heavy vehicles have been assumed. Construction works are day time (7am – 6pm) only activity.

In order to determine potential road traffic noise impacts, Calculation of Road Traffic Noise (CORTN, HMSO 1988) guidance has been applied. CORTN provides the following method for the determination of basic hourly road traffic noise level, for planning purposes:

Basic noise level hourly $L_{A10} = 42.2 + 10\log q$ (where q = hourly flow rate).

A correction factor addition is provided for the inclusion of heavy vehicles determined where V = velocity in km/h and p = percentage of heavy vehicles:

Correction; $33\log(v + 40 + {}^{500}\!/_{v}) + 10\log(1 + {}^{5p}\!/_{v}) - 68.8$

The basic noise level has been predicted to be 54 dB(A) $L_{A10,\ 1\ hour}$. At a distance of 20 metres between a given façade and the middle of the near side road carriage way, applying a CORTN distance correction, the basic noise level would be approximately 53 dB(A) $L_{A10,\ 1\ hour}$. This corresponds to an approximate received level of 50 dB(A) $L_{Aeq,\ 1\ hour}$ and below.

Hourly noise levels resultant from vehicle movements are predicted to be less than the ECRTN noise goal of 60 dB(A) $L_{Aeq,\ 1hr}$, despite the ECRTN goals applying to long term operational rather than during the short term construction phase.

Vehicle movements from the development are not considered significant when compared to existing traffic flows within the surrounding area.

5.6 Construction vibration assessment

The main source of construction vibration would be the excavation works required for ground clearance and site preparation. Received vibration levels are influenced by the specific construction equipment used, the geological conditions and generated vibration frequency spectrum.

Assessment of vibration impact has been undertaken qualitatively based on typical vibration levels for the operating construction plant, presented in Table 5-3 for reference. It is acknowledged that plant referenced may not be required for the substation construction works.

Table 5-3 Typical peak vibration levels for construction plant in operation

Plant	Peak vibration levels (mm/s)	
	10 metres	20 metres
Jack hammer	7	0.5
Roller (vibration off)	5	0.7

Note 1 PB database of attended source vibration levels

Typical vibration levels reported with specific geological conditions and frequency spectrum unknown

Adopted vibration guidance determined a perceptible residential vibration dose value (VDV) goal of 0.2 – 0.4 $m/s^{-1.75}$. Typically, where received vibration levels are within perceptible limits the commercial receptor perceptible goals of 0.4 – 0.8 $m/s^{-1.75}$ and DIN 4150 structural criterion of 5 – 20 mm/s are achieved.

For the purpose of this assessment, the PPV values in Table 5-3 are required to be converted to vibration dose values (VDV) for comparison to the adopted annoyance VDV

criteria. The following PPV to VDV relationship, as detailed in the DECC guidance, has been applied to determine the potential vibration impact of the excavation works.

$$eVDV = 1.4 \times (2\pi.8/1000) \times Vrms \times t^{0.25}$$

Figure 5-1 details the derived VDV received vibration levels.

The duration of the excavation activities at any given location has been assumed for a range of time periods (5 minutes – 1 hour); VDV levels have been calculated at 5 and 20 metres.

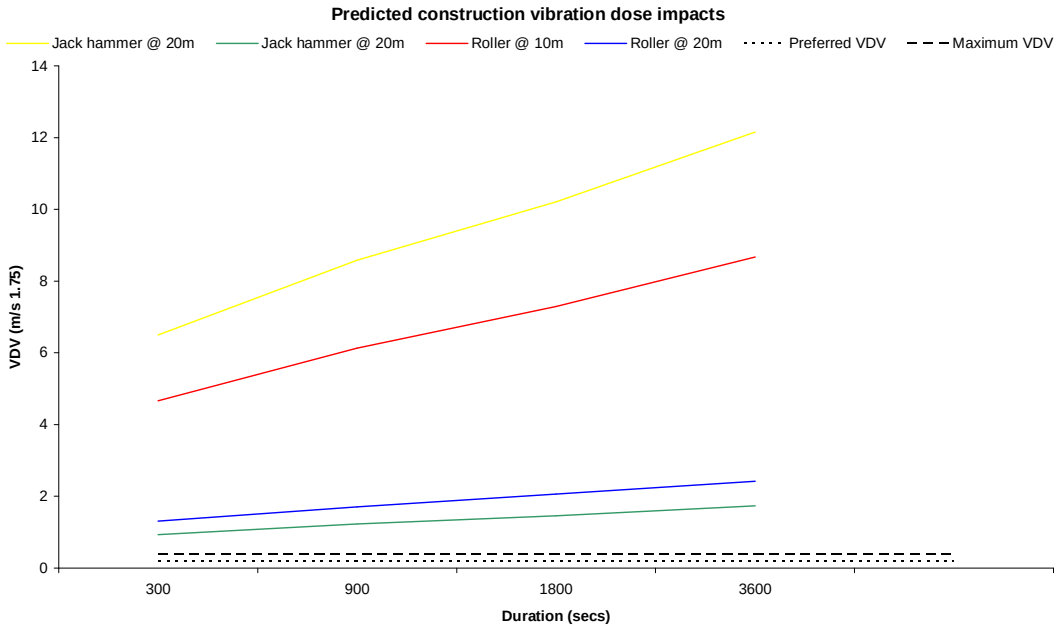


Figure 5-1 Predicted construction vibration dose impacts

Considerate of the required construction activity a separation distance of 30 metres has been adopted between the nearest potentially sensitive receptors and the proposed construction works. Referencing derived vibration VDV levels it is likely that receptor locations will not receive potential vibration impacts in exceedance of the acceptable annoyance or structural vibration criterion.

Vibration levels for the purpose of assessment have been determined where construction plant is continuously operational. It would be expected that plant will be operational intermittently; accordingly received vibration impacts would be expected to be reduced from those detailed in Table 5-3.

Any perceptible vibration impact at the nearest potentially affected receptors above the acceptable vibration dose levels is likely to occur intermittently over only a few hours duration.

To minimise the potential for exceedance of adopted structural vibration goals at the car park to the east of the proposed substation site, it is recommended that potential vibration generating construction work be undertaken at a distance greater than 10 metres from the nearest car park structures.

6. Operational noise assessment

6.1 Substation source noise levels

Noise source data has been provided by Energy Australia for the primary transformer noise sources associated with operation of the substation.

Adopted sound power levels (SWL's) are presented in Table 6-1.

Table 6-1 Measured source noise levels

Source	Guaranteed	Measured
37.5 MVA 132/11KV transformer (ONAN)	68	60.7
37.5 MVA 132/11KV transformer (ODAF)	68	67.5

Notes: Values expressed as dB(A)

ONAN (no pumps, no fans)

ODAF (pumps and fans)

The guaranteed SWL's have been adopted in this assessment. A single operational scenario was modelled to determine worse case impacts at the nearest potentially affected receptors.

There are no significant internal sources that have been modelled for operation of the substation switch and control rooms.

6.2 Operational noise model

An operational noise propagation model was established for the assessment of potential noise impacts from the substation operation at the nearest potentially affected receptors. Noise modelling was undertaken through the use of SoundPLAN noise propagation modelling software (Version 6.4). The modelling was based on the following:

- assumed uniform topography for the calculation study area
- adjacent structures digitised into the model
- ground coverage has been assumed to be non reflective
- the substation plant have been located as shown in Figure 2-1
- receptors have been established relative to the topography with receiver heights 1.2 metres above the ground, with an additional 2.8 metres for each storey for elevated receptors
- operational model runs reflective of the ODAF scenario
- model runs were performed accounting for neutral meteorological conditions (minimal separation distance from source to receiver would negate noise enhancing meteorological effects)
- CONCAWE industrial standard model parameters were applied

- no source adjustments were made for tonal or other modifying correction factors
- for internal receptors no adjustments were made for façade attenuation.

The transformers have been considered as area sources. Area sources display hemispherical propagation of noise and have been modelled accordingly. Barrier effects from intervening building structures have been included in the propagation model.

6.3 Operational noise impacts

Predicted operational noise impacts have been determined for the nearest potentially impacted receptors.

The following noise control zones have been determined for the nearest receptors.

- Hospital (existing and future) receptors 40 - 60 metres south of the proposed substation site
- TAFE receptors 30 - 80 metres west and south west of the site
- commercial receptors within 60 - 70 metres north of the site.

Tables 7-1 details predicted noise impacts within the noise catchment zones for the ODAF operational scenario. Potential noise impacts have been assessed to the adopted INP amenity noise design goals.

Impacts at ground level and elevated (3rd floor) locations have been provided.

Table 6-2 Predicted noise impacts – Configuration 1

Location	Predicted operational noise impacts (LAeq, 15min)		
	Adopted noise goal	ODAF[1]	Compliance
Hospital (existing ground level)	42 (external) 35 (internal)	31 (external) 23 (internal)	Yes
Hospital (existing elevated)	42 (external) 35 (internal)	32 (external) 24 (internal)	Yes
Hospital (proposed ground level)	42 (external) 35 (internal)	39 (external) 31 (internal)	Yes
Hospital (proposed elevated)	42 (external) 35 (internal)	40 (external) 32 (internal)	Yes
TAFE NE building (ground level)	35 (internal)	33	Yes
TAFE NE building (elevated)	35 (internal)	35	Yes
TAFE SE building (ground level)	35 (internal)	29.5	Yes
TAFE SE building (elevated)	35 (internal)	29	Yes
Commercial (ground level)	65	18	Yes
Substation Boundary	70	45	Yes

Notes: Values expressed as dB(A), to nearest 0.5 dB(A)

L_{Aeq} = Equivalent noise level (average). Soundplan predicted noise levels are external only

1. internal noise levels based on a 8dB correction for external to internal façade attenuation with windows less than 5% open.

With two 132/11kVa transformers, received noise impacts for the worst case ODAF operational scenario were compliant with the adopted noise goals.

Noise levels up to 35 dB(A) (external the TAFE buildings) for ODAF noise emissions have been predicted at the nearest TAFE receptor.

At the nearest hospital and commercial receptors, compliance with the adopted noise design goals is expected to be achieved (external noise levels). Internal noise levels at the hospital receptors are expected to be below the adopted internal noise goals with 5% of window area open.

Noise levels at the proposed hospital receptors are expected to be compliant with the adopted noise goals.

Emissions from Kiosks should not exceed a SWL of 61 dB(A) to ensure cumulative impacts are not increased.

Substation boundary noise impacts are expected to be satisfactory. Figure 7-1 details the noise impact contour isopleth for the ODAF operational scenario.

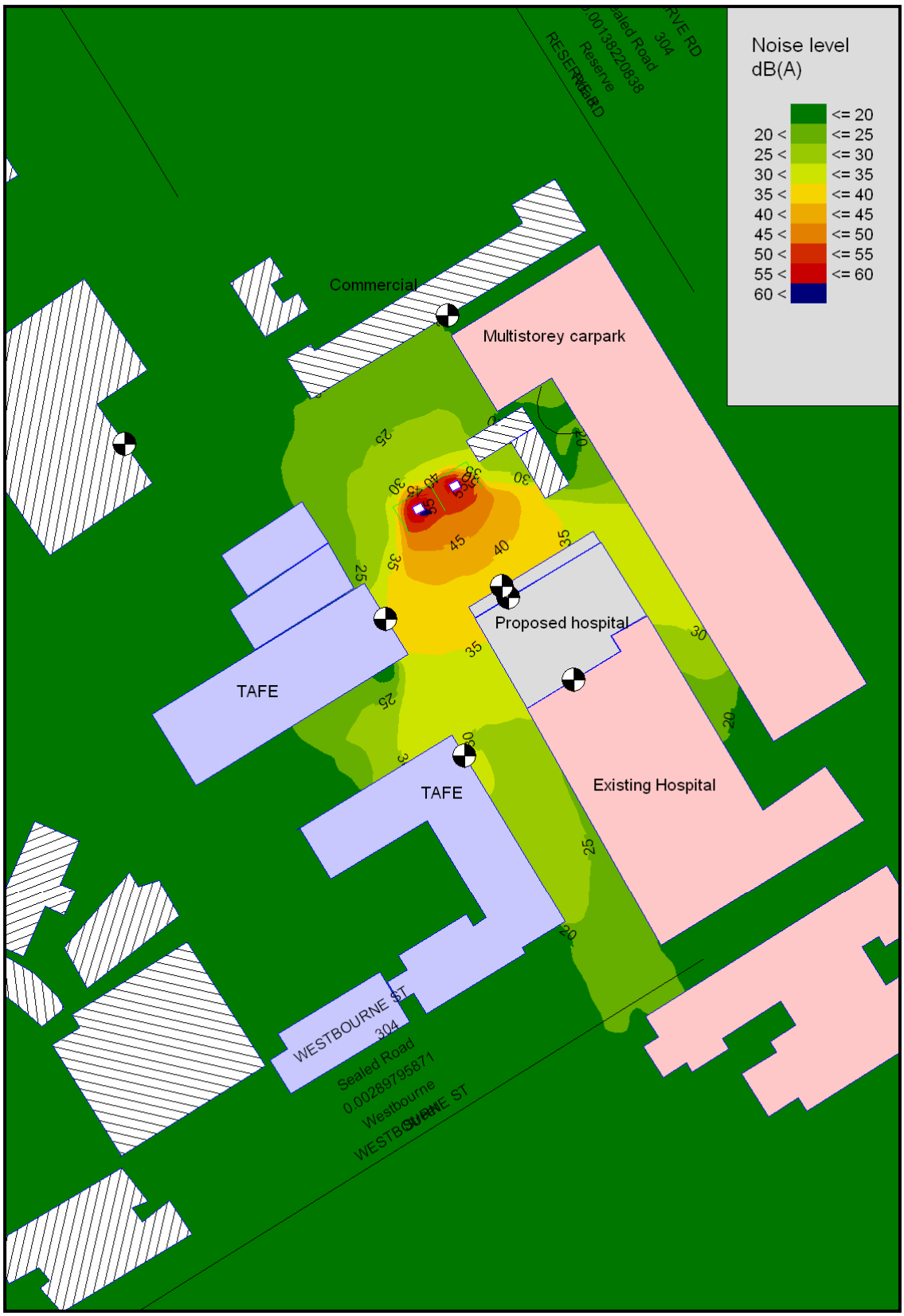


Figure 6-1: Noise impact isopleth – ODAF

7. Recommended noise management and mitigation measures

The following noise management and mitigation measures have been proposed where feasible, to minimise the potential for adverse off site noise impacts.

7.1 Construction noise and vibration management and mitigation

Construction noise levels are predicted to exceed the adopted ECNM criteria by up to 12 dB(A) during the demolition phase of works. The noise impact potential reported for the proposed construction works is consistent with short-term construction activities undertaken in the vicinity of existing TAFE receptors. This is a worst case prediction for the most intensive periods of activity, assuming required plant operating simultaneously and would be expected to occur for short term durations only.

It is expected that a range of economically reasonable and technically feasible noise mitigation measures would be considered by the construction contractor to manage the noise impact of the construction works. A series of pre-construction and construction phase measures and management practices designed to mitigate and reduce noise impacts are detailed in Section 7.1.1 and Section 7.1.2.

Compliance with the adopted noise design goals is the desired outcome. Where it is identified that the required noise criteria would not be met, all reasonable and feasible measures would be undertaken to reduce the noise emissions.

The assessment of potential vibration impacts has determined construction vibration to be unlikely to exceed the 0.2 – 0.4 $m/s^{-1.75}$ residential VDV acceptable perceptible vibration criteria at receptors within 20 metres of construction activity. Accordingly, compliance for nearest commercial receptors would be expected to be achieved.

7.1.1 Pre-construction noise and vibration impact management

During the planning and scheduling of construction works the predicted noise impacts should be considered in establishing work site locations, construction techniques and on site practises. The following principles and proactive noise management measures should be implemented prior to the commencement of construction works:

- A Construction Noise and Vibration Management Plan should be formulated to provide a framework for addressing potential noise and vibration impacts associated with construction works. Noise control options considerate of anticipated level of impact, including site mitigation and the investigation of low noise plant, should be detailed and direction provided for the delivery of best practice noise management on site.
- Works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as encouraged by the DECC and as addressed in current acoustic guidelines. BMP includes some of the factors discussed within this report, but also includes the encouragement of a general staff attitude to reducing noise emissions. Contractors would be made aware of the problems associated with noise. BATEA practices involve incorporating the most advanced and

affordable technology to minimise noise emissions. All plant should be selected after considering noise emissions.

7.1.2 Construction noise and vibration impact management

The measures detailed below incorporate the principles of BMP and BATEA, and are designed to be implemented to manage and mitigate construction noise and vibration impacts.

The application of construction noise mitigation techniques would be required, as a minimum, to include the following measures:

- Residential class mufflers and, where applicable, engine shrouds (acoustic lining) would be used. All equipment would be maintained in good order, including mufflers, enclosures and bearings to ensure unnecessary noise emissions are eliminated.
- Construction works including warming up, deliveries and staff entry should be restricted to between 7 am and 6 pm (Monday to Friday), and between 8 am and 1 pm Saturdays, with no works on Sundays or public holidays.
- Construction activities should be undertaken in accordance with Australian Standard AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*. All equipment used on site would be required to demonstrate compliance with the noise levels recommended within AS 2436-1981.
- Appropriate use of all plant and equipment, with reasonable work practices applied, including no extended periods of 'revving', idling or 'warming up' in proximity to existing residential receivers. Any excessively loud activities should be scheduled during periods of the day when general ambient noise levels are greatest. This would reduce the potential for cumulative noise impacts (relating to worst-case elevated operations) and extended periods of off-site annoyance.
- Minimising reversing alarm noise emissions from mobile plant and transport truck operations should be considered, provided occupational health and safety requirements are satisfied. Where practicable, site entry and exit points should be managed to limit the need for reversing.

7.2 Operational noise management and mitigation

Assessment of noise impacts for the proposal have been predicted to be compliant with the adopted noise design goals of 42 dB(A) $L_{Aeq,\ 15min}$.hospital external, 35 dB(A) $L_{Aeq,\ 15min}$.hospital internal, 35 dB(A) $L_{Aeq,\ 15min}$.TAFE internal and 65 dB(A) $L_{Aeq,\ 15min}$ commercial receptors.

Noise impacts at the proposed site boundary are expected to be compliant with respective noise design goals.

The following recommended source SWL measures are recommended considerate of the preservation of acoustic amenity and feasible substation source noise levels.

- Transformer (including cooling) units to emit a total SWL of 68 dB(A) L_{Aeq}
- kiosk facades to emit a SWL of 61 dB(A) L_{Aeq}.

Although it is expected that standard construction materials and typical construction methods for the proposed hospital extension will provide adequate attention to achieve the adopted internal noise deign goal of 35 dB(A) L_{Aeq}, it is recommended that where the sub station noise characteristics vary significantly to those assumed in this report, verification of internal noise levels may prove worthwhile.

It is recommended post commissioning source validation be undertaken to confirm recommended substation plant SWL's and adopted noise attenuation performance of transformer enclosure and substation structures.

8. Conclusion

8.1 Construction noise and vibration compliance

Noise impacts for the proposed substation construction works have been assessed to an adopted noise goal of 63 dB(A) L_{A10}. Noise levels at the nearest sensitive receptors during demolition works have the potential to exceed the adopted noise goal.

Civil works and infrastructure installation works are expected to be compliant with the adopted noise criteria.

The recommended construction noise management and mitigation measures detailed in Section 7 are considered appropriate to achieve reductions in received noise level to minimise the potential for noise goal exceedance.

Vibration levels are considered unlikely to exceed perceptible vibration limits at the nearest sensitive receptors where vibration generating activity is conducted at least 20 metres from the nearest façade,

8.2 NSW Industrial Noise Policy compliance

An operational predictive noise impact model was established using SoundPLAN Version 6.5 software. Indicative worst case ODAF noise emissions were adopted. Received noise levels at the nearest potentially impacted hospital, TAFE and commercial receptors were within the adopted noise goals.

9. References

AS 2374 - 2004 *Power Transformers Part 6: Determination of transformer and reactor sound levels (2004)*

AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*

DIN 4150-3 1999 *Structural Vibration Part 3 Effects of Vibration on Structures*

NSW DEC Environmental Noise Management Assessing Vibration: a technical guideline (2006)

NSW EPA *Environmental Noise Control Manual* (1994)

NSW EPA *Industrial Noise Policy* (2000)

10. Limitations

Scope of services and reliance of data

This noise impact study ('the study') has been prepared in accordance with the scope of work/services set out in the contract, or as otherwise agreed, between Parsons Brinckerhoff (PB) and the Client. In preparing this noise impact study, PB has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the noise impact study ('the data'). Except as otherwise stated in the noise impact study, PB has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this noise impact study ('conclusions') are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. PB will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to PB.

Study for benefit of client

This noise impact study has been prepared for the exclusive benefit of the Client and no other party. PB assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with in this noise impact study, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in this noise impact study (including without limitation matters arising from any negligent act or omission of PB or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in this noise impact study). Other parties should not rely upon the noise impact study or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

Other limitations

To the best of PB's knowledge, the proposal presented and the facts and matters described in this noise impact study reasonably represent the Client's intentions at the time of printing of the noise impact study. However, the passage of time, the manifestation of latent conditions or the impact of future events (including a change in applicable law) may have resulted in a variation of the Proposal and of its possible noise impact.

PB will not be liable to update or revise the noise impact study to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the noise impact study.

Appendix A

Glossary of noise terminology

A-weighted sound pressure

The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1kHz to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic "*A-weighting*" frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).

Ambient noise

Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 5 dB(A) penalty is typically applied to noise sources with tonal characteristics.

Community annoyance

Includes noise annoyance due to:

- characterise of the noise (for example, sound pressure level, tonality, impulsiveness, low-frequency content)
- characterise of the environment (for example, very quite suburban, suburban, urban, near industry)
- miscellaneous circumstances (for example, noise avoidance possibilities, cognitive noise, unpleasant associations)
- human activity being interrupted (sleep, communicating, reading, working, listening to radio / TV, recreation)

Compliance

The process of checking that source noise levels meet with the noise limits in a statutory context.

Cumulative noise level

The total level of noise from all sources.

EP Licence

Environment Protection Licence.

Extraneous noise

Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.

Feasible and reasonable measures

Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:

- noise mitigation benefits (amount of noise reduction provided, number of people protected)
- cost of mitigation (cost of mitigation versus benefit provided)
- community views (aesthetic impacts and community wishes)
- noise levels for affected land uses (existing and future levels, and changes in noise levels)

Impulsiveness

Impulsive noise is noise having a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.

Low frequency

Noise containing major components in the low-frequency range (20 Hz to 250 Hz) of the frequency spectrum.

Noise Criteria

The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (for example, noise levels for various land use)

Noise Level (goal)

A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.

Noise Limits

Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.

Non-compliance

A development is deemed to be in non-compliance with its noise consent / licence conditions if the monitored noise levels exceed its statutory noise limit by more than 2 dB.

NSW DEC

New South Wales Department of Environment and Conservation.

Performance-based goals

Goals specified in terms of the outcomes / performance to be achieved, but not in terms of the means of achieving them.

Rating Background Level

The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the median L_{A90} noise level measured over all day, evening and night time monitoring periods.

Receiver

The noise-sensitive land use at which noise from a development can be heard.

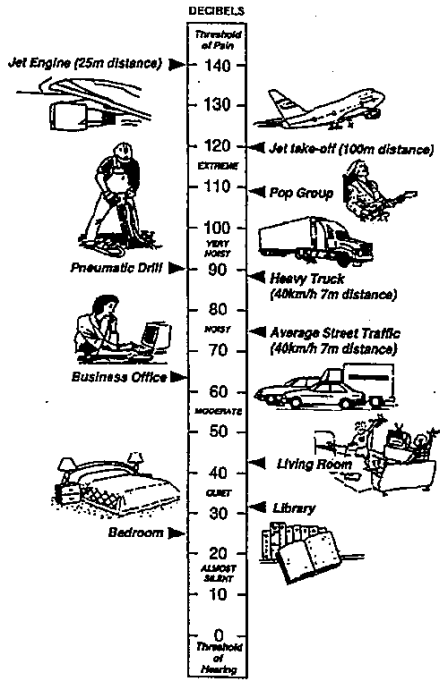
Sleep disturbance

Awakenings and disturbance of sleep stages.

Sound & decibels (dB)

Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which would cause permeant hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2×10^{-5} Pa.

The picture below indicates typical noise levels from common noise sources



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound Power Level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

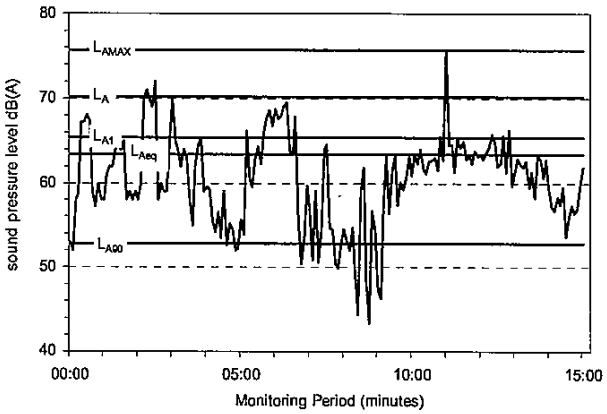
Sound Pressure Level (SPL)

The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistical noise levels

Noise levels varying over time (eg. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A Hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure



Key Descriptors:

L_{AMax} Maximum recorded noise level.

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.

L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

L_{A90} Noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

Steady State Noise Level

The steady state noise level is the operator observed baseline noise level where sources influencing the statistical results are determined.

Threshold

The lowest sound pressure level that produces a detectable response (in an instrument / person).

Tonality

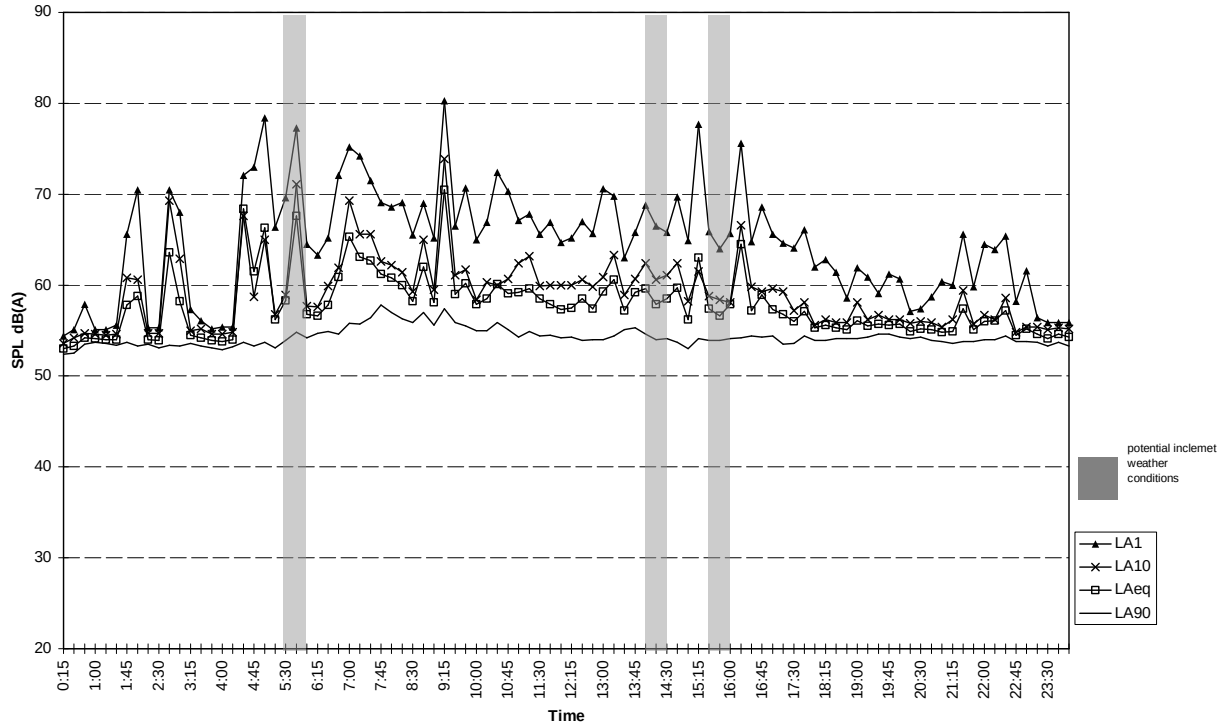
Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 5 dB(A) penalty is typically applied to noise sources with tonal characteristics.

Appendix B

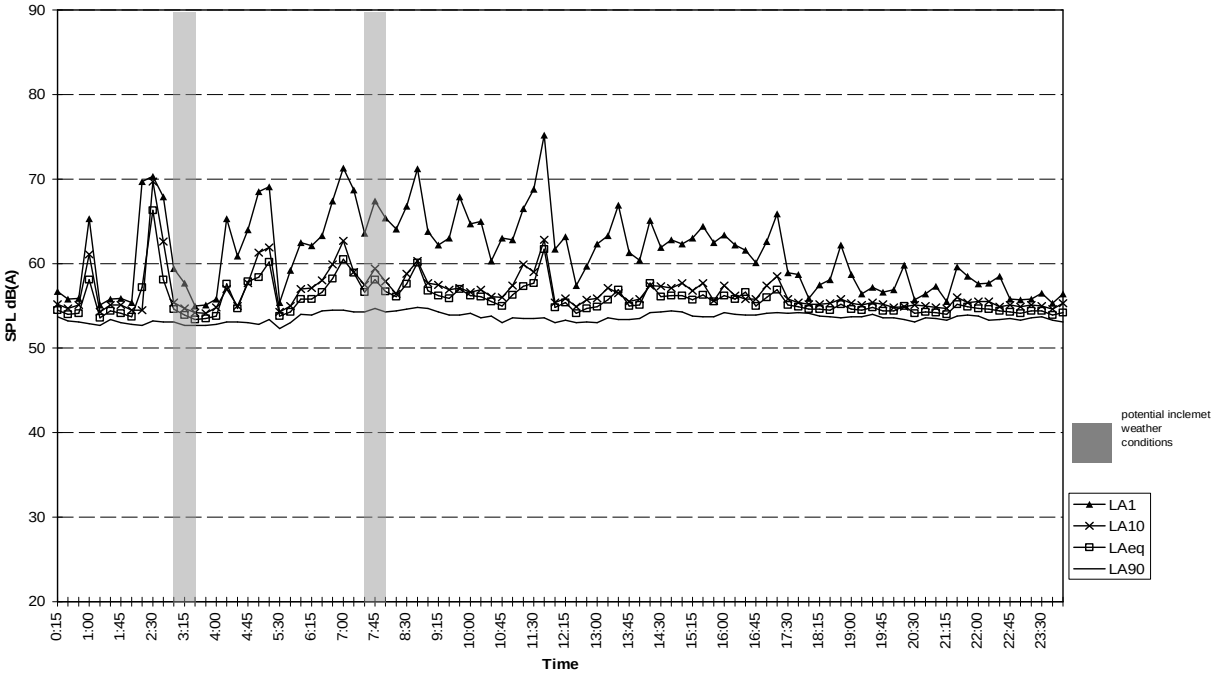
Noise logger graphs

Location 1 - Western Site Boundary
Measured Noise Levels - Thursday 29 May, 2008

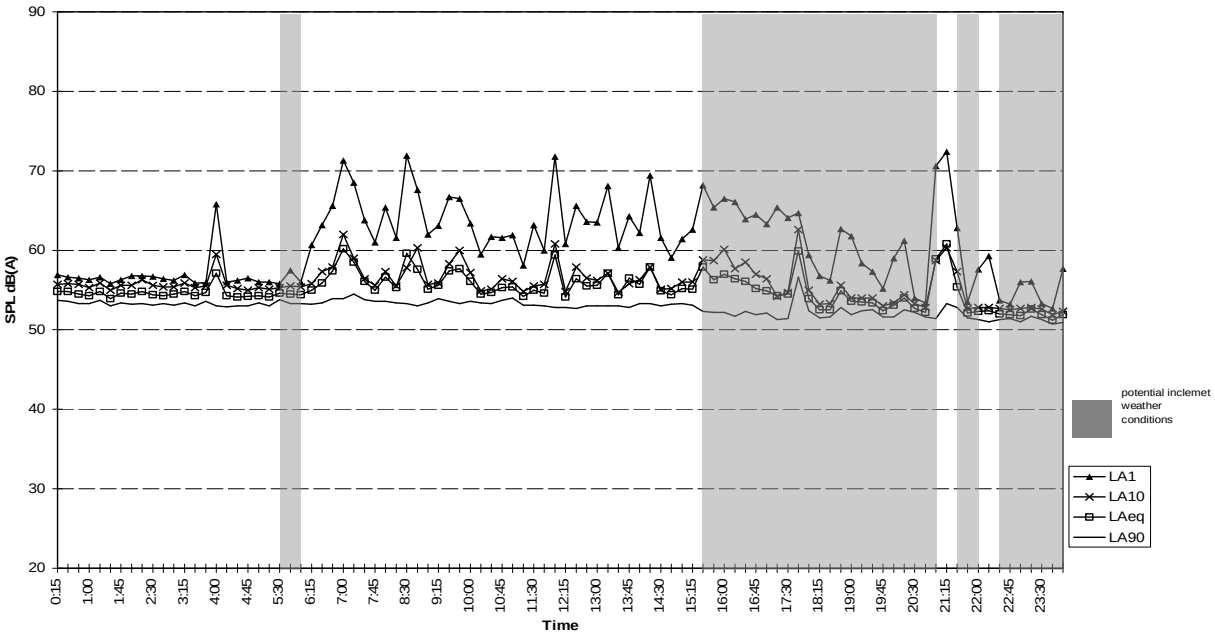
Location 1 - Western Site Boundary
Measured Noise Levels - Friday 30 May, 2008



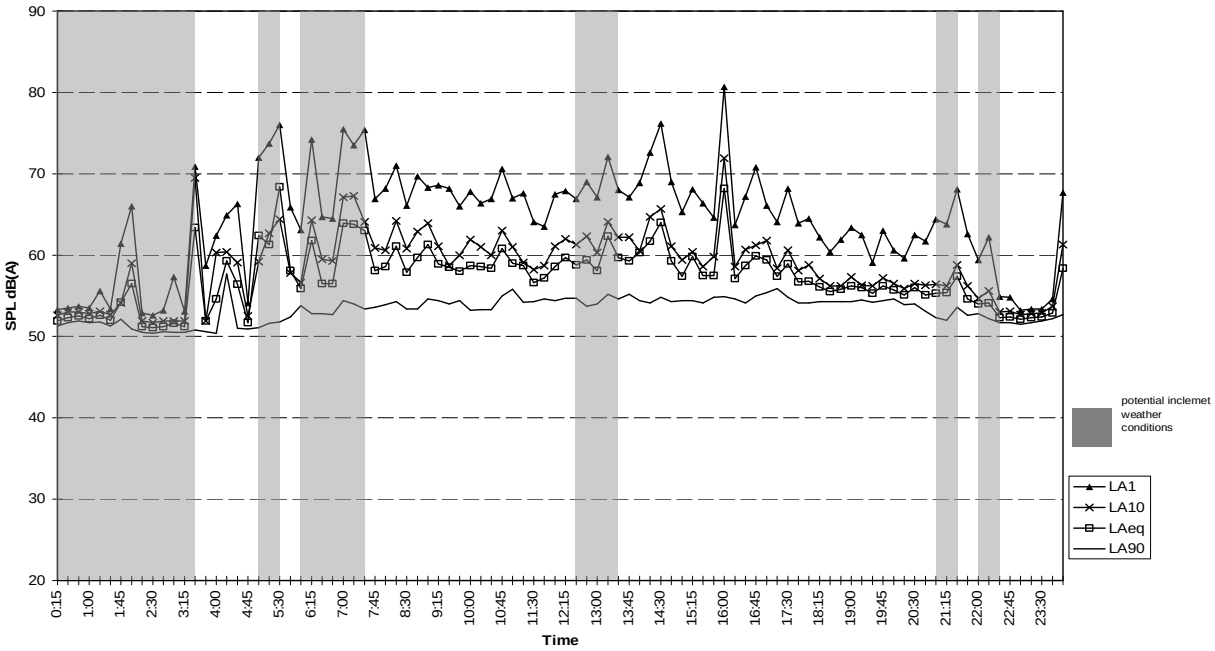
Location 1 - Western Site Boundary
Measured Noise Levels - Saturday 31 May, 2008



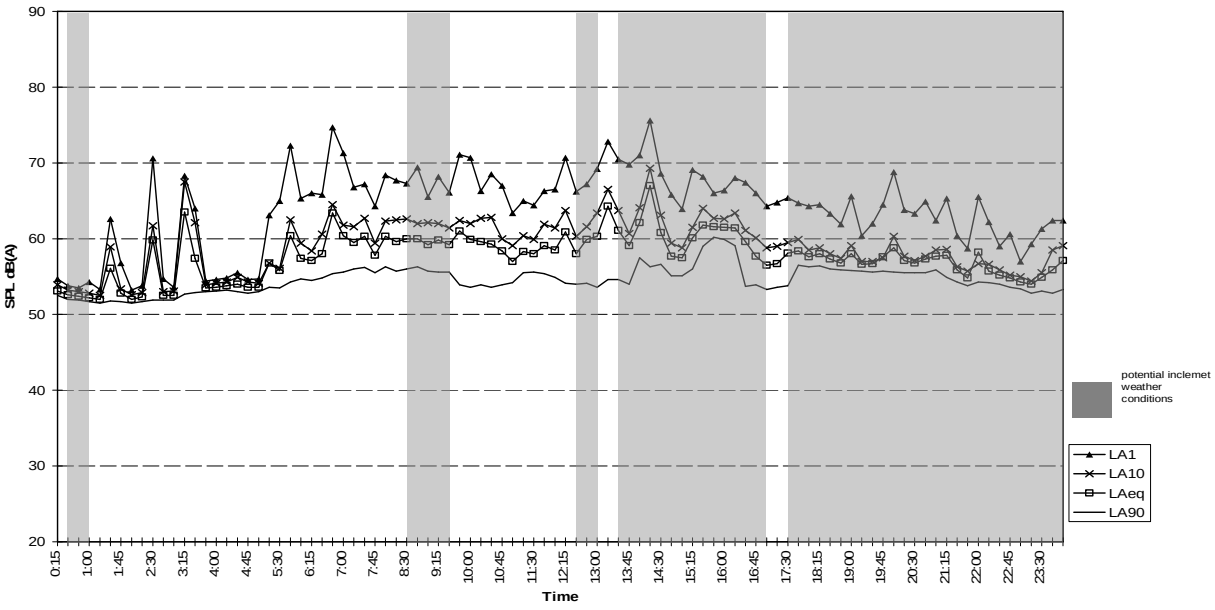
Location 1 - Western Site Boundary
Measured Noise Levels - Sunday 1 June, 2008



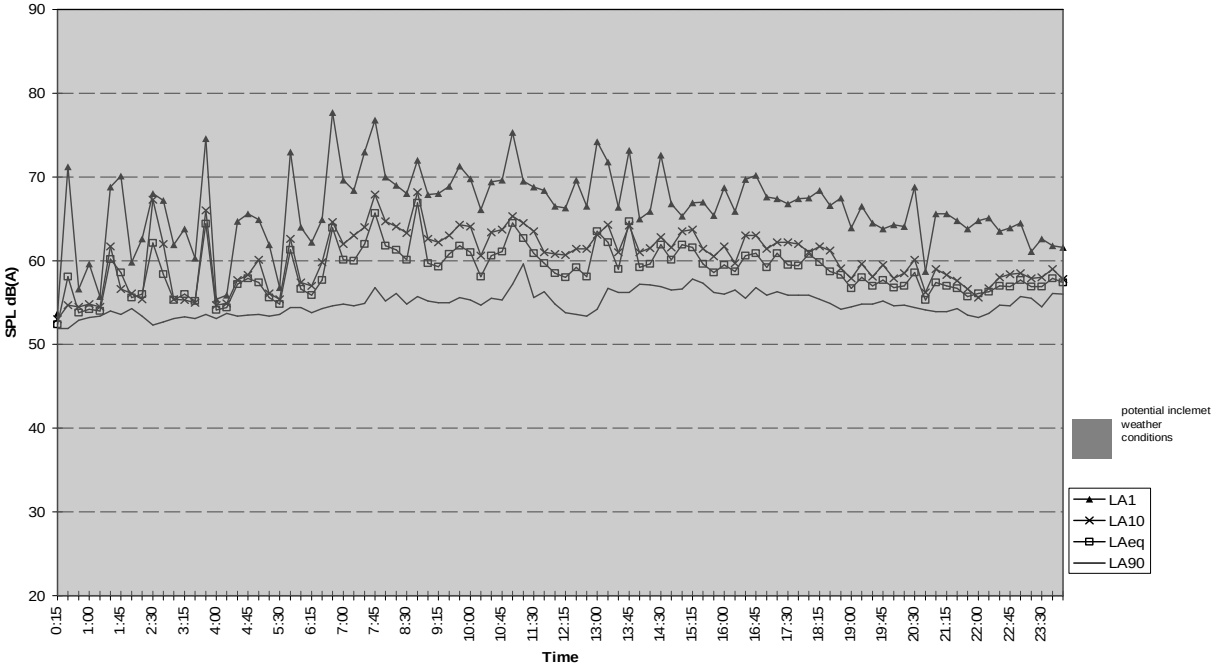
Location 1 - Western Site Boundary
Measured Noise Levels - Monday 2 June, 2008



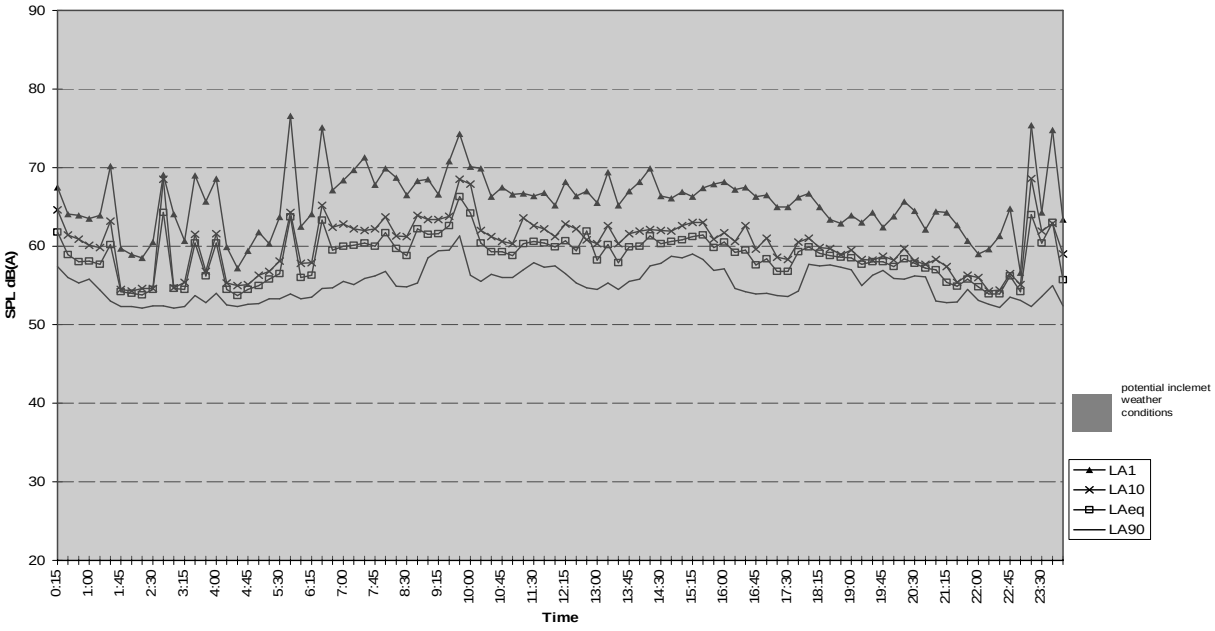
Location 1 - Western Site Boundary
Measured Noise Levels - Tuesday 3 June, 2008



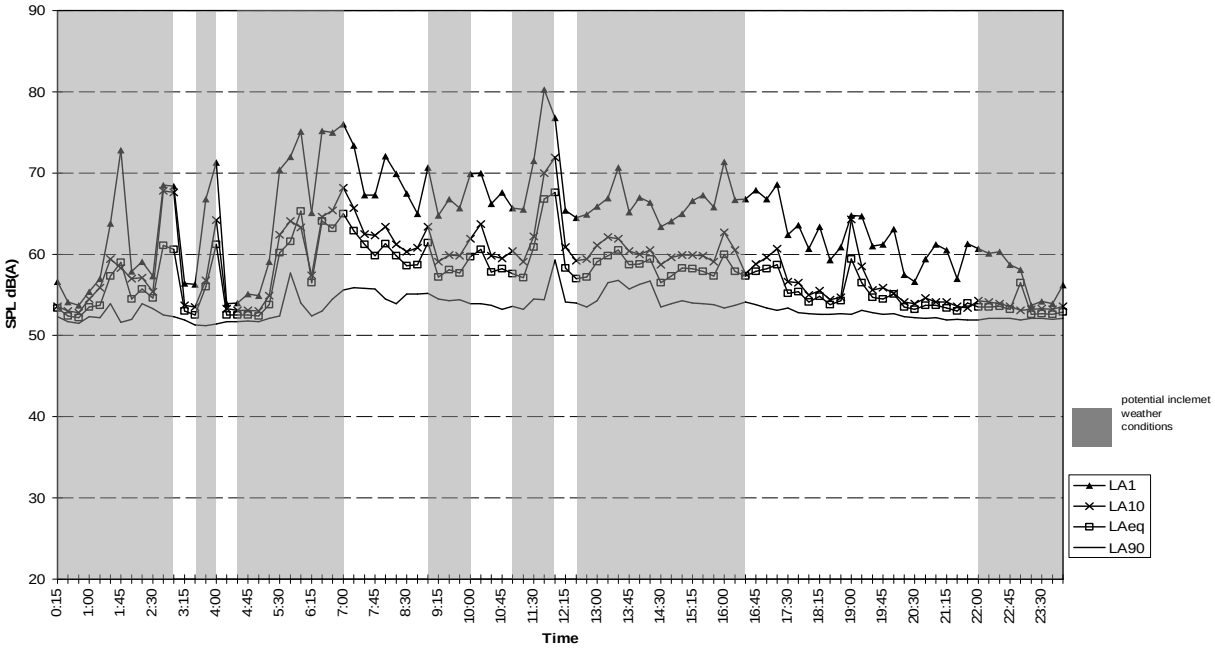
Location 1 - Western Site Boundary
Measured Noise Levels - Wednesday 4 June, 2008



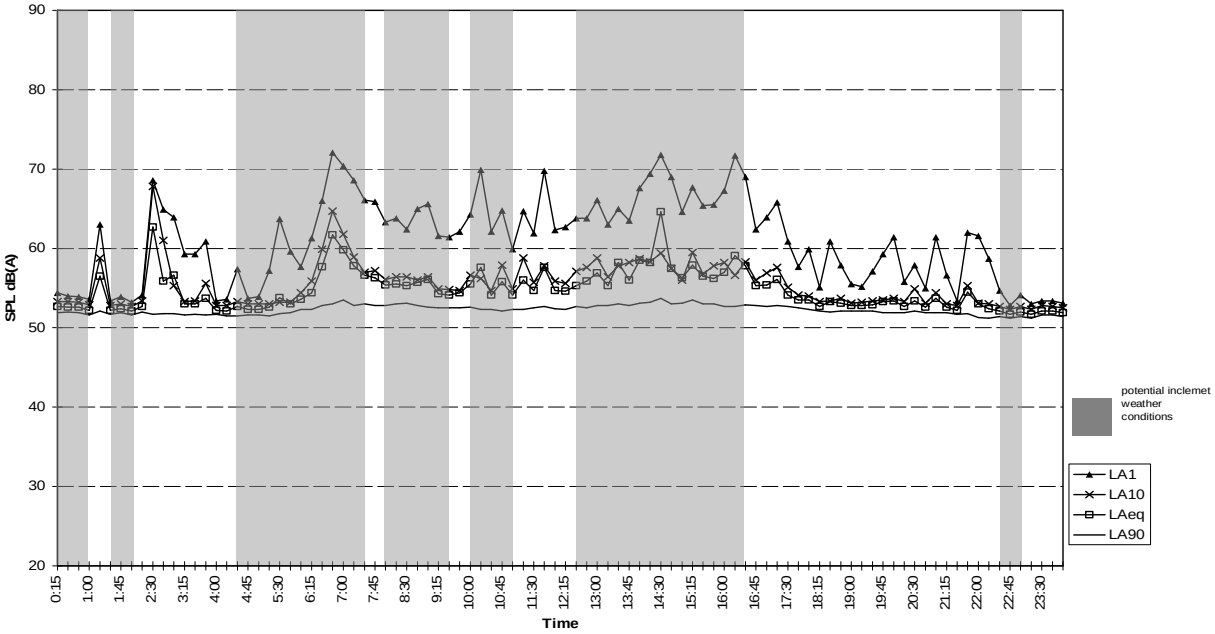
Location 1 - Western Site Boundary
Measured Noise Levels - Thursday 5 June, 2008



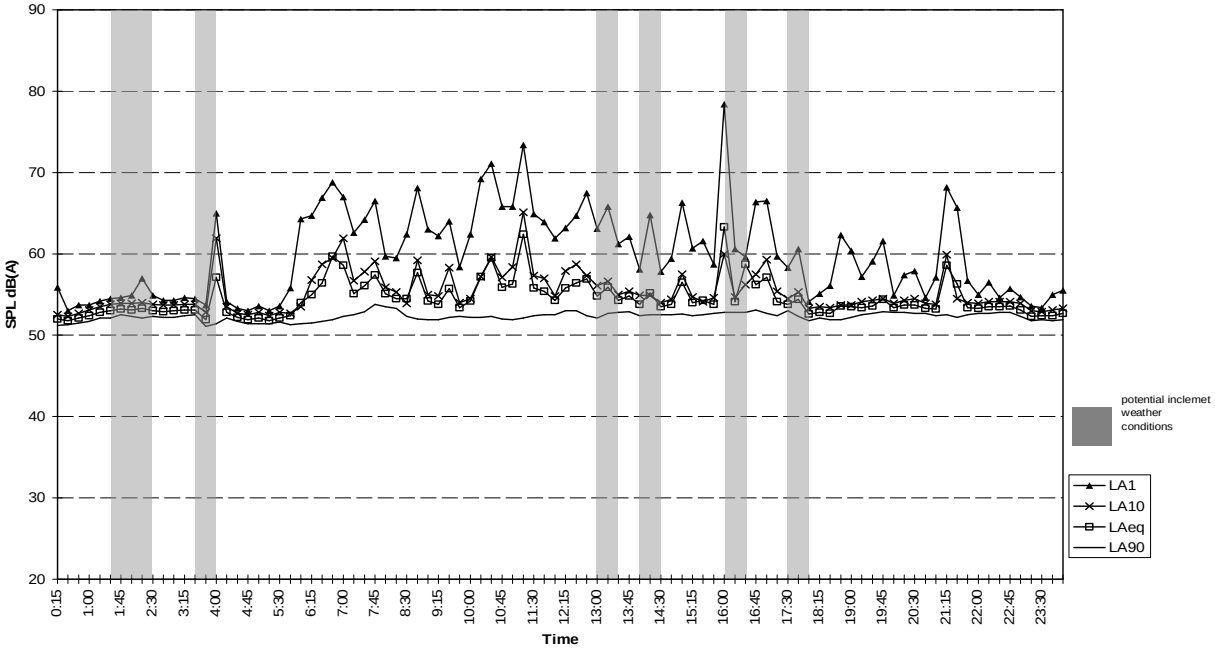
Location 1 - Western Site Boundary
Measured Noise Levels - Friday 6 June, 2008



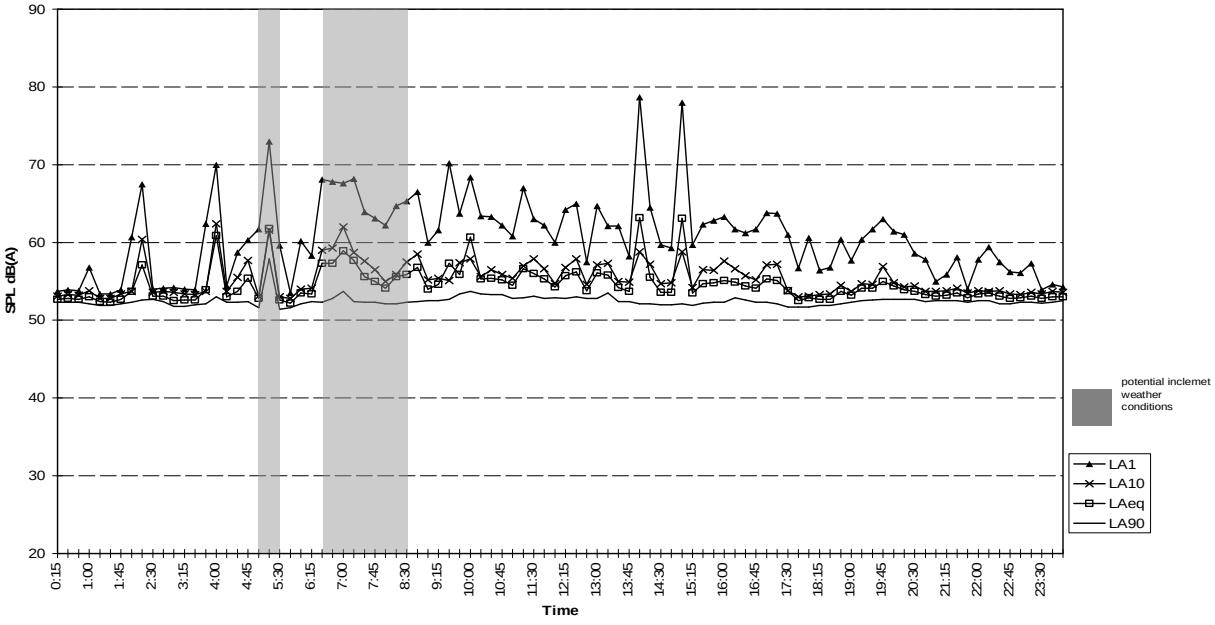
Location 1 - Western Site Boundary
Measured Noise Levels - Saturday 7 June, 2008



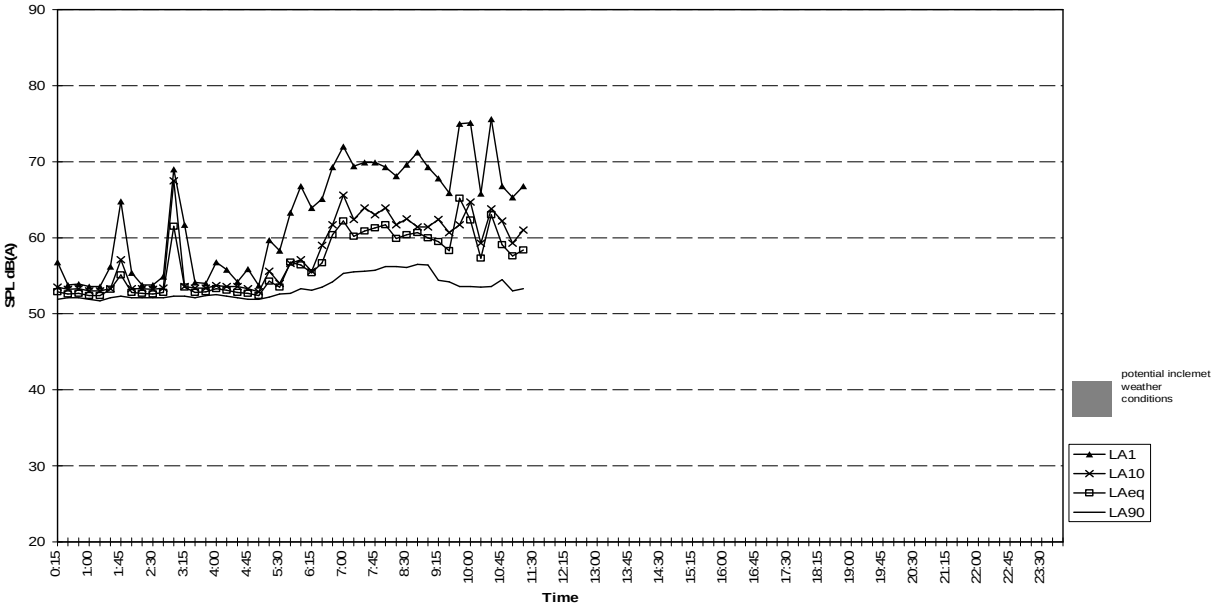
Location 1 - Western Site Boundary
Measured Noise Levels - Sunday 8 June, 2008



Location 1 - Western Site Boundary
Measured Noise Levels - Monday 9 June, 2008



Location 1 - Western Site Boundary
Measured Noise Levels - Tuesday 10 June, 2008



Appendix C

Calibration certification

Acoustic Research Laboratories
Proprietary Limited A.B.N. 47 050 100 804
Noise and Vibration Monitoring Instrumentation for Industry and the Environment

Sound Level Meter Test Certificate

Report Number : 07280.doc

Date of Test : 16/07/2007

Report Issue Date : 06/08/2007

Equipment Tested: **ARL Environmental Noise Logger**

Model Number: EL-316

Serial Number: 16-203-502

Client Name : Acoustic Research Laboratories Pty Ltd

Contact Name : Katie Fairjones

Tested by : Morgan Rae

Approved Signatory :

Ken Williams

Date : **6th August 2007.**

NATA
WORLD RECOGNISED ACCREDITATION

Acoustic Research Laboratories Pty Ltd is NATA Accredited Laboratory Number. 14172.
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

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Appendix D

Sample SoundPLAN output files

Royal North Shore Hospital Substation
transformers only

Source	SrcType	Lw dB(A)	Lw' dB(A)	l or S m,m²	Kl dB	KT dB	Ko dB	s m	Adiv dB	Agr dB	Amisc dB	Abar dB	Aatm dB	DI dB	Re dB(A)	Ls dB(A)	LrD dB(A)	LrN dB(A)
Name: Private Hospital 1	Floor: 1. Floor	LrD,lim: 57 dB(A)		LrN,lim: 47 dB(A)			LrD: 10.2 dB(A)		LrN: 10.2 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	76.49	48.7	-1.9		24.5	0.7	0.0	-4.6	0.6	0.6	0.6
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	76.37	48.7	-3.0		25.0	0.7	0.0	-2.4	0.2	0.2	0.2
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	75.26	48.5	-1.3		24.9	0.8	0.0	-1.3	1.4	1.4	1.4
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	76.13	48.6	-0.7		24.9	0.9	0.0	-4.4	-0.5	-0.5	-0.5
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	77.81	48.8	-0.9		24.1	0.7	0.0	-4.6	0.1	0.1	0.1
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	75.48	48.5	-0.5		24.4	0.8	0.0	-4.5	-0.3	-0.3	-0.3
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	75.36	48.5	-3.1		25.0	0.7	0.0	-4.2	-0.6	-0.6	-0.6
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	74.06	48.4	-1.1		24.9	0.8	0.0	-1.7	1.2	1.2	1.2
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	75.28	48.5	-0.5		24.9	0.9	0.0	-4.9	-0.8	-0.8	-0.8
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	76.68	48.7	-1.2		24.3	0.7	0.0	-5.5	-0.1	-0.1	-0.1
Name: Private Hospital 1	Floor: 2. Floor	LrD,lim: 57 dB(A)		LrN,lim: 47 dB(A)			LrD: 10.5 dB(A)		LrN: 10.5 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	76.57	48.7	-2.0		24.4	0.7	0.0	-4.2	0.9	0.9	0.9
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	76.40	48.7	-3.1		24.8	0.6	0.0	-1.8	0.6	0.6	0.6
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	75.34	48.5	-1.4		24.8	0.8	0.0	-0.9	1.7	1.7	1.7
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	76.22	48.6	-0.7		24.8	0.9	0.0	-4.2	-0.3	-0.3	-0.3
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	77.89	48.8	-0.9		24.0	0.7	0.0	-4.4	0.3	0.3	0.3
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	75.57	48.6	-0.5		24.3	0.8	0.0	-3.9	0.0	0.0	0.0
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	75.39	48.5	-3.1		24.8	0.6	0.0	-3.5	-0.2	-0.2	-0.2
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	74.15	48.4	-1.2		24.8	0.8	0.0	-1.2	1.5	1.5	1.5
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	75.36	48.5	-0.5		24.8	0.9	0.0	-4.4	-0.5	-0.5	-0.5
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	76.77	48.7	-1.3		24.2	0.7	0.0	-5.2	0.2	0.2	0.2
Name: Private Hospital 1	Floor: 3. Floor	LrD,lim: 57 dB(A)		LrN,lim: 47 dB(A)			LrD: 11.1 dB(A)		LrN: 11.1 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	76.75	48.7	-1.9		24.2	0.6	0.0	-4.0	1.0	1.0	1.0
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	76.53	48.7	-3.0		24.7	0.6	0.0	-1.7	0.7	0.7	0.7
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	75.53	48.6	-1.9		24.7	0.7	0.0	-0.8	2.1	2.1	2.1
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	76.40	48.7	-1.9		24.7	0.7	0.0	-4.1	0.7	0.7	0.7
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	78.07	48.8	-1.8		23.8	0.6	0.0	-4.2	1.1	1.1	1.1

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Source	SrcType	Lw dB(A)	Lw' dB(A)	l or S m,m²	Kl dB	KT dB	Ko dB	s m	Adiv dB	Agr dB	Amisc dB	Abar dB	Aatm dB	DI dB	Re dB(A)	Ls dB(A)	LrD dB(A)	LrN dB(A)
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	75.75	48.6	-1.9		24.2	0.6	0.0	-3.7	1.2	1.2	1.2
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	75.52	48.6	-3.0		24.7	0.6	0.0	-3.3	-0.1	-0.1	-0.1
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	74.34	48.4	-2.4		24.7	0.7	0.0	-1.0	2.4	2.4	2.4
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	75.55	48.6	-1.9		24.7	0.7	0.0	-4.2	0.7	0.7	0.7
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	76.95	48.7	-1.3		23.9	0.7	0.0	-5.0	0.4	0.4	0.4
Name: TAFE east 1	Floor: 1. Floor	LrD,lim: 57 dB(A)		LrN,lim:			LrD: 29.0 dB(A)		LrN: 29.0 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	81.64	49.2	-1.9		0.0	0.8	0.0	3.9	22.9	22.9	22.9
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	82.90	49.4	-3.0		3.8	1.1	0.0	-6.1	16.8	16.8	16.8
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	81.78	49.2	-1.4		0.0	0.9	0.0	-6.7	22.3	22.3	22.3
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	83.24	49.4	-1.3		7.4	0.2	0.0	-14.1	15.3	15.3	15.3
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	84.24	49.5	-1.5		10.6	0.2	0.0	-13.3	12.3	12.3	12.3
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	88.49	49.9	-0.9		0.0	1.1	0.0	-17.1	20.9	20.9	20.9
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	89.20	50.0	-2.9		3.6	1.2	0.0	-17.2	16.1	16.1	16.1
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	87.99	49.9	-1.2		0.0	1.0	0.0	-15.9	21.3	21.3	21.3
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	90.44	50.1	-1.7		8.2	0.2	0.0	-15.7	14.2	14.2	14.2
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	90.37	50.1	-1.5		10.3	0.2	0.0	-17.0	11.9	11.9	11.9
Name: TAFE east 1	Floor: 2. Floor	LrD,lim: 57 dB(A)		LrN,lim:			LrD: 29.2 dB(A)		LrN: 29.2 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	81.70	49.2	-2.0		0.0	0.8	0.0	4.5	23.0	23.0	23.0
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	82.93	49.4	-3.2		3.6	1.1	0.0	-3.2	17.2	17.2	17.2
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	81.85	49.3	-1.6		0.0	0.9	0.0	-4.8	22.5	22.5	22.5
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	83.32	49.4	-1.4		7.4	0.2	0.0	-14.1	15.4	15.4	15.4
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	84.31	49.5	-1.7		10.6	0.2	0.0	-12.4	12.5	12.5	12.5
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	88.56	49.9	-0.9		0.0	1.1	0.0	-17.0	20.9	20.9	20.9
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	89.22	50.0	-3.2		3.6	1.1	0.0	-15.9	16.6	16.6	16.6
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	88.06	49.9	-1.3		0.0	1.0	0.0	-15.2	21.4	21.4	21.4
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	90.50	50.1	-1.9		8.1	0.2	0.0	-14.9	14.4	14.4	14.4
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	90.44	50.1	-1.6		10.3	0.2	0.0	-16.9	12.1	12.1	12.1
Name: TAFE east 1	Floor: 3. Floor	LrD,lim: 57 dB(A)		LrN,lim:			LrD: 29.2 dB(A)		LrN: 29.2 dB(A)									

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Source	SrcType	Lw dB(A)	Lw' dB(A)	l or S m,m²	KI dB	KT dB	Ko dB	s m	Adiv dB	Agr dB	Amisc dB	Abar dB	Aatm dB	DI dB	Re dB(A)	Ls dB(A)	LrD dD(A)	LrN dB(A)
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	81.86	49.3	-1.9		0.0	0.8	0.0	5.0	22.9	22.9	22.9
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	83.06	49.4	-3.0		3.2	1.1	0.0	0.6	17.4	17.4	17.4
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	82.03	49.3	-1.5		0.0	0.9	0.0	-2.7	22.4	22.4	22.4
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	83.50	49.4	-1.3		7.3	0.2	0.0	-14.1	15.4	15.4	15.4
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	84.48	49.5	-1.6		10.5	0.2	0.0	-11.2	12.4	12.4	12.4
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	88.72	50.0	-0.9		0.0	1.1	0.0	-17.0	20.9	20.9	20.9
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	89.31	50.0	-3.1		3.1	1.2	0.0	-14.8	16.8	16.8	16.8
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	88.23	49.9	-1.3		0.0	1.0	0.0	-14.5	21.4	21.4	21.4
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	90.65	50.1	-1.8		8.1	0.2	0.0	-14.1	14.4	14.4	14.4
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	90.60	50.1	-1.6		10.3	0.2	0.0	-16.7	12.0	12.0	12.0
Name TAFE north east building	Floor 1. Floor	LrD,lim 57	dB(A)	LrN,lim	dB(A)	LrD 32.9	dB(A)	LrN 32.9	dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	36.91	42.3	-1.1		3.2	0.4	0.0	2.2	26.2	26.2	26.2
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	38.07	42.6	-3.1		5.0	0.5	0.0	-3.8	23.1	23.1	23.1
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	37.11	42.4	-1.2		0.0	0.4	0.0	-1.5	29.4	29.4	29.4
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	39.20	42.9	-1.3		9.6	0.1	0.0	-3.0	19.8	19.8	19.8
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	38.96	42.8	-1.2		13.0	0.1	0.0	-4.5	16.3	16.3	16.3
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	48.22	44.7	-0.8		11.5	0.1	0.0	-2.9	15.6	15.6	15.6
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	49.59	44.9	-3.1		15.8	0.4	0.0	-3.4	10.3	10.3	10.3
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	48.94	44.8	-1.3		3.8	0.5	0.0	-4.6	23.3	23.3	23.3
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	50.93	45.1	-1.5		10.9	0.2	0.0	-4.7	16.4	16.4	16.4
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	50.30	45.0	-0.6		18.2	0.4	0.0	-2.7	8.4	8.4	8.4
Name TAFE north east building	Floor 2. Floor	LrD,lim 57	dB(A)	LrN,lim	dB(A)	LrD 34.2	dB(A)	LrN 34.2	dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	37.00	42.4	-2.9		3.0	0.3	0.0	2.6	28.2	28.2	28.2
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	38.04	42.6	-3.0		3.8	0.6	0.0	-3.5	24.0	24.0	24.0
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	37.19	42.4	-2.7		0.0	0.4	0.0	-1.6	30.9	30.9	30.9
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	39.28	42.9	-2.3		9.7	0.1	0.0	-5.0	20.7	20.7	20.7
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	39.04	42.8	-2.5		13.6	0.1	0.0	-6.1	17.0	17.0	17.0
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	48.28	44.7	-0.8		11.4	0.1	0.0	-4.6	15.6	15.6	15.6

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trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	49.56	44.9	-3.0		9.2	0.2	0.0	-4.0	16.8	16.8	16.8
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	49.00	44.8	-1.3		3.8	0.5	0.0	-6.0	23.3	23.3	23.3
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	50.99	45.1	-1.5		10.8	0.2	0.0	-4.6	16.5	16.5	16.5
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	50.36	45.0	-0.6		17.9	0.4	0.0	-4.9	8.5	8.5	8.5
Name TAFE north east building	Floor 3. Floor	LrD,lim 57	dB(A)	LrN,lim	dB(A)	LrD 34.8	dB(A)	LrN 34.8	dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	37.29	42.4	-3.0		3.1	0.3	0.0	3.1	28.2	28.2	28.2
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	38.21	42.6	-3.0		2.7	0.6	0.0	-2.6	25.1	25.1	25.1
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	37.49	42.5	-3.0		0.0	0.4	0.0	-1.2	31.2	31.2	31.2
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	39.55	42.9	-3.0		9.9	0.1	0.0	-4.6	21.2	21.2	21.2
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	39.31	42.9	-3.0		13.3	0.1	0.0	-6.0	17.7	17.7	17.7
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	48.51	44.7	-3.0		11.5	0.1	0.0	-4.4	17.7	17.7	17.7
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	49.70	44.9	-3.0		9.1	0.2	0.0	-3.2	16.8	16.8	16.8
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	49.22	44.8	-3.0		3.5	0.4	0.0	-5.1	25.2	25.2	25.2
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	51.21	45.2	-3.0		10.9	0.2	0.0	-3.6	17.9	17.9	17.9
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	50.58	45.1	-3.0		18.0	0.3	0.0	-4.7	10.8	10.8	10.8
Name commercial 3	Floor 1. Floor	LrD,lim 69	dB(A)	LrN,lim 59	dB(A)	LrD 13.8	dB(A)	LrN 13.8	dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	98.29	50.8	-1.0		16.7	0.5	0.0	-3.2	4.7	4.7	4.7
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	99.53	51.0	-2.6		17.7	0.5	0.0	-3.5	2.6	2.6	2.6
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	100.39	51.0	-1.1		16.2	0.5	0.0	-2.8	5.1	5.1	5.1
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	100.68	51.1	-1.2		16.7	0.5	0.0	-2.3	4.9	4.9	4.9
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	98.80	50.9	-0.9		17.0	0.6	0.0	-3.1	4.3	4.3	4.3
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	108.67	51.7	-0.6		16.6	0.6	0.0	-5.4	3.3	3.3	3.3
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	110.19	51.8	-2.3		17.5	0.6	0.0	-6.3	1.3	1.3	1.3
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	111.14	51.9	-1.0		17.2	0.6	0.0	-5.2	3.0	3.0	3.0
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	111.36	51.9	-1.0		16.5	0.5	0.0	-5.3	3.7	3.7	3.7
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	109.49	51.8	-1.3		17.1	0.6	0.0	-4.9	3.5	3.5	3.5
Name commercial north 1	Floor 1. Floor	LrD,lim 69	dB(A)	LrN,lim 59	dB(A)	LrD 17.5	dB(A)	LrN 17.5	dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	65.82	47.4	-0.9		17.2	0.4	0.0	-3.6	7.3	7.3	7.3

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trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	64.90	47.2	-3.0		18.1	0.4	0.0	-4.4	5.7	5.7	5.7
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	65.93	47.4	-0.8		17.3	0.4	0.0	-2.5	7.2	7.2	7.2
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	63.92	47.1	-1.4		17.3	0.4	0.0	-3.3	8.0	8.0	8.0
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	63.88	47.1	-1.0		17.6	0.4	0.0	-3.0	7.3	7.3	7.3
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	57.28	46.2	-0.4		17.5	0.4	0.0	-5.8	7.7	7.7	7.7
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	56.66	46.1	-3.1		18.3	0.4	0.0	-5.8	6.6	6.6	6.6
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	57.82	46.2	-1.3		17.6	0.4	0.0	-5.2	8.3	8.3	8.3
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	55.76	45.9	-1.2		17.6	0.4	0.0	-4.5	8.5	8.5	8.5
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	55.47	45.9	-0.9		17.8	0.4	0.0	-5.5	8.0	8.0	8.0
Name commercial north 1	Floor 2. Floor	LrD,lim 69 dB(A)		LrN,lim 59 dB(A)			LrD 17.9 dB(A)		LrN 17.9 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	65.87	47.4	-1.0		17.1	0.4	0.0	-3.1	7.6	7.6	7.6
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	64.88	47.2	-3.1		17.0	0.3	0.0	-3.3	7.0	7.0	7.0
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	65.98	47.4	-0.8		17.1	0.4	0.0	-1.7	7.5	7.5	7.5
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	63.97	47.1	-1.6		17.2	0.4	0.0	-2.8	8.3	8.3	8.3
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	63.93	47.1	-1.1		17.5	0.4	0.0	-2.1	7.6	7.6	7.6
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	57.34	46.2	-0.5		17.3	0.4	0.0	-5.7	7.8	7.8	7.8
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	56.64	46.1	-3.0		17.4	0.3	0.0	-4.6	7.5	7.5	7.5
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	57.87	46.2	-1.4		17.4	0.4	0.0	-5.1	8.6	8.6	8.6
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	55.81	45.9	-1.2		17.4	0.4	0.0	-3.5	8.8	8.8	8.8
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	55.53	45.9	-1.0		17.7	0.4	0.0	-5.1	8.2	8.2	8.2
Name private hospital	Floor 1. Floor	LrD,lim 57 dB(A)		LrN,lim 47 dB(A)			LrD 38.8 dB(A)		LrN 38.8 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	38.20	42.6	-1.1		7.4	0.1	0.0	15.6	22.8	22.8	22.8
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	37.71	42.5	-3.1		5.0	0.3	0.0	22.4	25.9	25.9	25.9
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	36.41	42.2	-1.1		0.0	0.4	0.0	28.7	32.1	32.1	32.1
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	37.31	42.4	-0.9		0.0	0.5	0.0	27.6	31.4	31.4	31.4
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	38.91	42.8	-1.2		10.4	0.1	0.0	15.3	20.5	20.5	20.5
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	36.59	42.3	-0.1		0.0	0.5	0.0	27.3	30.9	30.9	30.9
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	36.67	42.3	-3.1		5.0	0.3	0.0	23.1	26.3	26.3	26.3

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Source	SrcType	Lw dB(A)	Lw' dB(A)	l or S m,m²	KI dB	KT dB	Ko dB	s m	Adiv dB	Agr dB	Amisc dB	Abar dB	Aatm dB	DI dB	Re dB(A)	Ls dB(A)	LrD dB(A)	LrN dB(A)
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	35.35	42.0	-1.0		0.0	0.4	0.0	29.1	32.4	32.4	32.4
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	35.85	42.1	-1.1		4.5	0.3	0.0	18.6	26.1	26.1	26.1
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	37.97	42.6	-1.2		10.5	0.1	0.0	15.5	20.6	20.6	20.6
Name private hospital	Floor 2. Floor	LrD,lim 57 dB(A)		LrN,lim 47 dB(A)			LrD 39.4 dB(A)		LrN 39.4 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	38.19	42.6	-1.2		7.4	0.1	0.0	15.8	23.0	23.0	23.0
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	37.59	42.5	-3.0		3.7	0.6	0.0	23.3	26.8	26.8	26.8
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	36.40	42.2	-1.1		0.0	0.4	0.0	28.7	32.1	32.1	32.1
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	37.30	42.4	-0.9		0.0	0.5	0.0	27.6	31.4	31.4	31.4
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	38.90	42.8	-1.3		10.3	0.1	0.0	15.5	20.7	20.7	20.7
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	36.59	42.3	-1.8		0.0	0.4	0.0	29.0	32.6	32.6	32.6
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	36.54	42.2	-3.0		3.7	0.6	0.0	24.0	27.2	27.2	27.2
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	35.35	42.0	-1.5		0.0	0.4	0.0	29.6	32.9	32.9	32.9
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	35.87	42.1	-1.3		4.4	0.3	0.0	18.7	26.3	26.3	26.3
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	37.96	42.6	-1.3		10.5	0.1	0.0	15.7	20.8	20.8	20.8
Name private_elevated	Floor 1. Floor	LrD,lim 57 dB(A)		LrN,lim 47 dB(A)			LrD 34.0 dB(A)		LrN 34.0 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	42.64	43.6	-3.0		17.8	0.1	0.0	12.0	15.2	15.2	15.2
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	41.95	43.4	-3.0		5.1	0.3	0.0	21.2	24.7	24.7	24.7
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	40.85	43.2	-3.0		6.6	0.2	0.0	23.4	26.7	26.7	26.7
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	41.34	43.3	-3.0		6.6	0.2	0.0	22.8	26.4	26.4	26.4
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	43.36	43.7	-3.0		18.0	0.1	0.0	11.6	14.9	14.9	14.9
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	41.21	43.3	-3.0		6.5	0.2	0.0	22.9	26.5	26.5	26.5
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	41.08	43.3	-3.0		5.2	0.3	0.0	21.2	24.8	24.8	24.8
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	39.97	43.0	-3.0		6.7	0.2	0.0	23.1	26.7	26.7	26.7
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	41.81	43.4	-3.0		17.4	0.1	0.0	12.2	15.7	15.7	15.7
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	42.57	43.6	-3.0		18.0	0.1	0.0	11.6	15.0	15.0	15.0
Name private_elevated	Floor 2. Floor	LrD,lim 57 dB(A)		LrN,lim 47 dB(A)			LrD 39.9 dB(A)		LrN 39.9 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	43.00	43.7	-3.0		7.3	0.1	0.0	16.1	23.7	23.7	23.7
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	42.23	43.5	-3.0		1.9	0.6	0.0	24.1	27.5	27.5	27.5

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Source	SrcType	Lw dB(A)	Lw' dB(A)	l or S m,m²	KI dB	KT dB	Ko dB	s m	Adiv dB	Agr dB	Amisc dB	Abar dB	Aatm dB	DI dB	Re dB(A)	Ls dB(A)	LrD dB(A)	LrN dB(A)
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	41.22	43.3	-3.0		0.0	0.4	0.0	29.6	32.9	32.9	32.9
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	41.73	43.4	-3.0		0.0	0.4	0.0	29.1	32.7	32.7	32.7
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	43.71	43.8	-3.0		10.8	0.1	0.0	15.6	20.8	20.8	20.8
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	41.58	43.4	-3.0		0.0	0.4	0.0	29.2	32.7	32.7	32.7
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	41.37	43.3	-3.0		1.9	0.6	0.0	24.3	27.8	27.8	27.8
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	40.35	43.1	-3.0		0.0	0.4	0.0	29.4	33.0	33.0	33.0
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	42.17	43.5	-3.0		5.0	0.2	0.0	16.5	25.9	25.9	25.9
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	42.93	43.6	-3.0		10.8	0.1	0.0	15.7	21.0	21.0	21.0
Name: private_elevated	Floor: 3. Floor	LrD,lim: 57 dB(A)		LrN,lim: 47 dB(A)			LrD: 39.9 dB(A)		LrN: 39.9 dB(A)									
trans 2 west	Area	68.0	59.2	7.7	0	0	3.0	43.54	43.8	-3.0		7.3	0.1	0.0	16.2	23.7	23.7	23.7
trans 2 roof	Area	68.0	58.8	8.4	0	0	0.0	42.67	43.6	-3.0		1.2	0.6	0.0	24.8	28.2	28.2	28.2
trans 2 south	Area	68.0	58.3	9.4	0	0	3.0	41.78	43.4	-3.0		0.0	0.4	0.0	29.7	32.9	32.9	32.9
trans 2 east	Area	68.0	59.2	7.7	0	0	3.0	42.29	43.5	-3.0		0.0	0.4	0.0	29.0	32.6	32.6	32.6
trans 2 north	Area	68.0	58.1	9.8	0	0	3.0	44.24	43.9	-3.0		10.7	0.1	0.0	15.7	20.9	20.9	20.9
trans 1 west	Area	68.0	59.2	7.7	0	0	3.0	42.14	43.5	-3.0		0.0	0.4	0.0	29.1	32.6	32.6	32.6
trans 1 roof	Area	68.0	58.8	8.4	0	0	0.0	41.83	43.4	-3.0		1.1	0.5	0.0	24.9	28.5	28.5	28.5
trans 1 south	Area	68.0	58.3	9.4	0	0	3.0	40.92	43.2	-3.0		0.0	0.4	0.0	29.4	32.9	32.9	32.9
trans 1 east	Area	68.0	59.2	7.7	0	0	3.0	42.71	43.6	-3.0		4.9	0.3	0.0	16.7	25.8	25.8	25.8
trans 1 north	Area	68.0	58.1	9.8	0	0	3.0	43.47	43.8	-3.0		10.7	0.1	0.0	15.8	21.0	21.0	21.0