The Acoustic Group
CONSULTING ACOUSTICAL & VIBRATION ENGINEERING

PROPOSED REZONING
SOUTH JERRABOMBERRA
45.5147.R1A:MSC

Prepared for: Tuggeranong Investments
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CONTENTS

		Page No
1.0	Introduction	1
2.0	The Site	1
3.0	Acoustic Criteria	4
4.0	Noise Measurements	10
	4.1 Attended Ambient Measurements	10
	4.2 Unattended Noise Monitoring	13
5.0	Acoustic Assessment	16
	5.1 Aircraft Noise	16
	5.2 Road Traffic Noise	26
	5.3 Rail Traffic Noise	28
	5.4 Industrial Noise	30
	5.5 Acoustic controls	32
6.0	Conclusions	36

APPENDICES

A: Site Location

B: Logger Measurement Locations

C: Logger Results – BG1

D: Logger Results – BG2

E: Logger Results – BG3

1.0 INTRODUCTION

The purpose of this report is to examine the potential noise impacts in relation to land located in South Jerrabomberra, Planning Proposal Area.

The subject land is in proximity to the southern flight track into Canberra Airport. Residential development/rezoning in the Planning Proposal Area requires an assessment under Australian Standard AS 2021.

In addition to the specific requirement to address AS2021 under the NSW Department of Planning's *Queanbeyan City Council Residential and Economic Strategy 2031, Addendum Report (2008)*, *the Section 117 Ministerial Directions – direction 3.5,* and the *Infrastructure SEPP,* there is a requirement under the NSW EPA policies to assess other potential noise sources (transport and industry) that could have an impact on the proposed development.

There is a proposal to rezone land bordering the ACT/NSW Border for residential use in accordance with the Council's residential strategy.

This acoustic assessment relies upon the planning strategies nominated by Council, the requirements and material contained in AS2021, ambient measurements obtained by Pacific Environment Limited at the subject site, noise assessment policies issued by the EPA (Industrial Noise Policy, NSW Road Noise Policy, Rail Infrastructure Noise Guideline) and the Infrastructure SEPP.

2.0 THE SITE

The site is situated to the immediate southeast of the NSW/ACT border, separated by the disused Goulburn to Bombala railway line. To the northwest of the rail line is the existing Hume Industrial Area.

There are two parcels of land covering 111 hectares in South Jerrabomberra, NSW that are the subject of rezoning (Parcel 1 and Parcel 2 in Figure 1).

The proposed site for rezoning is considered an extension of South Tralee that has recently been rezoned for residential purposes.

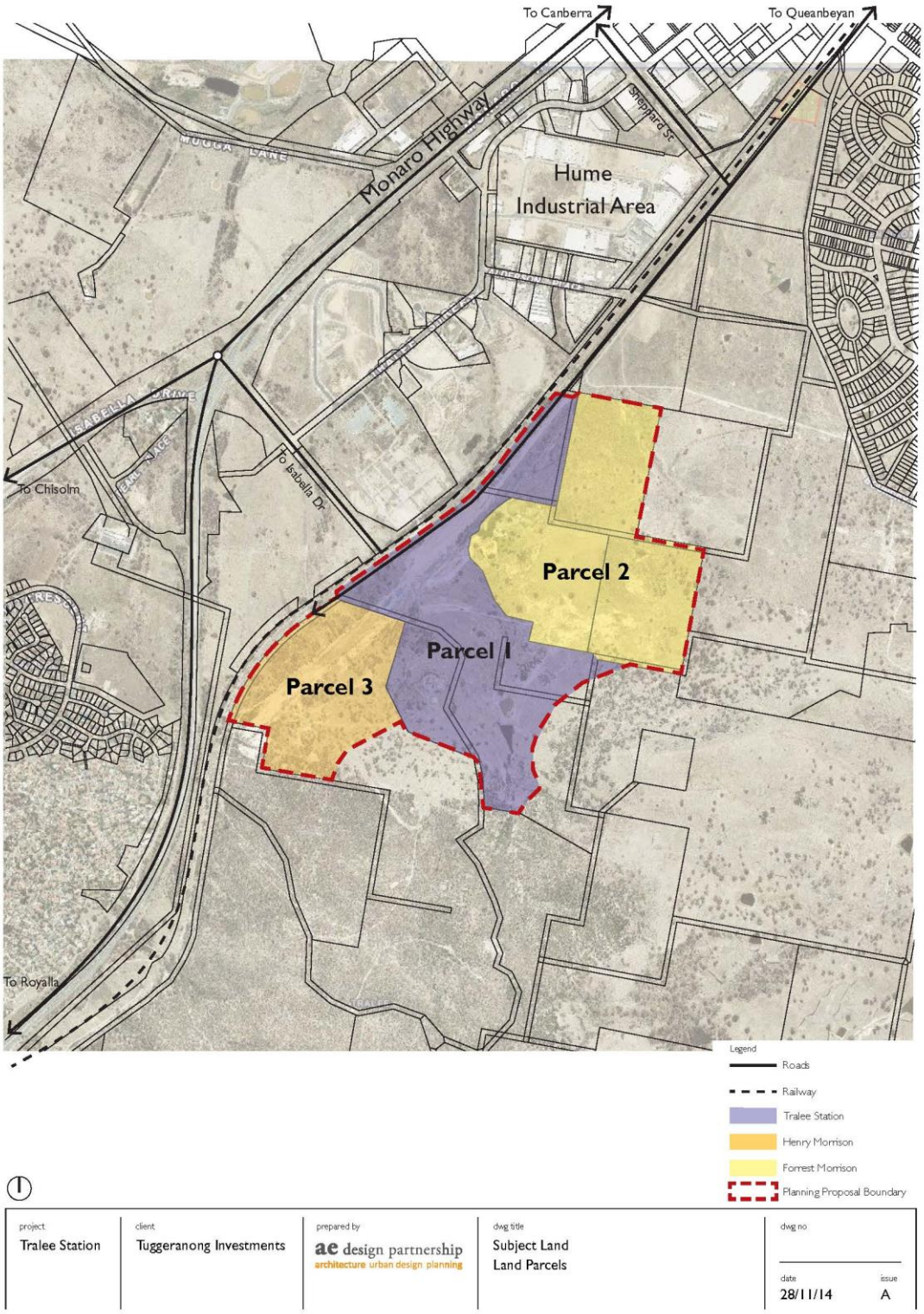


FIGURE 1: Subject Land

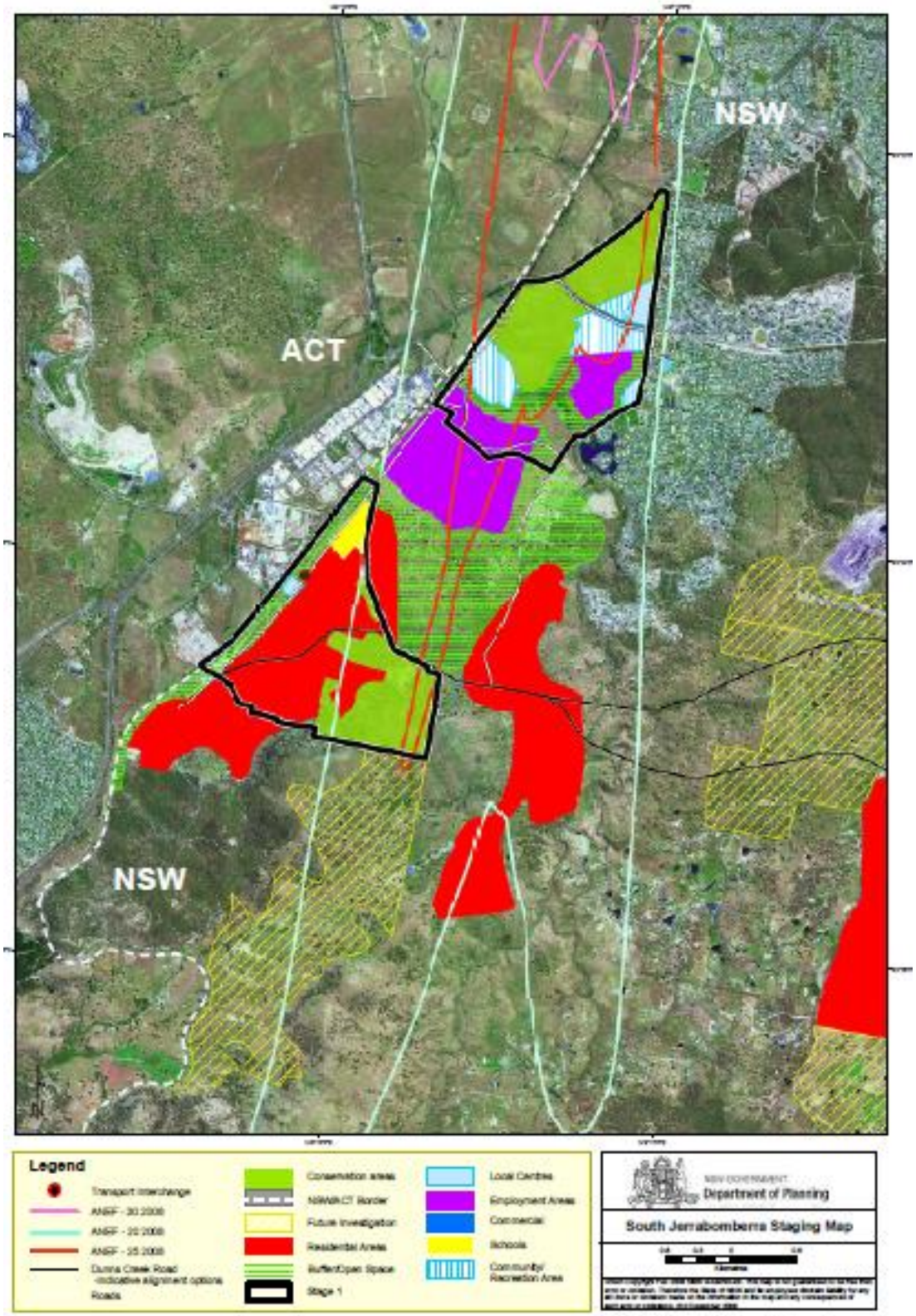


FIGURE 2: South Jerrabomberra Staging Map -1

Figure 2 from the Queanbeyan Residential and Economical Strategy identifies planning concepts for the immediate area with the subject area for rezoning in the red zone (designated residential areas).

Figure 2 reveals the ANEF contours assigned to Canberra Airport that places the entire rezoning area outside the 20 ANEF contour. Under Australian Standard AS 2021 aircraft noise is not expected to be an acoustic issue for the subject rezoning.

Figure 2 indicates the intent of a buffer/open space along the north western boundary of the residential area of South Tralee that encompasses a disused Goulburn to Bombala railway line. The railway line defines the ACT/NSW border.

On the north western side of the buffer/open space is a light industrial area designated the Hume Industrial Estate that is governed by ACT noise requirements.

Figure 2 (when read with Figure 1) indicates the subject land is not in close proximity to the Monaro Highway west and north west of the site.

3.0 ACOUSTIC CRITERIA

From an acoustic perspective there is not envisaged to be any significant noise impacts on the proposed rezoning that warrant any specific noise control measures.

There is potential for noise from aircraft operations, road traffic, future rail traffic and the existing industrial activities.

Acoustic assessments in relation to aircraft noise refer to Australian *AS 2021 – Acoustics – Aircraft Noise Intrusion – Building Siting and Construction.* The current version of AS2021 is dated 2000. The Principal of TAG was a member of the committee(s) responsible for the aircraft standard from 1985 – 2013 and was responsible for technical amendments of the 2000 version of the Standard.

The Standard requires in the first instance to assess the building site in terms of the ANEF (Aircraft Noise Exposure Forecast) contour and to ascertain what acceptability zone covers the site. For residential purposes AS2021 – 2000 advises that for areas outside 20 ANEF aircraft noise is not an issue and no further assessment under AS2021 is required. Figure 2 indicates the entire are for rezoning is outside the 20 ANEF contour.

Notwithstanding the location of the 20 ANEF for an absolute worst case noise scenario for Canberra Airport (the Ultimate Capacity) and that by the time such a capacity was reached (if ever) the noise output of the aircraft is expected to be lower than that modelled. This is because under the International Civil Aviation Organisation ("ICAO") all new aircraft seeking certification are required to generate lower noise levels than the current aircraft.

We are advised that for the subject rezoning in the initial assessment we are to adopt the approach the South Tralee rezoning process:

- A conservative approach to the identification of future aircraft noise by adopting Canberra Airport's Practical Ultimate Capacity ANEF,
- Locates all residential development outside the ANEF 20 contour,
- Requires all residential development, irrespective of its location or ANEF affectation, to meet the indoor design sound levels set out in Table 3.3 of AS 2021. This goes beyond the existing planning policy requirements and is designed to safeguard as far as possible the intrusion of night time aircraft noise into residential buildings. The Department imposed this additional requirement on Council to further reduce the likelihood that night-time noise would lead to complaints and affect the curfew free status of Canberra Airport.

Table 3.3 of AS 2021 specifies internal average maximum levels for residential dwellings as shown in Table 1.

TABLE 1: Assessment Criteria for Aircraft Noise Intrusion – dB(A) slow response

Type of room	Indoor design sound level, dB
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60

If the internal levels require that doors and windows are to be closed then under clause 3.3 of AS 2021-2000, building ventilation should be in accordance with the Building Code of Australia on the assumption that windows and doors are not openable. Mechanical ventilation or air conditioning systems complying with AS 1668.2 should be installed.

The EPA has issued the *NSW Road Noise Policy* ("RNP") that is the based document for the assessment of road traffic.

The RNP sets out noise criteria with respect to new road projects but does not specify noise criteria to new developments affected by noise from the existing traffic. The RNP nominates different noise targets for different road categories. Of importance with the RNP noise targets is that if the site is affected by Freeway/arterial/sub-arterial roads the criteria are assessed as an Leq (15 hour) level over 7am to 10pm and an Leq (9 hour) over the period 10pm to 7am. For local roads the Leq level during both the day and night periods are an Leq (1 hours).

The EPA's RNP repeatable maximum (1 hour) LAeq level is used for local road and is defined as being the upper 10% of the individual Leq levels and on a numerical basis the external level would be marginally higher than the 15 hour or 9 hour analysis method used by the EPA for arterial roads

For new land developments the footnote to Table 3 (in the RNP) refers to Appendix C in that document, which in turn refers to internal noise goals in the *Infrastructure SEPP* (Department of Planning NSW 2007) for sensitive developments near busy roads.

The *Infrastructure SEPP* refers to new residential developments adjacent to a transport corridor, whilst the RNP refers to development impacted by traffic noise near such corridors. The subject rezoning is not adjacent road transport corridor (the Monaro Highway).

Clause 102 of the *Infrastructure SEPP* requires new sensitive residential developments to meet internal noise levels of 35 dB(A)) at any time between 10 pm and 7 am for bedrooms during the night-time period and 40 dB(A) at any time for other habitable rooms. The *Infrastructure SEPP* does not define the time periods over which the Leq is assessed.

The Department of Planning *Development near Rail Corridors and Busy Roads – Interim Guideline* (2008) identifies in section 1.2 the application of the guideline and its relationship to the *Infrastructure SEPP*. The Interim Guideline is a useful document as it provides recommend forms of construction to achieve different levels of acoustic performance but of more importance in section 3.4 and again in Table 3.1 identifies the time periods to which the road and rail criteria apply.

On reading the *Infrastructure SEPP* criteria in-conjunction with the RNP the following noise targets are obtained:

TABLE 2: Assessment criteria for new residential developments near busy roads and rail corridors

Type of room	Time period	Assessment Criteria, dB
Bedrooms	Night (10 pm - 7 am)	LAeq (15 hour) - 35 (internal)
Other habitable rooms	Any time	LAeq (24 hour) - 40 (internal)

With respect to rail traffic noise the disused Goulburn to Bombala rail line between the site and Hume Industrial Area is not currently used (there are currently no rail services operating on the line) and therefore does present an acoustic issue of concern.

It has been suggested that where justification is established the use of the line could be reinstated. The rail line could be used for either freight or passenger services.

If the line was reinstated the responsibility of noise control measures/distance separation would in a planning sense lie with the operator/owner of the rail line. However, we are advised consideration in a planning sense should be undertaken for the railway line similar to that applied for the South Tralee development.

Under clause 87 of the Infrastructure SEPP dwellings in proximity to a rail corridor are to achieve the internal noise targets nominated for road traffic.

Under Tables 1 & 3 of the EPA's Rail Infrastructure Noise Guideline the criteria are classified for "redevelopment of existing rail line" that in the absence of any current operations would be subject to the noise targets set out in Table 3.

TABLE 3: External assessment criteria for redevelopment of existing rail line

Land Use	Time period	Assessment Criteria, dB(A)
Residential	Day (7am – 10pm)	Leq 65 Lmax 85
	Night (10 pm - 7 am)	Leq 60 Lmax 85
Other space – passive use	When in use	Leq 65
Other space – active use	When in use	Leq 65

Noise emitted from the Hume Industrial Estate is governed by the *Noise Environment Protection Policy* (Noise EPP) because the site is located in the ACT. In NSW the assessment of industrial noise falls under the *Industrial Nosie Policy* issued by the NSW EPA.

Industrial noise from existing of future developments potentially impacting on the site generated in the ACT is subject to *Noise Environment Protection Policy* (Noise EPP) (**ACT Government, 2010**).

The ACT method nominates different noise zones that as a result have different noise standards expressed as a LA10,T where T is not less than 5 minutes and no greater than 15 minutes.

Within industrial areas (Zone A) the daytime limit is 65 dB(A) reducing to 55 dB(A) at night. Zone B, D, E & F cover town centres, commercial areas, restricted access, broadacre areas that are not applicable to the subject site. Zone C includes land in corridor sites (55/45 limits) with zone G being all other land. Assuming zone G would apply to the subject site when used for residential purpose the daytime limit is 45 dB(A) reducing to 35 dB(A) at night.

In the case where two different noise zones meet, the average (rounded up to the nearest dB) is taken as the noise standard for that boundary.

This means that adjacent the rail corridor the land would be subject to a daytime limit for the industrial estate of 50 dB(A) reducing to 40 dB(A) at night. Further removed from the corridor the limits would be that for zone G.

In the case where noise generated within the ACT is received in NSW, the Noise EPP states:

> *"To the extent that noise generated in the ACT affects persons in NSW, the Act should be administered so as to deliver equivalent protection to residents of both jurisdictions…"*
>
> *"While NSW residents and businesses are not subject to ACT legislation as far as their noise generating activities are concerned, they may be affected by noise originating from the ACT. To provide them with protection from ACT noise, Schedule 2 of the Regulation establishes noise zones in NSW which are equivalent to those in the ACT and enables NSW residents to be recognised as an 'affected person' under ACT legislation."*

The above extract indicates that the Hume Industrial Estate is required to ensure noise emissions are to satisfy the criteria for Zone A and Zone G.

In NSW industrial sites are required to satisfy both the intrusive and amenity criteria when assessed at residential properties (not on large rural blocks 30 metre from the residence).

The intrusive noise target is backgrounds + 5 dB(A) when assessed as an Leq contribution over 15 minutes.

Whilst the subject site is a rural zone the consequence of the proposed rezoning leads to the residential sites being classified under the INP as "Suburban".

The amenity noise target seeks to restrict the cumulative noise impact of industrial sources. The INP amenity targets (extracted from Table 2.1) are shown in Table 4.

TABLE 4: Extract from Table 2.1 of the INP

Land Type / Receiver Location	Time of Day	Amenity Noise Objective dB(A)$L_{eq(Period)}$	
		Acceptable	Maximum
Rural	Day Time (7am – 6pm)	50	55
	Evening (6pm – 10pm)	45	50
	Night (10pm – 7am)	40	45
Suburban	Day Time (7am – 6pm)	55	60
	Evening (6pm – 10pm)	45	50
	Night (10pm – 7am)	40	45

From the above it can be seen that the ACT limits imposed upon the Industrial Estate and more stringent than the INP limits. As such if the industrial estate complies with the ACT requirements it will automatically comply with the INP requirements.

4.0 NOISE MEASUREMENTS

For the purpose of the subject assessment it is necessary to ascertain the existing acoustic environment of the area. Attended and unattended (logger) measurements were carried out by Pacific Environment Limited.

4.1 Attended Ambient Measurements

Attended measurements were conducted by Pacific Environment Limited In June 2014.

The attended measurements revealed relatively low ambient noise levels resulting in noise from the highway and the industrial area being audible but well below the relevant noise targets presented in Section 3.

The attended monitoring was found that the general ambient noise environment is controlled by road traffic noise from the Monaro Highway and the other roads in the vicinity of the site. Road traffic was noted as the most significant noise source at all locations during the day, evening and night. The road traffic noise was generally steady state and constant with occasional peaks observed from accelerating vehicles and truck compression braking.

Industrial noise was also noted at BG1, BG2 and BG3, with industrial noise clearly audible at BG2 during the day and lower during the evening and night. Tonal reversing alarms and to a lesser extent broadband reversing alarms from the Mugga Lane RMC and Hume Industrial Area were clearly audible at all locations during the day, evening and night.

Heavy vehicle movements on roads within the Hume Industrial Area and within industrial premises were difficult to distinguish as the source location cannot be accurately attributed to a particular premises. Acceleration, braking and other noise emission from heavy vehicles may also occur on public roads.

Aircraft movements were observed to be generally low in level (less than 43 dB(A)) and were not observed to pass directly over the site.

The noise environment varied over the area of the site with more industrial noise being noted at BG2, close to the Hume Industrial Area. At BG3, noise levels were generally noted to be lower than the other locations, due to the offset of the road and limited shielding by topography. At BG1, the background noise levels were observed to be similar to BG2 where road traffic noise dominates the noise environment.

The following table present the results of the statistical measurements utilising standard EPA 15 minute sampling periods. The comments included in the table reveal the relatively low contribution of road traffic, industrial noise and aircraft at the site.

TABLE 5: Attended Measurement Results

Date/ Time	Locn	Measured dB(A) Level over 15 min				Comments
		L1	L10	Leq	L90	
11/6/14 11.56 AM	BG1	50	47	45	42	Road traffic noise from Monaro Highway. Other noise sources included occasional bangs and tonal reversing alarms just audible from Mugga Lane RMC, and bird calls. Industrial noise not discernible from road traffic noise.
11/6/14 2.10 PM	BG2	50	47	44	41	Road traffic noise with contribution from industrial noise from Hume. Industrial noise estimated at LAeq <40 dB(A). Trucks movements in the industrial estate were audible but not discernible from general road traffic noise. Industrial noise sources noted observed to emanate from premises on Alderson Place and Saw Mill Circuit.
11/6/14 1.07 PM	BG3	43	39	38	35	Road traffic noise from Highway. Occasional industrial noise from Hume and Mugga Lane RMC. Truck movements not discernible from road traffic noise. Noise sources from Mugga Lane included distant tonal reversing alarms, bangs and track clack from dozer on tip. Estimated industrial noise contribution <35 dB(A). Aeroplane arrival flyover observed LAFmax 43 dB(A).
11/6/14 8.50 PM	BG1	44	41	39	37	Noise environment dominated by road traffic noise from Highway. Other sources included occasional bang from Hume (LAmax 38 dB(A)), aircraft flyover take off (LAmax 43 dB(A)), occasional frog calls (noted in the 2kHz and 3.15 kHz 1/3 octave bands, <35 dB(A)). Landing noise (reverse thrusting) noted from Airport (LAmax 39 dB(A)).
11/6/14 7.50 PM	BG2	47	44	42	38	Noise environment dominated by road traffic noise from Highway. Other sources included occasional bang from Hume (LAmax 48 dB(A)), aircraft flyover take off (noted in the 2kHz and 3.15 kHz 1/3 octave bands, <35 dB(A)). Industrial noise estimated to be <35 dB(A).
11/6/14 8.21PM	BG3	41	39	38	36	Noise environment dominated by road traffic noise from Highway. Truck movements at intersection with Highway also audible. Truck compression brakes observed at LAmax 37-41 dB(A). Occasional frog calls (noted in the 2kHz and 3.15 kHz 1/3 octave bands, <30 dB(A)).

Date/ Time	Locn	Measured dB(A) Level over 15 min				Comments
		L1	L10	Leq	L90	
12/6/14 1.59 PM	BG1	44	39	36	30	Ambient noise environment controlled by road traffic noise and distant road traffic noise in absence of vehicles passing on Highway. Other industrial noise noted during gaps in traffic in distance, estimated at <30 dB(A) including distant just audible reversing alarms.
12/6/14 12.38 AM	BG2	42	38	34	36	Ambient noise environment controlled by road traffic noise and distant road traffic noise in absence of vehicles passing on Highway. Other industrial noise noted during gaps in traffic in distance from the north north west in direction of Hume, estimated at <32-33 dB(A) including distant just audible reversing alarms. Industrial sources included steady state compressor or fan noise from direction of Downer plant and nearby premises.
12/6/14 1.11AM	BG3	36	34	32	30	Noise environment controlled by road traffic noise and distant road traffic noise in the absence of cars passing on Highway. Just audible reversing alarms and industrial noise/truck movements audible (<28 dB(A)). Truck compression brakes LAmax 29-37 dB(A) on Monaro Highway. Frogs also noted at low level.

4.2 Unattended Noise Monitoring

The unattended noise monitoring was carried out between 11th and 19th June 2014 at two locations (BG1 and BG3) and the 11th and 24th June 2014 at one location (BG 2).

BG1 was located at the south of the site representing the site nearest the highway. BG2 was located at a point representative of the closest part of the site to existing developed industrial areas within Hume. BG2 experienced a hardware fault from contact with local fauna and the monitoring period was repeated from 19th to 24 June 2014.

BG3 was located at a typical setback for proposed residential properties from the Highway and Hume area.

The logger locations for ambient monitoring are shown in Appendix B.

Noise monitoring was conducted using two NTi Audio XL2 Type 1 and one Rion NL-31 noise logger. All equipment carries current calibration certificates and the calibration was checked in the field before and after the measurements and no significant drift (>0.5 dB) was noted.

For the duration of the monitoring period, meteorological conditions were recorded at the Bureau of Meteorology (BoM) Stations located at Canberra Airport and Tuggeranong, located approximately 13 km and 6km away respectively.

Where monitoring data were identified to be adversely affected by extraneous noise or during periods of adverse weather (significant rainfall or wind speeds greater than 5 m/s), these periods were removed from the monitoring.

The logger stores statistical noise descriptors for each 15-minute sample. At the end of the measurements the stored data was downloaded onto a computer for subsequent analysis.

Appendix B of the *Industrial Noise Policy* (the “INP”) identifies a procedure for processing the ambient background level data to derive a single number for the background that is described as the Rating Background Level (the “RBL”).

Appendices C, D & E provide the results for monitoring conducted at location BG1, BG2 and BG3 respectively.

Table 6 summarises the ambient noise levels measured at the logger monitoring locations, split into day, evening and night time periods.

TABLE 6: Measured Ambient Noise Levels

Logger	Noise Descriptor	INP Assessment			RNP Assessment	
		Time of Day				
		Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)	Day (7am-6pm)	Night (10pm-7am)
BG1	Rating Background Noise Level (dB(A) L_{90})	40	35	27	NA	NA
	Ambient Noise Level dB(A) $L_{eq(Period)}$*	47	42	43	NA	NA
	Arterial Road LAeq	NA	NA	NA	48	46
BG2	Rating Background Noise Level (dB(A) L_{90})	42	37	31	NA	NA
	Ambient Noise Level dB(A) $L_{eq(Period)}$*	48	41	46	NA	NA
	Arterial Road LAeq	NA	NA	NA	50	49
BG3	Rating Background Noise Level (dB(A) L_{90})	37	33	27	NA	NA
	Ambient Noise Level dB(A) $L_{eq(Period)}$*	45	40	41	NA	NA
	Arterial Road LAeq	NA	NA	NA	47	44

The logger results in Table 6 agree with the attended measurements.

The Rating Background Levels identified in Table 6 above indicate that the industrial noise contributions (if taken as a steady contributor to the background level) are well below the acoustic targets for such operations.

The attended measurements confirm the general traffic roar to determine the ambient environment and by way of the estimated industrial contribution set out in Table 5 the ambient Leq level identified in Table 6 would be traffic, whereas the ambient Leq as a result of industry (for assessment of the amenity criterion) would be much lower.

The results in Table 6 reveal that whilst the highway may be audible and influence the ambient levels the existing Leq levels measured in terms of the EPA RNP reveals full compliance with the external noise targets that would apply to an y existing residences on the subject site.

5.0 ACOUSTIC ASSESSMENT

Section 3 of this report identifies the various acoustic criteria that could be applied to the subject rezoning.

It is noted that the different acoustic criteria and noise control concepts were applied to the South Tralee application (Renzo Tonin & Associates 2010, *South Tralee Supplementary Report to LES – Acoustic Review,* ref TE543-02F02 and Wilkinson Murray 2013, *South Tralee Sub-Division Concept – DA Noise and Air Assessmen*t, 02147-DA) where portions of that land were inside the 20 ANEF contour.

5.1 Aircraft Noise

As discussed above the subject of the rezoning lies outside the 20 ANEF contour and under AS 2021 aircraft noise is not an issue. However, notwithstanding the direction from AS 2021 that aircraft noise is not an issue for the subject site (even on the basis of an unsubstantiated Ultimate Capacity concept), for the protection of the operation of Canberra Airport the Minister for Planning has required the development to comply with the internal noise targets set out in Table 3.3 of AS 2021.

In utilising AS2021 the internal noise target set out in Table 1 (extract of Table 3.3 in AS2021-2000) is a dB(A) average maximum level.

The attended measurements did not record any aircraft maximum levels above 50 dB(A). Utilising an outside to inside attenuation of 10 dB(A) for an open windows reveals under the current operations no noise control measures are required to address aircraft operations under the current situation.

However, under the requirement to address the ultimate capacity of the airport (whether it occurs or not) there is a requirement to identify the external aircraft noise level for the loudest of the various aircraft types that would operate on a daily basis.

Canberra Airport is currently a major passenger and freight terminal, which operates 24 hours a day with no curfew. As part of its development and growth, additional routes and air traffic are proposed to occur in the future. The 2014 *Preliminary Draft Master Plan* (PDMP) (**Canberra Airport, 2014**) proposes that the no curfew is imposed and the airport remains able to operate over 24 hours.

The PDMP for Canberra Airport was released on 17 March 2014. This document is to replace the 2009 master plan.

The PDMP reiterates the importance of the airport remaining curfew free in conjunction with the ability to avoid noise sensitive persons unknowingly being exposed to noise impacts from aircraft movements through noise disclosure.

The airport operators are committed to a policy of noise disclosure about current and expected levels of aircraft noise. However there relevance of predicted noise levels from an ultimate capacity are questionable on a number of bases.

Normally an ANEF contour looks to a 10 – 20 year projection based upon current operations and possible expansions. The predicted number of aircraft movements for an Ultimate Capacity cannot be supplied with any substantial backing and at best becomes crystal ball type analysis of what could occur if various concepts were to eventuate.

There is a requirement (under the International Civil Aviation Organisation) for new aircraft to be quieter than exisitng operational aircraft that must lead to a reduction in noise contours, as has been experienced at Sydney Airport.

The development of new aircraft with greater lifting capacity and streamlined airframes level to different profiles and lower noise level than current aircraft. For example, using different models of the Hornet jet fighter (including the Super Hornet and the replacement Joint Strike Fighter) as measured by TAG show significantl reduction in noise levels, just as later versions of the 747 (and the replacment A380) have lower noise levels.

It therefore follows that the noise contours under the PDMP must be conservative.

A *Submission to Canberra Airport Preliminary Draft Master Plan* prepared by ae design partnership (July 2014) for Tuggeranong Investments highlights the inadequacy of the predicted aircraft traffic movements.

The PDMP forecasted noise contours are based the Ultimate Practical Capacity (UPC) which its states as 282,000 fixed wing aircraft based on 24 hour a day operations.

A number of aircraft noise abatement procedures are currently practised by the airport, including noise abatement areas which limits over flight at a certain height above ground level. The areas are proposed to be extended to include the Googong New Town, however no plans are in place to include the proposed site at South Jerrabomberra.

Other noise abatement procedures include preferred runway operations during the night, whereby arrivals are preferred on Runway 17 and departures on 35. The use of the 17/35 runway is preferred over the cross runway 12/30 for night freight carriers.

Standard Instrument Departures (SIDs) followed by Standard Terminal Arrival Routes (STARs) were implemented in order to accurately manage aircraft arrivals paths and provide accurate tracking of flight paths to permit compliance with the noise abatement areas.

Required Navigation Performance (RNP) systems are GPS based tools which allow aircraft to follow flight paths accurately. These technologies have currently been fitted to Qantas Boeing 737-800 and B767-300 aircraft and have been applied to arrivals on Runway 35. This system is proposed to be expanded to Runway 17.

Similarly, additional approach procedures have been proposed for the main north south runway. Where aircraft approach from the south or south west they will be diverted further west away from Jerrabomberra and rural-residential areas of Fernleigh Park, Googong and Little Burra.

FIGURE 3: Aircraft Flight Paths (Canberra Airport Masterplan 2009)

The PDMP also produced N60, N65 and N70 contours maps. These maps detail the number of events over a certain noise levels are predicted over a certain day. For example the N60 contour represents the total number of instances during the average day where a location is exposed to a noise event greater than 60 dB(A) from aircraft movements. Plots of single event noise levels from 737-800 and 787-300 were also included in the PDMP. These plots show noise events from these aircraft above 65 dB(A).

Figure 3 indicates the flight tracks south of the airport have two different approaches with Figure 4 indicating the tracks closer to the subject land would generate higher noise levels than at present, i.e. the ultimate capacity would generate higher noise levels than at present by utilising flight paths south of the airport. Figure 4 indicates the number of events exceeding 70 dB(A) would be less than 10 a day at the site.

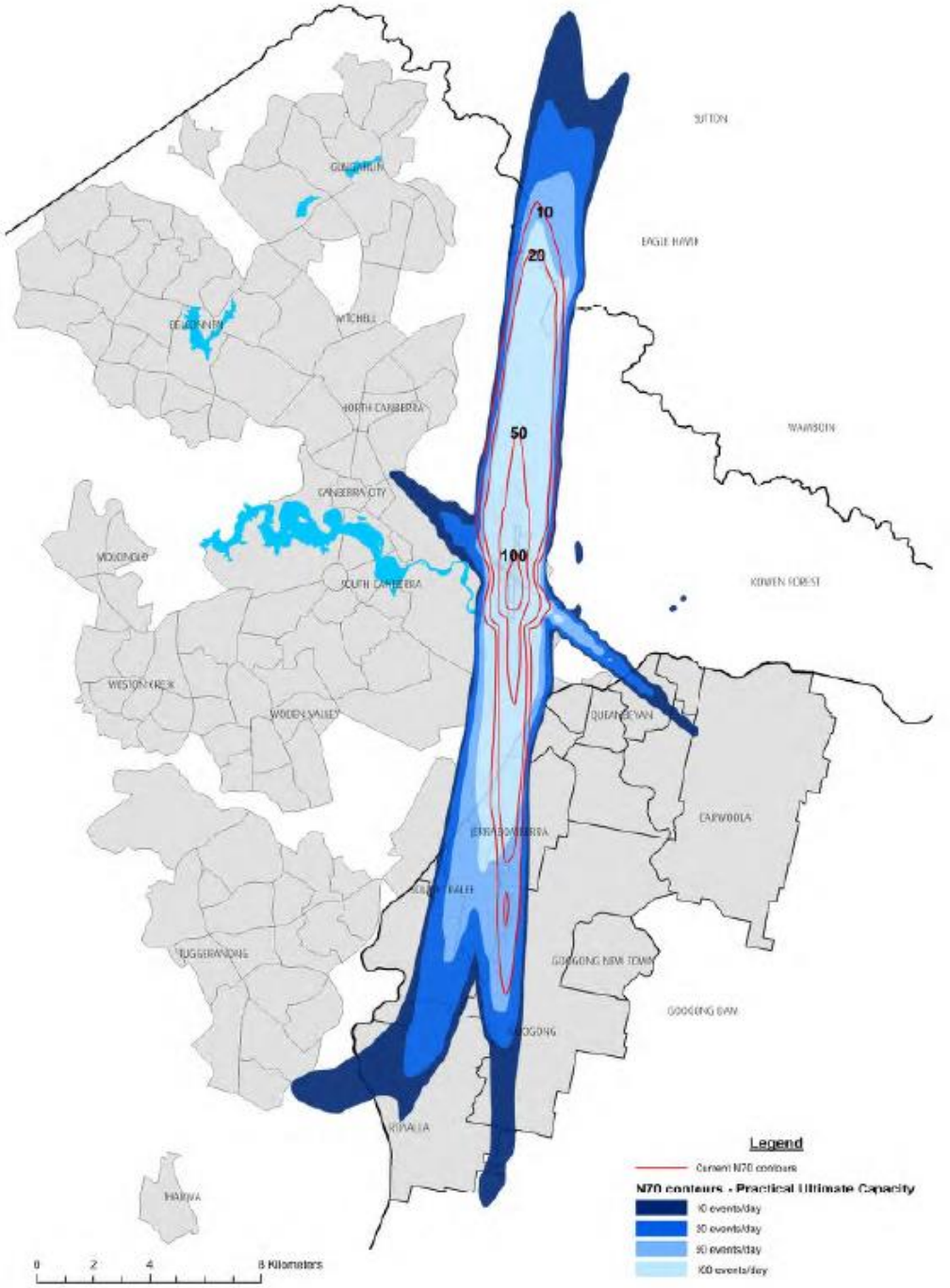
The Australian Standard AS2021 sets out a procedure for determining the position of a building site with respect to an aerodrome by the determination of a distance in metres from the building site to the extended runway centreline (DS), the distance in metres from the closest end of the runway to the intersection of the extended runway centreline (DL) and the distance in metres from the further end of the runway to the intersection of the runway centreline (DT).

Examination of Figure 2 (ANEF contours across the site) indicates for an extended curved centre line DL of 10300m the site will experience a range of sideline distances from 700 metres to 1500 metres.

Australian Standard AS2021 contains a series of tables providing noise levels at different displacements from the flight track for aircraft operating in commercial airports around Australia. From these tables the highest aircraft noise of common aircraft at the building site is determined to address the noise control measures.

The issue that is present for this site is the uncertainty of what aircraft would be operating at the ultimate capacity, and how many of the flights would be to international destination on a daily basis. As there can be significant differences in external noise levels (and therefore controls) caution is needed in providing specific noise control measures.

However it is noted that providing the necessary noise controls to satisfy the internal noise levels specified in AS 2021 -2000 are both feasible and practical – apart from the issue of whether they are necessary.



This is a plan of the areas receiving a sound level of 70dB(A) and above in 2012 compared to ultimate capacity. Each contour shows the average number of times 70dB(A) is/will be reached in 24 hours.

Figure 4 Comparison of N70 Contours now to ultimate capacity (Canberra Airport Preliminary Draft Master Plan 2014)

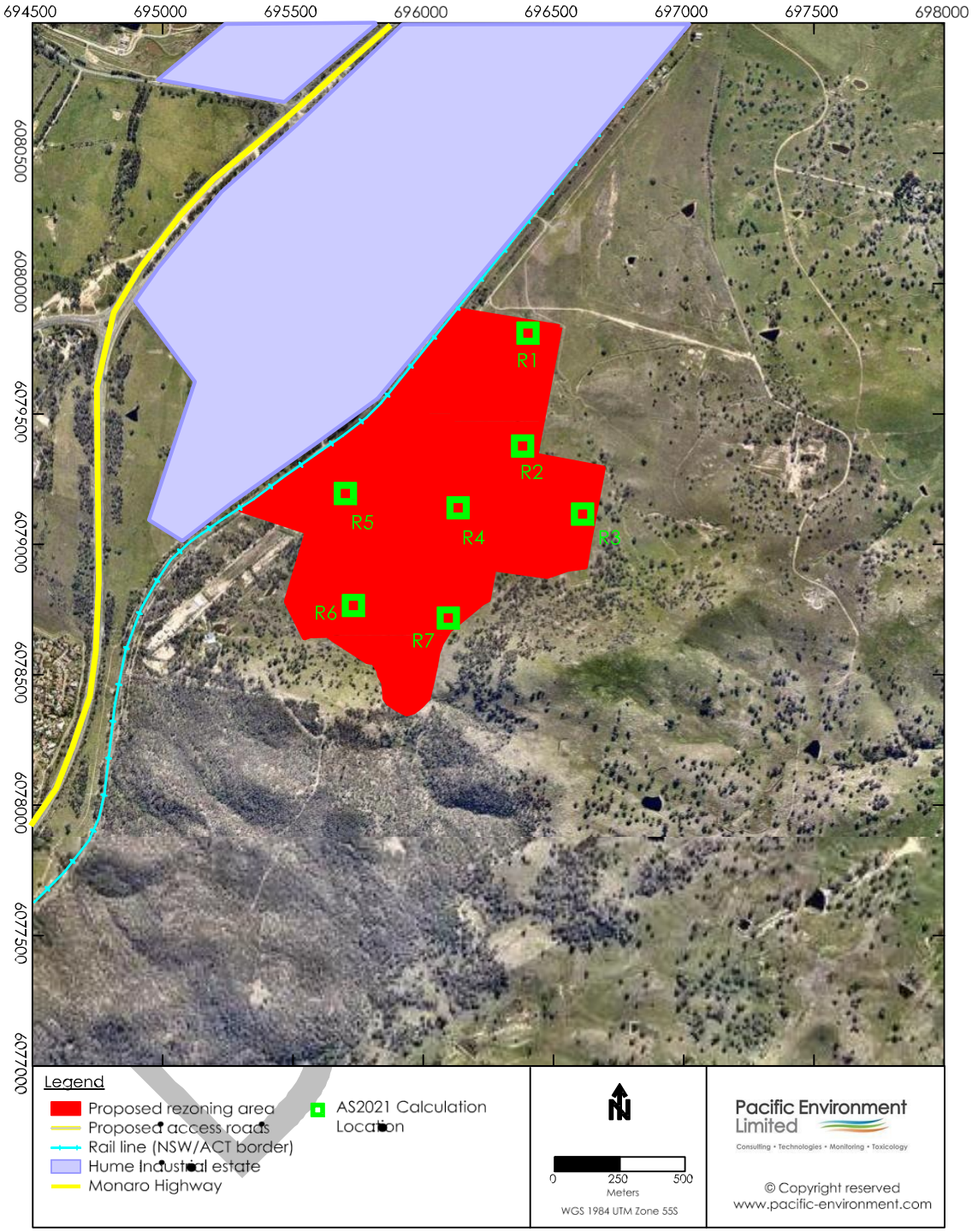


FIGURE 5 PEL assessment locations

An analysis of aircraft noise levels undertaken by Pacific Environment Limited utilised 7 representative locations as shown in Figure 5.

Utilising the maximum level tables from AS 2021 for Boeing 747-400 and Airbus A320/Boeing 737-300/ Boeing 737-400 aircraft resulted in the following predicted external aircraft noise levels.

TABLE 7: Predicted External Aircraft Noise Levels (from PEL)

Location	Average Maximum dB(A) slow response			
	747-400		A320/737-300	
	Landing	Take off	Landing	Take off
R1	63	71	56	64
R2	67	73	59	65
R3	73	76	63	67
R4	63	71	55	64
R5	62	67	<54	61
R6	<62	67	<54	61
R7	64	71	56	64

The Aircraft Noise Reduction ("ANR") is based upon a recommended internal design goal for sleeping areas and dedicated lounges of not more than 50 dB(A). For other habitable spaces, AS2021 recommends an internal design sound level of 55 dB(A) whilst for bathrooms, toilets and laundries the design goal is 60 dB(A).

Therefore for the subject site a proposed building at the most affected point (R3) is required to have an ANR of not less than 76-50 = 26 dB(A) for sleeping areas and dedicated lounges, 21 dB(A) for other habitable spaces, and 16 dB(A) for bathrooms, toilets and laundries.

In considering the internal noise levels the frequency characteristics of the aircraft noise has a bias towards the low frequencies which therefore tends to require an attenuation performance (when expressed as an Rw value) greater than the ANR that is expressed as a dB(A). Typically for aircraft noise nominated above the Rw of a building element is to be not less than the ANR + 7.

From Table 7 if the airport did not operate Boeing 747-400 on a daily basis (of at least 5 per day) then the requirement address the noise reduction for that aircraft would not apply and the controls would be based on the typical domestic aircraft as the A320/737-200.

For regular operations of A320/7437-300 aircraft other than for location R3 other than bedrooms and other habitable spaces normal form of construction and natural ventilation would suffice. For dwellings in proximity to R3 that had facades with a clear line of sight to the aircraft the windows and doors would need to be not less than 6.38mm glazing with the provision of air conditioning/mechanical ventilation satisfying AS1668.2.

The regular daily operation of 747-400 aircraft (as described as whole number of aircraft movements on a daily basis for the Ultimate Capacity scenario) would require all dwellings to incorporate acoustic upgrading to achieve compliance with Table 3.3 of AS 2021 and the provision of air conditioning/mechanical ventilation satisfying AS1668.2.

For dwellings subject to maximum aircraft noise levels between 65 and 72 dB(A) typical constructions would be as set out in Table 8.

TABLE 8: Typical Constructions Lmax 65 – 72 dB(A)

Room	Element	Construction
Sleeping areas and dedicated lounges	Windows	6.38 mm laminated glass with acoustic seals
	External doors	40mm solid core timber with full perimeter acoustic seals
	External Walls	Brick-veneer and standard plasterboard on timber studs with insulation in cavity
	Roof	Tiles or 0.77mm metal deck roof with thermal insulation hard under roof + 1 layer of 13mm plasterboard ceiling with insulation in the cavity
Other habitable spaces	Windows	6 mm float glass with standard seals
	External doors	40mm solid core timber with weather seals
	External Walls	Brick-veneer and standard plasterboard on timber studs with insulation in cavity

Room	Element	Construction
	Roof	Tiles or 0.77mm metal deck roof with thermal insulation hard under roof + 1 layer of 13mm plasterboard ceiling with insulation in the cavity
Bathrooms, toilets, laundries	Windows	6 mm float glass with standard seals
	External doors	40mm solid core timber with weather seals
	External Walls	Brick-veneer and standard plasterboard on timber studs
	Roof	Tiles or 0.77mm metal deck roof with thermal insulation hard under roof + 1 layer of 13mm plasterboard ceiling with insulation in the cavity

For the higher external levels the constructions require upgrading as shown in Table 9.

TABLE 9: Typical Constructions Lmax 73 – 76 dB(A)

Room	Element	Construction
Sleeping areas and dedicated lounges	Windows	10.38 mm laminated glass with acoustic seals
	External doors	45mm solid core timber with full perimeter acoustic seals
	External Walls	Double brick with cavity and plasterboard lining on timber battens with insulation between battens
	Roof	Tiles or 0.77mm metal deck roof with thermal insulation hard under roof + 2 layers of 10mm plasterboard ceiling with 100mm thick insulation in the cavity
Other habitable spaces	Windows	6.38mm laminated glass with full perimeter acoustic seals
	External doors	40mm solid core timber with acoustic seals
	External Walls	Double brick construction
	Roof	Tiles or 0.77mm metal deck roof with thermal insulation hard under roof + 2 layers of 10mm plasterboard ceiling with insulation in the cavity
Bathrooms, toilets, laundries	Windows	6 mm float glass with standard seals
	External doors	40mm solid core timber with weather seals
	External Walls	Brick-veneer and standard plasterboard on timber studs
	Roof	Tiles or 0.77mm metal deck roof with thermal insulation hard under roof + 1 layer of 13mm plasterboard ceiling with insulation in the cavity

5.2 Road Traffic

The ambient noise measurements reveal the highway is the major source in the area but the levels that have been recorded on site are well below the EPA's RNP limits for arterial roads and highways. Therefore under the EPA's RNP a preliminary concept is that road traffic is not a major issue.

However the RNP requires new developments to comply with the criteria in the *Infrastructure SEPP* shown in Table 2.

It is noted that the *Infrastructure SEPP* (being prepared prior to the RNP) automatically applies to dwellings adjacent to road corridors have an annual average daily traffic in excess of 40,000 vehicles. As such the *Infrastructure SEPP* would not apply to the land that is the subject of rezoning. But under the RNP the internal limits in the Infrastructure SEPP would apply and are specified as the levels over the 15 hour period (for the day) and 9 hour period for the night.

The ambient data from the unattended loggers reveals for the daytime traffic levels the provision of an open window to provide an attenuation of 10 dB from outside to inside will satisfy the *Infrastructure SEPP* internal targets for other habitable spaces. The night time levels indicate BG3 will be satisfied with BG1 being marginally over and BG 2 over by 4 dB.

However BG2 is located further from the highway than BG1 and as such should have a lower level than BG1. This suggests that the logger results for BG2 is also influenced by noise from the industrial estate. Whether the additional impact is as a result of traffic movements in the estate or on roads is unknown.

The construction of dwellings in the subdivision will automatically provide acoustic shielding to other houses so that it would only be the houses along the "rail corridor" that would be exposed to the highway traffic and require a marginal degree of noise control.

The closing of bedroom windows for dwellings at BG2 and BG1 would result in compliance with the internal limits in the Infrastructure SEPP. The buildings will require mechanical ventilation to bedrooms to address aircraft noise and therefore will automatically require air conditioning or mechanical ventilation to satisfy AS 1668.2.

The development of the internal traffic routes in the subdivision would generate localised traffic of an intermittent nature throughout the day and not of a continuous nature as for the Monaro Highway.

We are instructed the access routes are the subject of further deliberations with a number of options proposed. In traffic capacity the normal procedure is to look to maximum capacities in the AM and PM peak periods and not the total traffic flows across the entire day and night periods. That material is not available at the present time.

Figure 6 provides a simple tool from the Interim Guideline (Figure 3.4) to determine if an acoustic assessment is required (under the *Infrastructure SEPP*) for road traffic.

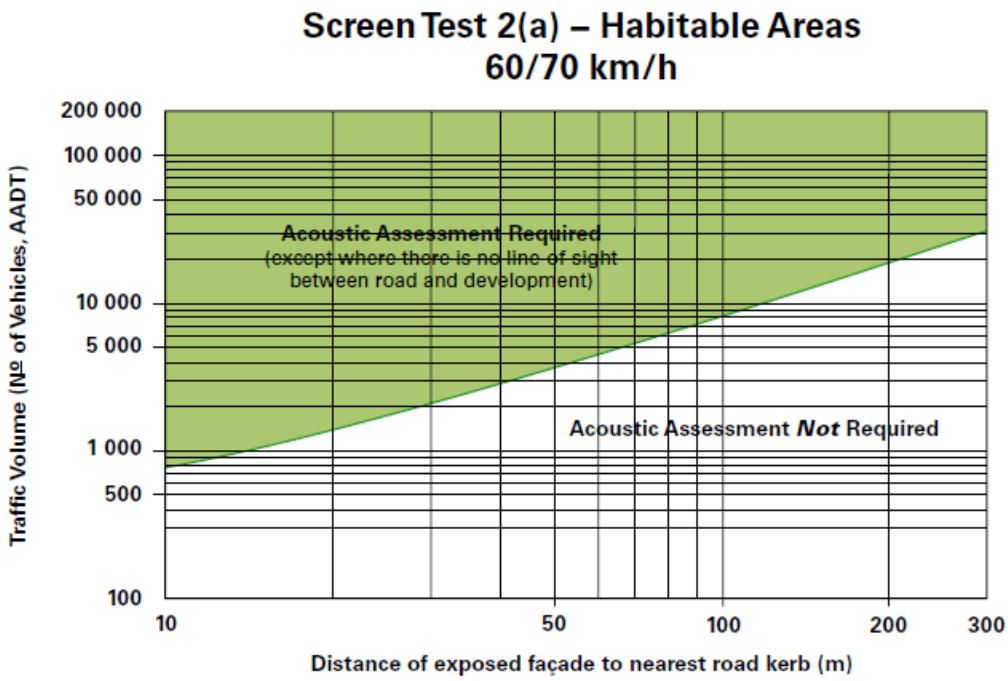


Figure 6 Screening test for habitable areas of multiple dwellings

However preliminary material suggests the major internal roads would for standard setbacks exceed the internal noise targets that as such would require doors and windows to be closed at times or the provision of fences to provide acoustic shielding. Section 3.8 of the Interim Guidelines provides practical solution as to orientation of dwellings, with Appendix B providing different forms of building construction to provided different levels of attenuation.

Apart from the provision of controls to address aircraft noise the provision of additional physical controls in terms of mounds or barriers falls into the development application stage. However the provision of appropriate controls to achieve the internal noise targets is both feasible and practical.

5.3 Rail Traffic

The requirement to consider an abandoned railway line present constraints on the use of the land that may never eventuate.

The planning map nominates a buffer that runs with the railway corridor so in effect already introduces a planning mechanism.

From an acoustic perspective there is an issue that there is no information to undertake and assessment of potential rail operations. Speculation as to noise impacts is fraught with a high degree of uncertainty.

However on going to the *Infrastructure SEPP* and the aforementioned Interim Guidelines issued by the Department of Planning in 2008 if the buffer zone is to be classified as a rail corridor, then consideration of rail traffic noise and vibration (clause 87 of the *Infrastructure SEPP*) would apply.

Section 3.5.1 of the Interim Guidelines provides advice on rail corridors. Figure 6 reproduces Figure 3.1 from the Interim Guidelines.

The figure reveals different rail services and different generic speeds lead to a greater separation distance for sensitive users.

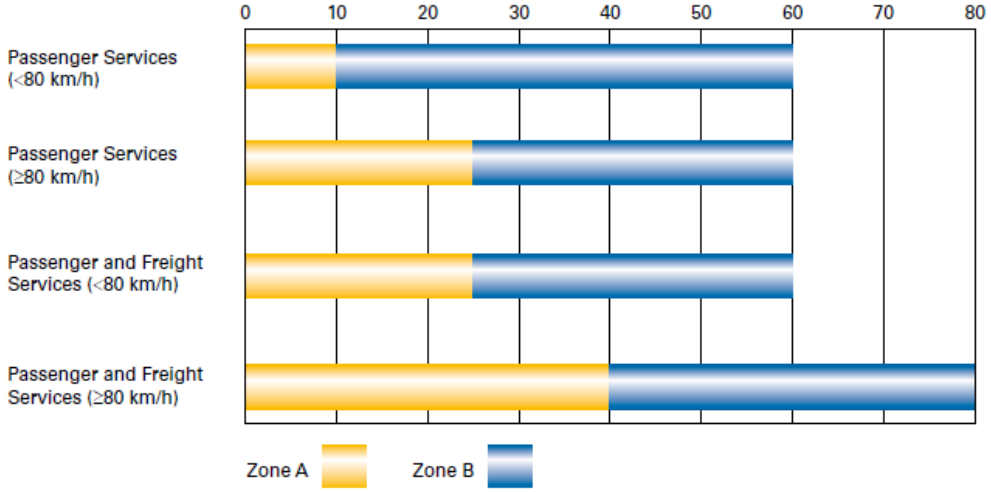


FIGURE 6: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track (not corridor)

The Interim Guideline notes:

> *Within Zone A, a full noise assessment should be undertaken.*
>
> *For single dwelling residences in Zone B, the standard mitigation measures consistent with Road Nosie Control Treatment Category 2 (refer road section below and Appendix C, for development will normally provide adequate mitigation to reduce internal noise levels to an acceptable level. If these measures are adopted as a minimum for single dwelling residences in Zone B, there should be no need for a specialist acoustic assessment. However the particular circumstances would also need to be considered.*
>
> *It should be noted that the Zone B standard mitigation measures are based on having windows and external doors closed, therefore consideration of ventilation requirements for noise-exposed rooms will be required to meet the provisions of the Building Code of Australia and other relevant standards. To minimise sleep disturbance, air should be ducted into these rooms from a quiet area not exposed to rail noise or through the use of quiet, acoustically treated ventilators.*

In addressing rail vibration Figure 3.2 of the Interim Guidelines provides a distance separation, shown in Figure 7 below.

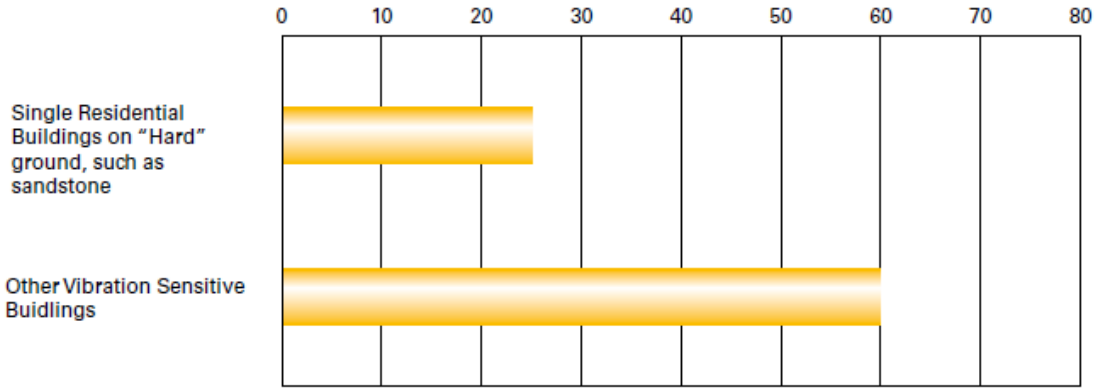


FIGURE 7: Distance (m) from operational track m

On combining Figure 6 and Figure 7 if the rail corridor was to be limited to passenger and freight services operating at a speed less than 80 km/hr then a separation distance greater than 60 metres from the nearest track would, from the Interim Guidelines, resolve both noise and vibration.

5.4 Industrial Noise

The attended measurements conducted in June 2014 by Pacific Environment Limited identified the current operations in the Hume Industrial Estate satisfy both the INP and the ACT zone G noise limits.

The issue at hand is that the industrial estate is not fully developed. Under the ACT policy whilst the individual industrial lots are required to satisfy the 65/55 dB(A) Zone A limit it is questioned whether the for the current open area of Tralee it would be classified as broadacre and therefore the industrial developments would also have to satisfy the Zone E requirements of 50/40 dB(A).

Alternatively if the rail line is a corridor or the nominated buffer zone is a "corridor" then that area is Zone C being 55/45.

The operation of an industrial estate when dealing with the nominated site boundary limit gives rise to a range of noise emission levels for individual lots.

Under the INP the development of an industrial estate requires consideration of the total number of sites to derive a specific site emission level so that the cumulative impact of all sites does not exceed the nominated amenity limit.

The Noise Environment Protection Regulation does not identify the application of noise limits for individual sites with respect to the contribution to the overall level in another zone.

For the South Tralee application Tonin considered the operation of the Industrial Estate at full capacity for each and every lot with a daytime sound power level of 109 dB(A) and a night time sound power level of 99 dB(A). The exercise was a desk top audit with no measurement data to support the hypothesis.

The sound level contributions from the existing industrial estate obtained by Pacific Environment Limited reveal noise levels less than the Zone G criteria and indicates the Tonin methodology is flawed as it does not reflect reality for the Hume Industrial Estate simply because not all sites generate high levels by reason of their activities and the presence of buildings to attenuate the noise.

For example in the noise planning of Warriewood Valley Industrial Estate (for Warringah Council) from results of other industrial areas the noise emission “rate” was considered for 50% of the site generating emission levels that would contribute to the overall sound level contribution in the day at residential receivers and 33% at night. Dependent upon the distance to the critical residential areas the industrial estate was divided into noise zones where a site boundary limit and a residential boundary limit were applied.

If one considers the industrial estate is at 50% capacity and reduces 3 dB off the Tonin predictions for the southern boundary of Tralee (adjacent the northern end of the subject rezoning) the current noise emission levels from the industrial estate recorded by PEL are 13 dB(A) below the daytime predicted level and 17 dB(A) below the predicted night time level.

Accordingly the provision of buffer zones and controls to protect a hypothetical noise emission that will never occur introduces significant implications as to the usability of a site. Based upon a doubling of the current number of operational industrial site on the estate would on the basis of a duplication of the current noise emission levels would result in compliance with the zone 4 day time limit but a marginal exceedance of the night time zone 4 limit for locations on the estate side of the rezoning.

Whilst the current noise emission from the industrial area fully satisfies the Zone G requirements, In view of the concerns to ensure full compliance with Zone G requirements with additional industrial lots that comply with the lot site boundary limit the provision of an 80 metre set back from the nearest rail track would achieve the desired Zone G result for the industrial noise, and easily comply with the rail traffic noise and vibration targets.

5.5 Acoustic Controls

Whilst the subject land is outside the ANEF 20 contour and as such would not require noise control measures there is a direction from the Minister of Planning for additional controls to achieve the internal noise targets set out in AS 2021. The provision of those additional noise control measures is both feasible and practical to implement.

The only consequence of the control is the requirement for mechanical ventilation or air conditioning to satisfy Australian Standard AS16668.2. It is noted the split air conditioning systems that only condition the internal space do not provide fresh air and therefore without a supplementary fan would not satisfy AS 1668.2 Fully ducted air conditioning system incorporate fresh air and with the appropriate design can satisfy the required ventilation air flow requirements.

Road traffic noise levels as a result of the Monaro Highway are well under the criteria and do not require any controls for that source. Under the *Infrastructure SEPP* the road traffic noise is assessed as an internal Leq level over the day (15 hours) and the night (9 hours).

The main access roads to the rezoning are yet to be determined and dependent upon the traffic volumes could require noise controls, subject to the design of the road corridor.

The potential rail traffic noise is subject to the reactivation of the railway line and is unknown at this point in time. On taking the conservative view that it is used for freight and passenger traffic operating at a speed less than 80 km/hr gives a separating distance to satisfy the SEPP Infrastructure limits for normal construction.

The concept shown below has been proposed for the provision of a 50 metre wide service corridor for the rezoned land that is located on the western side of the subject land that taking into account the required separation to the railway line and a residential boundary would automatically provide the recommended setback.

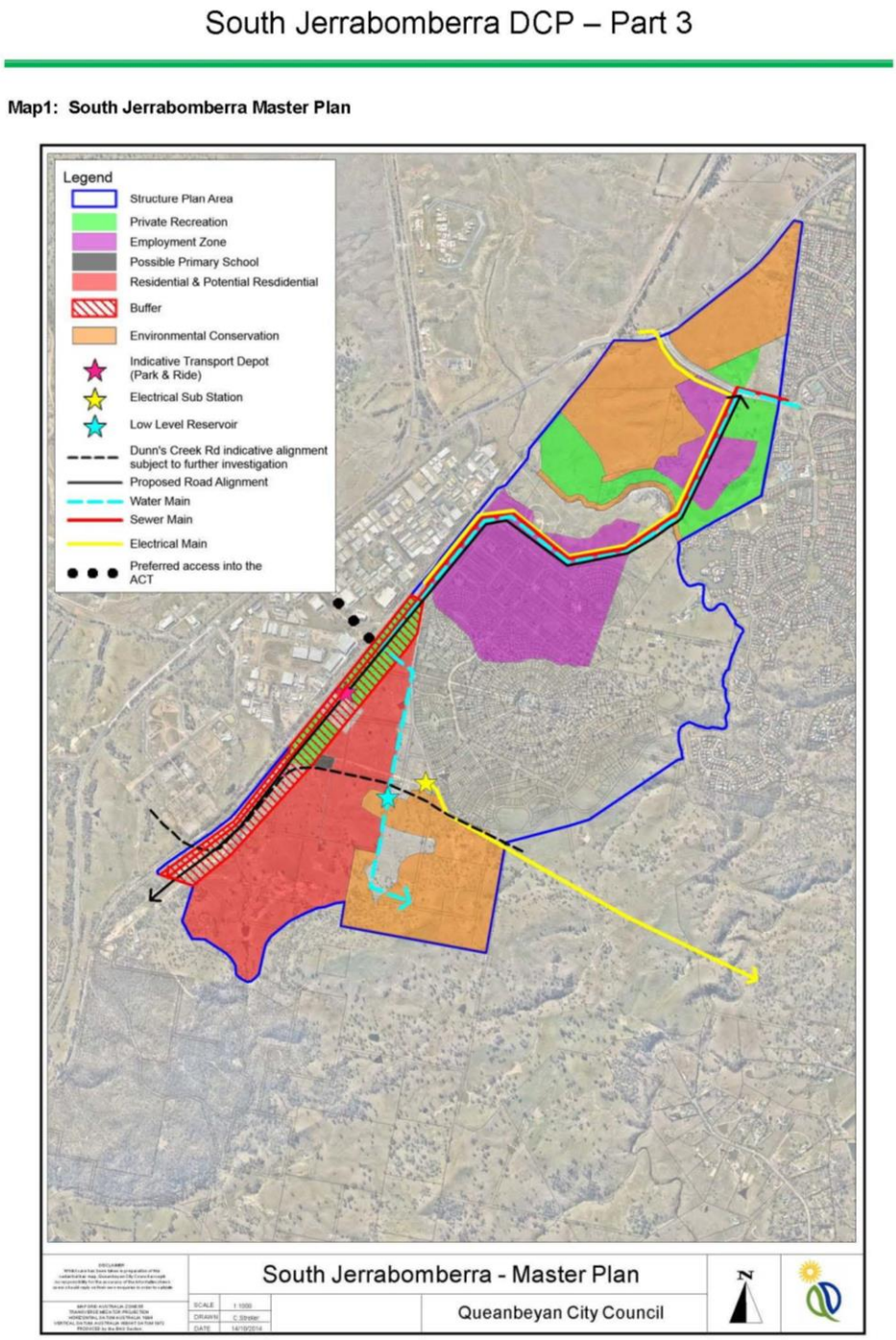


FIGURE 8: Indicative Layout of Future South Jerrabomberra Roads (South Jerrabomberra Masterplan (draft DCP 2014))

The above setback would automatically address the industrial noise issues, as discussed in section 5.4. However to provide a conservative approach imposed upon the Council for more noise controls than are actually required a 3 metres high earth mound or barrier could be placed on the eastern side of the access road to provide further attenuation of the industrial noise and noise from traffic using the proposed access road.

6 CONCLUSION

The proposal to rezone parcels 1 & 2 as shown in Figure 1 has been the subject of an acoustic assessment to address potential noise impacts and as such determine the suitability of the proposed rezoning.

The Renzo Tonin & Associates desktop review for South Tralee and the Department of Planning's *Queanbeyan City Council Residential and Economic Strategy 2031, Addendum Report (2008)* that has been provided as reference material for the assessment reveals an extremely conservative approach has been taken for nearby land rezonings as a result of a requirement to ensure Canberra Airport has unrestricted use and is to be applied for the subject site.

The provision of noise controls to satisfy the internal noises levels specified in AS 2021 can be achieved.

Noise from the Monaro Highway, the existing industrial estate and the abandoned railway line are not an issue or impose any restrictions on the rezoning.

The reactivation of the railway line has been addressed with respect to the proposed rezoning and requires a separation distance greater than 60 metres from the track so as to fully comply with the noise and vibration targets nominated in the *Infrastructure SEPP.*

It is proposed that an access road to the development site has a nominal 50 metre corridor adjacent the rail corridor that as such provides the required separation to the rail line.

The volume of traffic on the proposed road is not known to determine the external Leq levels for evaluation of the internal noise levels nominated in the *Infrastructure SEPP,* although the aircraft noise control measures would be sufficient.

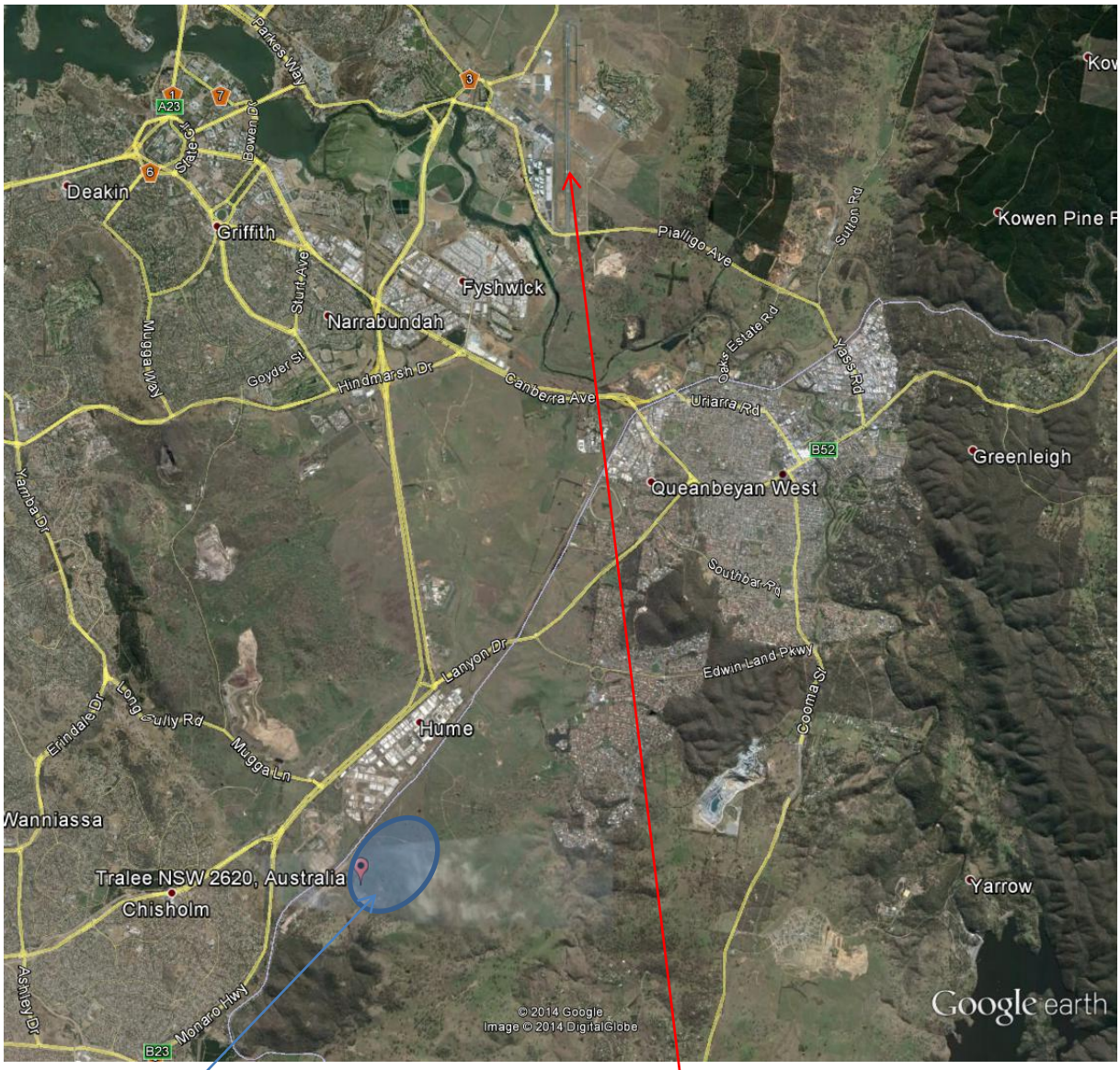
Whilst the current noise emission from the industrial area fully satisfies the Zone G requirements, In view of the concerns to ensure full compliance with Zone G requirements with additional industrial lots that comply with the lot site boundary limit the provision of an 80 metre set back from the nearest rail track would achieve the desired Zone G result for the industrial noise, and easily comply with the rail traffic noise and vibration targets.

Yours faithfully,

THE ACOUSTIC GROUP PTY LTD

STEVEN E. COOPER

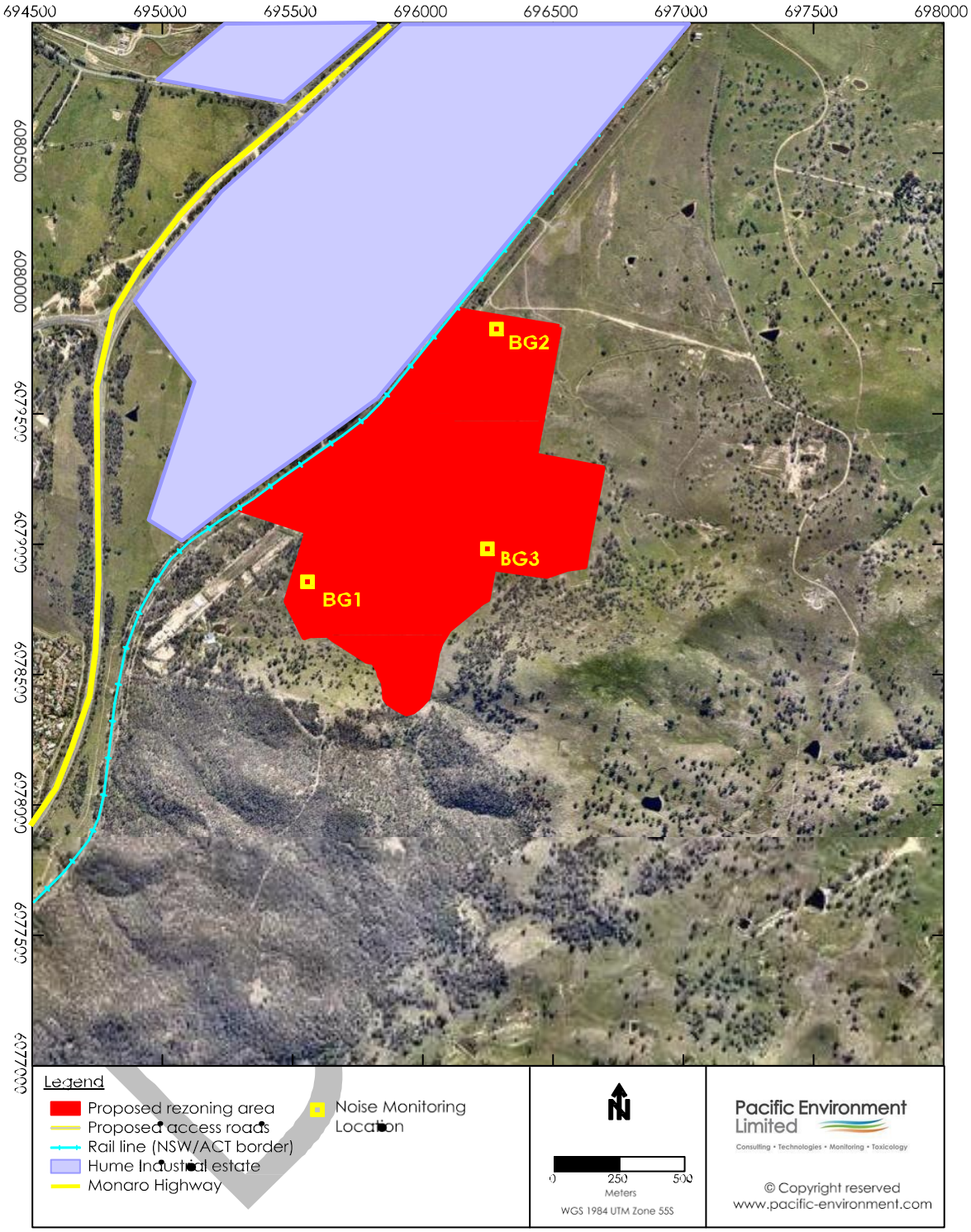
APPENDIX A: Site Location



Site

Canberra Airport

APPENDIX B: Logger Measurement Locations



APPENDIX C: Logger Results – Location BG1

South Jerrabomberra Planning Proposal

Job Number: 44.5147.R1
Instrumentation: Logger 1
Logger Location: BG1
Free Field: yes
Monitoring Period: Wednesday 11 June 2014 to Saturday 0 January 1900

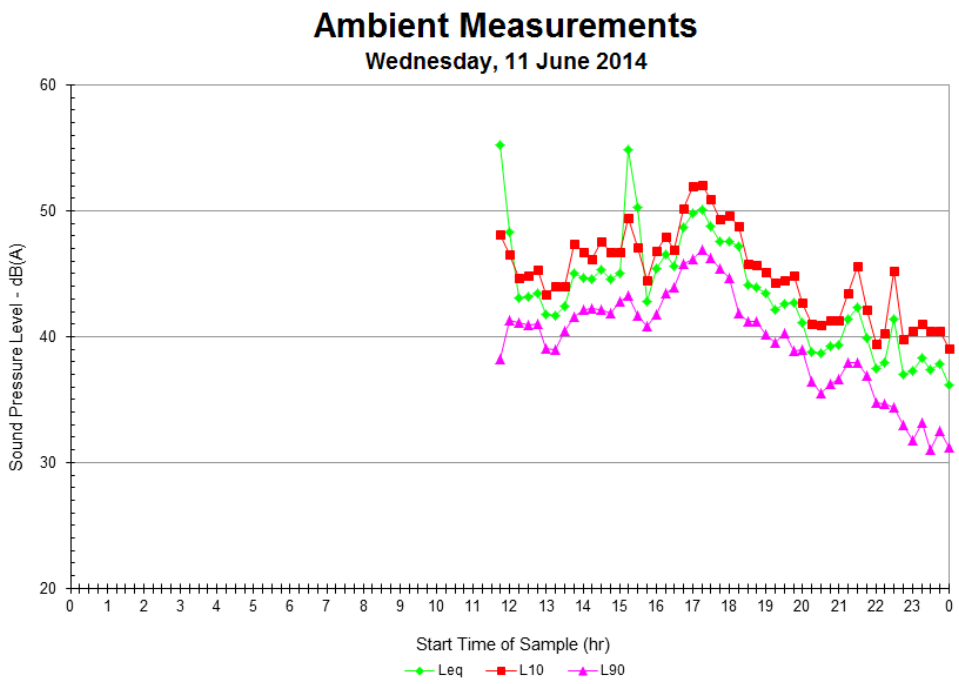
BACKGROUND AND AMBIENT NOISE MONITORING RESULTS
NSW EPA's INDUSTRIAL NOISE POLICY , 2000

Day	L90 Background Noise Levels			Leq Ambient Noise Levels		
	Day 7am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am	Day 7am - 6pm	Evening 6pm -	Night 10pm - 7am
Wednesday 11 June 2014	*	34.8	28.1	*	39.6	45.9
Thursday 12 June 2014	41.4	37.3	27.6	46.8	42.2	44.8
Friday 13 June 2014	42.8	37.5	27.1	46.7	40.6	41.1
Saturday 14 June 2014	37.1	34.4	26.1	44.7	41.4	40.3
Sunday 15 June 2014	39.8	33.7	27.3	47.2	38.2	40.9
Monday 16 June 2014	42.1	38.7	29.8	48.0	41.9	45.5
Tuesday 17 June 2014	36.8	35.4	24.7	45.1	44.2	41.7
Wednesday 18 June 2014	39.1	35.3	26.8	46.2	44.8	38.2
Thursday 19 June 2014	*	*	*	*	*	*
RBL Median	**39.8**	**35.4**	**27.2**	-	-	-
Log Average	-	-	-	**46.5**	**42.1**	**43.1**

TRAFFIC NOISE MONITORING RESULTS
DECCW's NSW Road Noise Policy 2011

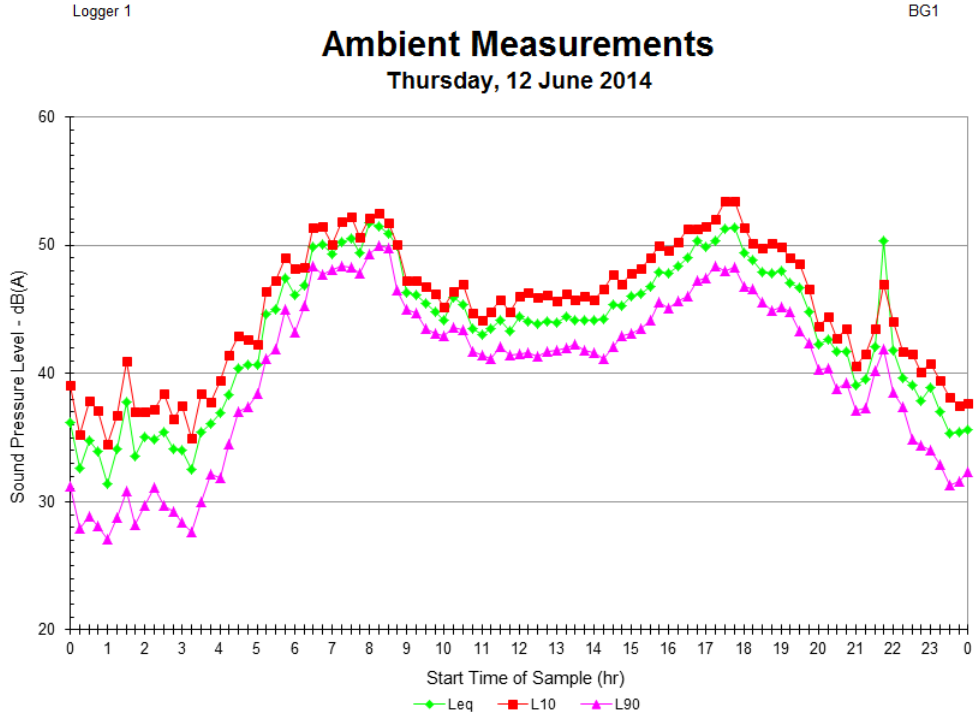
Day	Leq Ambient Noise Levels		Leq 1 Hr Noise Levels			
	Day 7am - 10pm	Night 10pm - 7am	Day - Max	Day - Min	Night - Max	Night - Min
Wednesday 11 June 2014	*	48.4	51.7	*	53.6	37.1
Thursday 12 June 2014	48.5	47.3	53.3	39.4	52.6	33.8
Friday 13 June 2014	48.3	43.6	52.3	41.2	47.9	35.8
Saturday 14 June 2014	46.5	42.8	48.7	42.6	47.6	36.4
Sunday 15 June 2014	48.5	43.4	51.4	38.8	47.3	36.2
Monday 16 June 2014	49.5	47.7	55.0	40.8	53.2	37.7
Tuesday 17 June 2014	47.1	44.2	50.4	42.2	50.2	35.9
Wednesday 18 June 2014	48.4	40.7	52.5	41.9	43.7	36.8
Thursday 19 June 2014	*	*	48.0	*	*	*
Friday 20 June 2014	*	*	*	*	*	*
Log Average	**48.2**	**45.5**	**51.9**	**41.2**	**50.6**	**36.3**

* indicates an incomplete set of data for a given time period
\# Nighttime for a given day continues through to the following morning



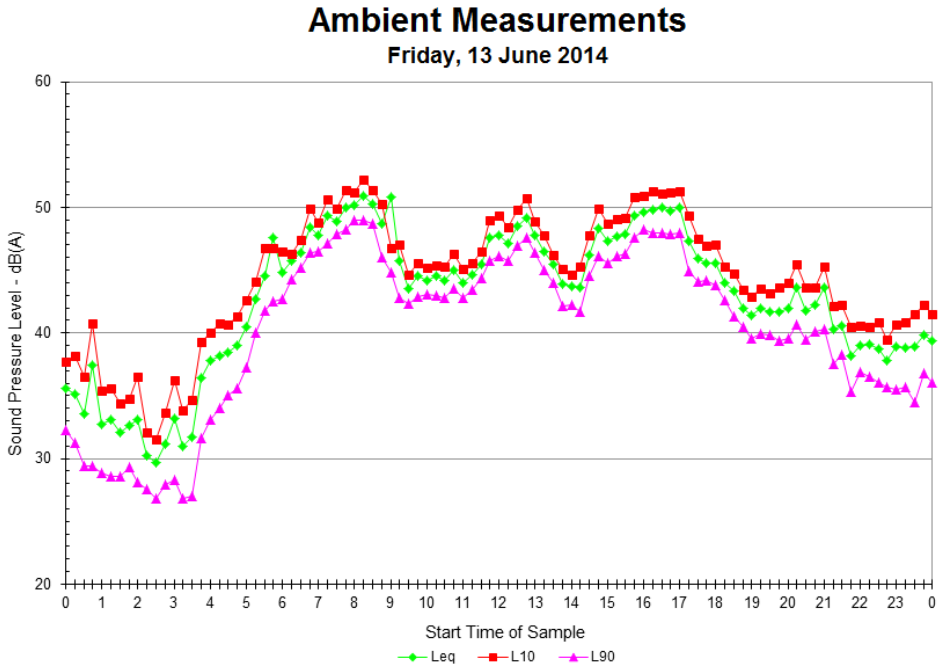
South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



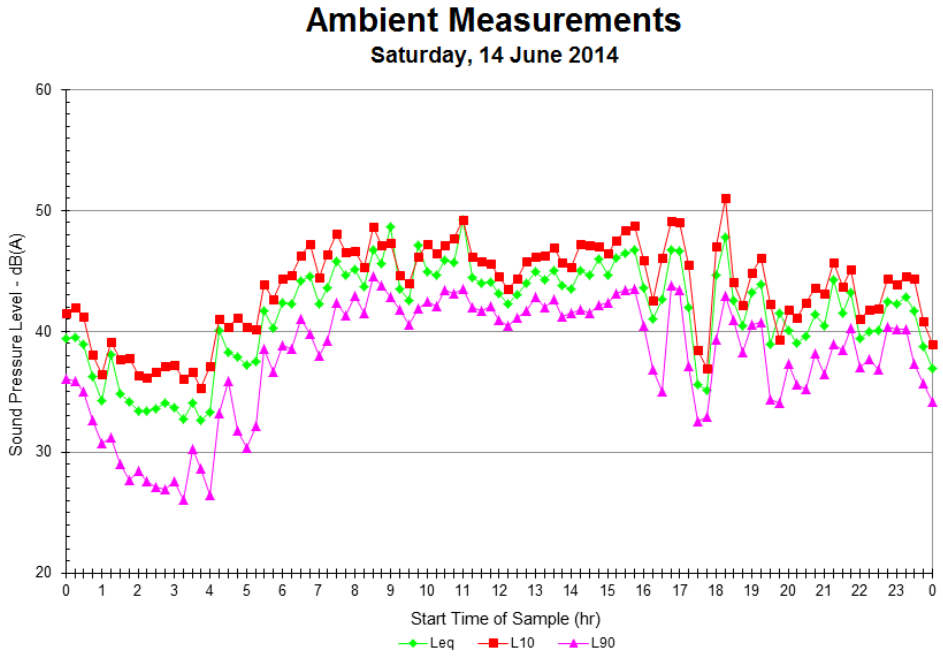
South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



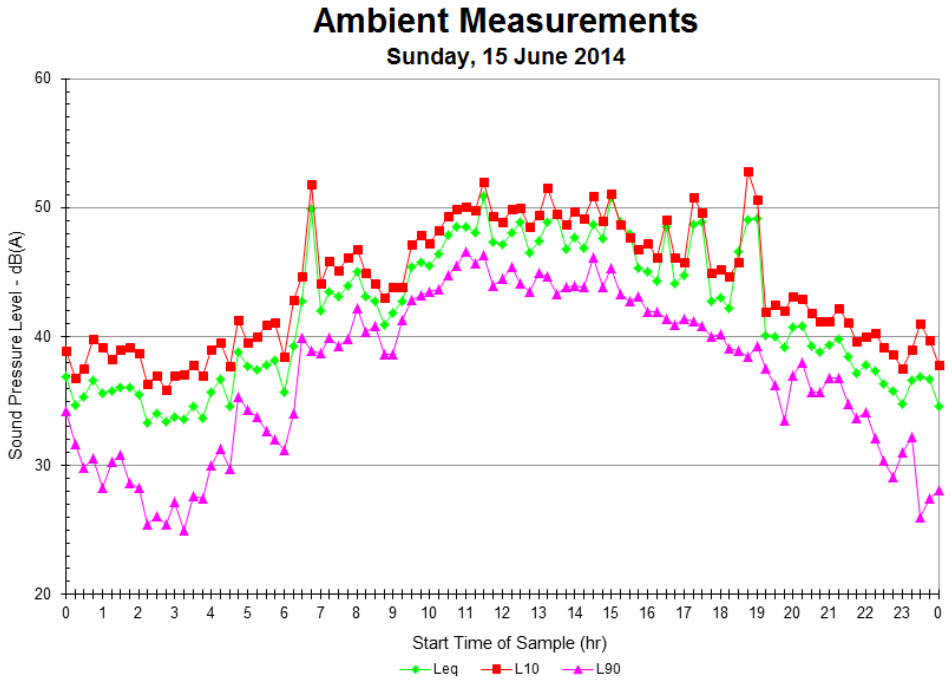
South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



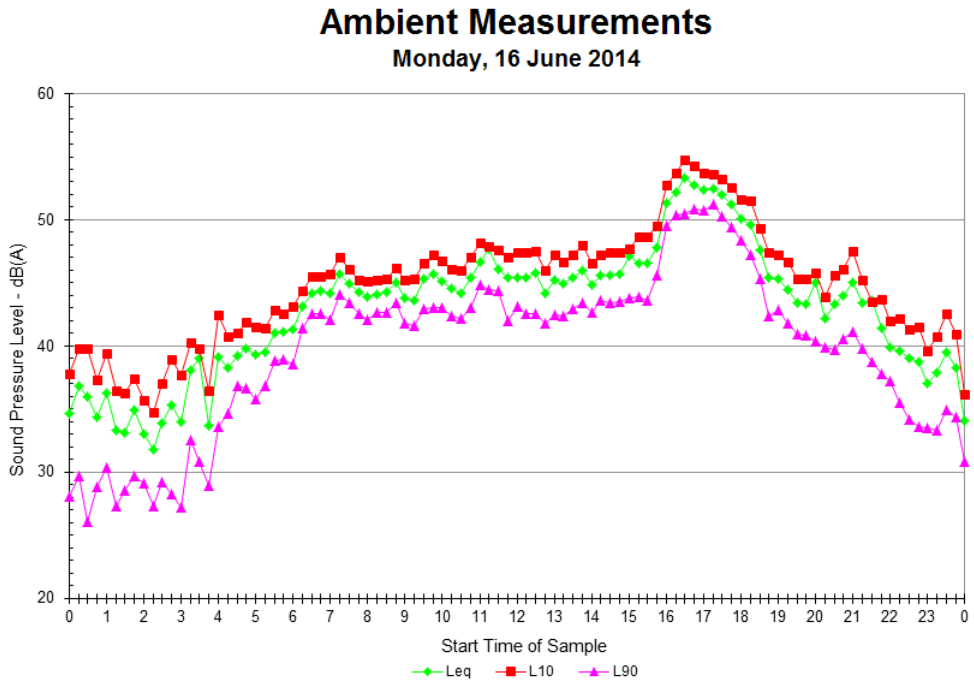
South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



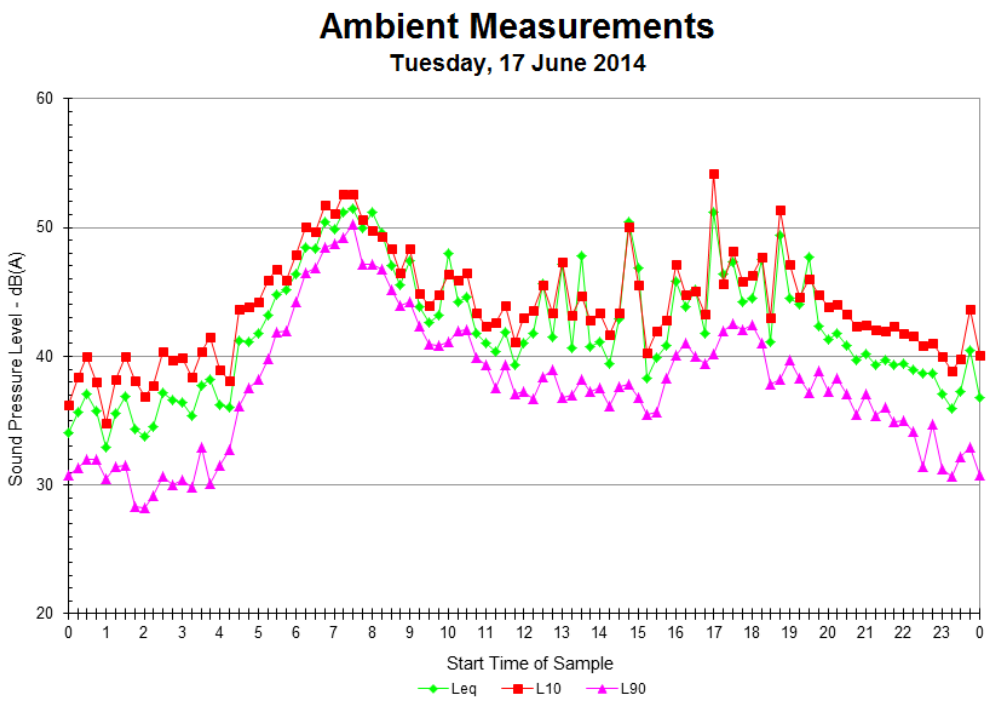
South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



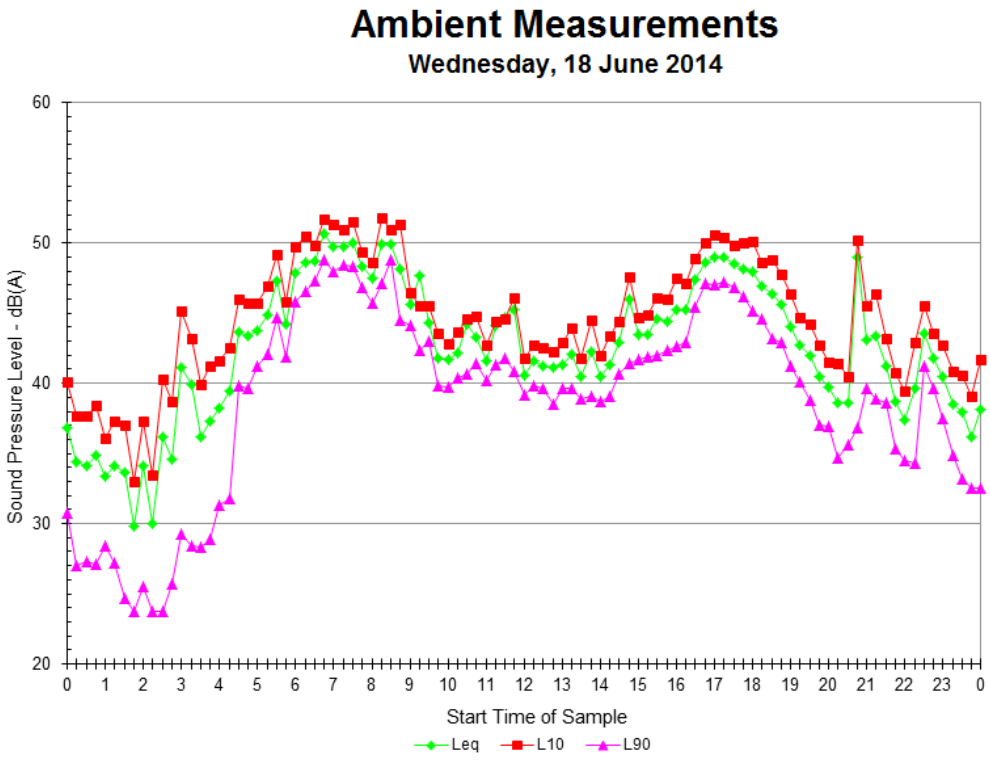
South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



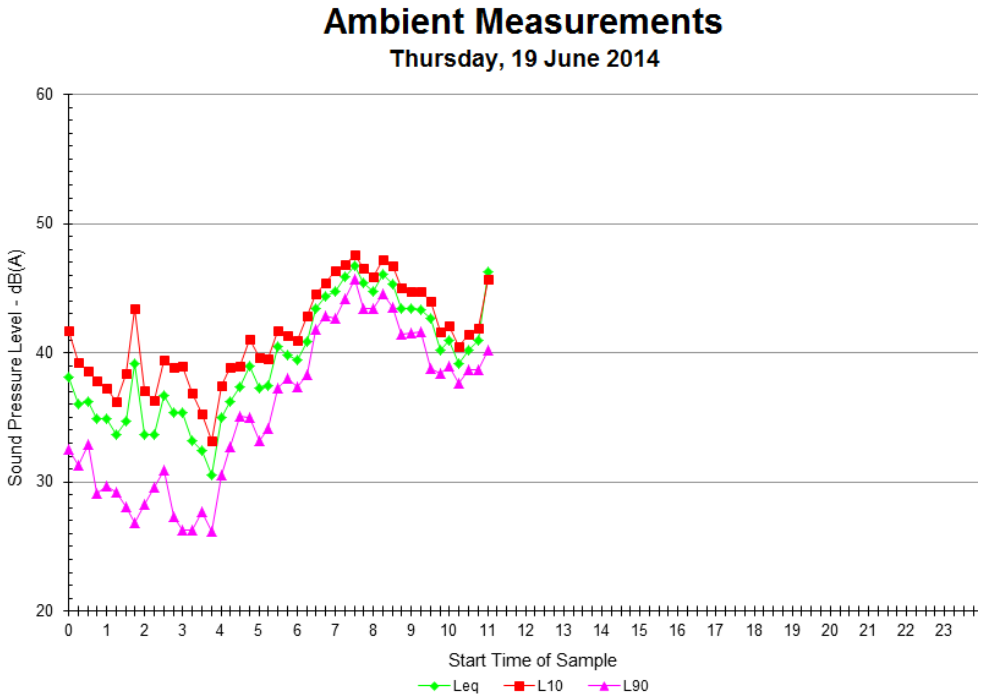
South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1



South Jerrabomberra Planning Proposal
Logger 1

44.5147.R1
BG1

APPENDIX D: Measurement Results – Location BG2

South Jerrabomberra Planning Proposal

Job Number: 44.5147.R1
Instrumentation: Logger 2
Logger Location: BG2
Free Field: yes
Monitoring Period Wednesday 11 June 2014 to Tuesday 24 June 2014

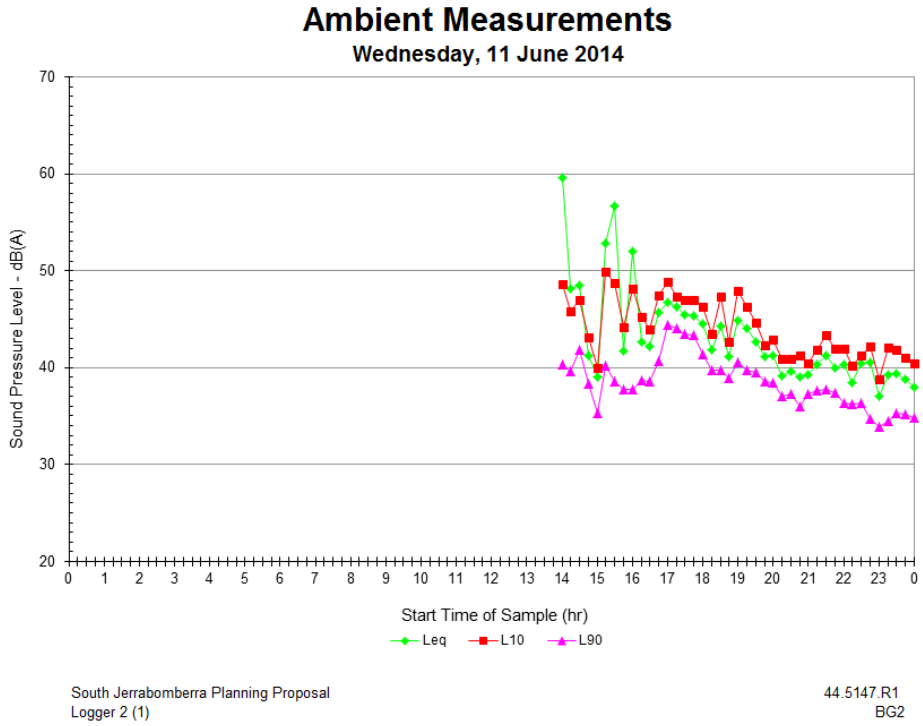
BACKGROUND AND AMBIENT NOISE MONITORING RESULTS
NSW EPA's INDUSTRIAL NOISE POLICY , 2000

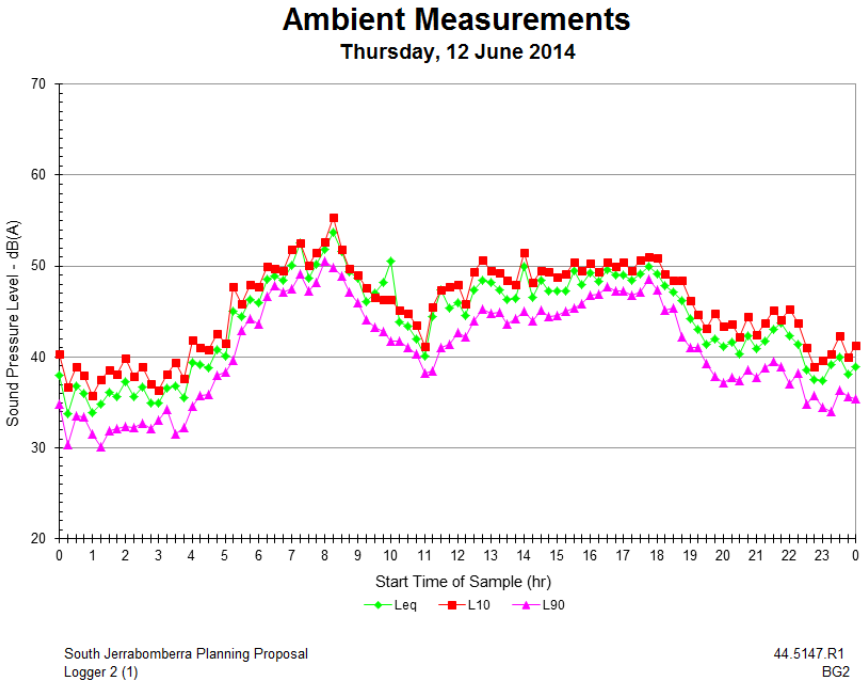
Day	L90 Background Noise Levels			Leq Ambient Noise Levels		
	Day 7am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am	Day 7am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am
Wednesday 11 June 2014	*	36.2	31.6	*	40.0	46.4
Thursday 12 June 2014	41.1	37.4	*	47.4	41.0	*
Thursday 19 June 2014	*	37.4	31.0	*	43.0	48.4
Friday 20 June 2014	43.1	36.8	30.7	47.0	42.1	43.5
Saturday 21 June 2014	34.1	30.6	28.6	42.1	37.5	40.4
Sunday 22 June 2014	31.7	35.3	30.6	40.6	38.7	48.3
Monday 23 June 2014	47.0	41.5	35.6	50.4	45.1	47.1
Tuesday 24 June 2014	47.5	40.0	*	49.7	41.1	*
Wednesday 25 June 2014	*	*	*	*	*	*
RBL Median	**42.1**	**37.1**	**30.9**	-	-	-
Log Average	-	-	-	**47.5**	**40.8**	**46.4**

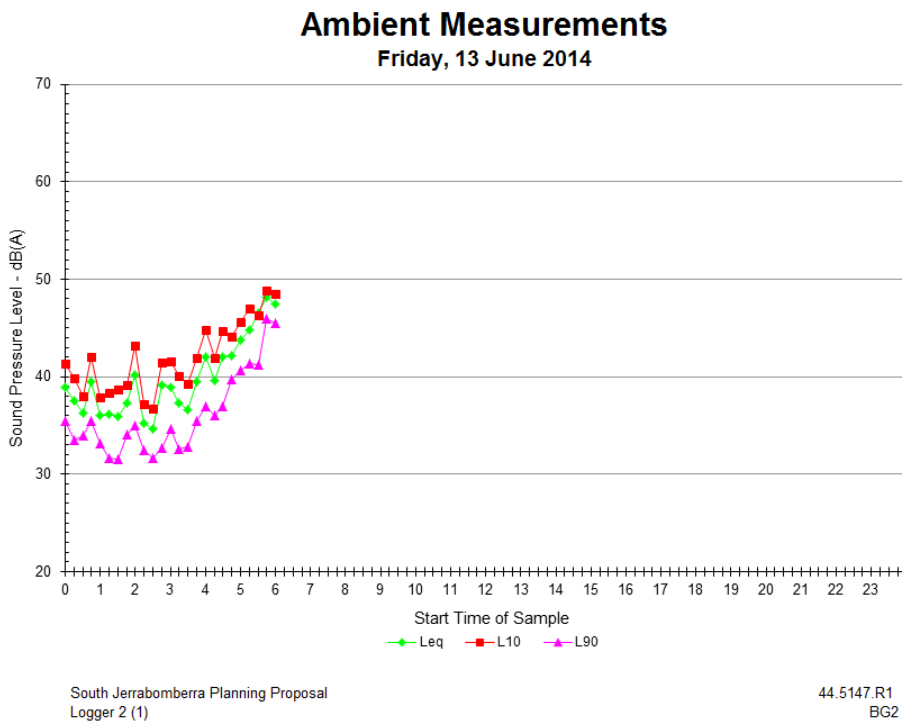
TRAFFIC NOISE MONITORING RESULTS
DECCW's NSW Road Noise Policy 2011

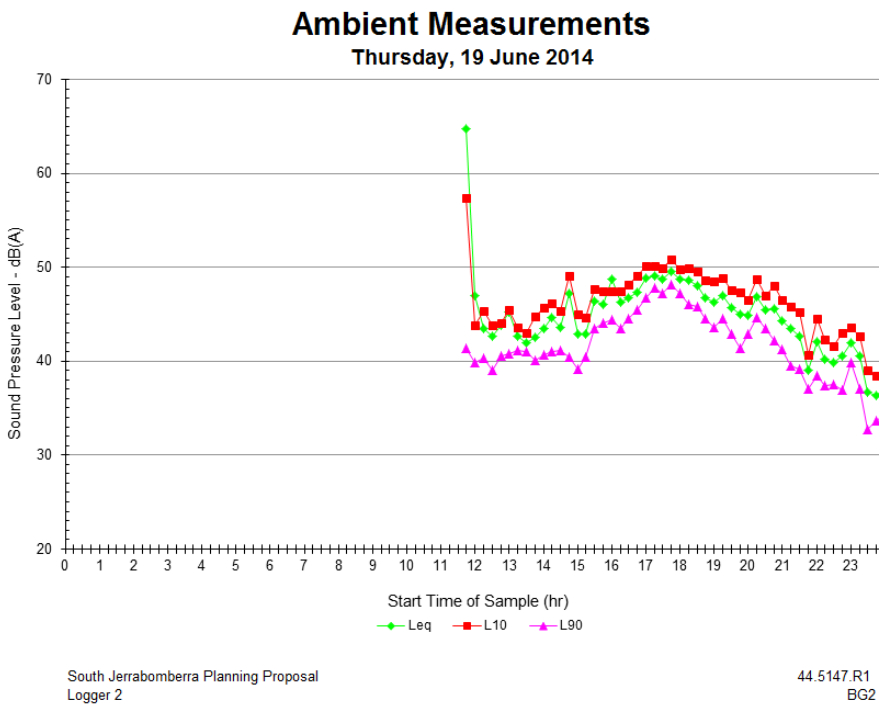
Day	Leq Ambient Noise Levels		Leq 1 Hr Noise Levels			
	Day 7am - 10pm	Night 10pm - 7am	Day - Max	Day - Min	Night - Max	Night - Min
Wednesday 11 June 2014	*	48.9	56.7	*	54.4	37.7
Thursday 12 June 2014	48.9	*	51.7	41.3	48.6	*
Thursday 19 June 2014	*	50.9	61.3	*	55.8	37.8
Friday 20 June 2014	48.6	46.0	51.4	42.1	50.2	38.4
Saturday 21 June 2014	43.8	42.9	47.5	37.4	49.3	34.8
Sunday 22 June 2014	42.7	50.8	47.5	37.9	56.5	38.4
Monday 23 June 2014	52.0	49.6	54.5	43.4	52.9	42.1
Tuesday 24 June 2014	51.0	*	53.7	*	*	*
Tuesday 24 June 2014	51.0	*	53.7	*	*	*
Wednesday 25 June 2014	*	*	*	*	*	*
Log Average	**50.0**	**49.3**	**55.0**	**41.0**	**53.1**	**38.8**

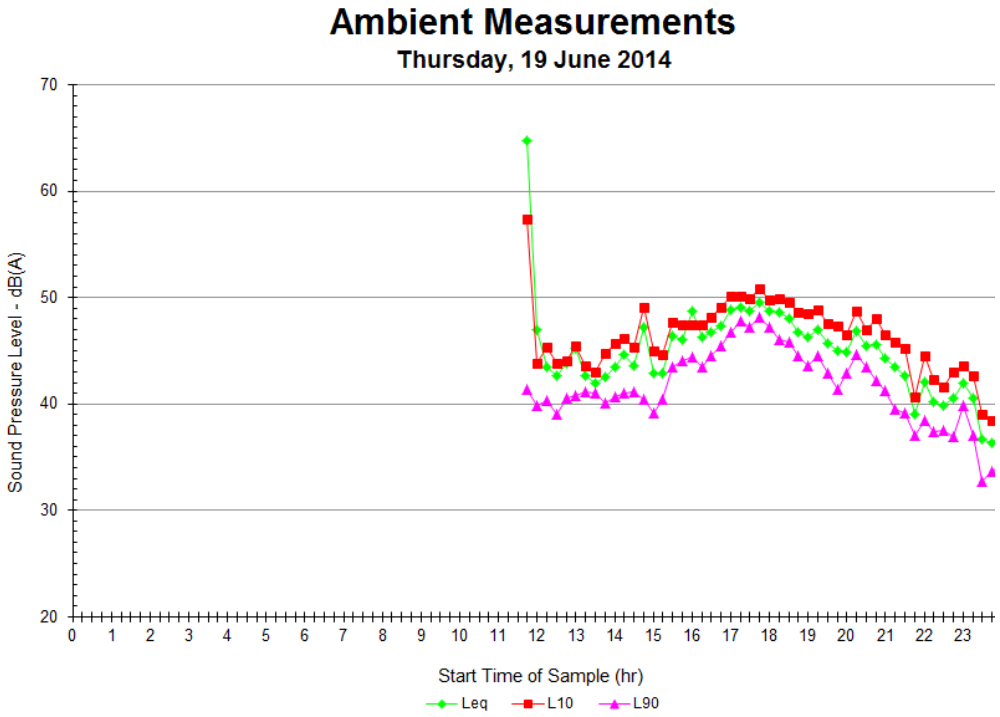
* indicates an incomplete set of data for a given time period
\# Nighttime for a given day continues through to the following morning


Ambient Measurements
Wednesday, 11 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample (hr)
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 2 (1)
44.5147.R1
BG2


Ambient Measurements
Thursday, 12 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample (hr)
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 2 (1)
44.5147.R1
BG2

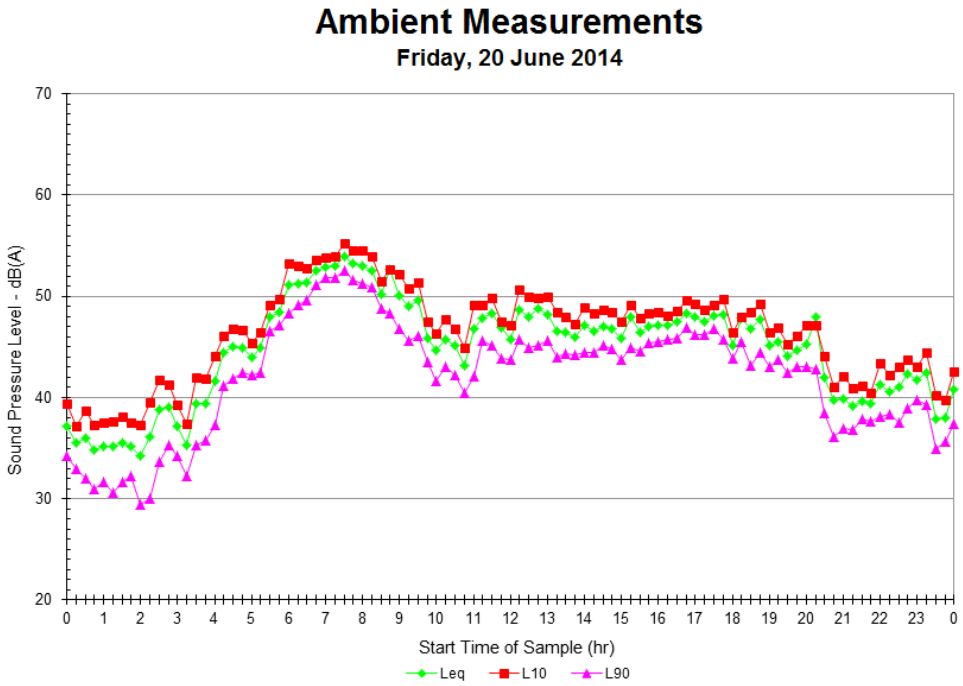

Ambient Measurements
Friday, 13 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 2 (1)
44.5147.R1
BG2


Ambient Measurements
Thursday, 19 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample (hr)
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 2
44.5147.R1
BG2



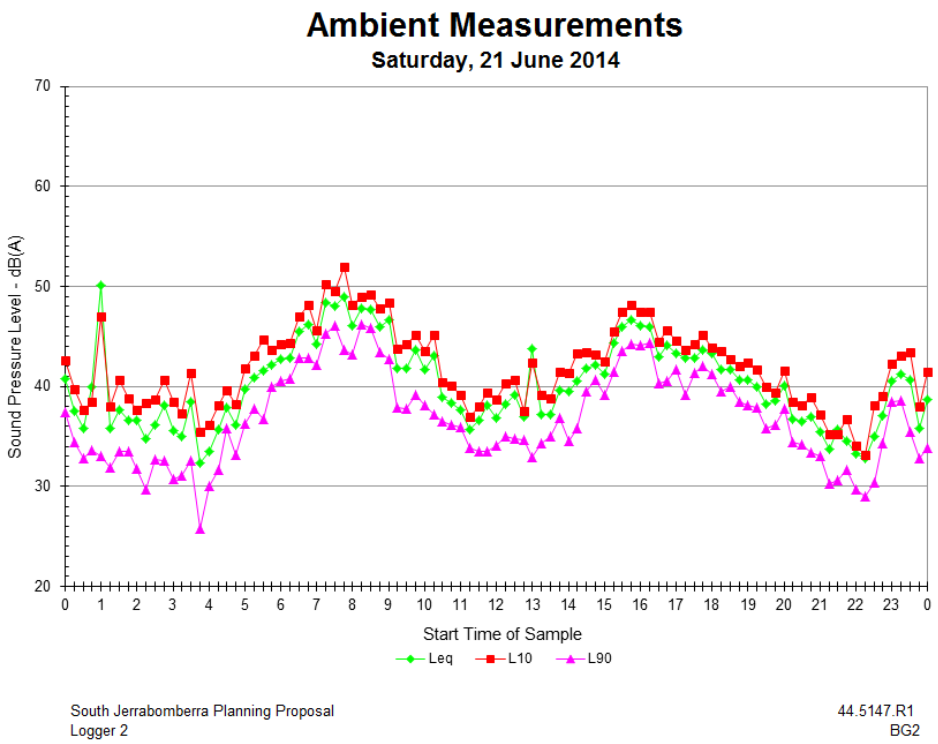
South Jerrabomberra Planning Proposal
Logger 2

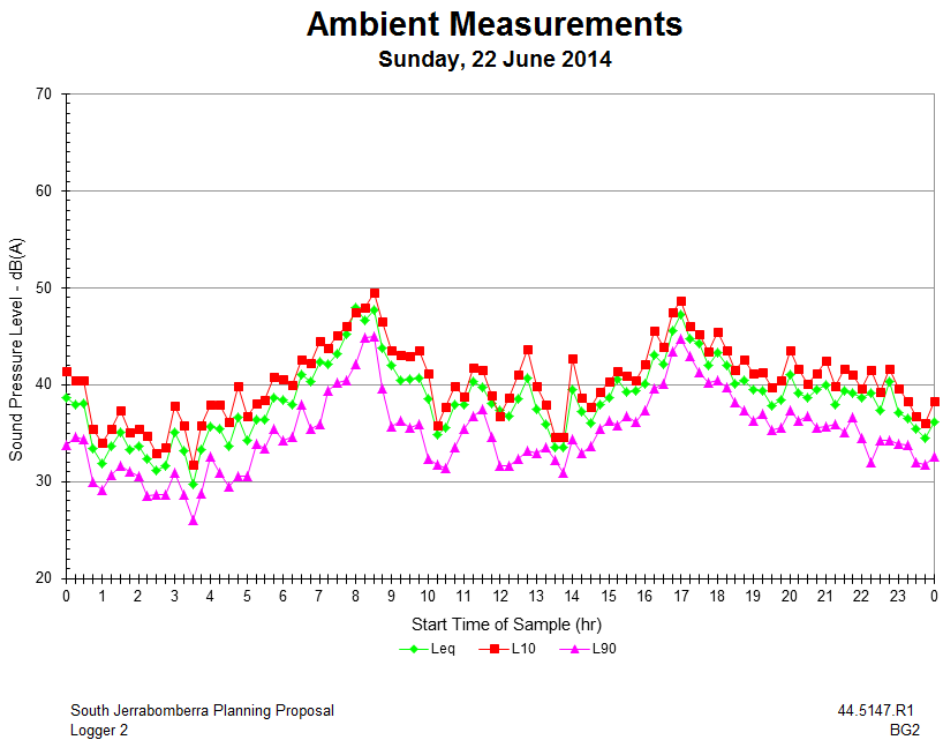
44.5147.R1
BG2

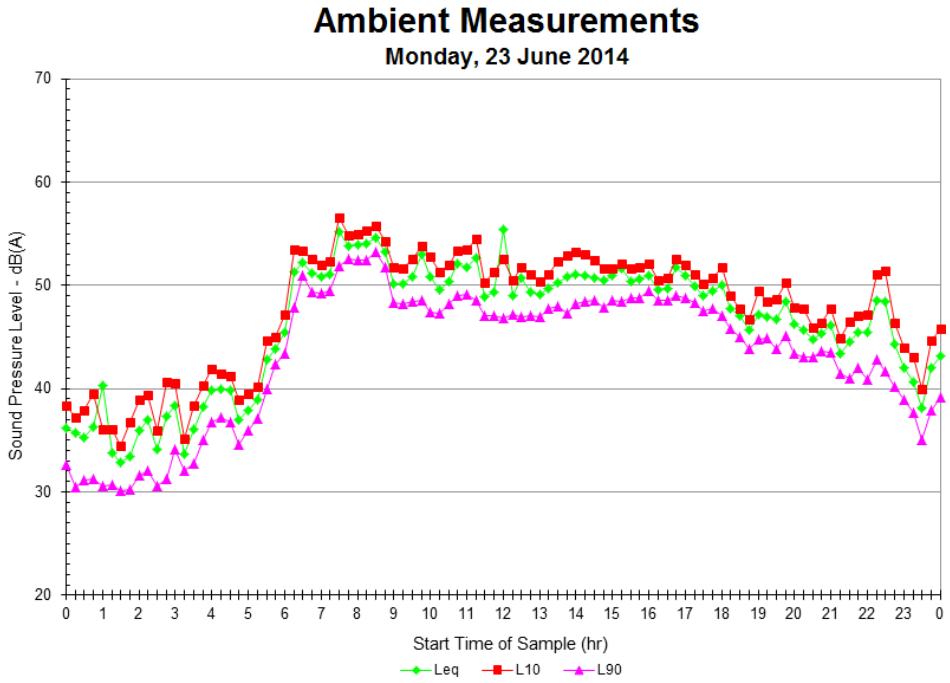


South Jerrabomberra Planning Proposal
Logger 2

44.5147.R1
BG2

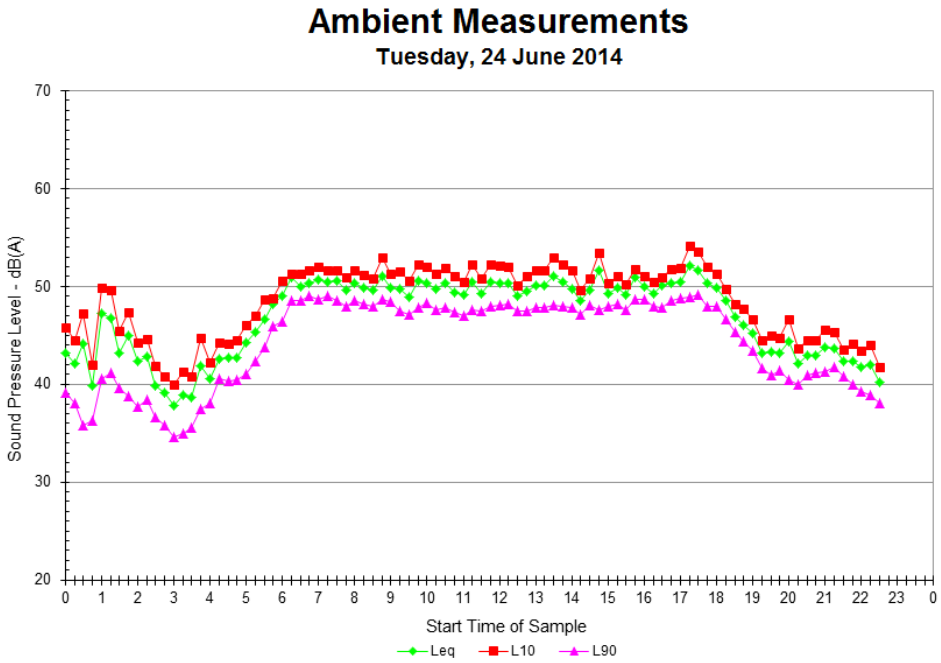

Ambient Measurements
Saturday, 21 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 2
44.5147.R1
BG2


Ambient Measurements
Sunday, 22 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample (hr)
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 2
44.5147.R1
BG2



South Jerrabomberra Planning Proposal
Logger 2

44.5147.R1
BG2



South Jerrabomberra Planning Proposal
Logger 2

44.5147.R1
BG2

APPENDIX E: Logger Results – Location BG3

South Jerrabomberra Planning Proposal

Job Number: 44.5147.R1
Instrumentation: Logger 3
Logger Location: BG3
Free Field: yes
Monitoring Period: Thursday 19 June 2014 to Friday 27 June 2014

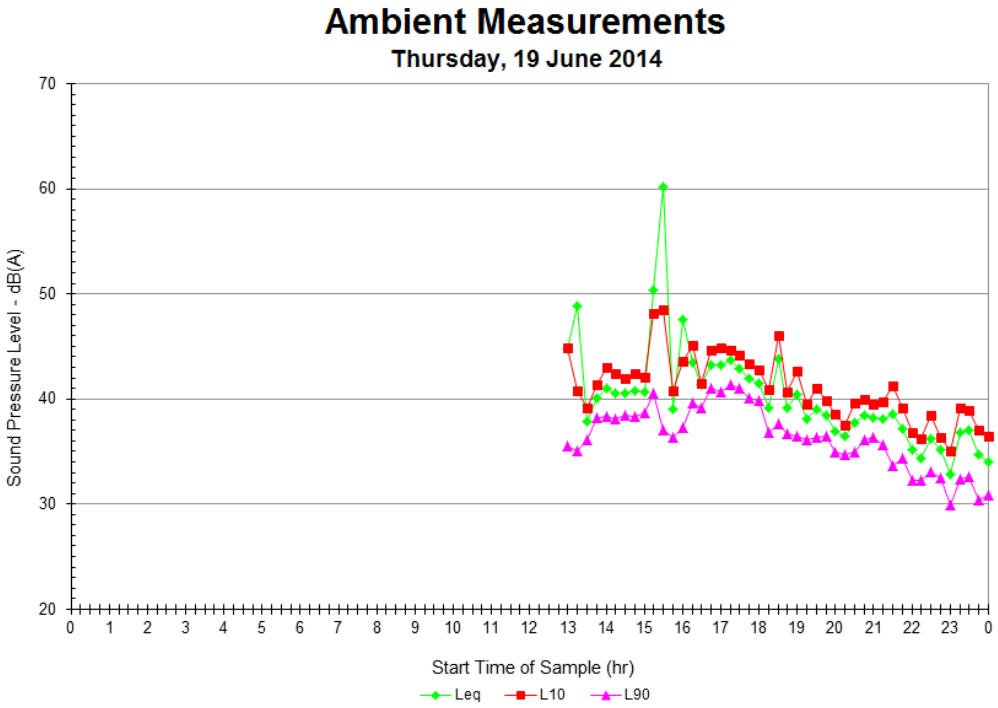
BACKGROUND AND AMBIENT NOISE MONITORING RESULTS
NSW EPA's INDUSTRIAL NOISE POLICY , 2000

Day	L90 Background Noise Levels			Leq Ambient Noise Levels		
	Day 7am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am	Day 7am - 6pm	Evening 6pm -	Night 10pm - 7am
Thursday 19 June 2014	*	32.2	28.4	*	37.0	43.9
Friday 20 June 2014	38.8	35.3	27.1	45.7	39.0	43.1
Saturday 21 June 2014	41.5	37.5	27.6	45.3	39.6	38.8
Sunday 22 June 2014	33.3	30.5	25.8	41.1	40.3	39.2
Monday 23 June 2014	35.8	29.4	25.8	45.9	33.9	38.2
Tuesday 24 June 2014	39.1	37.2	30.5	44.3	39.5	43.7
Wednesday 25 June 2014	30.0	28.7	25.3	46.0	45.0	38.4
Thursday 26 June 2014	36.6	33.0	27.3	43.9	41.7	36.3
Friday 27 June 2014	*	*	*	*	*	*
RBL Median	**36.6**	**32.6**	**27.2**	-	-	-
Log Average	-	-	-	**44.9**	**40.5**	**41.1**

TRAFFIC NOISE MONITORING RESULTS
DECCW's NSW Road Noise Policy 2011

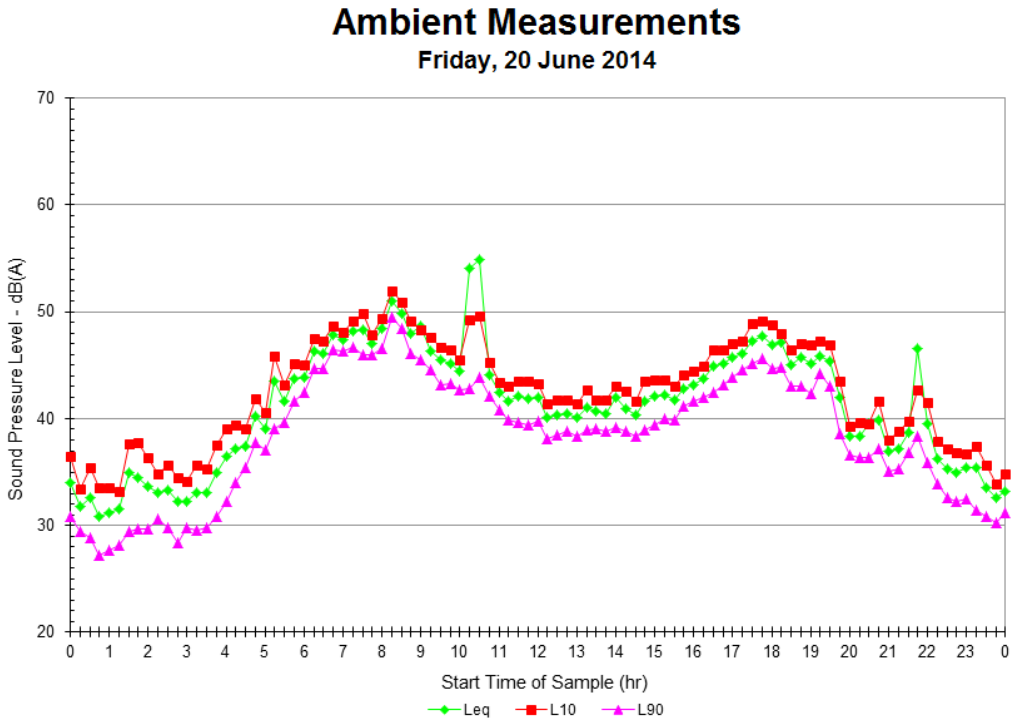
Day	Leq Ambient Noise Levels		Leq 1 Hr Noise Levels			
	Day 7am - 10pm	Night 10pm - 7am	Day - Max	Day - Min	Night - Max	Night - Min
Thursday 19 June 2014	*	46.4	47.4	*	52.0	35.0
Friday 20 June 2014	47.2	45.6	54.4	36.9	51.1	32.8
Saturday 21 June 2014	46.9	41.3	50.5	40.3	45.4	35.1
Sunday 22 June 2014	43.4	41.7	49.8	40.0	47.9	32.4
Monday 23 June 2014	47.1	40.7	51.1	34.5	43.8	34.3
Tuesday 24 June 2014	45.9	46.0	49.8	39.7	51.3	37.9
Wednesday 25 June 2014	47.7	40.9	51.7	35.9	47.0	32.7
Thursday 26 June 2014	45.9	38.8	51.4	39.7	40.3	35.0
Friday 27 June 2014	*	*	43.1	*	*	*
Saturday 28 June 2014	*	*	*	*	*	*
Log Average	**46.5**	**43.5**	**50.7**	**38.6**	**48.8**	**34.8**

* indicates an incomplete set of data for a given time period
\# Nighttime for a given day continues through to the following morning



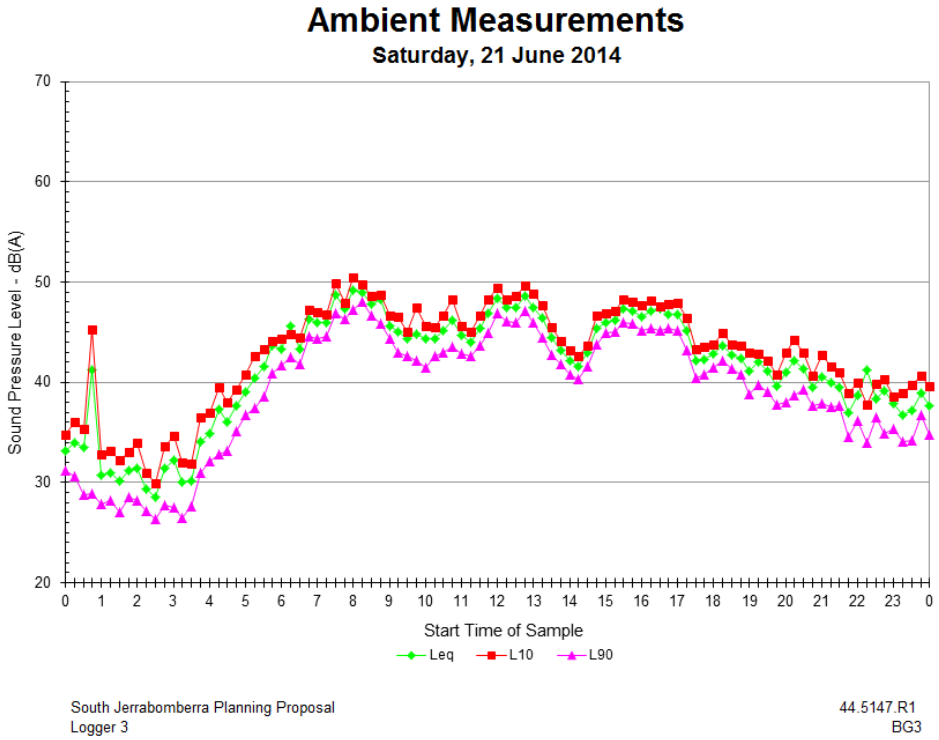
South Jerrabomberra Planning Proposal
Logger 3

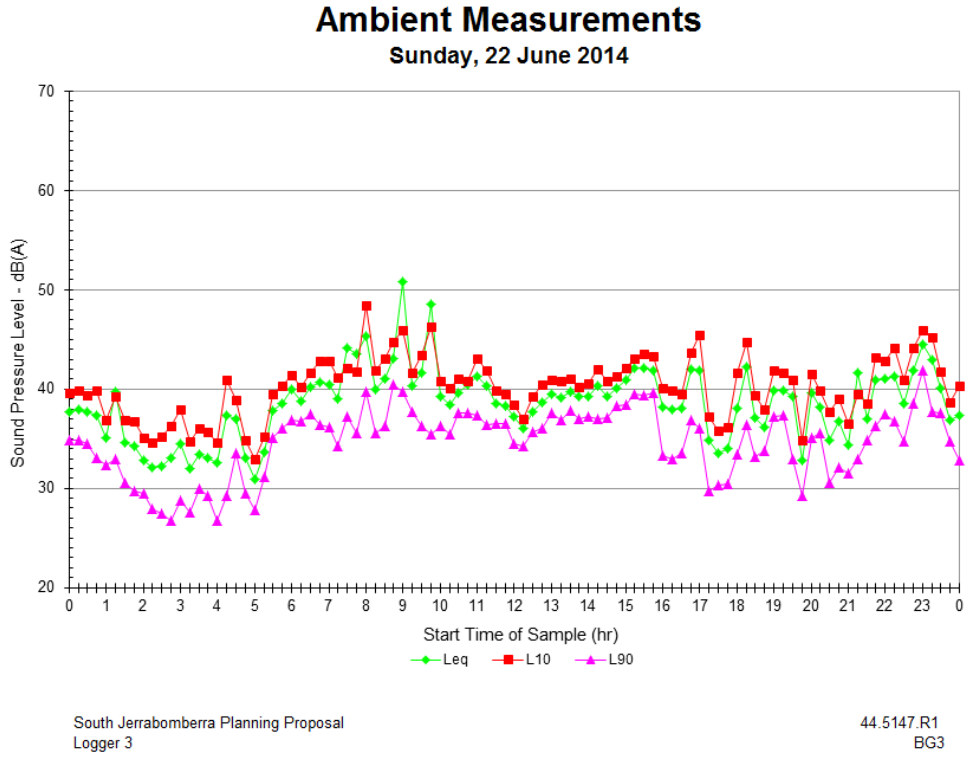
44.5147.R1
BG3

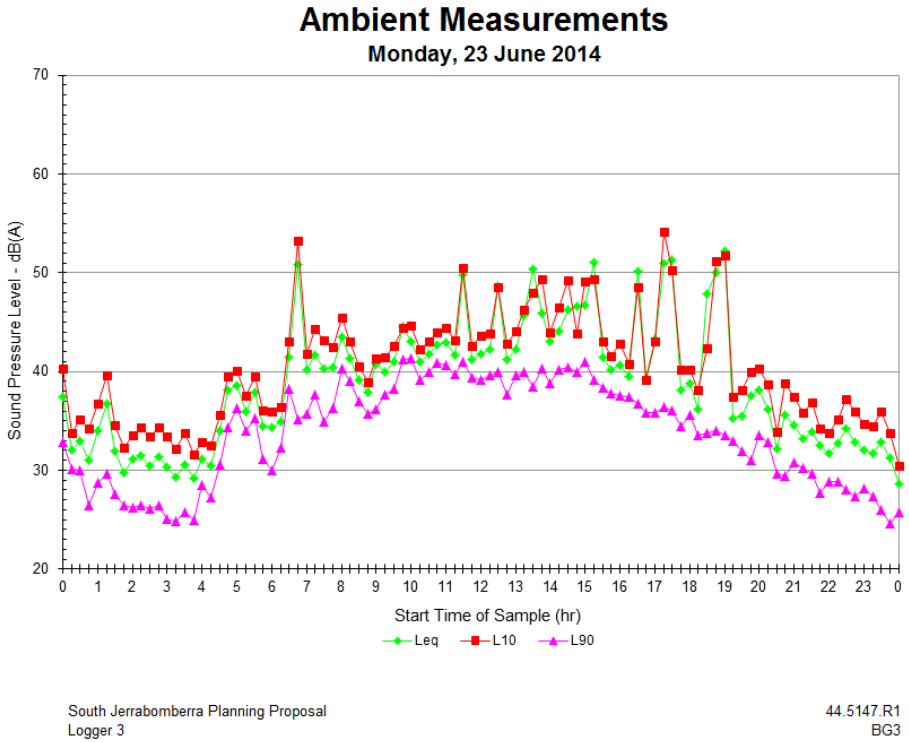


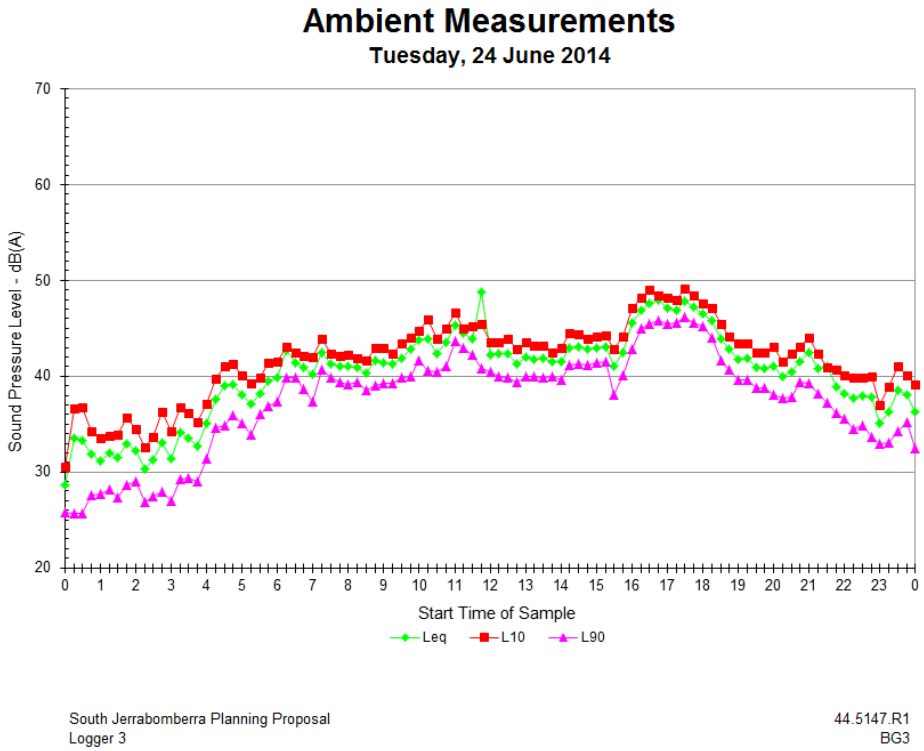
South Jerrabomberra Planning Proposal
Logger 3

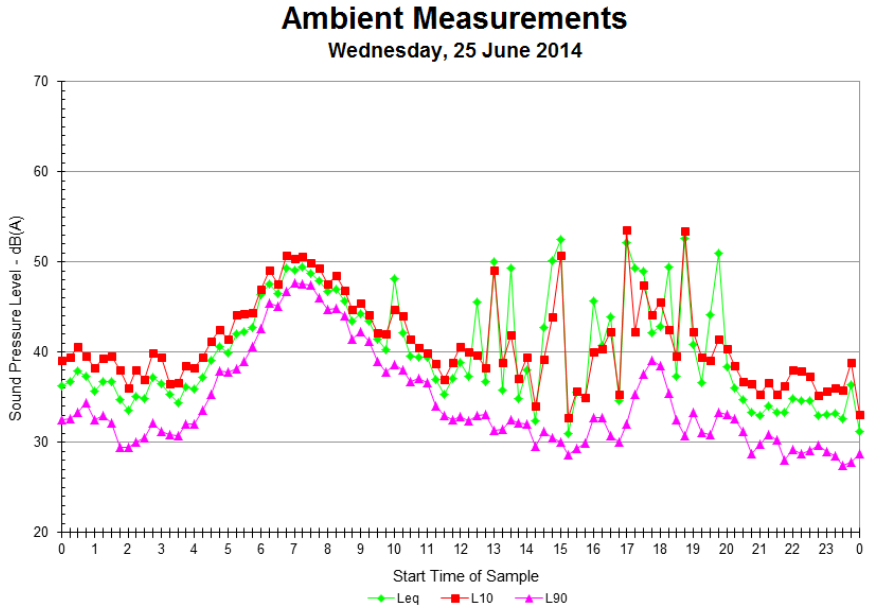
44.5147.R1
BG3


Ambient Measurements
Saturday, 21 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 3
44.5147.R1
BG3


Ambient Measurements
Sunday, 22 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample (hr)
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 3
44.5147.R1
BG3

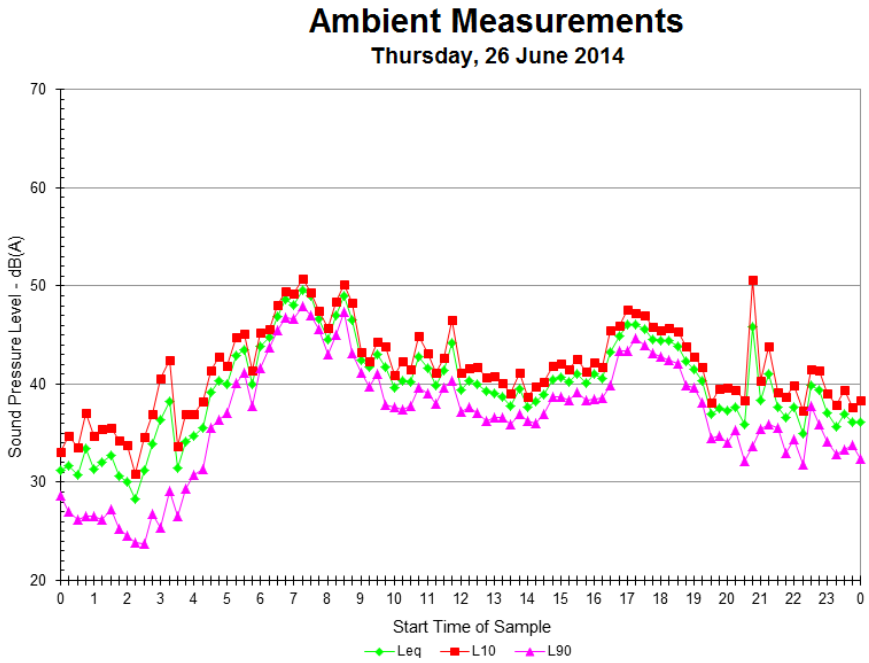

Ambient Measurements
Monday, 23 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample (hr)
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 3
44.5147.R1
BG3


Ambient Measurements
Tuesday, 24 June 2014
Sound Pressure Level - dB(A)
Start Time of Sample
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 3
44.5147.R1
BG3



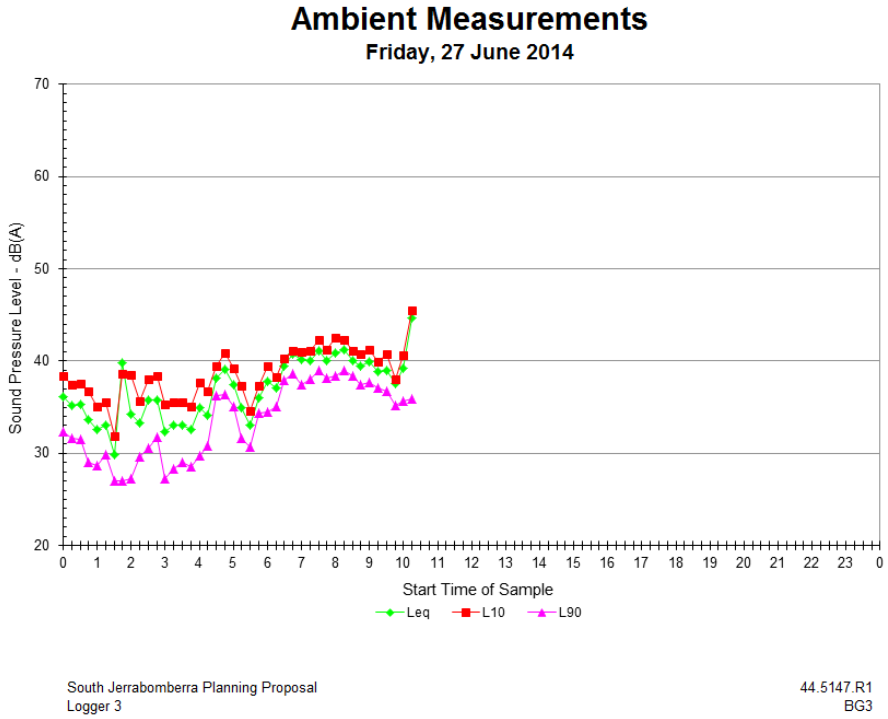
South Jerrabomberra Planning Proposal
Logger 3

44.5147.R1
BG3



South Jerrabomberra Planning Proposal
Logger 3

44.5147.R1
BG3


Ambient Measurements
Friday, 27 June 2014
Sound Pressure Level - dB(A)
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Start Time of Sample
Leq
L10
L90
South Jerrabomberra Planning Proposal
Logger 3
44.5147.R1
BG3