North Byron Parklands

Technical Paper

D2

Noise Impact Assessment - Traffic

TRAFFIC NOISE IMPACT ASSESSMENT
FOR
NORTH BYRON PARKLANDS

Prepared for: North Byron Parklands

Prepared by: Anita Joh, Acoustical Engineer
R T Benbow, Principal Consultant
BENBOW ENVIRONMENTAL
13 Daking Street, North Parramatta

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Benbow
ENVIRONMENTAL

Engineering a Sustainable Future for Our Environment

Head office: 13 Daking Street North Parramatta NSW 2151 AUSTRALIA
Tel: 61 2 9890 5099 Fax: 61 2 9890 5399
BE Australia: Wollongong NSW, Taree NSW, Calamvale QLD
BE Asia: Causeway Bay, Hong Kong
Email: admin@benbowenviro.com.au
Visit our website at: www.benbowenviro.com.au

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1. INTRODUCTION

1.1 BACKGROUND INFORMATION

This traffic noise assessment is prepared in respect of a concurrent Concept Plan and Project Application Environmental Assessment report (EA) for the North Byron Parklands (Parklands) project. This EA has been prepared on behalf of Billinudgel Property Trust (Billinudgel Property Pty. Ltd.)

The project is to establish a world class sustainable cultural events site within an enhanced ecological setting.

Cultural events involving music, arts, food, leisure and technology are proposed at the Parklands located at Tweed Valley Way/Jones Road, Yelgun.

The site location (in its regional context) has been provided as Figure 1-1. This figure also shows the proposed noise sources, i.e. parking lots and traffic movements along the onsite access road which is the main north-south road bisecting the property from Tweed Valley Way to Wooyung Road (the 'Spine Road'). Figure 1-2 further details the Spine Road, and all other internal minor access roads hereforth referred to as Event Laneways.

The primary objectives of this study are to assess the potential noise impacts at the potentially worst affected noise sensitive receivers caused by additional road traffic associated with the proposed site operation and to make recommendations on any necessary noise mitigation measures and management plan where required.

Road traffic noise impacts have been assessed against the criteria set out in NSW DECCW's Environmental Criteria for Road Traffic Noise (ECRTN, NSW Environment Protection Authority, 1999) and the NSW DECCW's Industrial Noise Policy (INP, 2000).

For this assessment, existing and proposed road traffic information contained within the Traffic Impact Assessment (Parsons Brinckerhoff, 15 April 2010) has been referenced and applied to eight (8) nearest receiver locations to the Pacific Highway and Tweed Valley Way. Fifteen (15) nearby residential locations were considered for the assessment of potential impacts due to the proposed onsite traffic movements.

These locations were identified as the most potentially affected noise sensitive locations in relation to the proposed traffic volume increase.

Figure 1-1: Site Locality with Proposed Onsite Traffic Movements and the Parking Lots

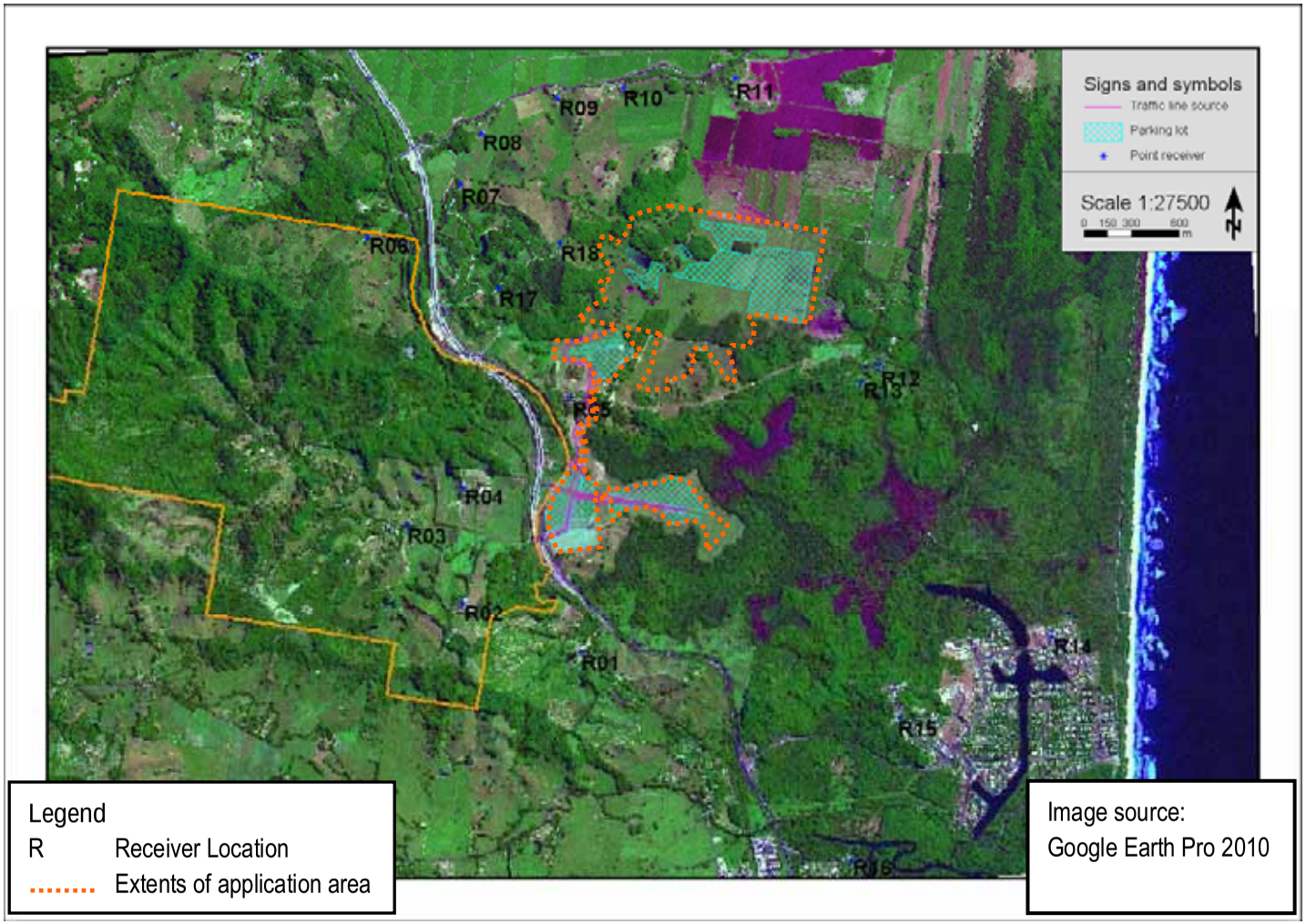


Figure 1-2: Traffic Access Routes and Designated Parking Lots Onsite

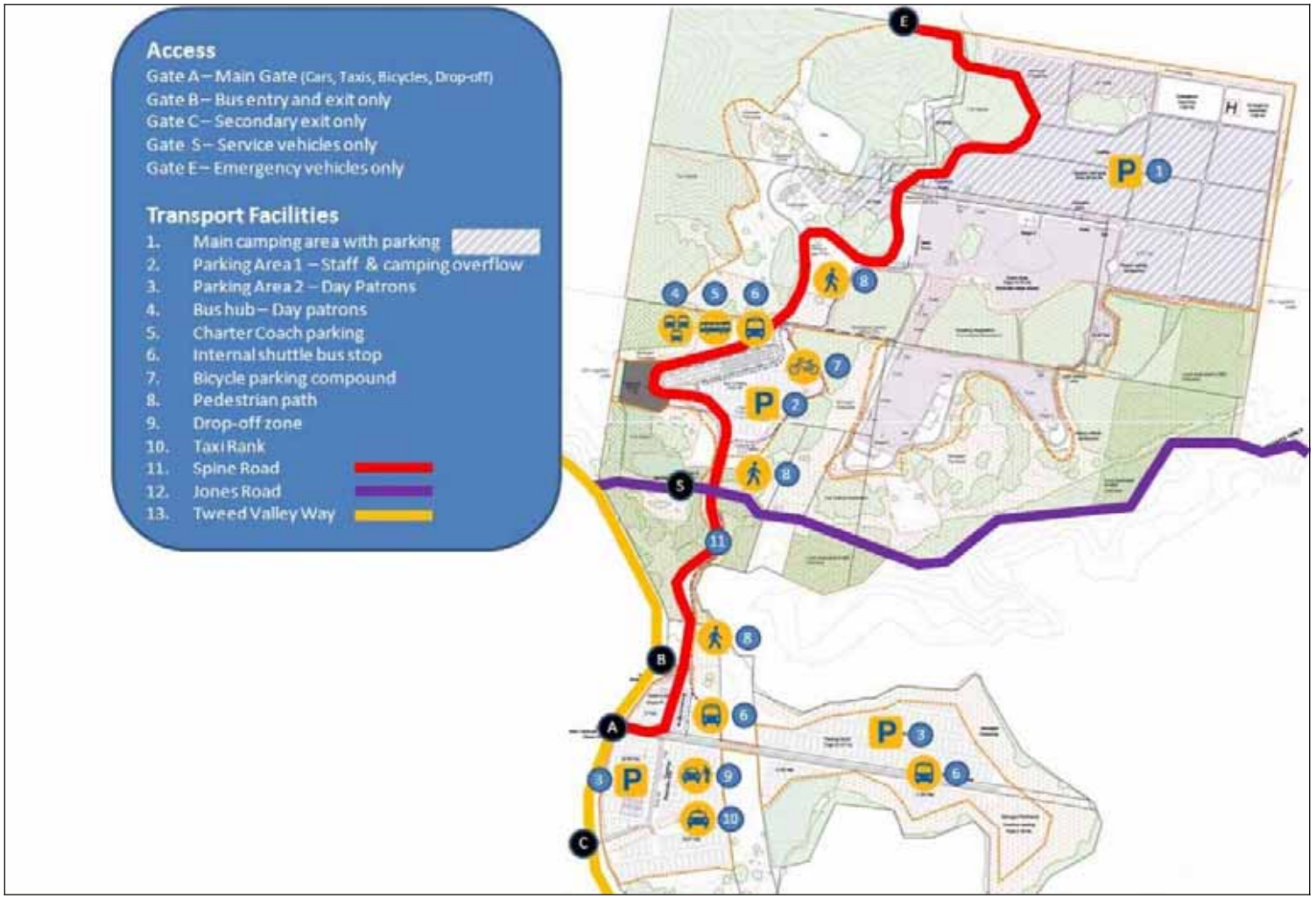


Image source: Parsons Brinckerhoff

2. ROAD TRAFFIC NOISE CRITERIA

In assessing the offsite road traffic noise impact, NSW DECCW's Environmental Criteria for Road Traffic Noise (ECRTN) has been referenced to establish criteria for this assessment.

The following nearby roads would be used for vehicle movements associated with the Concept Plan and Project Application:

- Pacific Highway; and
- Tweed Valley Way.

For the purpose of this assessment, Tweed Valley Way could be classified as a 'collector road' as these roads collect local traffic leaving a locality and connect to a sub-arterial road.

Pacific Highway could be classified as an 'arterial' road as this road is handling through-traffic, with characteristically heavy and continuous traffic flows during peak periods. Through-traffic is traffic passing through a locality bound for another locality.

Table 1 of the ECRTN – 'Road traffic noise criteria for proposed road or residential land use development' sets out the criteria to be applied to particular types of road and land uses. In addition, Table 2 – 'Road traffic noise criteria for sensitive land uses' provide more stringent standards which are expected when assessing noise sensitive developments such as hospitals and schools. There were no sensitive land uses identified within the study area affected by the site's vehicle movements, thus no noise criteria were required.

The categories that are relevant to this assessment are shown in Table 2-1 below:

Table 2-1: NSW Environmental Criteria for Road Traffic Noise

Type of Development	Criteria		
	Day (7.00am – 10.00pm) dB(A)	Night (10.00pm – 7.00am) dB(A)	Where Criteria are Already Exceeded
7. Land use developments with potential to create additional traffic on existing freeways/arterials	$L_{Aeq(15hr)}$ 60	$L_{Aeq(9hr)}$ 55	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

Table 2-1: NSW Environmental Criteria for Road Traffic Noise			
Type of Development	Criteria		
	Day (7.00am – 10.00pm) dB(A)	Night (10.00pm – 7.00am) dB(A)	Where Criteria are Already Exceeded
8. Land use developments with potential to create additional traffic on collector road	$L_{Aeq(1hr)}$ 60	$L_{Aeq(1hr)}$ 55	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

In summary, the noise criteria applicable are presented in Table 2-2 below:

Table 2-2: Summary of Traffic Noise Criteria (values expressed as dB(A))		
Assessment Location	Day	Night
Receivers R01, R04, R05, R06, R07, R08, R16, R17 – Residences near Tweed Valley Way	$L_{Aeq(1hr)}$ 60	$L_{Aeq(1hr)}$ 55
Receivers R01, R04, R05, R06, R07, R08, R16, R17 – Residences near Pacific Highway	$L_{Aeq(15hr)}$ 60	$L_{Aeq(9hr)}$ 55

Notes:

- Day period from 7.00am to 10.00pm / Night period from 10.00pm to 7.00am

3. ONSITE TRAFFIC NOISE CRITERIA

The Spine Road is an onsite access route handling onsite traffic to the event areas, car parks and camp grounds.

3.1 ADOPTED CRITERIA AND GUIDELINES

Road traffic noise from onsite vehicle movements is considered 'industrial noise' as per the NSW DECCW'S Industrial Noise Policy (INP).

Therefore, the project-specific criteria for onsite traffic noise are based on methods outlined in the INP:

- Controlling intrusive noise impacts in the short-term for sensitive receivers; and
- Maintaining noise level amenity for particular land uses for residences and other land uses. The criteria relate to industrial-type noise and do not include road, rail or community noise.

3.1.1 Intrusive Noise Impacts

According to the INP, the intrusiveness of a mechanical noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A).

The intrusiveness criterion is summarised as follows:

$L_{Aeq,\ 15\ minute} \leq L_{A90}$ background noise level plus 5 dB(A)

The intrusiveness criteria for each assessment location are presented below.

Table 3-1: Intrusiveness Criteria – Determined at each Assessment Location, dB(A)

Receiver	Intrusiveness Criteria at each Assessment Location, dB(A)		
	Day ($L_{Aeq,\ 15\ min}$)	Evening ($L_{Aeq,\ 15\ min}$)	Night ($L_{Aeq,\ 15\ min}$)
R01	≤ 45 + 5 = 55	≤ 47 + 5 = 51	≤ 44 + 5 = 49
R02	≤ 45 + 5 = 55	≤ 47 + 5 = 51	≤ 44 + 5 = 49
R03	≤ 45 + 5 = 47	≤ 47 + 5 = 46	≤ 44 + 5 = 44
R04	≤ 44 + 5 = 49	≤ 44 + 5 = 49	≤ 44 + 5 = 49
R05	≤ 42 + 5 = 47	≤ 43 + 5 = 48	≤ 40 + 5 = 45
R06	≤ 44 + 5 = 49	≤ 44 + 5 = 49	≤ 40 + 5 = 45
R07	≤ 44 + 5 = 49	≤ 44 + 5 = 49	≤ 40 + 5 = 45
R08	≤ 44 + 5 = 49	≤ 44 + 5 = 49	≤ 40 + 5 = 45

Table 3-1: Intrusiveness Criteria – Determined at each Assessment Location, dB(A)			
Receiver	Intrusiveness Criteria at each Assessment Location, dB(A)		
	Day ($L_{Aeq, 15\ min}$)	Evening ($L_{Aeq, 15\ min}$)	Night ($L_{Aeq, 15\ min}$)
R09	≤ 37 + 5 = 42	≤ 40 + 5 = 45	≤ 39 + 5 = 44
R10	≤ 37 + 5 = 42	≤ 40 + 5 = 45	≤ 39 + 5 = 44
R11	≤ 45 + 5 = 50	≤ 46 + 5 = 51	≤ 44 + 5 = 49
R12	≤ 35 + 5 = 40	≤ 36 + 5 = 41	≤ 40 + 5 = 45
R13	≤ 35 + 5 = 40	≤ 36 + 5 = 41	≤ 40 + 5 = 45
R17	≤ 44 + 5 = 49	≤ 44 + 5 = 49	≤ 40 + 5 = 45
R18	≤ 44 + 5 = 49	≤ 44 + 5 = 49	≤ 40 + 5 = 45

Note: Day refers to the period from 7.00am to 6.00pm (Monday to Saturday) and 8.00am to 6.00pm (Sundays and Public Holidays)
Evening refers to the period from 6.00pm to 10.00pm
Night refers to the period from 10.00pm to 7.00am (Monday to Saturday) and 10.00pm to 8.00am (Sundays and Public Holidays)

3.1.2 Protecting Noise Amenity

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the INP, the applicable parts of which are reproduced below.

Table 3-2: Amenity Criteria – Recommended L_{Aeq} Noise Levels from Industrial Sources				
Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable	Recommended Maximum
Residence R02, R03, R09, R10, R11, R12, R13, R18	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Residence R01, R04, R05, R06, R07, R08, R17	Urban	Day	60	65
		Evening	50	55
		Night	45	50

Note: The NSW INP defines 'Suburban' as an area with local traffic with characteristically intermittent traffic flows and 'Urban' as an area dominated by 'urban hum' which from our site visits was mainly due to vehicular traffic along the Pacific Highway. Furthermore, an 'Urban' Amenity Area has an acoustical environment that has through traffic with characteristically heavy and continuous traffic flows during peak periods, i.e. Pacific Highway

3.1.3 'Modifying Factor' Adjustments

Table 3-3: Modification to Acceptable Noise Level (ANL[1]) to Account for Existing Levels of Stationary Noise

Total Existing L_{Aeq} Noise Level From Industrial Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone
≥ ANL + 2	If existing noise level is likely to decrease in future: ANL – 10 If existing noise level is unlikely to decrease in the future: Existing level – 10
ANL + 1	ANL – 8
ANL	ANL – 8
ANL –1	ANL - 6
ANL – 2	ANL – 4
ANL – 3	ANL – 3
ANL – 4	ANL – 2
ANL – 5	ANL –2
ANL – 6	ANL – 1
< ANL - 6	ANL

Source: Table 2.2 NSW EPA INP
Note: [1]ANL is the recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day.

Generally, the existing noise levels are compared to the acceptable level and Table 3-3 is used to derive the amenity criteria.

Modification to Acceptable Noise Level (ANL) as presented in Table 3-3 is not required for these residential locations as the L_{Aeq} noise levels obtained for these locations were not affected by 'industrial sources' or in this case, site vehicular movements.

The Acceptable Noise Levels from the NSW INP has been applied to the Amenity Criteria for the Parklands as opposed to the Recommended Maximum Noise Levels. This would provide a suitably conservative assessment.

Table 3-4: Amenity Criteria – Determined at each Assessment Location, dB(A)			
Receiver	Amenity Criteria at each Assessment Location, dB(A)		
	Day (L_{Aeq})	Evening (L_{Aeq})	Night (L_{Aeq})
R01	60	50	45
R02	55	45	40
R03	55	45	40
R04	60	50	45
R05	60	50	45
R06	60	50	45
R07	60	50	45
R08	60	50	45
R09	55	45	40
R10	55	45	40
R11	55	45	40
R12	55	45	40
R13	55	45	40
R17	60	50	45
R18	55	45	40

The INP also allows for corrections for 'modifying factors' if the characteristics of the noise source/s include:

- annoying tonal components;
- impulsiveness;
- intermittency;
- irregularity; or
- prevailing low frequency.

Table 4.1 in Chapter 4 of the INP specifies the adjustments allowed for each modifying factor, however the maximum allowable correction is 10 dB(A), where two or more modifying factors are present.

Noise emissions from this site are currently not determined to be tonal, impulsive or intermittent in character.

3.1.4 Project-Specific Noise Levels

The project-specific noise levels reflect the most stringent noise limits derived from both the intrusiveness and amenity criteria determined above, in accordance with INP requirements.

The established criteria are presented in Table 3-5 below.

Table 3-5: Project-Specific Noise Levels

Receiver	Project-Specific Criteria at each Assessment Location, dB(A)		
	Day (L_{Aeq})	Evening (L_{Aeq})	Night (L_{Aeq})
R01	55	50	45
R02	55	45	40
R03	47	45	40
R04	49	49	45
R05	47	48	45
R06	49	49	45
R07	49	49	45
R08	49	49	45
R09	42	45	40
R10	42	45	40
R11	50	45	40
R12	40	41	40
R13	40	41	40
R17	49	49	45
R18	49	45	40

4. EXISTING TRAFFIC

Traffic volume information is based on data obtained from the RTA 'weigh-in-motion' count locations as described in Parsons Brinckerhoff's (PB) Traffic Assessment (the 'Traffic Assessment').

As described in PB's Traffic Assessment, the weigh-in-motion equipment collects information on the axle configuration of the vehicle as well as its weight as it passes over the detectors and then classifies the vehicle according to the Austroads 13 vehicle classes.

For the purposes of this study, classes 1 and 2 (motorcycles, cars or cars with trailers) are grouped as light vehicles, and the remaining vehicle classes are grouped as heavy vehicles.

4.1 ATTENDED MONITORING

In order to increase the confidence level of the predicted road traffic noise levels, existing traffic noise levels were obtained from the attended noise monitoring results.

The primary contribution to the overall noise levels at certain receiver locations was from the passage of traffic on Pacific Highway and Tweed Valley Way. Extraneous noise such as birds have been excluded from the traffic noise measurements presented in Table 4-1.

Where measurement data is not available, traffic noise levels have been extrapolated from its nearest measurement location so a meaningful analysis could be undertaken.

These data have been compared to the potential road traffic noise impacts presented in Section 4.2.

4.2 COMPARATIVE ANALYSIS

The comparative results of the road traffic noise modelling at each receiver location are presented in the following Table 4-1:

Table 4-1: Comparative Analysis of Existing Road Traffic Levels on Pacific Highway (values expressed as dB(A))

Location	Road Traffic Noise Levels	Day, $L_{Aeq(15hr)}$	Night, $L_{Aeq(9hr)}$
R01	Extrapolated from measured data at R04 (Weekend Average)	60.4	54.6
	Modelled Noise Levels (Weekend Average)	61.4	54.7
	Variation	+ 1.0	+ 0.1
R04	Measured Noise Levels (Weekend Average)	57.4	51.6
	Modelled Noise Levels (Weekend Average)	57.7	51.0
	Variation	+ 0.3	- 0.6
R05	Measured Noise Levels (Weekend Average)	58.0	50.9
	Simulated Noise Levels (Weekend Average)	57.7	51.0
	Variation	- 0.3	+ 0.1
R06	Extrapolated from measured data at R07 (Weekend Average)	56.4	50.5
	Simulated Noise Levels (Weekend Average)	56.7	50.0
	Variation	+ 0.3	- 0.5
R07	Measured Noise Levels (Weekend Average)	58.0	52.1
	Simulated Noise Levels (Weekend Average)	59.2	52.5
	Variation	+ 1.2	+ 0.4
R08	Extrapolated from measured data at R07 (Weekend Average)	54.5	48.6
	Simulated Noise Levels (Weekend Average)	54.6	47.9
	Variation	+ 0.1	- 0.7
R16	Measured Noise Levels (Weekend Average)	-	-
	Simulated Noise Levels (Weekend Average)	55.3	48.6
	Variation	-	-
R17	Extrapolated from measured data at R07 (Weekend Average)	56.4	50.5
	Simulated Noise Levels (Weekend Average)	57.2	50.5
	Variation	+ 0.8	0.0

Note: "-" indicates no logging data available

The comparative analysis results indicate that the noise levels simulated by the TNOISE model is accurate to within 0.0 to 1.2 dB(A), which is acceptable for analysing data accuracy.

4.3 TRAFFIC VOLUME

According to Figure 1-2, vehicles would enter the site via Tweed Valley Way. Traffic movements along the Pacific Highway have also been considered due to the audibility of the heavy and continuous traffic volumes observed along this highway at the identified receiver locations.

The values applied to the hourly traffic distribution are for modelling purposes only.

4.3.1 Pacific Highway

Average traffic volumes (vehicles per day, vpd) have been sourced from PB's Traffic Assessment, the applicable parts of which have been reproduced in the below Table 4-2.

Table 4-2: Existing average road traffic volumes (vpd) on Pacific Highway

	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
Weekend	8,541	831	9,372	8,635	837	9,472

Source: Parsons Brinckerhoff

PB's Traffic Assessment has been referenced in deriving the peak hourly volumes (vehicles per hour, vph) as shown in Table 4-3 below.

Table 4-3: Existing peak road traffic volumes (vph) on Pacific Highway

	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
Saturday peak (10:00am-11:00am)	684	51	715	812	49	862
Sunday peak (11:00am-12:00pm)	735	37	772	781	54	835

Source: Parsons Brinckerhoff

The hourly traffic volumes for the remaining hours of the day have been extrapolated from the available average and peak traffic data above and are shown in Table 4-4 below. The extrapolated traffic distribution data has been applied to the traffic noise model for the applicable sections of the Pacific Highway running adjacent to the identified receivers.

Due to the nature of the proposed activities, the weekend traffic volumes have been considered in this traffic noise assessment.

Table 4-4: Existing hourly road traffic distribution on Pacific Highway - Weekend

Time	Northbound				Southbound			
	Light	Heavy	Light + Heavy	Heavy %	Light	Heavy	Light + Heavy	Heavy %
12:00 AM	50	10	60	0.1	40	10	50	0.1
1:00 AM	50	10	60	0.1	40	10	50	0.1
2:00 AM	50	10	60	0.1	40	10	50	0.1
3:00 AM	70	20	90	0.2	50	20	70	0.2
4:00 AM	100	30	130	0.3	110	20	130	0.2
5:00 AM	150	30	180	0.3	230	30	260	0.3
6:00 AM	250	40	290	0.4	220	40	260	0.4
7:00 AM	350	50	400	0.5	360	40	400	0.4
8:00 AM	500	50	550	0.5	380	50	430	0.5
9:00 AM	620	60	680	0.6	430	60	490	0.6
10:00 AM	746	80	826	0.9	675	70	745	0.7
11:00 AM	730	80	810	0.9	680	70	750	0.7
12:00 PM	750	70	820	0.7	700	70	770	0.7
1:00 PM	620	50	670	0.5	690	60	750	0.6
2:00 PM	790	40	830	0.4	690	50	740	0.5
3:00 PM	600	40	640	0.4	680	50	730	0.5
4:00 PM	550	38	588	0.4	650	40	690	0.4
5:00 PM	500	38	538	0.4	580	30	610	0.3
6:00 PM	350	25	375	0.3	430	30	460	0.3
7:00 PM	250	20	270	0.2	300	27	327	0.3
8:00 PM	160	10	170	0.1	240	20	260	0.2
9:00 PM	150	10	160	0.1	190	10	200	0.1
10:00 PM	100	10	110	0.1	140	10	150	0.1
11:00 PM	55	10	65	0.1	90	10	100	0.1
	8541	831			8635	837		
TOTAL	9372				9472			

Receivers R01, R04, R05, R06, R07, R08, R16 and R17 have been included in the road traffic noise model to assess for traffic movements along the Pacific Highway at the nearest potentially affected receivers.

For the short-term 1-year traffic forecast, a 4.4% (per annum) increase to the existing traffic volume has been applied and is shown in Table 4-5 below.

Table 4-5 presents the hourly traffic flow along Pacific Highway under a 1-year forecast of a 4.4% traffic volume increase per annum.

Table 4-5: Existing hourly road traffic distribution on Pacific Highway – Weekend, 1-year forecast

Time	Northbound				Southbound			
	Light	Heavy	Light + Heavy	Heavy %	Light	Heavy	Light + Heavy	Heavy %
12:00 AM	53	6	59	0.1	45	5	50	0.1
1:00 AM	71	8	79	0.1	51	6	57	0.1
2:00 AM	98	11	109	0.1	81	9	90	0.1
3:00 AM	117	13	130	0.1	90	10	100	0.1
4:00 AM	162	18	180	0.2	126	14	140	0.1
5:00 AM	189	21	210	0.2	234	26	260	0.3
6:00 AM	261	29	290	0.3	234	26	260	0.3
7:00 AM	360	40	400	0.4	360	40	400	0.4
8:00 AM	496	55	551	0.6	387	43	430	0.4
9:00 AM	613	68	681	0.7	441	49	490	0.5
10:00 AM	744	83	827	0.9	671	75	745	0.8
11:00 AM	771	86	857	0.9	684	76	760	0.8
12:00 PM	774	86	860	0.9	693	77	770	0.8
1:00 PM	726	81	807	0.9	675	75	750	0.8
2:00 PM	747	83	830	0.9	666	74	740	0.7
3:00 PM	576	64	640	0.7	657	73	730	0.7
4:00 PM	529	59	588	0.6	621	69	690	0.7
5:00 PM	484	54	538	0.6	585	65	650	0.7
6:00 PM	338	37	375	0.4	549	61	610	0.6
7:00 PM	243	27	270	0.3	411	46	457	0.5
8:00 PM	153	17	170	0.2	234	26	260	0.3
9:00 PM	144	16	160	0.2	180	20	200	0.2
10:00 PM	99	11	110	0.1	135	15	150	0.2
11:00 PM	58	7	65	0.1	90	10	100	0.1
	8804	980			8900	989		
TOTAL	9784				9889			

4.3.2 Tweed Valley Way

Similarly, the weekly average traffic volumes are presented below for Tweed Valley Way in vehicles per day.

Table 4-6: Existing average road traffic volumes (vpd) on Tweed Valley Way

	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
Weekend	1,372	55	1,427	1,548	60	1,608

Source: Parsons Brinckerhoff

The relevant parts of the peak hourly road traffic volumes have been reproduced from PB's Traffic Assessment as per below.

Table 4-7: Existing average road traffic volumes (vph) on Tweed Valley Way

	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
Saturday peak (11:00am-12:00pm)	122	7	129	142	5	147
Sunday peak (11:00am-12:00pm)	135	2	137	174	8	182

Source: Parsons Brinckerhoff

Based on the available data reproduced in Table 4-2 and Table 4-3, the peak hour figures and the total values have been applied with the remaining hourly traffic distribution extrapolated for modelling purposes as shown below.

Table 4-8: Existing hourly road traffic distribution on Tweed Valley Way - Weekend

Time	Northbound vehicles				Southbound vehicles			
	Light	Heavy	L+H	Heavy %	Light	Heavy	L+H	Heavy %
12:00 AM	50	1	51	0.1	50	1	51	0.1
1:00 AM	50	0	50	0.0	50	1	51	0.1
2:00 AM	50	1	51	0.1	50	1	51	0.1
3:00 AM	50	0	50	0.0	50	1	51	0.1
4:00 AM	50	1	51	0.1	50	1	51	0.1
5:00 AM	50	2	52	0.1	50	2	52	0.1
6:00 AM	50	3	53	0.2	60	2	62	0.1
7:00 AM	50	4	54	0.3	60	2	62	0.1
8:00 AM	60	4	64	0.3	70	3	73	0.2
9:00 AM	70	5	75	0.4	90	5	95	0.3
10:00 AM	80	6	86	0.4	100	6	106	0.4
11:00 AM	85	7	92	0.5	90	8	98	0.5
12:00 PM	70	5	75	0.4	84	7	91	0.4
1:00 PM	60	3	63	0.2	80	4	84	0.2
2:00 PM	65	3	68	0.2	70	3	73	0.2
3:00 PM	50	2	52	0.1	90	2	92	0.1
4:00 PM	60	2	62	0.1	80	2	82	0.1
5:00 PM	60	1	61	0.1	60	2	62	0.1
6:00 PM	62	1	63	0.1	64	2	66	0.1
7:00 PM	50	1	51	0.1	50	1	51	0.1
8:00 PM	50	1	51	0.1	50	1	51	0.1
9:00 PM	50	1	51	0.1	50	1	51	0.1
10:00 PM	50	0	50	0.0	50	1	51	0.1
11:00 PM	50	1	51	0.1	50	1	51	0.1
	1372	55			1548	60		
TOTAL	1427				1608			

5. TRAFFIC NOISE ASSESSMENT

5.1 METHODOLOGY OF ROAD TRAFFIC NOISE ASSESSMENT

Road traffic noise modelling was undertaken using two different methods to predict traffic noise impacts potentially affecting the residences within the study area. For road traffic noise, a computer modelling program, TNOISE was used. TNOISE calculates traffic noise following the method described in the book: "Calculation of Road Traffic Noise" (CRTN) issued by the U.K. Department of Transport in 1988. This program predicts the $L_{A10(1hr)}$ noise levels, then calculates $L_{Aeq(1hr)}$ noise levels for every hour in a day (24 hours) by applying a correction of – 3 dB(A). TNOISE does not account for meteorological conditions and therefore the road traffic noise along the Pacific Highway and Tweed Valley Way has been modelled under 'neutral' meteorological conditions.

For an accurate assessment, the model was compared with the attended monitoring results near the Pacific Highway. After the comparison, the predicted increase in traffic noise levels at each assessment location was calculated, and the levels were assessed against the established traffic noise criteria.

The calculation of future road traffic noise levels have been undertaken using the following assumptions:

- Road surface: Bituminous;
- Average road gradient: 3 %;
- Absorbing ground: 50 % between the road and the receivers;
- An angle of 180 degrees at the receivers;
- Average source height: 1.5m to account for the high percentage of heavy vehicles for some periods; and
- Receiver heights: 1.5m.

Due to the abundance of greenfields within the subject locality and the absence of road barriers present, ground was taken to be 50% soft. This has generally found to give a good correlation with measured noise levels. If barriers were present, hard ground would be assumed, in accordance with the CoRTN procedures.

Assuming the receivers are positioned at a building façade, a +2.5dB correction has been applied to the model under the CoRTN procedures.

5.2 METHODOLOGY OF ONSITE TRAFFIC NOISE ASSESSMENT

For road traffic noise while vehicles are onsite, an EPA-recognised modelling program SoundPLAN v7.0 was used to predict the potential onsite traffic noise levels. The NSW DECCW's INP was applied to the calculations in the SoundPLAN model to suitably assess the onsite vehicles as industrial noise sources.

Compared to the traffic volumes of the proposed light and heavy vehicles onsite, service and emergency vehicles were considered to be negligible and therefore not assessed in the model.

5.3 ONSITE TRAFFIC NOISE SOURCES

The octave band sound power levels for the sources identified have been measured by environmental engineers from Benbow Environmental at similar sites. The results are presented in Table 5-1 below. The data has been used to model noise emissions from the site at the nearest potentially affected sensitive receivers.

Table 5-1: Noise Source Data Adopted Sound Power Levels (dB(A))

Descriptor	dB(A)	1/1 and 1/3 Linear Weighted Octave Band Centre Frequency (Hz)																						
		50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
ONSITE CAR PARK SOURCES																								
Light Vehicles Manoeuvring within Car park (speed approx. 15km/h)																								
L_{Aeq}	75.5	-	52.6	-	-	67.7	-	-	59.2	-	-	66.6	-	-	66.8	-	-	70.0	-	-	68.8	-	-	62.7	-
Heavy Vehicles Manoeuvring (speed approx. 10km/h)																								
L_{Aeq}	102.5	69.8	67.2	76.4	77.5	74.9	77.7	82.1	85.9	86.6	87.2	86.8	89.9	90.1	92.9	95.0	94.4	93.1	91.7	89.8	86.7	84.8	82.7	80.4	77.0
ONSITE ACCESS 'SPINE' ROAD SOURCES																								
Light Vehicles Traversing along the Spine Road (speed approx. 30km/h)																								
L_{Aeq}	80.5	-	57.6	-	-	72.7	-	-	64.2	-	-	71.6	-	-	71.8	-	-	75.0	-	-	73.8	-	-	67.7	-
Heavy Vehicles Traversing along the Spine Road (speed approx. 25km/h)																								
L_{Aeq}	106.5	73.8	71.3	80.4	81.5	78.9	81.7	86.1	89.9	90.6	91.2	90.8	93.9	94.1	96.9	99.0	98.4	97.1	95.7	93.8	90.7	88.8	86.7	84.4	81.0

5.4 MODEL SCENARIOS

Model scenarios were configured that provided a worst-case assessment of potential site-related traffic noise emissions. Each model configuration was used to calculate noise levels at the nearest potentially affected receivers under the proposed maximum operations. Road traffic noise along the Pacific Highway and Tweed Valley Way were predicted under four (4) operating scenarios as shown in Table 5-2.

Based on the local meteorological analyses presented in our Noise Impact Assessment for North Byron Parklands (June 2010), it can be concluded that there is no need for the predictive noise model to apply any noise enhancing meteorological factors. However, light winds of 3 m/s from source to receiver (a noise enhancing meteorological condition) has been applied to the predictive noise model in order to assess under a worst-case scenario. Consequently, the modelling results are deemed to be conservative.

Table 5-2: Modelled Noise Scenarios Considered (Road traffic onsite) – Proposed Operations

Scenario	Description	Sources Included	Source Location
Maximum Operations			
1*	Light vehicles and heavy vehicles traversing along the Spine Road and parking	3,875 light vehicles	3,875 light vehicles enter the access road from 'Gate A' and egress via 'Gate A' and 'Gate C' Northern parking lot: 1,300 vehicles Central parking lot: 1,000 vehicles Southern parking lot: 1,575 vehicles
		590 heavy vehicles	590 heavy vehicles entering and exiting the access road via ''Gate B' Central parking lot: 500 vehicles Southern parking lot: 90 vehicles
The Spine Road			
2	3,875 light vehicles traversing along the Spine Road	3,875 light vehicles	3,875 light vehicles enter the access road from 'Gate A' and egress via 'Gate A' and 'Gate C'
3	590 heavy vehicles traversing along the Spine Road	590 heavy vehicles	590 heavy vehicles entering and exiting the access road via ''Gate B'
Parking Lots			
4	Light vehicles and heavy vehicles parking in the car park lots	3,875 light vehicles	Northern parking lot: 1,300 vehicles Central parking lot: 1,000 vehicles Southern parking lot: 1,575 vehicles
		590 heavy vehicles	Central parking lot: 500 vehicles Southern parking lot: 90 vehicles

* : It is unlikely that all heavy and light vehicles will ever be traversing the access road at 100% capacity. However this scenario provides a stringent assessment of potential off-site noise impact.

5.4.1 Assumptions and Limitations

Each scenario was run with noise enhancing meteorological conditions, in accordance with the INP. The following conditions were considered:

- Noise enhancing meteorological condition of 3 m/s wind from source to receiver; and
- Calm isothermal 'neutral' meteorological condition.

In our previous Noise Impact Assessment Report Prepared for North Byron Parklands noise enhancing meteorological conditions such as lights winds (3 m/s) or temperature inversions were not found to be a feature of this locality. Therefore, this conservative approach (by applying light winds to this assessment) should be duly noted by the reader. Furthermore, the event site has been modelled at 100% capacity to provide a worst-case assessment.

The number of light vehicles assigned to the predictive model has been derived from the following assumptions with the transport mode split figures referenced from PB's Traffic Assessment (Table 3.11 Mode split to site for future event):

- 100% event site capacity with an example number of 50,000 campers and day patrons and 3,000 event personnel;
- An assumed transport mode split for campers and day patrons of 1% taxi, 18% car, with 4 persons per taxi/car;
- An assumed transport mode split for event personnel of 100% cars, with 2 persons per car; and
- Total of 3,875 light vehicles traversing to the north, central and south car park areas via the onsite access road during the daytime and evening periods, i.e. 7am – 10pm.

The number of heavy vehicles accessing the site have been assumed as follows:

- 100% event site capacity with an example number of patrons of 50,000;
- An assumed transport mode split of 73% for 'Festival organised shuttle bus', 1% 'Other type of bus';
- 35 persons per shuttle bus;
- 40 persons per bus;
- 84 coach bays and 10 bus bays proposed in the Central parking area; and
- Total of 1,055 heavy vehicles traversing to the coach and bus bays during the daytime and evening periods, i.e. 7am – 10pm.

Based on the above assumptions, the light vehicles account for a transport mode split of 19%, with 74% for heavy vehicles resulting in a total of 93% for both light and heavy vehicles.

The remaining 7% can be attributed to 'camping at site', 'bicycle' and 'other'.

5.5 PREDICTED ROAD TRAFFIC NOISE LEVELS

Based on the existing and proposed traffic volume data for the road, the following predicted increases in road traffic noise levels have been determined for the expected traffic volume increase due to the proposed Parklands events site.

Table 5-3: Predicted Increase in Traffic Noise Levels – Pacific Highway
(values expressed as dB(A))

Receiver Location	Existing Noise Level[1]		Predicted Noise Level[1]		ECRTN Criteria[2]		Exceedance over Criteria	
	Day, $L_{Aeq(15hr)}$	Night, $L_{Aeq(9hr)}$	Day, $L_{Aeq(15hr)}$	Night, $L_{Aeq(9hr)}$	Day, $L_{Aeq(15hr)}$	Night, $L_{Aeq(9hr)}$	Day	Night
R01	61.4	54.7	62.3	55.1	63.4	55.0	0.0	0.1
R04	57.7	51.0	58.6	51.4	60.0	55.0	0.0	0.0
R05	57.7	51.0	58.6	51.4	60.0	55.0	0.0	0.0
R06	56.7	50.0	57.6	50.4	60.0	55.0	0.0	0.0
R07	59.2	52.5	60.1	52.9	60.0	55.0	0.1	0.0
R08	54.6	47.9	55.5	48.3	60.0	55.0	0.0	0.0
R16	55.3	48.6	56.2	49.0	60.0	55.0	0.0	0.0
R17	57.2	50.5	58.1	50.9	60.0	55.0	0.0	0.0

Notes:
1. Based on simulated noise levels by TNOISE, combined levels of northbound and southbound traffic.
2. After applying a 2 dB-increase allowance to existing levels as the existing noise levels already exceed the criteria for all locations.

Table 5-3 shows that the existing road traffic noise (simulated) on the Pacific Highway exceed the daytime criteria of 60$L_{Aeq(15hr)}$ by 1.4dB(A) at R01 located approximately 140m from the Pacific Highway.

The ECRTN states that where criteria are already exceeded, the development should be designed so as not to increase existing noise levels by more than 2 dB. It also states that all feasible and reasonable noise mitigation opportunities should still be explored, to endeavour to reduce noise levels towards the ECRTN noise criteria before applying a 2 dB allowance.

In many instances this may be achievable only through long-term strategies such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.

RTA's Environmental Noise Management Manual (ENMM) provides guidelines in selecting and designing 'feasible and reasonable' treatment options as following:

'Feasibility' relates to engineering considerations (what can be practically built). These engineering considerations may include:

- The inherent limitation of different techniques to reduce noise emissions from road traffic noise sources;
- Safety issues, such as restrictions on road vision;
- Road corridor site constraints such as space limitation;
- Floodway and stormwater flow obstruction;
- Access requirements;
- Maintenance requirements; and
- The suitability of building conditions for architectural treatments.

'Reasonableness' relates to the application of wider judgements. The factors to be considered are:

- The noise reduction provided and the number of people protected;
- The cost of mitigation, including the total cost and cost variations with different benefits provided;
- Community views and wishes;
- Visual impacts;
- Existing and future noise levels, including changes in noise levels, and
- The benefits arising from the proposed road or road redevelopment.

A potential 2.3dB increase in road traffic noise levels would not be clearly discernible to the human auditory system and therefore it is considered to be a negligible change. As such, a 2dB increase allowance has been considered for the receiver location at R01 which would result in a daytime road traffic criterion of 63.4$L_{Aeq(15hr)}$ at this location.

A minor exceedance of 0.1dB is predicted at R01 during the night time with a 0.1dB exceedance expected at R07 during the daytime which are not considered as an 'exceedance' as a 0.1dB increase is not detectable. Table 5-3 shows that an increase in traffic noise is expected in the range of 0.9dB during the daytime and 0.4dB during the night time at the receivers near the Pacific Highway which are considered to be negligible.

Compliance with the ECRTN noise criteria is predicted to be achieved for all assessment locations.

A short term forecast of existing traffic volumes along the Pacific Highway with a linear growth rate of 4.4% per annum as per (PB's Traffic Assessment) have been predicted for the expected traffic volume increase due to the proposed Parklands events site.

The results are shown in Table 5-4 below.

Table 5-4: Predicted Increase in Traffic Noise Levels with 4.4% linear growth – Pacific Highway, 1-year forecast (values expressed as dB(A))

Receiver Location	Existing Noise Level[1]		Predicted Noise Level[1]		ECRTN Criteria[2]		Exceedance over Criteria	
	Day, $L_{Aeq(15hr)}$	Night, $L_{Aeq(9hr)}$	Day, $L_{Aeq(15hr)}$	Night, $L_{Aeq(9hr)}$	Day, $L_{Aeq(15hr)}$	Night, $L_{Aeq(9hr)}$	Day	Night
R01	61.4	54.7	62.5	55.5	63.4	55.0	0.0	0.5
R04	57.7	51.0	58.8	51.8	60.0	55.0	0.0	0.0
R05	57.7	51.0	58.8	51.8	60.0	55.0	0.0	0.0
R06	56.7	50.0	57.8	50.8	60.0	55.0	0.0	0.0
R07	59.2	52.5	60.3	53.3	60.0	55.0	0.6	0.0
R08	54.6	47.9	55.7	48.7	60.0	55.0	0.0	0.0
R16	55.3	48.6	56.4	49.4	60.0	55.0	0.0	0.0
R17	57.2	50.5	58.3	51.3	60.0	55.0	0.0	0.0

Notes:
1. Based on simulated noise levels by TNOISE with an expected 4.4% linear growth, combined levels of northbound and southbound traffic.
2. After applying a 2 dB-increase allowance to existing levels as the existing noise levels already exceed the criteria for all locations.

At 4.4% per annum, minor traffic noise level increases (compared to the existing traffic noise) are expected, viz. 0.1dB during the daytime and 0.5dB during the night time. Marginal compliance is expected at R01 during the night time and at R07 during the daytime.

Overall, compliance is predicted at all locations.

Based on the existing and proposed traffic movements along Tweed Valley Way, the following predicted increases in road traffic noise levels have been determined for the expected traffic volume increase. $L_{Aeq,1hr}$ values were calculated from the L_{A10} values predicted by the CoRTN algorithms in TNOISE using the well-validated approximation $L_{Aeq,1hr} = L_{A10,1hr} - 3dB$.

Table 5-5: Predicted Increase in Traffic Noise Levels – Tweed Valley Way
(values expressed as dB(A))

Receiver Location	Existing Noise Level[1]		Predicted Noise Level[1]		ECRTN Criteria		Exceedance over Criteria	
	Day, $L_{Aeq(1hr)}$	Night, $L_{Aeq(1hr)}$	Day, $L_{Aeq(1hr)}$	Night, $L_{Aeq(1hr)}$	Day, $L_{Aeq(1hr)}$	Night, $L_{Aeq(1hr)}$	Day	Night
R01	50.5	49.2	57.5	50.5	60	55	0	0
R04	46.8	45.5	53.8	46.8	60	55	0	0
R05	46.8	45.5	53.8	46.8	60	55	0	0
R06	45.8	44.5	52.8	45.8	60	55	0	0
R07	48.3	47.0	55.3	48.3	60	55	0	0
R08	43.7	42.4	50.7	43.7	60	55	0	0
R16	44.4	43.1	51.4	44.4	60	55	0	0
R17	46.3	45.0	53.3	46.3	60	55	0	0

Notes:
1. Based on simulated noise levels by TNOISE, combined levels of northbound and southbound traffic.

The predicted increase in traffic noise levels presented in Table 5-5 above are 7.0dB during the daytime and 1.3dB during the night time period at the receiver locations near Tweed Valley Way.

In all, compliance with the ECRTN noise criteria is predicted to be achieved for all assessment locations.

5.6 PREDICTED ONSITE TRAFFIC NOISE LEVELS

Table 5-6: Modelled Noise Impacts – NO CONTROLS (3m/s wind from source to receiver), Daytime 7am to 6pm

Scenario		Receiver Location														
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R17	R18
Design Criteria (L_{Aeq})		55	55	47	49	47	49	49	49	42	42	50	40	40	49	49
Scenario 1 (L_{Aeq})	Maximum traffic movements	40.9	44.8	43.0	48.2	61.3	22.6	23.3	20.7	20.3	31.0	32.8	35.9	27.0	49.8	30.5
Scenario 2 (L_{Aeq})	Light vehicles only	5.8	19.9	18.7	23.7	35.5	-2.2	-0.6	-3.4	-2.5	9.3	10.1	13.0	9.6	23.2	11.6
Scenario 3 (L_{Aeq})	Heavy vehicles only	40.8	44.8	42.9	48.2	61.3	20.6	21.9	18.8	18.6	30.6	32.5	35.7	24.9	49.7	29.3
Scenario 4 (L_{Aeq})	Parking areas only	22.8	25.4	23.7	27.6	32.6	18.3	17.8	16.3	15.3	20.2	20.8	22.3	22.5	24.9	24.2

Note: ▢ Potential exceedance

5.6.1 Comments (Daytime 7am to 6pm)

The onsite traffic noise is expected to be audible at R05 under Scenarios 1 and 3 with a potential exceedance of 14.3dB during the daytime period during a noise enhancing meteorological condition of 3m/s wind source to receiver. Heavy vehicles accessing the site are predicted to be the main onsite traffic noise contributor. Marginal compliance is expected at R17 under Scenarios 1 and 3 with a 0.7-0.8dB exceedance which is considered to be negligible. Compliance is predicted at all other receiver locations.

Table 5-7: Modelled Noise Impacts – NO CONTROLS (3m/s wind from source to receiver), Evening 6pm to 10pm

Scenario		Receiver Location														
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R17	R18
Design Criteria (L_{Aeq})		50	45	45	49	48	49	49	49	45	45	45	41	41	49	45
Scenario 1 (L_{Aeq})	Maximum traffic movements	40.9	44.6	42.8	48.0	60.6	21.9	22.6	20.0	19.6	30.7	32.3	35.1	26.2	49.0	29.7
Scenario 2 (L_{Aeq})	Light vehicles only	4.6	18.7	17.5	22.5	34.1	-3.5	-2.0	-4.8	-3.9	8.0	8.8	11.6	8.2	21.8	10.2
Scenario 3 (L_{Aeq})	Heavy vehicles only	40.8	44.6	42.7	47.9	60.6	20.1	21.3	18.1	18.1	30.4	32.0	34.9	24.4	49.0	28.6
Scenario 4 (L_{Aeq})	Parking areas only	22.0	24.6	23.0	26.8	31.7	17.3	16.9	15.3	14.4	19.0	19.5	21.1	21.4	24.0	22.9

Note: ☐ Potential exceedance

5.6.2 Comments (Evening 6pm to 10pm)

During the evening period, onsite traffic noise levels are expected to be audible at R05 under Scenarios 1 and 3 with a potential exceedance of 12.6dB during a noise enhancing meteorological condition of 3m/s source to receiver. Heavy vehicles accessing the site are predicted to be the main onsite traffic noise contributor.

Compliance is expected at the remaining receiver locations.

A list of the assumptions made and the general limitations of the predictive modelling has been included in Section 5.4.1 of this report.

Table 5-8: Modelled Noise Impacts – NO CONTROLS (no wind), Daytime 7am to 6pm

Scenario		Receiver Location														
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R17	R18
Design Criteria (L_{Aeq})		55	55	47	49	47	49	49	49	42	42	50	40	40	49	49
Scenario 1 (L_{Aeq})	Maximum traffic movements	36.2	40.1	38.2	43.6	58.1	20.2	20.4	18.2	17.5	26.4	28.0	31.0	24.4	45.1	27.5
Scenario 2 (L_{Aeq})	Light vehicles only	1.2	15.0	13.7	18.9	31.8	-6.8	-5.3	-8.1	-7.1	4.1	4.9	7.8	4.4	18.4	7.2
Scenario 3 (L_{Aeq})	Heavy vehicles only	36.0	39.9	38.0	43.5	58.1	15.7	16.9	13.8	13.5	25.1	27.0	30.4	19.7	45.0	24.8
Scenario 4 (L_{Aeq})	Parking areas only	22.8	25.4	23.7	27.6	32.6	18.3	17.8	16.3	15.3	20.2	20.8	22.3	22.5	24.9	24.2

Note: ☐ Potential exceedance

5.6.3 Comments (Daytime 7am to 6pm – No wind)

During the daytime, onsite traffic noise levels are expected to be audible at R05 under Scenarios 1 and 3 with a potential exceedance of 11.1dB during neutral meteorological conditions. Heavy vehicles accessing the site are predicted to be the main onsite traffic noise contributor.

Compliance is expected at all other receiver locations.

Table 5-9: Modelled Noise Impacts – NO CONTROLS (no wind), Evening 6pm to 10pm

Scenario		Receiver Location														
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R17	R18
Design Criteria (L_{Aeq})		55	55	47	49	47	49	49	49	42	42	50	40	40	49	49
Scenario 1 (L_{Aeq})	Maximum traffic movements	36.2	39.9	38.0	43.4	57.4	19.4	19.6	17.4	16.7	25.9	27.3	30.2	23.5	44.3	26.6
Scenario 2 (L_{Aeq})	Light vehicles only	0.1	13.8	12.5	17.7	30.3	-8.1	-6.6	-9.5	-8.5	2.8	3.6	6.4	3.0	17.0	5.8
Scenario 3 (L_{Aeq})	Heavy vehicles only	36.0	39.7	37.8	43.3	57.4	15.1	16.3	13.1	12.9	24.9	26.5	29.6	19.2	44.3	24.0
Scenario 4 (L_{Aeq})	Parking areas only	22.0	24.6	23.0	26.8	31.7	17.3	16.9	15.3	14.4	19.0	19.5	21.1	21.4	24.0	22.9

Note: ☐ Potential exceedance

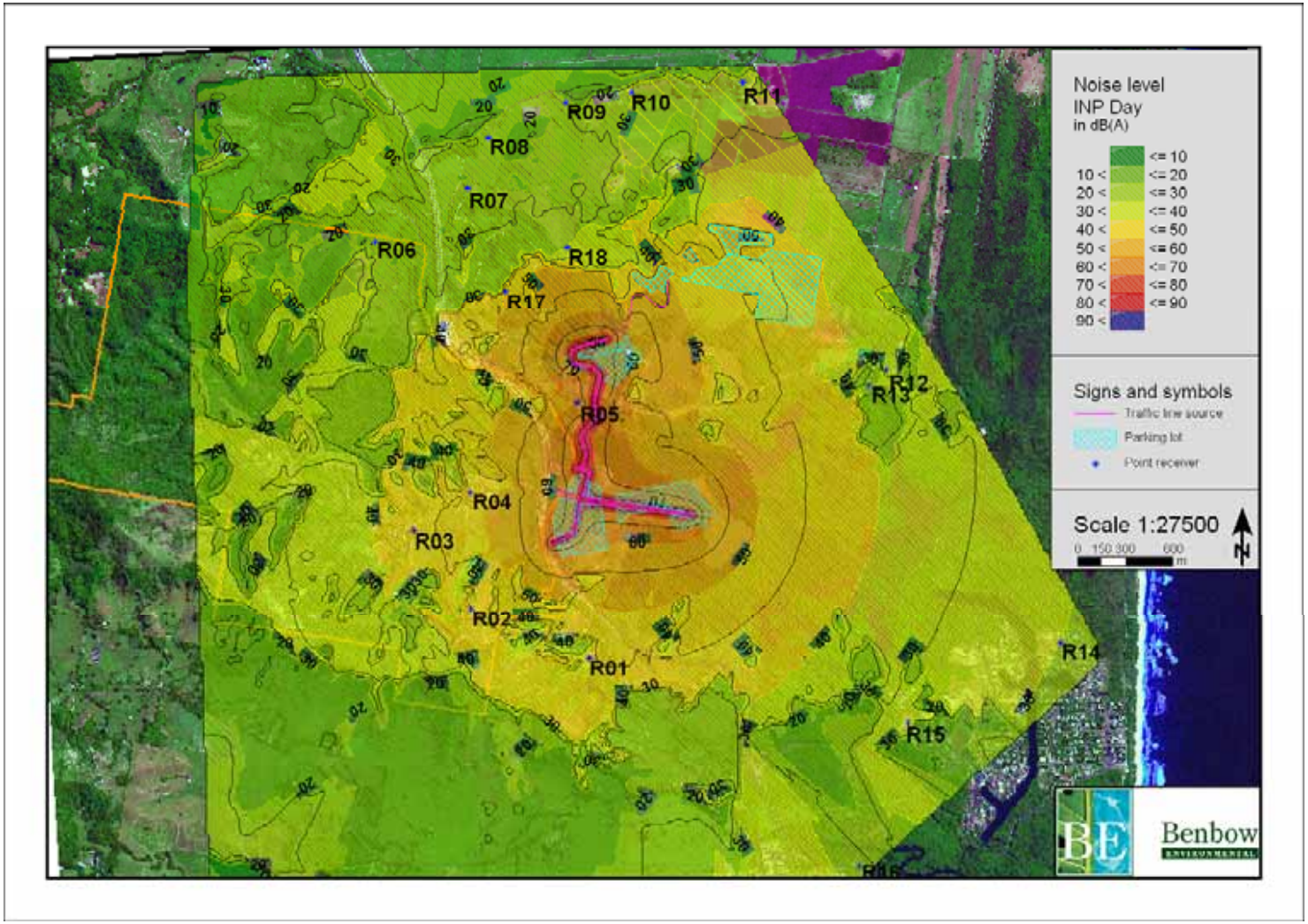
5.6.4 Comments (Evening 6pm to 10pm – No wind)

During the evening period, onsite traffic noise levels are expected to be audible at R05 under Scenarios 1 and 3 with a potential exceedance of 10.4dB during neutral meteorological conditions. Heavy vehicles accessing the site are predicted to be the main onsite traffic noise contributor.

Compliance is expected at the remaining receiver locations.

A sample noise contour plot generated using SoundPLAN is shown in Figure 5-1 below for Scenario 1.

Figure 5-1: Noise Contour Generation Plot – Scenario 1, Daytime (no controls, 3m/s wind source to receiver)



6. CONCLUSION

A road traffic noise study was carried out to assess potential noise impacts on nearby residences within the study area under the worst-case scenario of 100% event capacity.

Road traffic noise impacts have been assessed against the criteria set out in NSW DECCW's Environmental Criteria for Road Traffic Noise (ECRTN, NSW Environment Protection Authority, 1999).

Onsite traffic noise impacts have been assessed against the guidelines set out in NSW DECCW's Industrial Noise Policy (INP, 2000).

Surveys for the existing noise environment have been conducted at the residential locations within the study area to measure the noise levels of existing road traffic, ambient and background. The measured traffic data have been compared to the simulated levels to increase the confidence level of the road traffic noise levels applied to the TNOISE model.

This study found that the expected increase in road traffic noise levels due to the Parkland's Concept Plan and Project Application would be insignificant and the expected noise increase would meet the ECRTN noise criteria for the residential locations within the study area.

Onsite traffic noise readily satisfies the acceptable noise levels at all identified receiver locations with the exception of R05 (1 Jones Road). Insulation of the residence and/or erection of noise barriers would be recommended to achieve noise levels that would protect the acoustic amenity of the occupants at this location.

This concludes the report.

Anita Joh
Acoustical Engineer

R T Benbow
Principal Consultant

7. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use by North Byron Parklands, as per our agreement for providing environmental assessment services. Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that required by law) in relation to the information contained within this document.

North Byron Parklands is entitled to rely upon the findings in the report within the scope of work described in this report. No responsibility is accepted for the use of any part of the report in any other context or for any other purpose.

Opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions.

ATTACHMENTS

Glossary of Acoustic Terminology

Acceptable Noise Level	The acceptable L_{Aeq} noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Acoustic Barrie	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc used to reduce noise, without eliminating it.
Adverse Weather	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far. This is represented as the L_{eq} noise level.
Assessment Period	The period in a day over which assessments are made.
Assessment Point A	position at which noise measurements are undertaken or estimated.
Background Noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level.
Decibel [dB]	The units of sound pressure level
dB(A)	A-weighted decibels. Noise measured using the A-filter.
Free field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.
Frequency	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive noise	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	Level that drops to the background noise level several times during the period of observation.
L_{Amax}	The maximum sound pressure level measured over a period.
L_{Amin}	The minimum sound pressure level measured over a period.
L_{A1}	The sound pressure level that is exceeded for 1% of the time for which the sound is measured.
L_{A10}	The sound pressure level that is exceeded for 10% of the time for which the sound is measured.
L_{A90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{Aeq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object meets on its path.

R-w	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

UNATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

An ARL noise logger EL-215 S/N was used to conduct the long-term unattended noise monitoring. This equipment complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as a Type 2 instrument suitable for field use.

The measured data is processed statistically and stored in memory every 15 minutes. The equipment was calibrated prior and subsequent to the measurement period using a Rion NC-73 sound level calibrator. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in our previous report Noise Impact Assessment Report for North Byron Parklands.

METEOROLOGICAL CONSIDERATION DURING MONITORING

For the long-term attended monitoring, meteorological data for the relevant period were provided by the Bureau of Meteorology, which was considered representative of the site for throughout the monitoring period.

Measurements affected by wind or rain over certain limits were excluded from the final analyses of the recorded data in accordance with the NSW DECCW's Industrial Noise Policy (INP). The wind data were modified to take into account the difference of height between the AWS (Automatic Weather Station) used by the Bureau of Meteorology (10m above ground level), and the microphone (1.5m above ground level). The correction factor applied to the data was calculated according to the Australian Standard AS1170.2 1989 Section 4.2.5.1.

DESCRIPTORS & FILTERS USED FOR MONITORING

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

Noise environments can be described using various descriptors depending on characteristics of noise or purpose of assessments. For this survey the L_{A90} and L_{Aeq} levels were used to analyse the monitoring results. The statistical descriptors L_{A90} measures the noise level exceeded for 90% of the sample measurement time, and is used to describe the "Background noise". Background noise is the underlying level of noise present in the ambient noise, excluding extraneous noise or the noise source under investigation. The L_{Aeq} level is the equivalent continuous noise level or the level averaged on an equal energy basis which is used to describe the "Ambient Noise".

Measurement sample periods were fifteen minutes.

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Type 1 sound level meter. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS 1259 and was set on A-weighted, fast response.

The microphone was positioned at 1.2 to 1.5 metres above ground level and was fitted with windsocks. The instrument was calibrated using a Bruel & Kjaer type 4230 acoustic calibrator prior and subsequent to the measurement period to ensure the reliability and accuracy of the instrument sets. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in our previous report Noise Impact Assessment Report for North Byron Parklands.

WEATHER CONDITIONS

It was a cool day with relatively still conditions with slight wind gusts and partial cloud cover. The weather conditions on the day would not have adversely affected the results and were conducive for measuring noise under typical conditions.

METHODOLOGY

The attended noise measurements were carried out generally in accordance with Australian Standard AS1055-1997 - "Acoustics – Description and Measurement of Environmental Noise".