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Environmental and Aircraft Noise Assessment
Tweed Billabong Holiday Park
Proposed Caravan Park Extensions

ACOUSTIC REPORT

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Date Prepared:

22 February 2010

TTMref: 33756 R02 Tweed Billabong Holiday Park.doc

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1. INTRODUCTION

TTM Group has been engaged by Darryl Anderson Consulting Pty Ltd to conduct an environmental and aircraft noise impact assessment of the proposed extension to the Tweed Billabong Holiday Park at Tweed Heads South.

The assessment is based on the following information;

- Noise criteria applied by the Tweed Shire Council.
- Aircraft Noise Intrusion assessment as per AS 2021-2000.
- Development Plan (refer to Appendix A).
- Local Environmental Study by Landpartners (*Ref. No. BA060204.000, 5 November 2008*).
- Site inspection, noise measurements, analysis and predictions by TTM.

This report includes the following:

- Description of the site and proposal.
- Measurement of the existing ambient background noise.
- The statement of assessment criteria relating to noise produced by development.
- Identification of the nearest receiver locations.
- The identification of potential noise sources.
- Prediction of noise impacts to the nearest noise sensitive properties.
- Calculation of aircraft noise at the site and building treatment recommendations that should be included to reduce noise to acceptable levels.
- Details of any recommendations and management principles that should be incorporated into the development.

2. SITE DESCRIPTION

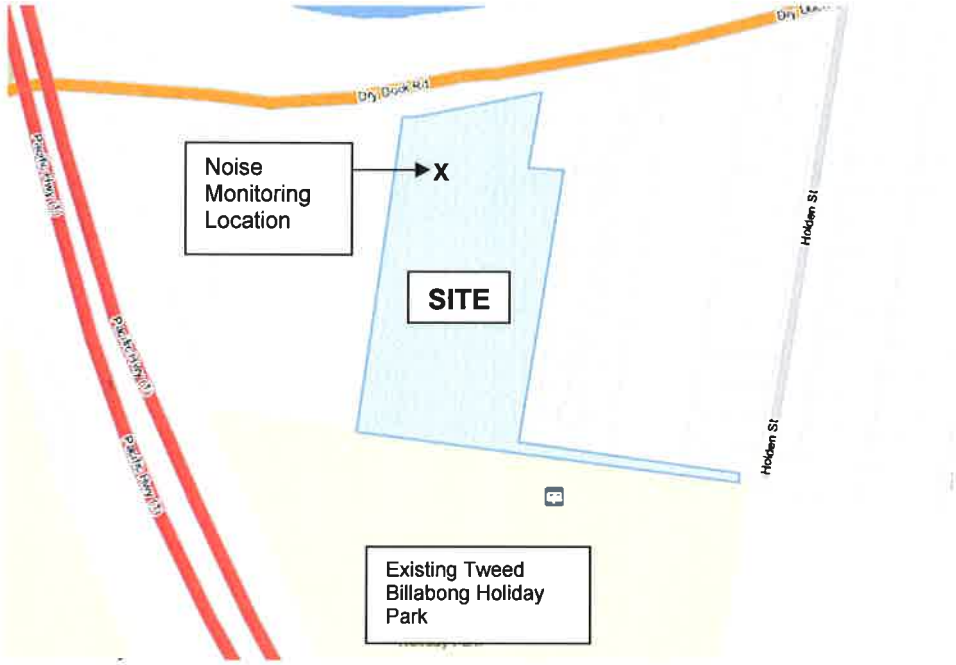
2.1. Site Location

The subject site is described by the following:

Lot 6 on DP 9042
Lot 1 on DP 9042
Lot 14 on DP 733411

The site is bound by Dry Dock Road to the north, residential property to the east, the existing Tweed Billabong Holiday Park to the south, with vacant land and the Pacific Highway to the west. The location of the subject site is shown in Figure 1 below.

Figure 1: Locality Map



2.2. Proposal

The proposed development comprises extensions to the adjoining park which may include, retail shops, tourist cabin accommodation, reception and car parking.

This is assessment is based on the development layout shown in Appendix A.

3. NOISE CRITERIA

3.1. Noise Produced by the Development

On-site noise sources are regulated by the NSW Industrial Noise Policy, published by the NSW Environmental Protection Agency (also known as DEC), which includes commercial premises under the Scope of the Policy. On-site noise sources investigated under the Policy are as follows:

- Car movements
- Car park activity
- People talking
- Mechanical plant; and
- Truck movements and deliveries.

The assessment procedure has two components:

1. Control of intrusive noise impacts – The limit criteria for this assessment is as follows: L_{Aeq}, 15 min ≤ Rating Background Level + 5 dB;
2.
3. Maintaining noise level amenity for adjacent residential premises. This is achieved by ensuring that the proposed development complies with the noise limit criteria set in Table 2.1 of the EPA Industrial Noise Policy.

3.1.1. Intrusive Noise Impacts

The EPA Industrial Noise Policy sets a basic criteria that the $L_{eq\ (15\ min)}$ associated with commercial activity should not exceed the measured L_{90} Background Level + 5 dB(A). A modifying factor should also be added where appropriate to allow for tonality, impulsiveness, and intermittency or low frequency effects.

3.1.2. Amenity Criteria

The Amenity criteria in intended to limit the absolute noise level from all sources to a level that is consistent with the general environment and land use.

The Industrial Noise Policy sets out acceptable noise levels for various locations. Table 2.1 on page 16 of the EPA Industrial Noise Policy specifies four categories to distinguish between different residential areas. These are rural, suburban, urban and urban/industrial interface (for existing situations only).

Under the policy the nearest residences would be assessed against the sub-urban criteria, being located within a predominately residential area with decreasing noise levels in the evening period.

3.1.3. Modifying Factors

Section 4 of the EPA NSW Industrial Noise Policy refers to correction factors that are applied to noise sources to account for additional annoyance.

These include tonal noise, low-frequency noise, impulsive noise, and intermittent noise. Where two or more modifying factors are present, the maximum adjustment to a noise source level is 10dB(A).

3.2. Aircraft Noise

The assessment of aircraft noise is pursuant to Australian Standard AS 2021:2000 *'Acoustics - Aircraft Noise Intrusion - Building Siting and Construction'*. The Tweed Shire Council ANEF 2020 Map locates the development site between the 20-25 noise exposure contours.

Table 3.3 of AS2021:2000, "*Indoor Design Sound Levels for Determination of Aircraft Noise Reduction*" sets limits for noise intrusion when a development is located within an ANEF (Aircraft Noise Exposure Forecast) Contour. The indoor noise limits are as follows;

- 50 dB(A) in sleeping areas and dedicated lounges.
- 55 dB(A) in other habitable spaces, such as living areas.
- 60 dB(A) in bathrooms, toilets, laundries.

4. AMBIENT NOISE MONITORING

4.1. Measurement Equipment

The following equipment was used to record ambient noise levels at the subject site:

- ARL EL215 Environmental Noise Monitor (SN # 194632).
- Rion NC73 Acoustical Calibrator.

4.2. Measurement Methodology

An ambient noise survey was performed in order to assess the existing noise environment. The unattended noise monitor was located on the subject site between Friday 11th December and Friday 18th December 2009. The microphone was in a free-field location, and was approximately 1.4m above ground level. The noise logger position is shown in Figure 1 and Figure 2.

The environmental noise monitor was set to record noise levels as follows;

- 'A'-weighting
- 'Fast' response
- 15 minute statistical interval

The statistical interval was chosen to provide data in accordance with the New South Wales "Industrial Noise Policy" produced by the NSW Environmental Protection Agency (DEC).

All measurements were conducted generally as per Australian Standard AS1055:1997 '*Acoustics – Description & Measurement of Environmental Noise*'.

The operation of the logging equipment was field calibrated before and after the measurement session and was found to be within 0.2dB of the reference signal.

Weather conditions during the measurement survey were generally fine. The temperature range during the monitoring period was between 21°C and 30°C (Source: Bureau of Meteorology 2009).

4.3. Measured Noise Levels

The measured noise levels are presented in the tables below. Graphical presentation of the measured noise levels in shown in Appendix B.

4.3.1. Ambient Background Noise Level

The measured background noise levels, in accordance with EPA policy, are as follows;

Table 1: Background L_{A90} Noise Levels

BACKGROUND NOISE LEVELS $L_{A90,15min}$				
Day	Date	Day ABL	Evening ABL	Night ABL
		0700-1800	1800-2200	2200-0700
Friday	11/12/2009	53.5	47.0	41.5
Saturday	12/12/2009	51.5	44.1	37.8
Sunday	13/12/2009	49.0	44.3	36.9
Monday	14/12/2009	49.0	42.8	37.5
Tuesday	15/12/2009	50.5	44.3	39.0
Wednesday	16/12/2009	49.2	44.5	38.3
Thursday	17/12/2009	51.0	48.8	39.5
Friday	18/12/2009	55.5	x	x
RBL		**51**	**45**	**39**

4.3.2. LAeq Noise Levels

The measured existing L_{Aeq} noise levels, in accordance with EPA policy, are as follows;

Table 2: Ambient L_{Aeq} Noise Levels

EXISTING AMENITY NOISE LEVELS L_{Aeq}				
Day	Date	Day	Evening	Night
		0700-1800	1800-2200	2200-0700
Friday	11/12/2009	58.5	53.5	50.0
Saturday	12/12/2009	57.0	52.8	47.5
Sunday	13/12/2009	55.5	51.5	45.3
Monday	14/12/2009	55.7	51.3	46.8
Tuesday	15/12/2009	57.0	52.4	47.8
Wednesday	16/12/2009	56.0	51.8	46.8
Thursday	17/12/2009	56.7	54.8	46.5
Friday	18/12/2009	59.5	x	x
RBL		**57**	**53**	**47**

5. PROJECT SPECIFIC NOISE LIMITS

Based on the measured logger data presented in Section 4.3 above, the noise limits for intrusive and amenity noise impacts are detailed below.

5.1. Intrusive Noise Impacts

The EPA Industrial Noise Policy sets a basic criteria that the $L_{eq\ (15\ min)}$ associated with commercial activity should not exceed the measured RBL + 5 dB(A). Based on the measured data, the intrusive noise limits are presented in Table 3 below.

Table 3: Intrusive Noise Criteria

Time period	Criteria $L_{eq\ (15min)}$ dB(A)
Day (7am-6pm Mon-Sat; 8am-6pm Sun)	56
Evening (6pm-10pm)	50
Night (10pm-7am Sun-Fri, 10pm-8am Sat)	44

5.2. Amenity Criteria

The acceptable noise levels applying to the residences potentially affected by the proposal, based on the urban requirement and measured logger data, are shown in Table 4 below.

Table 4: Amenity Criteria

Time period	Criteria $L_{eq(period)}$ dB(A)
Day	47
Evening	43
Night	37

6. RESULTS AND CALCULATIONS

6.1. Noise Produced by the Development

Noise emissions from the development have been predicted to the nearest receivers. These noise levels have been compared to the noise objectives determined using EPA guidelines set out in Section 5.

6.1.1. Receiver Locations

The nearest noise sensitive residential receivers are identified as follows;

- Receiver 1: 108 Dry Dock Road.
- Receiver 2: 102 Dry Dock Road.

Figure 2: Receiver Locations

6.1.2. Noise Source Levels

The potential noise sources are listed in Table 5 below along with the noise emission levels. The noise levels have been obtained during noise measurements conducted for similar activities associated with commercial developments.

Noise measurements were performed using a Casella CEL593 sound level meter. The sound level meter was calibrated before and after the measurements using a Rion NC-73 calibrator. No significant drift was recorded.

Table 5: Noise Sources and Typical Average Continuous Noise Levels

Noise Source Description	Noise Level dB(A) at 1m	Typical Duration (secs)
Single event car door closure	76 L_{Aeq} #	3
Single event car bypass @ 5km/h	74 L_{Aeq}	7
Loud Voice (1 conversation)	72 L_{Aeq}	300
Waste collection (collection of industrial waste bin)	93L_{Aeq} #	40

Note a 5 dB(A) modifying factor has been applied to this source to account for the impulsiveness of noise produced.

The following parameters were used for noise calculations;

- Car door closures and car movements predicted from within the site.
- Voice predicted from the most relevant location.
- Waste collection predicted from the northern part of the site.

Noise levels for voice are based on published data contained in *Harris CM, Handbook of Acoustical measurements and Noise Control – 3rd ed. Ch 16.3, Mc-Graw-Hill Inc.* The average A-Weighted Sound Levels (long term averages) of speech for different individual vocal efforts under quiet conditions at a distance of 1 metre are as follows;

Table 6: Voice Noise Levels

Vocal Effort	Male dB(A)	Female dB(A)
Casual	53	50
Normal	58	55
Raised	65	62
Loud	75	71

The voice levels used for assessment are from the "Loud" category with an associated noise level of 75dB(A) for an individual male.

6.1.3. Predicted Noise Levels

6.1.3.1. Intrusive Noise Criteria

No Shielding

The calculated noise levels in Table 7 below include no shielding reductions from acoustic barriers.

The calculations for noise occurring during one peak 15 minute period at the development are based on the following:

- 12 car door closures.
- 6 car passbys.
- Conversations of 5 minute duration.
- 1 waste collection event.

Table 7: Predicted Intrusive Leq15min noise levels - no barriers

Noise Source	Predicted Noise Level dB(A) $L_{eq,\ 15\ minute}$	
	Receiver 1 108 Dry Dock Rd	Receiver 2 102 Dry Dock Rd
Car door closure	40	48
Car passby	44	47
Loud voice	46	47
Waste collection	45	44
Total Combined Noise	**50**	**53**

The results of the assessment show the following main observations;

- Noise associated with car door closures, passenger vehicle movements, and voice is predicted to comply during the day and evening periods.
- Waste collection is generally predicted to comply at all receivers.
- Sound attenuation treatment should be provided to reduce potential noise impacts at receivers during the night period.

With Acoustic Barriers

The noise reduction offered by acoustic barriers depends on numerous factors. These include distance from source to barrier, distance from barrier to receiver, height of source relative to the top of the barrier, height of receiver relative to the top of the barrier, nature of the source (line or point) etc.

Noise levels from the development would need to be reduced in some instances. Therefore, acoustic barriers along the eastern boundary should be included. The predicted results based on the inclusion of acoustic barriers are presented in Table 8 below.

Table 8: Predicted Intrusive Leq15min noise levels - with barriers

Noise Source	**Predicted Noise Level dB(A) $L_{eq,\ 15\ minute}$**	
	Receiver 1 108 Dry Dock Rd	Receiver 2 102 Dry Dock Rd
Car door closure	32	38
Car passby	32	38
Loud voice	39	40
Waste collection	40	37
Total Combined Noise	**43**	**44**

These noise levels are calculated with the use of acoustic barriers as shown in Section 7. With acoustic barriers, the results of the assessment are as follows;

- Noise associated with car door closures and passenger vehicle movements is predicted to comply with the criteria at all receivers.
- Voice levels are predicted to comply with the criteria.
- The total combined noise level from all sources is predicted to comply based on the incorporation of the acoustic fences.

6.1.3.2. Amenity Noise Criteria

The following noise levels include shielding from acoustic barriers, as reductions would be required in order to reduce intrusive noise levels. The acoustic barriers are detailed in Section 7.

The predicted levels for the amenity noise assessment are based on the number of events occurring within the period.

Day Period

The predicted amenity noise levels during the day period are presented in Table 9 below.

Table 9: Predicted Amenity Noise Levels - Day

Noise Source	**Predicted Noise Level dB(A) $L_{eq,\ (7am\ -\ 6pm)}$**	
	Receiver 1	Receiver 2
Car door closure	32	36
Car passby	34	26
Loud voice	39	40
Waste collection	24	22
Total Combined Noise	**41**	**42**

Noise associated with the development is predicted to comply with the day criteria of 47 dB(A).

Evening Period

The predicted amenity noise levels during the evening period are presented in Table 10 below.

Table 10: Predicted Amenity Noise Levels - Evening

Noise Source	**Predicted Noise Level dB(A) $L_{eq,\ (6pm\ -\ 10pm)}$**	
	Receiver 1	Receiver 2
Car door closure	32	36
Car passby	34	26
Loud voice	39	40
Waste collection	28	27
Total Combined Noise	**41**	**42**

Noise associated with the development is predicted to comply with the evening criteria of 43 dB(A).

Night Period

The predicted amenity noise levels during the night period are presented in Table 11 below.

Table 11: Predicted Amenity Noise Levels - Night

Noise Source	Predicted Noise Level dB(A) $L_{eq, (7am - 6pm)}$	
	Receiver 1	Receiver 2
Car door closure	32	36
Car passby	34	26
Loud voice	39	40
Waste collection	n/a	n/a
Total Combined Noise	**41**	**42**

Based on the car movement rates applied to the day and evening periods, noise during the night would be slightly above the criteria. The actual occurrence of noise events is expected to decrease during the night period, hence reducing the total noise levels at receiver locations.

6.1.4. Plant Noise

Detailed plant selections are not available at this stage. Consequently it is not possible to carry out detailed examination of any measures that may be required to achieve compliance with the noise targets. Plant and equipment must be acoustically treated to prevent noise emissions from adversely impacting the receiver. This may include selecting the quietest plant possible, or treating the plant equipment with enclosures, barriers, duct lining and silencers, etc if required to comply with the assessment criteria.

Experience with similar projects indicates that it is possible to achieve the criteria with appropriate acoustic treatment. This treatment would be determined at the Building Approval/Construction Certificate stage.

6.2. Aircraft Noise

6.2.1. Calculated Noise Levels

Calculated aircraft noise levels are obtained from Australian Standard AS 2021. This methodology incorporates baseline data from the ANEF predictions, and relative location of the runway compared to the development site. The following variables were used in the prediction:

- Distance to flight path (DS) 370 m.
- Distance to landing point (DL) 2,450 m.
- Distance to takeoff point (DT) 5,060 m.

Table 12 below list the types of aircraft and their associated noise levels based on the location of the site (i.e. ANEF 20-25 Contour).

Table 12: Aircraft Noise Levels

Aircraft Type	Noise Level dB(A) Take-Offs	Noise Level dB(A) Arrivals
Boeing 737-300, -400	78	73
Airbus A320	78	73
British Aerospace BAe 146	77	70
SAAB 340	67	67
Being Dash 8	67	67
Fokker F50	67	67
Corporate Jet	78	66
Typical light general aviation aircraft	69	66

The maximum aircraft noise level is expected to be 78 dB(A) from Boeing 737, Airbus A320 and Corporate Jet take-offs.

It is noted that the Boeing 737 and Airbus A320 are the most commonly used aircraft by Jetstar, Virgin Blue and Tiger Airways.

7. RECOMMENDATIONS

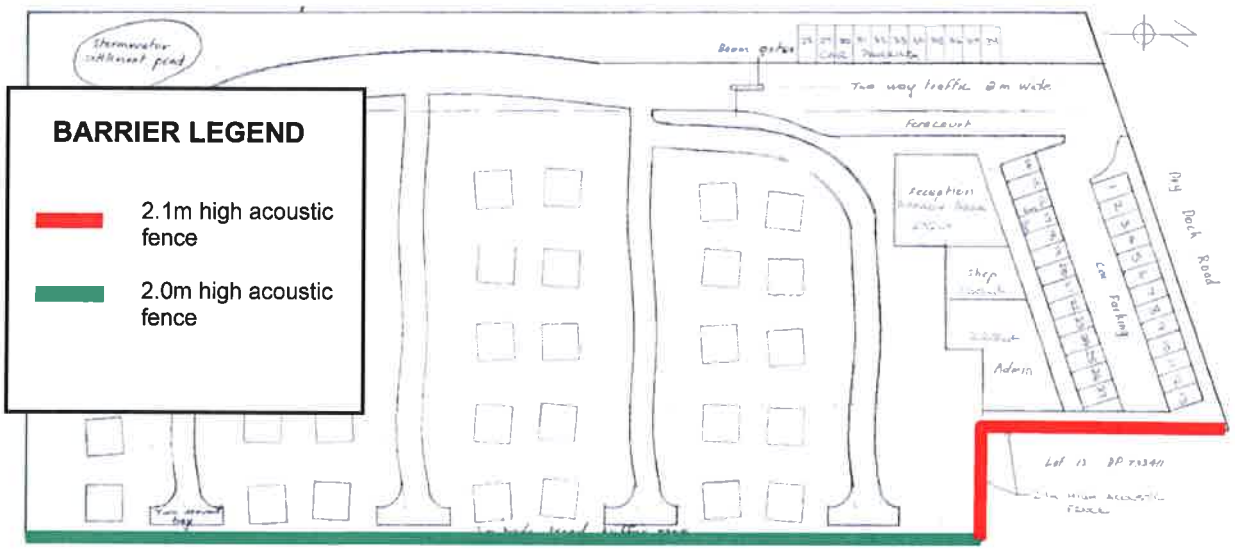
7.1. Environmental Noise Emissions

The following recommendations should be implemented in order to reduce noise:

7.1.1. Acoustic Barriers

- Noise attenuation in the form of acoustic barriers should be constructed at the site. The location and heights of the acoustic barriers are shown in Figure 3 below.

Figure 3: Acoustic Barriers



- The height of the acoustic barriers must be relative to the finished ground level of the development site.
- The acoustic barriers can be constructed using masonry, Hebel, concrete, fibre cement sheet, plywood, glass, Perspex, earth mounding, timber palings (50% lap) or a combination of these materials. The surface mass of the material must be greater than 12kg/m^2, and there must be no holes or gaps in the barrier.

7.1.2. Management Principles

To further reduce noise where possible, we recommend the following management principles;

- Deliveries, waste removals, etc should occur between the hours of 7am - 6pm.
- Any grates or other protective covers in the car parks and access driveways must be rigidly fixed in position to eliminate clanging.
- Surface finish for grade must be low-squeal i.e. no polished or painted concrete etc.

7.2. Aircraft Noise

7.2.1. Cabin Treatments

The building treatments below are for a typical cabin that may be constructed in the holiday park.

Building treatments have been determined to achieve the internal aircraft noise levels stated in Australian Standard AS2021:2000 *'Acoustics - Aircraft Noise Intrusion - Building Siting and Construction'*.

7.2.1.1. Glazing Treatment

The glazing treatments for a typical cabin are presented in Table 13. Acoustic seals refer to Schlegel Q-Lon, Raven, or an equivalent product.

Table 13: Glazing Treatments

Room	Glazing Thickness	Acoustic Seals	Rw
Living/Dining	6.38mm laminate	Yes	30
Bedrooms	10.38mm laminate	Yes	35
Bathroom	4mm float	No	22

7.2.1.2. Wall Construction to Achieve R_W40

The wall construction of cabins is to be designed to achieve an R_W40 rating or higher. Some typical wall systems that achieve the required rating are detailed in Table 14 below.

Table 14: Typical Wall Construction for R_W40

Typical Wall Treatment	Insulation	Min Rw
Conventional masonry construction with 10mm plasterboard internal	-	40
OR		
Rendered finished over minimum 6mm Fibre Cement sheeting external, with 70mm studs, 10mm plasterboard internal	Minimum 50mm Fibreglass batts or Tontine TSB-4 polyester insulation	40
OR		
Lightweight wall consisting of Hardies 'Lineaboard' cladding externally, with 70mm studs and 10mm plasterboard internal	Minimum 50mm Fibreglass batts or Tontine TSB-4 polyester insulation	40
OR		

Typical Wall Treatment	Insulation	Min Rw
Lightweight wall consisting of minimum 70mm polystyrene cladding with 8mm render externally, 70mm studs and 10mm thick plasterboard internal	Minimum 50mm fibreglass batts or Tontine TSB-4 polyester insulation	40

Other wall systems may be used providing they achieve an R_W40 acoustic rating or higher.

7.2.1.3. Ceiling/Roof Construction to Achieve R_W40

Typical ceiling/roof constructions that achieve an R_{W40} rating are detailed in Table 15.

Table 15: Typical Ceiling/Roof Construction to achieve R_W40

Ceiling/Roof Treatment	Insulation	Min Rw
Pitched concrete tiled roof or pitched sheet metal roof over 10mm thick plasterboard ceiling	Minimum 50mm glasswool batts or Tontine TSB-4 polyester insulation	40

Other roof/ceiling systems may be used providing they achieve an R_W40 acoustic rating or higher.

7.2.1.4. Alternative Ventilation

To achieve the required internal noise levels in noise affected habitable rooms, doors and/or windows would need to be closed. Therefore, provision of alternative ventilation in accordance with BCA requirements should be included in these rooms. This could include air-conditioning, borrowed ventilation, mechanically assisted ventilation or other suitable methods.

All habitable rooms (i.e. living areas and bedrooms) would require the provision of ventilation. The plant should not reduce the acoustic performance of the building.

Would be a Condition of any D/A.

8. CONCLUSION

TTM Group has conducted an environmental noise assessment for the proposed extension of the Tweed Billabong Holiday Park.

Without acoustic treatment, noise associated with the site is predicted to be above the criteria in some instances. Therefore, acoustic boundary fences have been recommended in order to attenuate noise to acceptable levels.

Aircraft noise levels have been calculated at the development based on the procedures outlined in Australian Standard AS2021:2000. Building treatments have been specified for typical cabin designs to reduce internal noise levels.

It is concluded that, with the inclusion of the recommendations, noise emissions from the site are capable of complying with the relevant criteria.

If you should have any further question, please do not hesitate to contact us.

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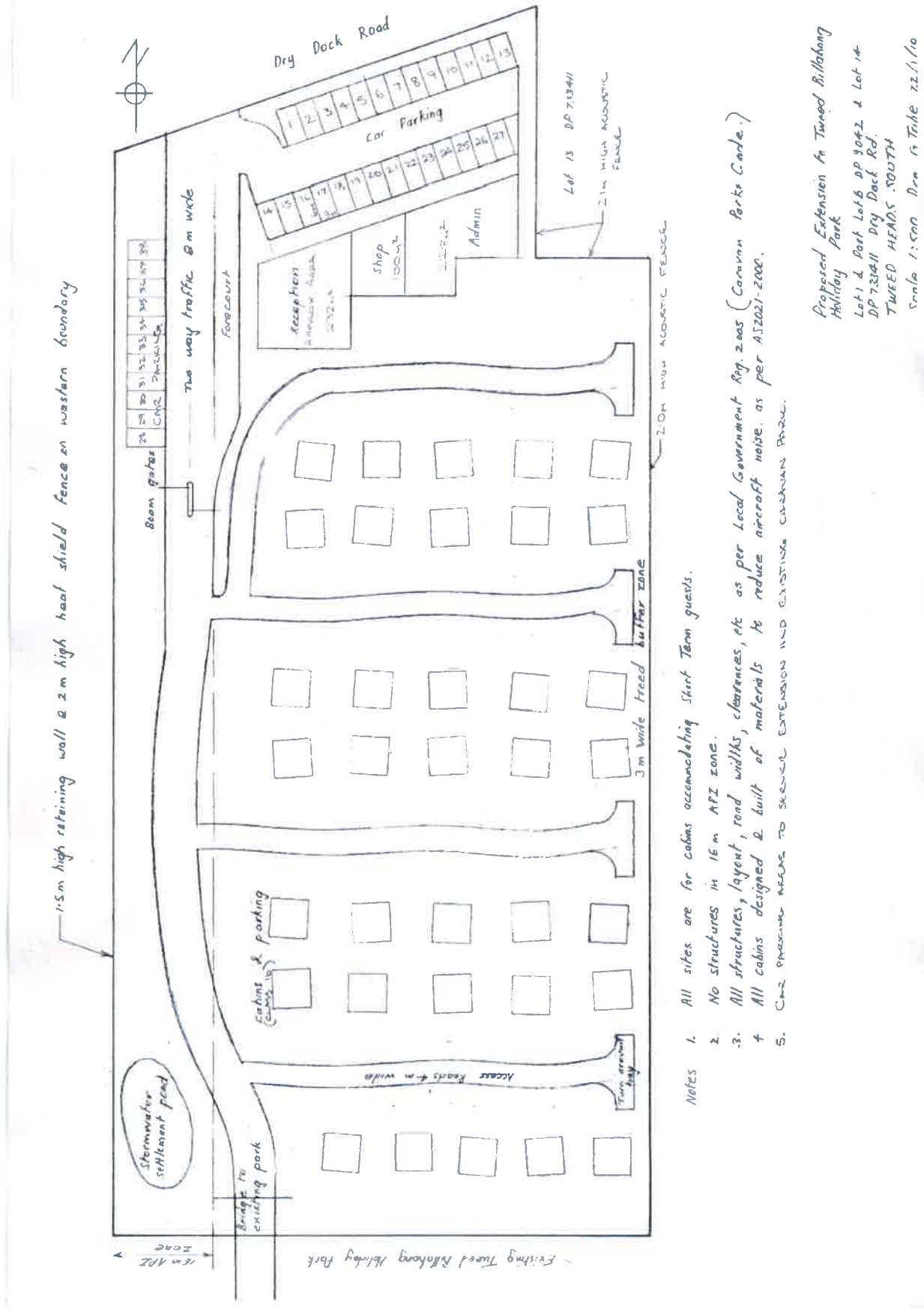
9. APPENDICES

9.1. Appendix A - Development Plan



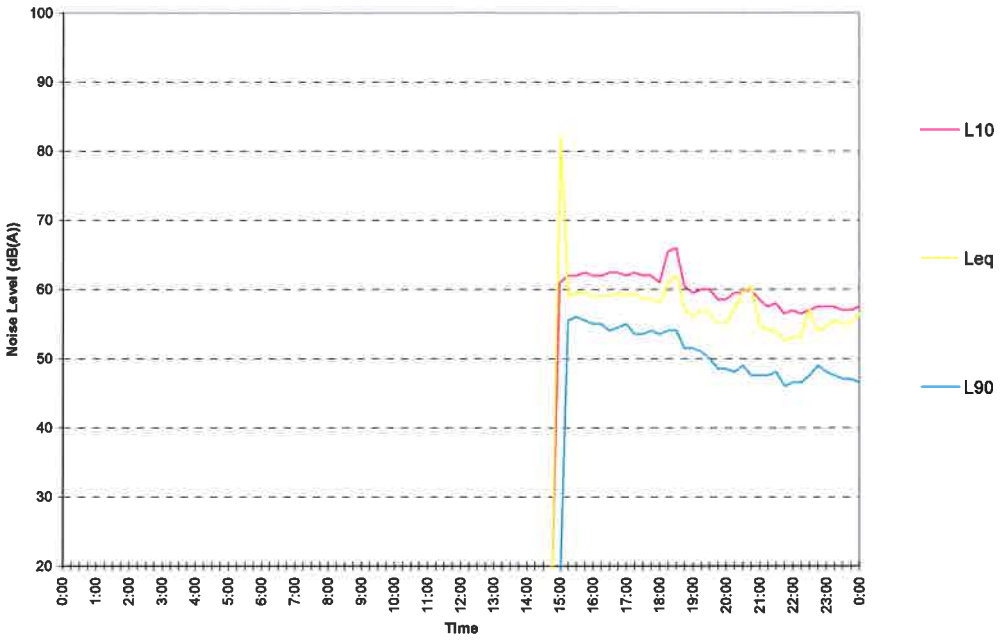
Notes
1. All sites are for cabins accommodating short Term guests.
2. No structures in 16m APZ zone.
3. All structures, layout, road widths, clearances, etc as per Local Government Reg. 2005 (Caravan Parks Code.)
4. All cabins designed & built of materials to reduce aircraft noise as per AS2021-2000.
5. Final pressure hoses to service extension and existing caravan Parks.

Proposed Extension to Tweed Billabong Holiday Park
Lot 1 & Part Lot 6 DP 9042 & Lot 14 DP 713411 Dry Dock Rd.
TWEED HEADS. SOUTH
Scale 1:500 Date 12/1/10

9.2. Appendix B - Noise Monitoring Graphs

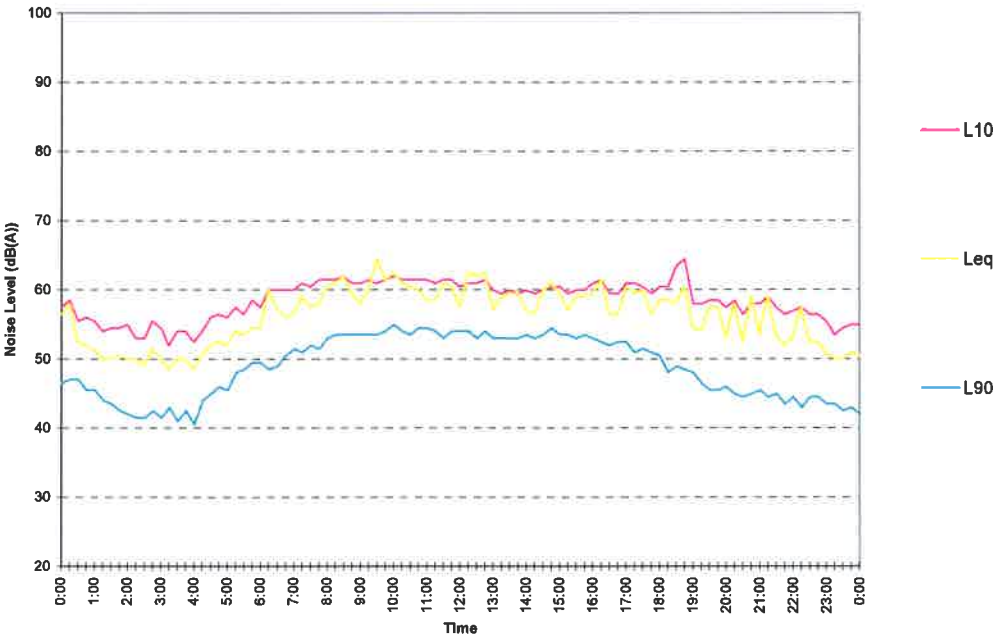
Ambient Noise Survey - 106 Dry Dock Road, Tweed Heads

Friday, 11 December 2009



Ambient Noise Survey - 106 Dry Dock Road, Tweed Heads

Saturday, 12 December 2009

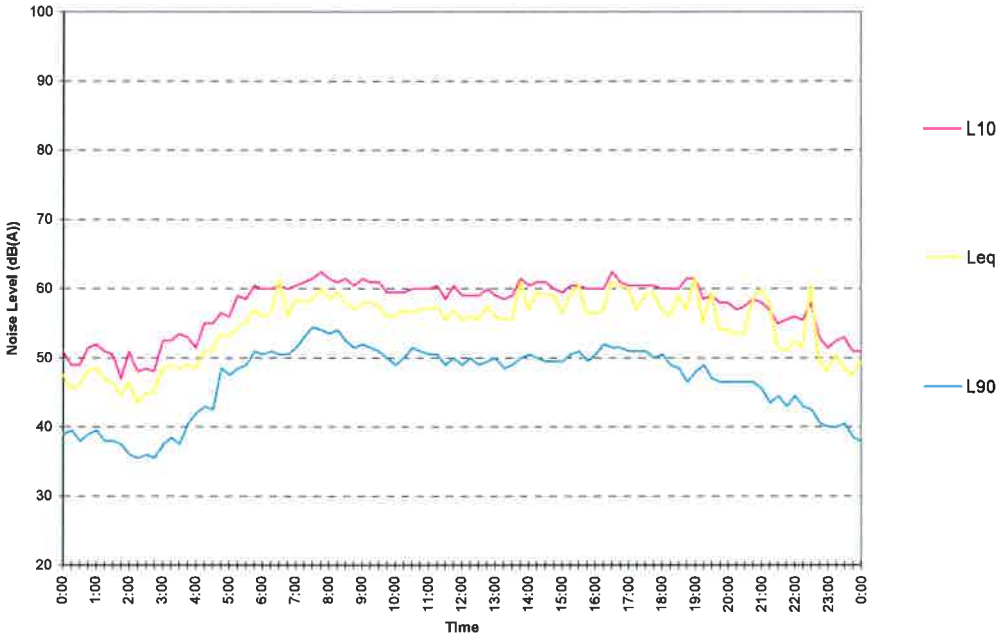


Ambient Noise Survey - 106 Dry Dock Road, Tweed Heads

Sunday, 13 December 2009

Ambient Noise Survey - 106 Dry Dock Road, Tweed Heads

Monday, 14 December 2009



Ambient Noise Survey - 106 Dry Dock Road, Tweed Heads

Tuesday, 15 December 2009

Ambient Noise Survey - 106 Dry Dock Road, Tweed Heads

Wednesday, 16 December 2009