Volume 3

Noise Impact Statement

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ESTABLISHED - 1982

A NOISE IMPACT STATEMENT

FOR THE

PROPOSED RESIDENTIAL DEVELOPMENT

AT

MOONEE N S W

Revision 1

4 January 2006

file-RESIDENTIAL RDM MOONEE 2
(ELECTRONIC COPY – PDF FORMAT)

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I. INTRODUCTION

This Noise Impact Statement (NIS) was requested by Mr Dale Holt of Winten Property Group and is required for submission to the appropriate authorities.

The author was required to investigate and report on the likely road traffic noise impact on a proposed residential development.

To achieve this aim the site was visited on Wednesday 11th February, Monday 9th August, Tuesday 10th August and Saturday 14th August 2004. During these visits details of the site and environs were studied and recorded and measurements of the existing road traffic noise impact conducted.

This NIS is a revised edition of the original that was published on 16th August 2004. Specifically, the road traffic noise impact has been re-assessed based on proposed changes to the topography and layout of the site and the location of earth berm noise barriers. All other information is sourced from the original report.

H K Clarke & Associates was incorporated in 1982 for the purpose of providing an acoustical consulting service based in the rapidly developing area of the North Coast and North West of New South Wales.

II. SITE DETAILS

The site of the proposed development is as shown on Appendix "A".

The title of the site is –

Lots 1 & 2, DP 725785

Parish of Moonee

County of Fitzroy, City of Coffs Harbour

The characteristics of the site are that it comprises undulating cleared land covered with long grass and scattered trees, zoned 2(a), 'Residential Low Density'. The site is bounded –

- On the north by Skinners Creek then existing rural/residential development.
- On the south by undeveloped land zoned 2(a), 'Residential Low Density'.
- On the east by Moonee Creek, Moonee Beach Nature Reserve then Moonee Beach.
- On the west by the Pacific Highway.

There are geographic features that will significantly affect the propagation[i] of sound. The proposed development site and highway are undulating. Hence, where the 'Line of Sight' between the receiver location and the highway is broken by topography the receiver noise level will be reduced due to barrier attenuation[ii].

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[i] Propagate Transmit through space or a medium (propagation).

[ii] Attenuation The reduction in magnitude of some variable in a transmission system (re AS1633)

III. PROPOSED DEVELOPMENT

The proposed development involves the establishment of a residential estate that has a common boundary with the Pacific Highway.

Auspacific Engineers Pty Ltd Drawing No. 04-1600/9, dated October 2005, shows a proposed layout of residential lots and roads, existing site topography and proposed site topography. Also detailed is a 20m wide strip of land along the highway side of the site where residential development is precluded. The drawing is reproduced, in part, as Appendix "B".

Auspacific Engineers Pty Ltd Drawing No. 04-1600/4, received 18th October 2005, shows the location of proposed earth berm noise barriers along the highway side of the site.

As per the original NIS commencement of the proposed residential development is assumed to be in 2005, based on information from RDM. However, it is now our understanding that commencement of the proposed residential development is anticipated to be in 2007 based on information provided by Mr Dale Holt of the Winten Property Group.

This Noise Impact Statement (NIS) considers the potential RTN impact from the Pacific Highway.

IV. CRITERIA

Road Traffic Noise

The Environment Protection Authority (EPA) in their "Environmental Criteria for Road Traffic Noise" (ECRTN), May 1999, specify criteria for the assessment of road traffic noise (RTN) as dB(A)[iii], L_{eq}[iv], T for various situations.

The following is extracted from Table 1 (ECRTN, page 6).

Type of Development	Criteria		
	Day (7am-10pm) dB(A)	Night (10pm-7am) dB(A)	Where Criteria Are Already Exceeded
2. New residential land use developments affected by freeway / arterial traffic noise.	L_{eq}(15hr) 55	L_{eq}(9hr) 50	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen to minimise noise impacts.

The following is stated on page 12 of the ECRTN.

> "*In assessing noise levels at residences, the noise level is to be measured at 1 m from the facade that is the most exposed to traffic noise, and at a height of 1.5 m from the floor level.*"

The RTN noise impact is to be determined at –

1. The operational commencement of the proposed development (2005).
2. 10 years after development operational commencement (2015).

[iii] dB(A) — decibel, dB. One tenth of a Bel. Two powers P_1 and P_2 are said to be separated by an interval of n bels (or 10n decibels) when $n=\log(P_1/P_2)$. (re AS1633) The decibel is logarithmic.
dB(A). Weighting of the measured noise level, relative to frequency. The A-Weighted sound pressure level correlates fairly well with subjective response.

[iv] $L_{eq,T}$ — Equivalent Continuous Sound Pressure Level. The value of the sound pressure level of a continuous steady sound that, within a specified time interval T, has the same mean squared sound pressure as a sound under consideration whose level varies with time (re EPA Manual). In simple terms this could be considered to be similar to an average.

V. ROAD TRAFFIC VOLUME

A count of the existing volume and makeup of road traffic on the Pacific Highway was conducted by Coffs Harbour City Council from Tuesday 29th May until Monday 4th June 2001 at a location 70m north of Bucca Road.

The RTA (Grafton) advise a growth rate of 4% per annum for planning purposes.

Predictions of RTN made herein are based on hourly heavy vehicle percentages and hourly traffic volume (7 day ave), from Council's traffic count, grown at 4% per annum.

The RTA (Grafton) also advise that –

1. The route of a potential by-pass has not, as yet, been decided.
2. Roads that have been by-passed are quickly back to pre-bypass traffic volume levels (Sth Tweed Heads was stated as an example).

Therefore, no corrections have been made to future traffic volumes/predictions relative to the potential for a bypass to be constructed in the future.

VI. EXISTING ROAD TRAFFIC NOISE LEVEL

The existing RTN impact was measured from 1532hrs on Monday 9th August until 0008hrs on Saturday 14th August 2004.

A total of 4 'day' periods and 5 'night' periods were monitored. The microphone and microphone cable of the SLM were damaged by cattle on Saturday 14th and the measurement ceased.

The Sound Level Meter (SLM) was located 20m in from the boundary with the highway reserve, approximately 100m south of the common boundary between lots 1 and 2 and 1.5m above ground level.

The following is stated on page 12 of the ECRTN.

> " *The residential noise level criterion includes an allowance for noise reflected from the facade ('facade correction'). If reflection during measurement is unlikely (as, for instance, when measuring on open land before a residence is built), add an appropriate correction—generally 2.5 dB(A)—to the measured value.*"

The measurement results, including a +2.5dB(A) facade correction, were –

Table A
Existing Road Traffic Noise

Date	dB(A), L_{eq}, T	
	15hr (Day)	9hr (Night)
9/8/04	-	61.4
10/8/04	62.0	61.6
11/8/04	61.9	61.6
12/8/04	62.4	61.6
13/8/04	62.3	61.6

As shown the measured RTN levels exceed the EPA's criteria by –

- 6.9 to 7.4dB(A) for day, and,
- 11.4 to 11.6dB(A) for night.

It was observed on the 9th and 10th of August that traffic on the Pacific Highway was the dominant noise source at the meter location for the duration of the site visits (day).

Calculations of the RTN level at the measurement location for 2005 traffic volumes, implementing CoRTN and ENM as per Section "VII. Noise Modelling", result in the following predicted receiver noise levels at the measurement location (1.5m above ground level).

62.8dB(A), L_{eq}, 15 hours (Day)
58.6dB(A), L_{eq}, 9 hours (Night)

The predicted 'Day' RTN level is approximately equivalent to the measured RTN level.

The predicted 'Night' RTN level is approximately 2.9dB(A) less than the measured RTN level.

It requires to be noted that CoRTN specifies that an increase of 3dB(A) applies to a doubling of the traffic volume (all other conditions remaining constant). Therefore, the variation between average traffic in 2004 and 2005 would result in an insignificant change to the RTN level.

The measurement location is approximately 2km from Moonee Beach. The measured 'night' noise levels may have been affected by a contribution from surf noise.

Investigation of the measured L_{90}, 15 minute noise levels reveals that a logarithmic average of approximately 45dB(A), L_{90}, 15minutes was recorded for each night period.

There were no adverse atmospheric conditions considered sufficient to significantly affect the results of these measurements.

VII. NOISE MODELLING

Environmental Noise Model (ENM) software, version 3.06, has been used to predict the RTN impact of traffic on the Pacific Highway at the proposed residential development. ENM is mentioned in Appendix C, Paragraph C5, of the EPA's ECRTN as one of three models generally used in Australia.

The EPA states on page 36 of the INP that ENM is an acceptable 'model' for noise prediction.

The following applies to all noise modelling.

- Generated noise level.

  The considered road section is broken into 5 segments based on gradient.

  Calculation of Road Traffic Noise (CoRTN) is used to determine the traffic noise Sound Pressure Level (SPL[v]), for the years 2005 and 2015, at 10m from the nearside road edge with corrections for percent heavy vehicles, gradient and speed.

  With reference to measurements of the pass of multiple vehicles, including heavy vehicles, the Sound Power Level (SWL[vi]) of RTN is determined as dB(A), L_{eq}, 15hrs and 9hrs in octave[vii] bands implementing the following formula.

$$SWL = SPL + 10\log(rb) + 3$$

  Where –

  r = distance from the source, m.
  b = RTN source spacing along road. (50m)

- CoRTN specifies a noise source height of road + 0.5m. RDM provided RL's of the edge of the road on the development side. A noise source height of road + 1m is used for modelling as detailed topography of the road surface has not been provided.

- A source location 3.5m in from the nearside road edge is used (CoRTN).

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[v] SPL — Sound Pressure Level. 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure, dB. The reference sound pressure 20 x 10^{-6}Pa.

[vi] SWL — Sound Power Level. 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power, dB. The reference sound power is 10^{-12}W.

[vii] Octave — The interval between two frequencies having a ratio of two.

- Site and highway topography sourced from –

  - Auspacific Engineers Pty Ltd Drawing No. 04-1600/9, dated October 2005, that shows the proposed site topography and site layout.
  - RDM Drawing No. RDM-MRD/2, Highway topography.
  - RDM Aerial Photograph, 1:3000, dated 3/6/2002.

  It requires to be noted that if dwellings are constructed on the site RTN noise propagation will change from that shown in modelling due to the barrier affect of the buildings.

  Therefore, the modelling is most pertinent to the proposed residential lots along the highway side of the development.

- Topography on the western side of the highway has not been provided. Therefore, noise contour maps do not show propagation of RTN to the west of the highway.

- Due to the modelling technique, contours within the 1st 100m (south end) and last 100m (north end), shown on noise contour maps, are considered to be inaccurate.

- Relative to the affect of ground absorption the highway is defined as an asphalt surface sealed by dust and the site, and remaining area, is defined as grass/rough pasture. The defined surface types, in ENM, have no relationship to road surface types specified in CoRTN.

- The road includes an impervious to water, bituminous surface. A texture depth (TD) of 2mm is assumed.

  CoRTN provides the following formula for the affect of impervious to water, bituminous road surfaces.

$$Correction = 10\log(20TD + 60) - 20dB(A)$$

  Implementing the formula the following corrections are calculated.

TD, mm	dB(A), Correction
1	–1
2	**0**
3	+0.8
4	+1.5
5	+2

- The ECRTN specifies that RTN noise levels be measured at 1m from the facade most exposed to traffic noise and 1.5m above the floor level.

  Noise contour maps are calculated at 2.5m above existing ground level, which is approximately equivalent to a single storey eave height. A receiver height of 2.5m is used to ensure any recommendations for noise barriers result in adequate RTN attenuation.

- Electronic searches of the ECRTN reveal no occurrence of the words 'weather', 'meteorology' or 'meteorological'. That is, the ECRTN does not specify how to consider the affects of weather on the propagation of RTN.

  However, ENM requires the temperature and humidity conditions to be specified.

  The following information has been collected from the Bureau of Meteorology (BoM) website for Coffs Harbour MO (059040).

  - Monthly Temperature (Appendix "C").
  - Monthly 9am and 3pm Humidity (Appendix "D").

  Modelling tests were conducted to determine the affect of changing temperature and humidity.

  It was found that –

  - RTN propagation at low temperature resulted in a marginally higher receiver noise level than at high temperature (constant humidity).

  - At low temperature a humidity variation of 98% resulted in an insignificant change in the receiver noise level.

  Therefore, modelling is conducted for a mean daily temperature of 7°C and mean 9am humidity of 68% (Re July).

  It requires to be noted that temperature and humidity would not remain at constant levels for 15hr and 9hr periods.

- A nil wind condition.

VIII. NOISE LEVEL PREDICTION

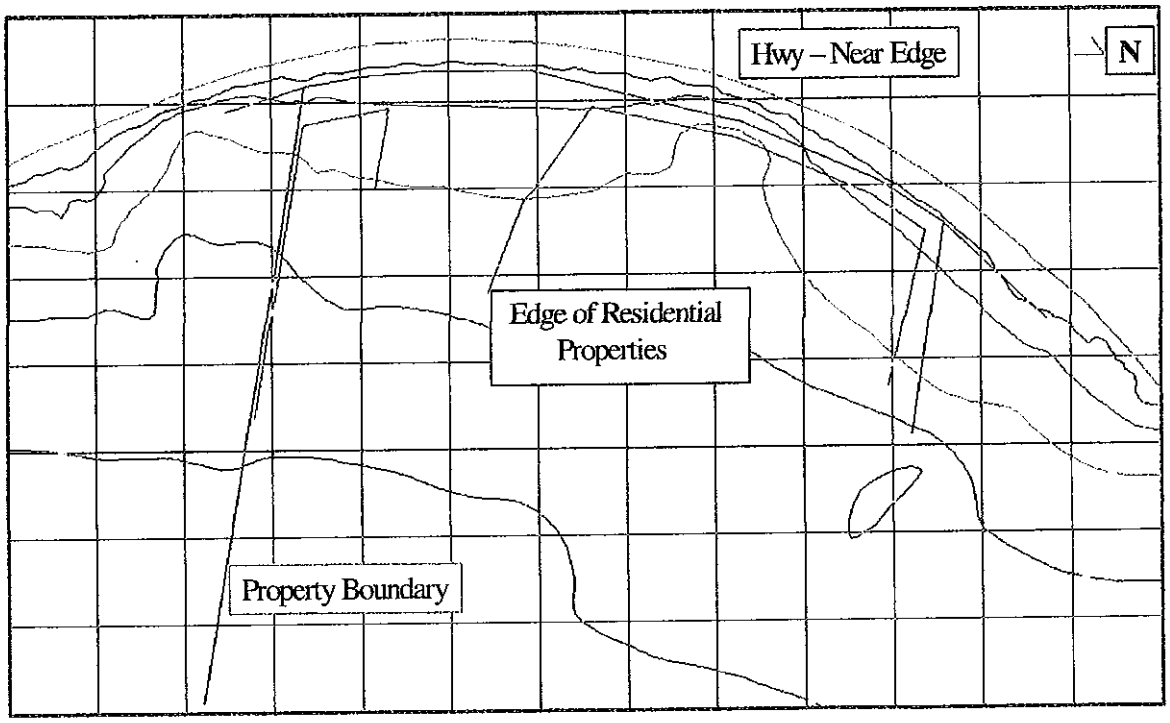
Following is –

- Noise contour maps representing dB(A), L_{eq}, 15hr and 9hr RTN impacts for the years 2005 and 2015,
- discussion on the results of modelling, and,
- recommended noise amelioration methods.

2005, 15hr (re proposed site topography)

Figure 1

2005, dB(A), L_{eq}, 15hrs



Grid = 100m x 100m
L_{eq} 15hr, Key : Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A), Red = 65dB(A)

As shown, it is predicted that the day criteria of 55dB(A), L_{eq}, 15hrs will be exceeded by up to approximately 5dB(A) at residences along the highway side of the development.

As the day criteria is predicted to be exceeded noise amelioration methods were investigated.

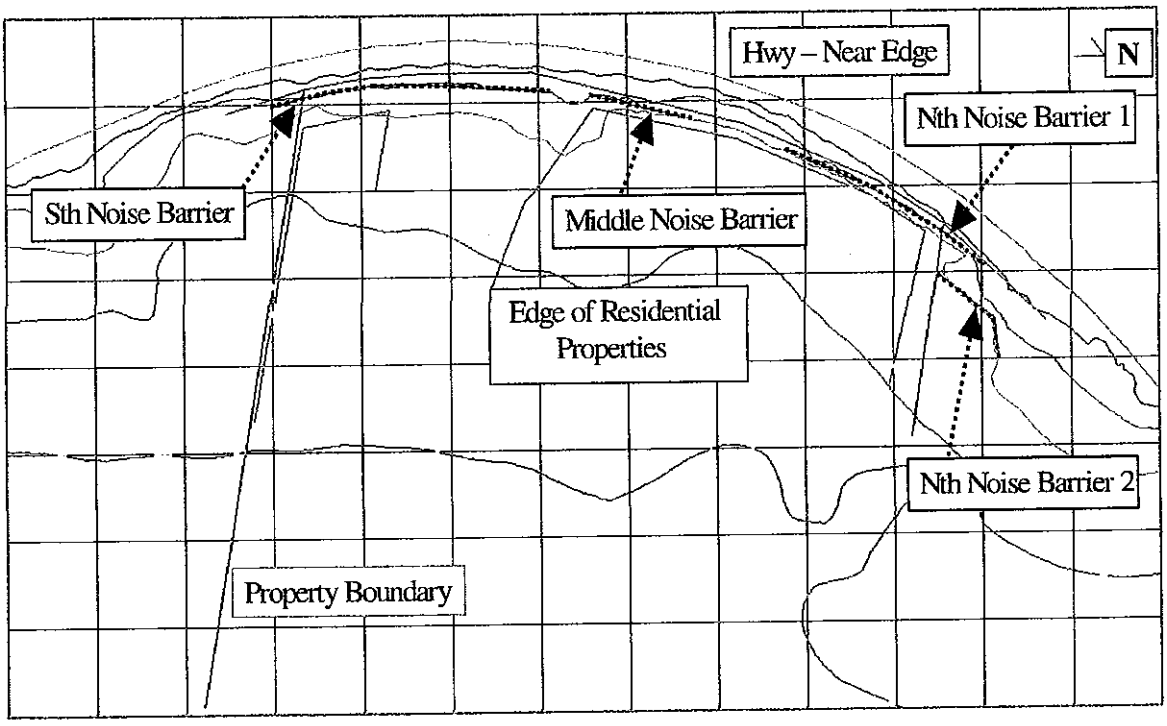
Earth berms were designed to act as noise barriers and the model re-run. Generally, these noise barriers are as shown on Auspacific Engineers Pty Ltd Drawing No. 04-1600/4 with the exception of the South Noise Barrier being extended to the southern side of the proposed access road. The noise barriers are –

1. South Noise Barrier - an earth berm 3m above ground level, but not less than RL7m, located as shown in Figure 2.
2. Middle Noise Barrier – an earth berm 4m above ground level, but not less than RL9m, located as shown in Figure 2.
3. North Noise Barrier 1 – an earth berm 4m above ground level, but not less than RL9m, located as shown in Figure 2.
4. North Noise Barrier 2 – an earth berm 4m above ground level, but not less than RL9m, located as shown in Figure 2.

The result of modelling, including noise barriers, is as shown in Figure 2.

Figure 2

2005, dB(A), L_{eq}, 15hrs, plus Noise Barriers



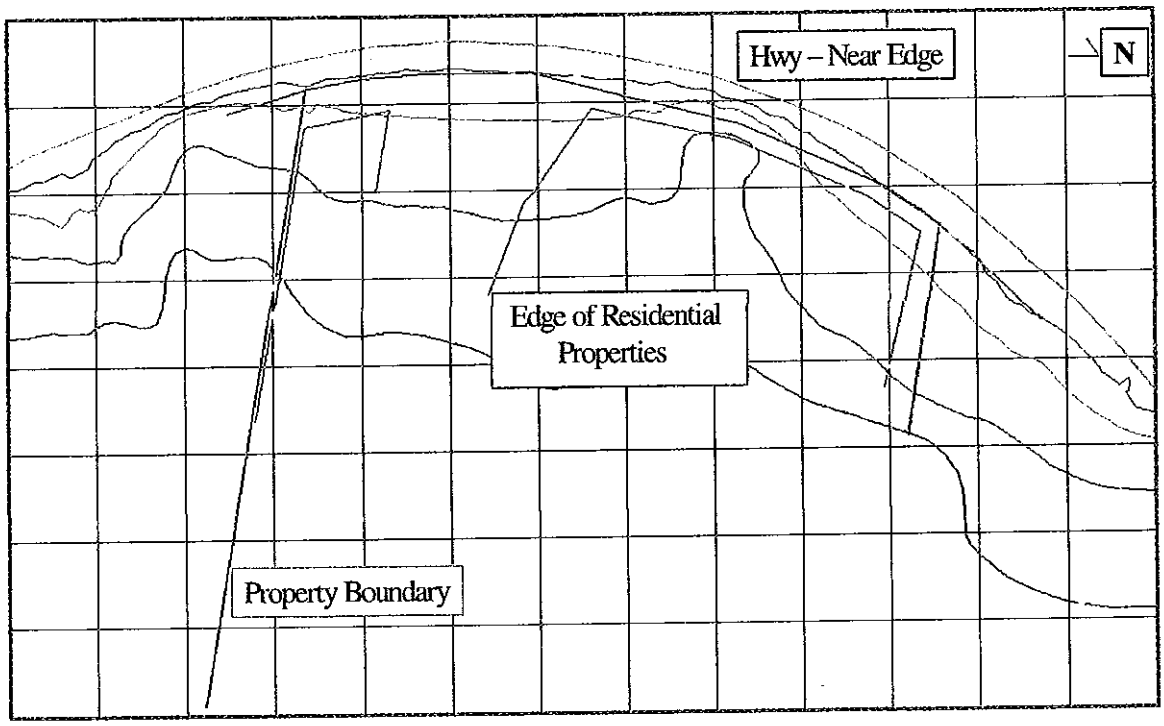
Grid = 100m x 100m
L_{eq} 15hr, Key : Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A), Red = 65dB(A)

As shown, the noise barrier results in the 55dB(A), L_{eq}, 15hr contour *not* significantly encroaching past the proposed edge of residential properties.

2005, 9hr (re proposed site topography)

Figure 3

2005, dB(A), L_{eq}, 9hrs



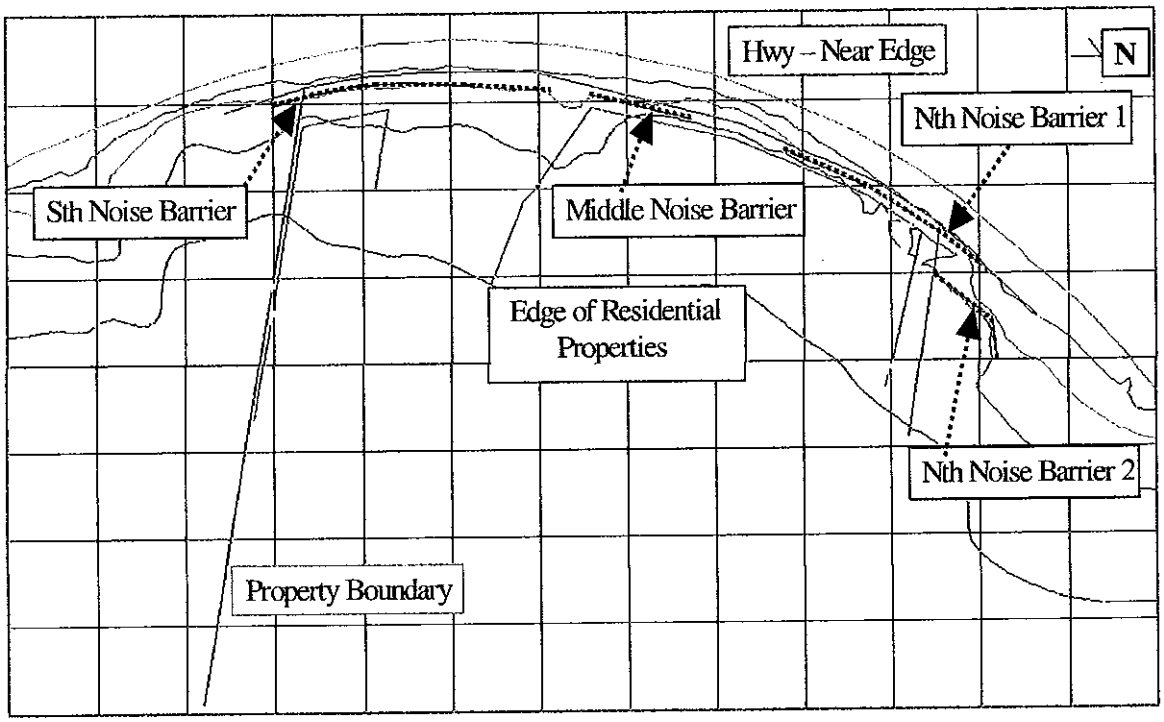
Grid = 100m x 100m
L_{eq} 9hr, Key : Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A)

As shown, it is predicted that the night criteria of 50dB(A), L_{eq}, 9hrs will be exceeded by approximately 5dB(A) at residences along the highway side of the development.

The result of modelling, including noise barriers (refer page 14), is as shown in Figure 4.

Figure 4

2005, dB(A), L_{eq}, 9hrs, plus Noise Barriers



Grid = 100m x 100m

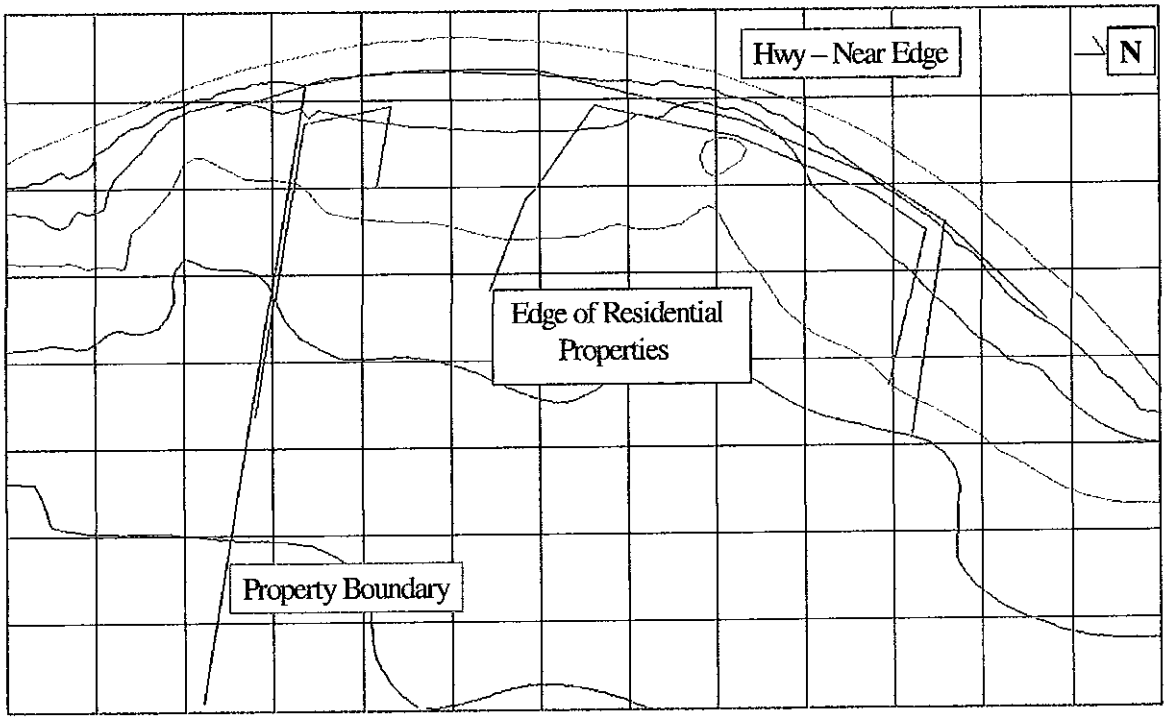
L_{eq} 9hr, Key : *Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A)*

As shown in Figure 4, the noise barrier results in the 50dB(A), L_{eq}, 9hr contour *not* significantly encroaching past the proposed edge of residential properties.

2015, 15hr (re proposed site topography)

Figure 5

2015, dB(A), L_{eq}, 15hrs



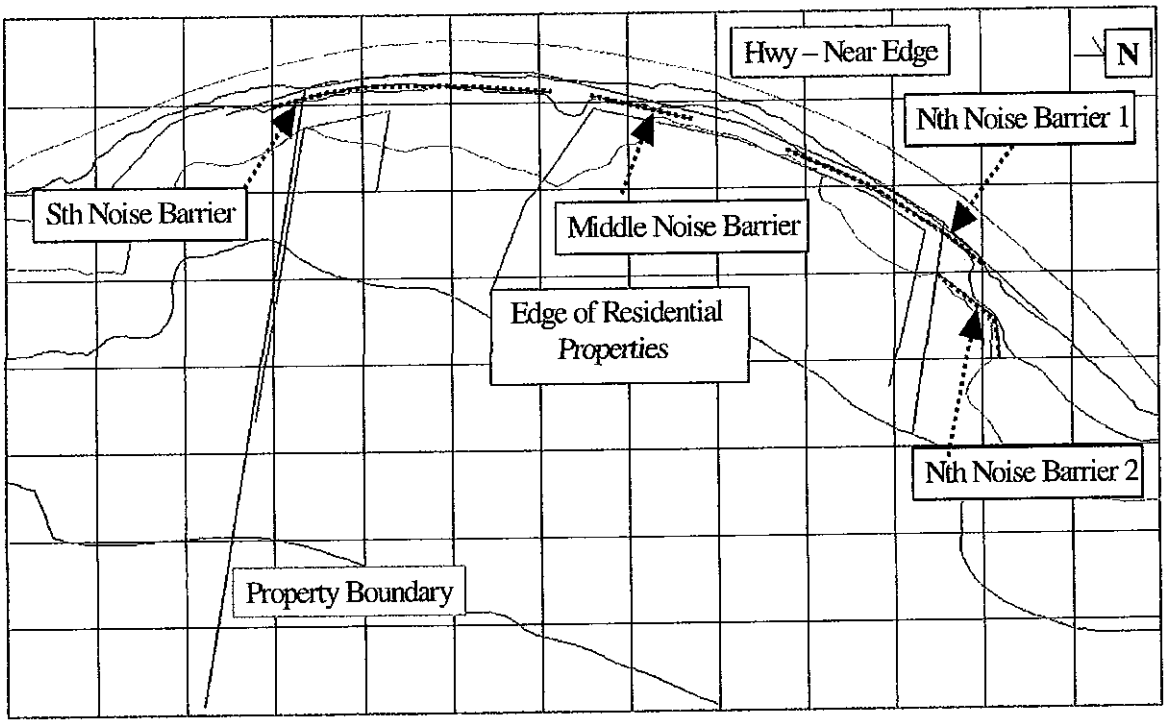
Grid = 100m x 100m
L_{eq} 15hr, Key : Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A), Red = 65dB(A)

As shown, it is predicted that the day criteria of 55dB(A), L_{eq}, 15hrs will be exceeded by approximately 5 to less than 10dB(A) at residences along the highway side of the development in 2015.

The result of modelling, including noise barriers (refer page 14), is as shown in Figure 6.

Figure 6

2015, dB(A), L_{eq}, 15hrs, plus Noise Barriers



Grid = 100m x 100m
L_{eq} 15hr, Key : Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A), Red = 65dB(A)

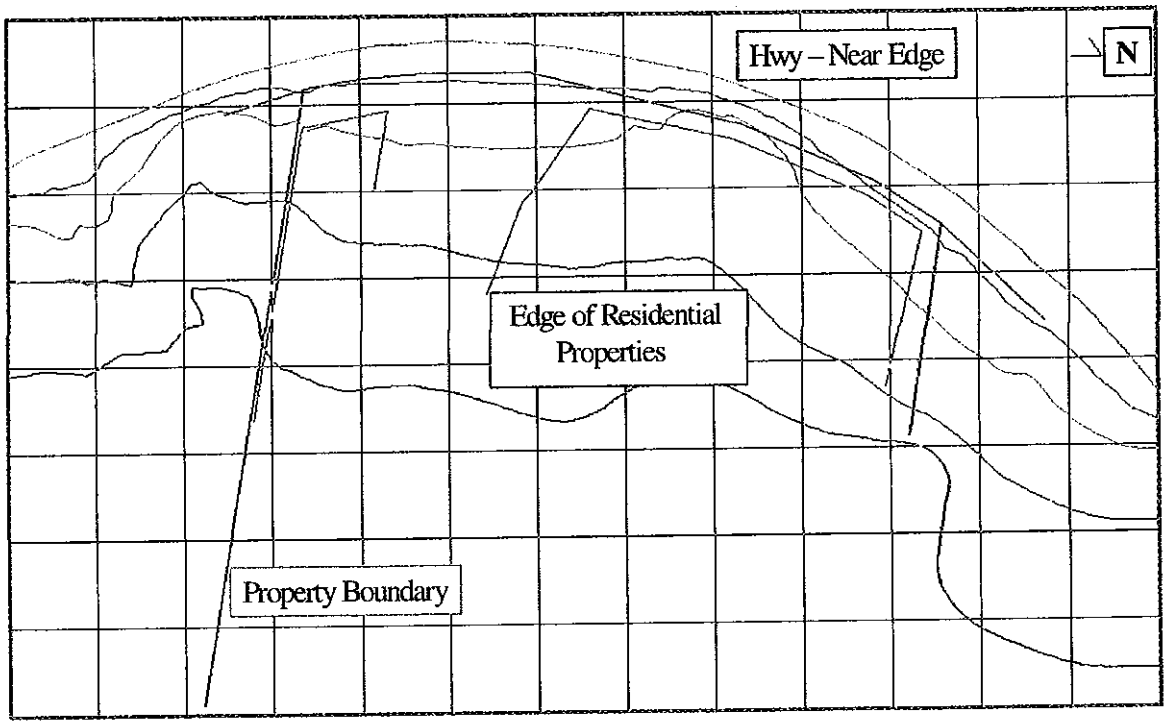
As shown in Figure 6, the noise barrier significantly reduces the predicted day RTN impact, in 2015, at residences along the highway side of the development (compared to Figure 5).

However, the contours show that some residential lots will be subject to exceedances of the criteria by less than 5dB(A).

2015, 9hr (re proposed site topography)

Figure 7

2015, dB(A), L_{eq}, 9hrs



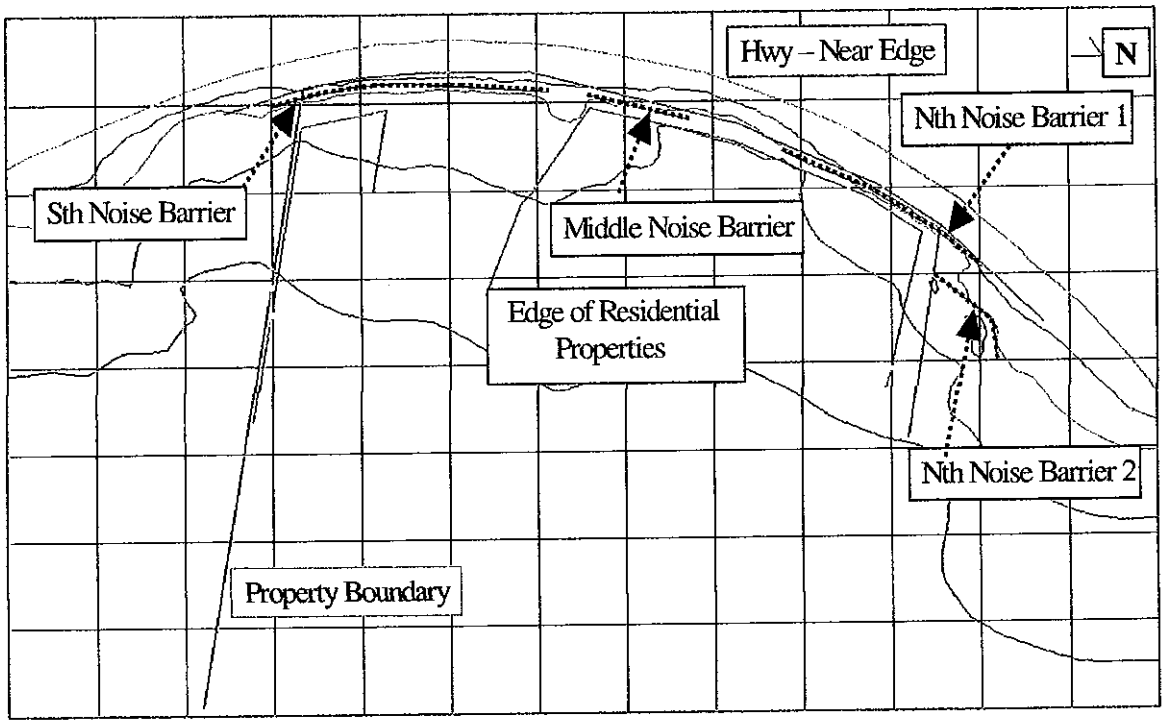
Grid = 100m x 100m
L_{eq} 9hr, Key : Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A)

As shown, it is predicted that the night criteria of 50dB(A), L_{eq}, 9hrs will be exceeded by approximately 5 to less than 10dB(A) at residences along the highway side of the development in 2015.

The result of modelling, including noise barriers (refer page 14), is as shown in Figure 8.

Figure 8

2015, dB(A), L_{eq}, 9hrs, plus Noise Barriers



Grid = 100m x 100m
L_{eq} 9hr, Key : Blue = 45dB(A), Green = 50dB(A), Orange = 55dB(A), Pink = 60dB(A)

As shown in Figure 8, the noise barrier significantly reduces the predicted night RTN impact, in 2015, at residences along the highway side of the development (compared to Figure 7).

However, the contours show that a significant portion of the residential lots along the highway side of the development will be subject to exceedances of the night criteria by less than 5dB(A).

General

It is important to note that dB(A) are logarithmic[viii].

[viii] Logarithm Maths. The exponent of that power to which a fixed number (called the base) must be raised in order to produce a given number (called the antilogarithm) : 3 is the logarithm of 8 to the base 2. (logarithmic)

To assist the understanding of this logarithmic scale we provide the following.

Table B

Subjective Response to Change in Sound Pressure Level[ix]

Change in SPL, dB	Pressure Ratio	Subjective Response
3	1.4	Just perceptible
5	1.8	Clearly noticeable
6	2.0	
10	3.2	Twice/Half as Loud
14	*5*	
20	10	Much Louder/Quieter

Predictions for the RTN impact in 2005 show that compliance with the EPA's RTN criteria can be achieved for the majority of the residential area by the provision of noise barriers.

Therefore, it is recommended that –

Recommendation No. 1

Four earth berms are constructed along the highway side of the development.

1. ***South Noise Barrier – an earth berm to a height of 3m above ground level, but not less than RL7m located as shown on Figures 2, 4, 6 and 8 herein.***
2. ***Middle Noise Barrier – an earth berm to a height of 4m above ground level, but not less than RL9m, located as shown in figures 2, 4, 6 and 8 herein.***
3. ***North Noise Barrier 1 – an earth berm to a height of 4m above ground level, but not less than RL9m, located as shown in figures 2, 4, 6 and 8 herein.***
4. ***North Noise Barrier 2 – an earth berm to a height of 4m above ground level, but not less than RL9m, located as shown in figures 2, 4, 6 and 8 herein.***

A small portion of the residential area is not within the noise contour that is equivalent to the EPA's night and/or day RTN criteria (relative to 2005 RTN). Specifically, –

- The southwest corner of the northern residential area, approximately 65m long and up to approximately 25m wide, is predicted to experience RTN levels of less than 5dB(A) above the day RTN criteria of 55dB(A), L_{eq}, 15 hours. The area represents approximately 4 affected residential lots.
- The southwest corner of the northern residential area, approximately 80m long and up to approximately 35m wide, is predicted to experience RTN levels of less than 5dB(A) above the night RTN criteria of 50dB(A), L_{eq}, 9 hours. The area represents approximately 4 affected residential lots.

[ix] Reference The Assessment and Control of Noise - Vipac, June 82, Table 1.3.

- The western edge of the southern residential area, approximately 60m long and up to approximately 15m wide, is predicted to experience RTN levels of less than 5dB(A) above the night RTN criteria of 50dB(A), L_{eq}, 9 hours. The area represents approximately 3 affected residential lots.

The following is extracted from page 14 of the EPA's ECRTN.

> "*Where there is new residential development that can be affected by noise from existing roads, it is expected that developers will be able to use a number of noise control options to mitigate traffic noise. These options include designing developments so that sensitive land uses are protected from excessive noise through the use of options such as optimum location and orientation on the site, wellplanned internal layouts, noise insulating building materials and construction methods that facilitate noise control.*"

> "*It is preferable for internal noise level criteria to be set by the relevant planning or building authority. The internal levels that are set may vary depending on the type of development the planning authority wants to encourage for an area. The Hornsby Shire and Sydney City councils have codes for internal noise level criteria in place. Sleeping areas are usually the most sensitive to noise impact, so in the absence of any local codes internal levels of 35–40 dBA at night are recommended. As a guide for other living areas, internal noise levels 10 dB below external levels are recommended on the basis of openable windows being opened sufficiently to provide adequate ventilation (refer to Building Code of Australia for additional information). For most residences this equates to a minimum of 20% of the window area left open.*"

Based on experience it is our understanding that the Coffs City Council specifies the following criteria relative to residences affected by RTN.

> "*All habitable rooms other than sleeping rooms; 45dB(A), L_{eq}, 15hours and 40dB(A), L_{eq}, 9hours, and sleeping rooms 35dB(A), L_{eq}, 9hours.*

It is our opinion that judicious design of those residences predicted to be outside the noise contours that are equivalent to the applicable RTN criteria will ensure that the preceding internal noise level criteria are achieved.

For those dwellings outside the noise contours that are equivalent to the RTN criteria standard construction techniques will provide sufficient attenuation to ensure that the above internal noise level criteria are achieved with the exception of –

1. Open windows where air conditioning, or mechanical ventilation, is not proposed.
2. Sleeping rooms that adjoin the facades worst affected by RTN.

Therefore, it is recommended that –

Recommendation No. 2

Dwellings, outside the noise contours that are equivalent to the RTN criteria, either –
1. Include air conditioning or mechanical ventilation such that windows on affected facades may be kept closed, or,
2. Are designed such that suitable natural ventilation can be achieved via facades not adversely affected by RTN.

Recommendation No. 3

For dwellings located outside the noise contours that are equivalent to the RTN criteria, layout is designed such that sleeping rooms are on the opposite side of the dwelling to the facades worst affected by RTN.

As shown it is predicted that by the year 2015, with the recommended noise barriers, RTN will exceed the EPA's day and night RTN criteria by less than 5dB(A).

The EPA's RTN criteria for redevelopment of existing arterial roads is 60dB(A), L_{eq}, 15hrs, day and 55dB(A), L_{eq}, 9hrs, night. It is predicted that the 2015 RTN impact, with the recommended barriers, will not exceed these criteria.

Also –

1. There is potential for a bypass of Coffs Harbour to be constructed. Hence, traffic levels on this section of the Pacific Highway may not necessarily grow by 4% p.a.
2. In a period of ten years there is potential for technological improvements that reduce the generated level of RTN.

Therefore, the predicted RTN impact in 2015 is considered to be marginal.

As stated in Section "VII. Noise Modelling" an impervious to water bituminous road surface having a texture depth of 2mm is assumed.

If the existing road surface is replaced with a pervious to water macadam then a reduction of approximately 3.5dB(A) to the generated noise level would be achieved. This assumes an existing texture depth of 2mm.

The following is stated in the ECRTN under "3 Applying the Criteria", "3.4 New Residential Developments Affected by Road Traffic Noise".

> "*Appropriate building design on development around roads to minimise noise impacts, for example by:*
>
> - *Designing buildings to locate noise-insensitive areas such as kitchen, storage areas and laundry towards the noise source; minimising the number and size of windows oriented towards the noise source; replacing a conventional roof design with eaves by a flat roof with parapets; and using the building structure to shield outdoor areas.*
> - *Using construction techniques that pay good attention to sealing air gaps around doors and windows exposed to the noise; using solid core doors; and using thicker window glass or double glazing.*"

That is, dwellings, and other noise sensitive buildings, should be constructed with consideration for the acoustic environment of the location.

The recommended noise barriers are relative to a receiver height 2.5m above ground level. Raised or two storey dwellings may result in facades that are not provided with sufficient barrier attenuation.

IX. INSTRUMENTATION USED

The instrumentation used during the course of this study was as listed below, the sound level meter being calibrated before and after each set of measurements.

* 01dB SLS95S Sound Level Meter & Data Logging System, Serial Number 008362, NATA Calibrated 19/4/05.

* Lutron SC-941 1kHz/94dB Calibrator, Serial Number W.A 54627, NATA Calibrated 25/9/04.

* 01dB Trait32 Series Programs.

* Office 2000 Computer Programs.

X. NOISE IMPACT ASSESSMENT

It is our opinion that road traffic noise resulting from traffic on the Pacific Highway will –

1. Not exceed the requirements of the Environment Protection Authority's Environmental Criteria for Road Traffic Noise at residential sites within the proposed development in the year 2005.

2. Will marginally exceed the requirements of the Environment Protection Authority's Environmental Criteria for Road Traffic Noise at residential sites within the proposed development in the year 2015.

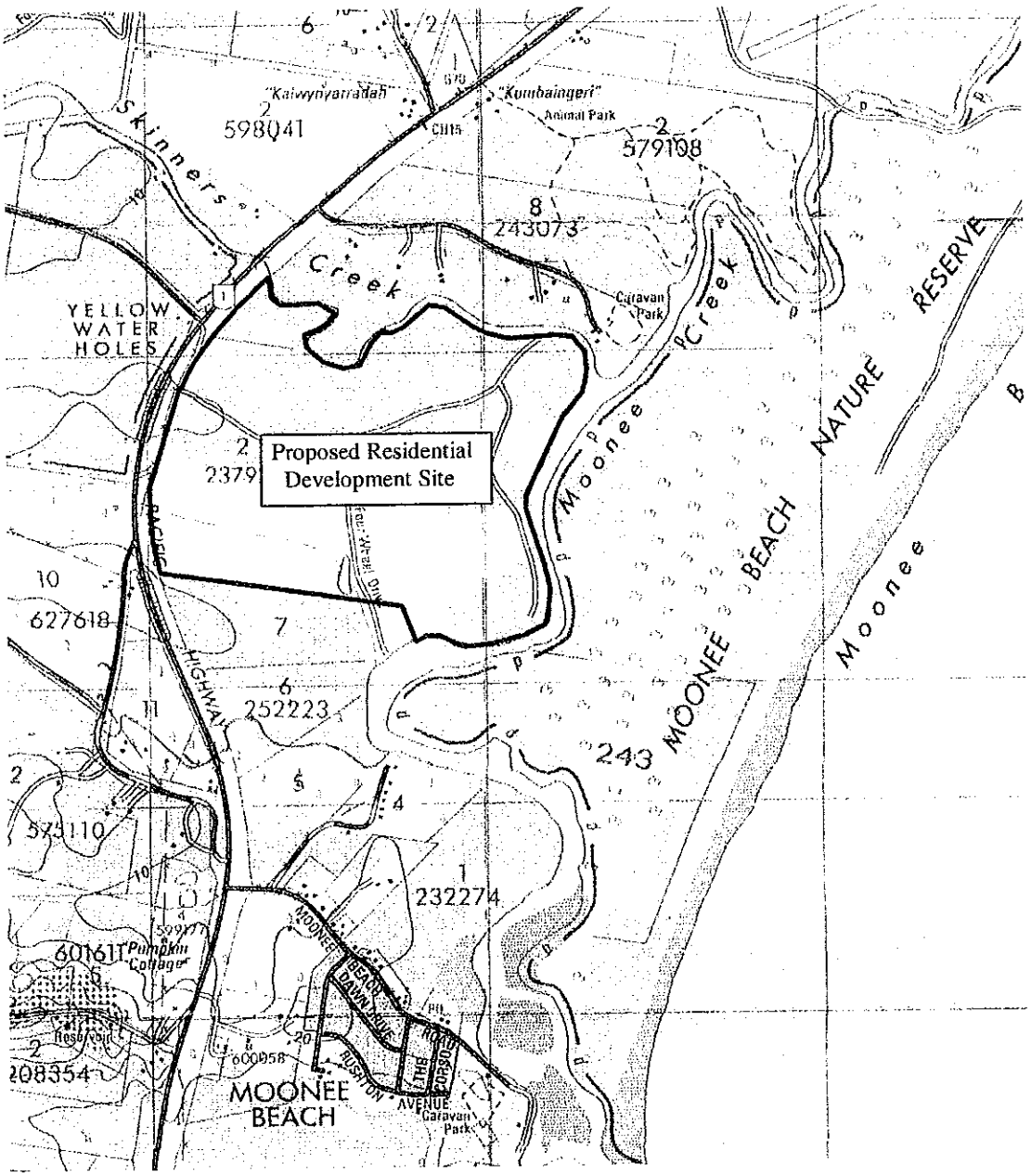
These opinions are expressed on the strict conditions that the development is as specified and the recommendations contained herein are implemented.

This Statement has been prepared on the basis of information provided in drawings –

- Auspacific Engineers Pty Ltd Drawing No. 04-1600/9, dated October 2005, Proposed Residential Subdivision, Moonee Beach, Coffs Harbour.
- RDM Drawing No. RDM-MRD/2, Site and highway topography.
- RDM Aerial Photograph, 1:3000, dated 3/6/2002.

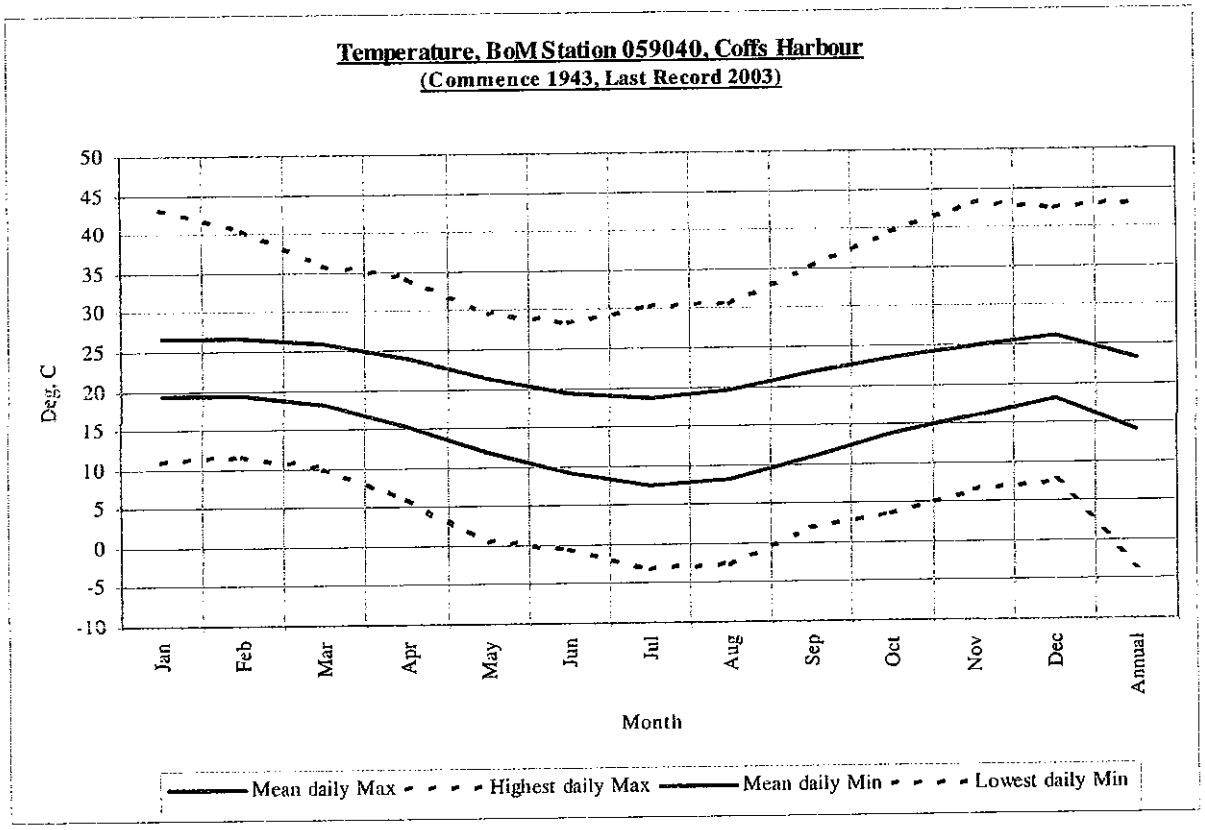
P A Clarke
Senior Consultant

APPENDIX "A"
SITE LOCATION

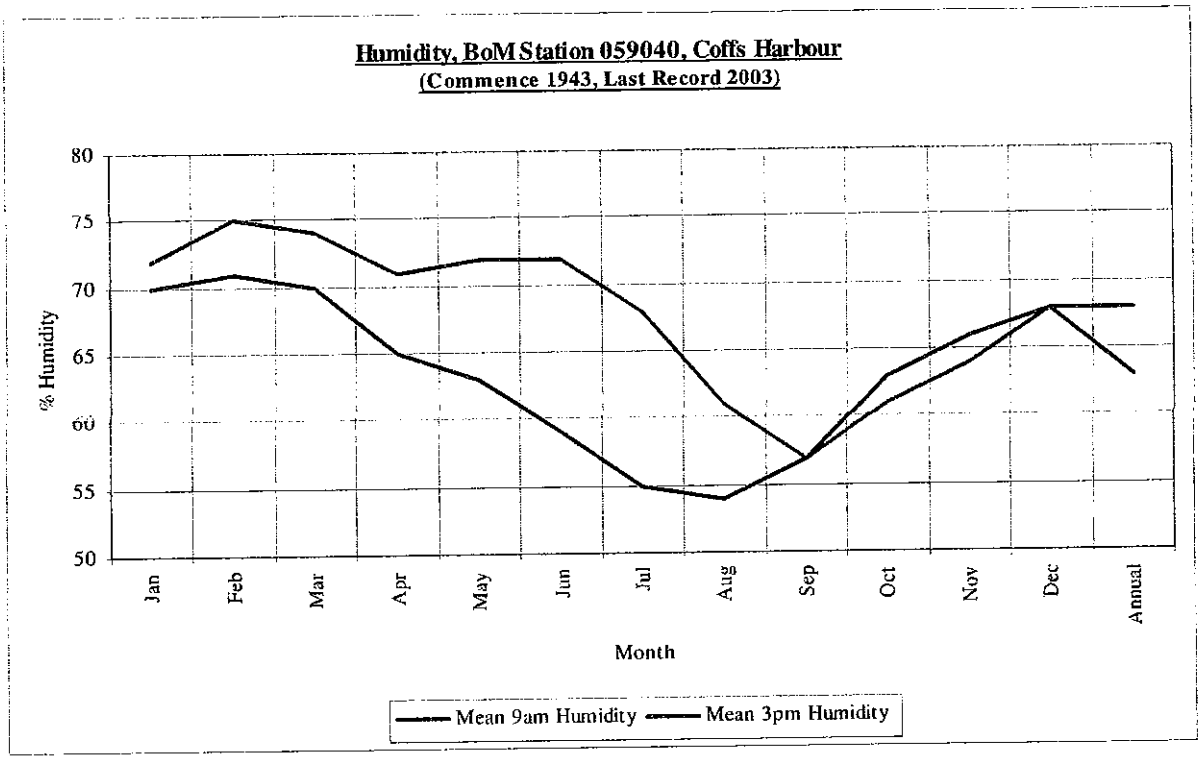


APPENDIX "B"
PROPOSED SITE LAYOUT

APPENDIX "C"
MONTHLY TEMPERATURE



APPENDIX "D"
MONTHLY HUMIDITY



7 December, 2006

Rothwell Boys Pty Ltd
L1, 13-15 Short Street
SOUTPORT 4215
AUSTRALIA

Our Reference: THE GLADES REP 1 REV 0.DOC

Attention Dale Holt:

Dear Dale,

RE: ADDENDUM TO THE ACOUSTIC REPORT "A NOISE IMPACT STATEMENT"

ERM was engaged to undertake a technical review of the noise barrier design and improve the graphics of the report entitled "A Noise Impact Statement, for the Proposed Residential Development at Moonee NSW, Revision 1" dated 4 January 2006.

Calculations have been undertaken to determine whether the barriers recommended in the acoustic report should achieve the level of attenuation stated in the report and be sufficient to shield the proposed residences from road traffic noise from the Pacific Highway in most cases. As ERM was engaged to check the barrier design only, traffic calculations have not been reviewed.

Descriptions of Treatments

Existing Option: 148 lots

Calculations indicate that the barrier attenuations noted in the report are appropriate. As stated in the report some residential lots will require building façade design in conjunction with the noise barriers to ameliorate road traffic noise from the Pacific Highway. Based on *Figure 6* and *Figure 8* in the report, it is recommended that houses on lots 1-4, 13-19, 22, 85 & 86 be acoustically treated. These lots will also require mechanical ventilation and should be designed with noise sensitive rooms facing away from the Pacific Highway (such as bedrooms and living rooms) and noise insensitive rooms facing the Pacific Highway (such

as bathrooms and kitchens). The design should be carried out by a qualified acoustic consultant.

It should be noted that the gap between the southern and middle barriers is for the access road from the Pacific Highway to the site.

The gap between the middle barrier and north barrier 1 is due to the existing hill top that will be used as part of the barrier. The barrier effect due to the hilltop will be enhanced by the fact that both the Pacific Highway and the residences facing the highway are cut below the natural terrain. It should be ensured that the recommended barrier height of 4m is maintained along the length of the proposed residential lots.

The middle barrier should be returned along the southern side of lot 1 (refer *Figure 9*). This will require the construction of an acoustic fence that joins or over laps the proposed earth berm. Any overlap should be at least twice the distance between the barrier and the crest of the earth berm.

The two northern barriers are split to allow vehicle access to the park for maintenance vehicles as well as pedestrian access.

Revised Option: 154 lots

Barrier calculations have been undertaken to determine the noise attenuation that would be required if the lots were extended out to the north (see the plan dated Oct 2006, amendment C). A combination of barriers and façade design has been considered as in the original report for Option 1. Based on these calculations a 4m barrier would be required along the edge of the road adjacent to the proposed lots. This barrier should follow the curve of the new road until it is opposite the centre of lot 94 (refer *Figure 9*).

A 4m high earth berm may not be feasible as a barrier around the lots to the north as it would be at least 17m wide at the base (1:2 earth berm with a 1m crest). Alternatively a 4m acoustic barrier (RL of top to be 5.5m minimum) could be built within 10m of the edge of the road adjacent to the lots. This barrier could either be constructed with a 2m acoustic fence on top of a 2m earth berm or with a 4m acoustic fence. It would also be possible (pending permission from the RTA) to build a 2m acoustic barrier (RL top of barrier to be 2m above road level) along the edge of the Pacific Highway, within 15m of the kerb. This barrier would need to extend approximately 200m north of the Bucca Road intersection.

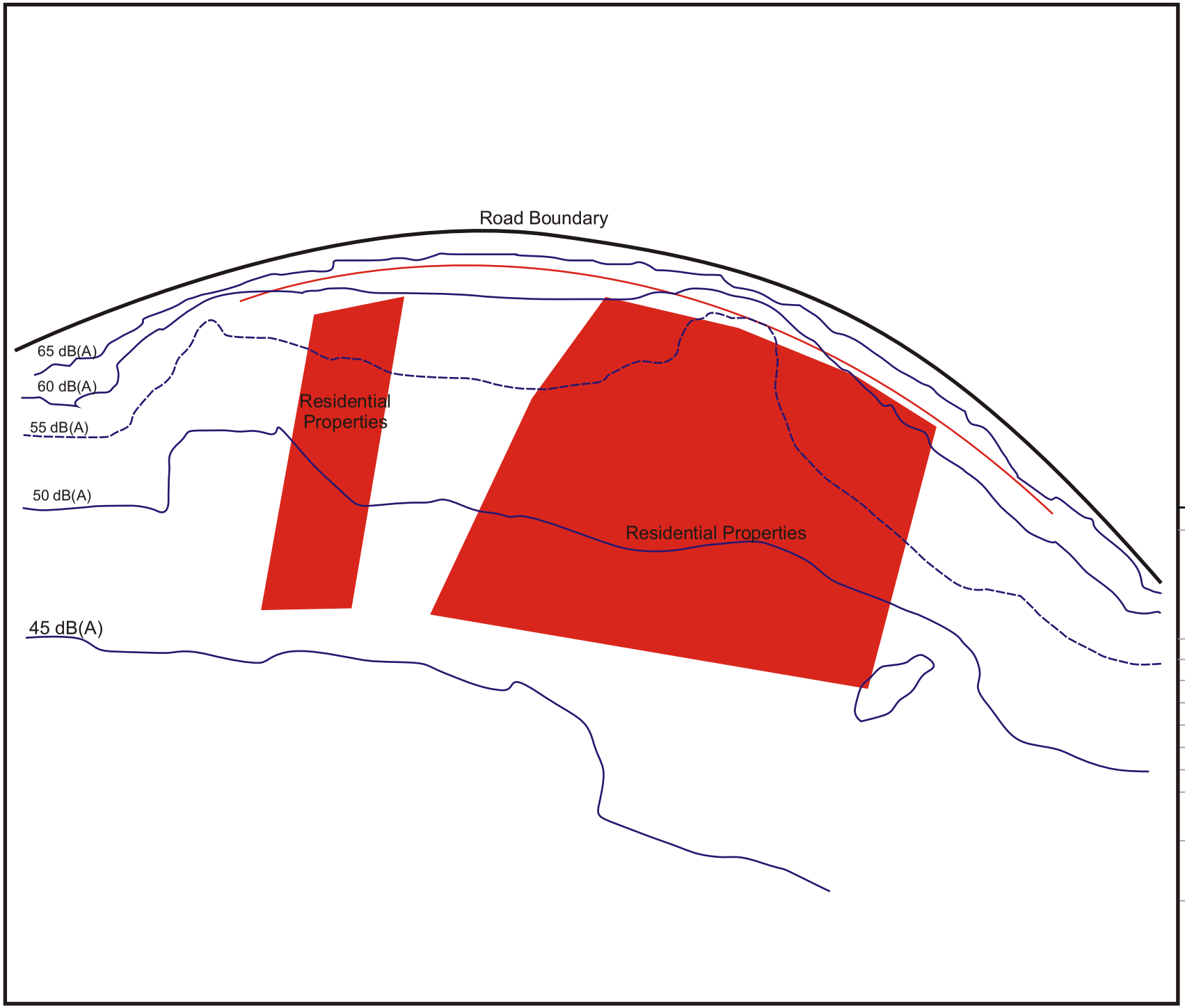
In addition to the lots mentioned above, buildings on lots 89 to 94 would also require design by a qualified acoustic consultant and mechanical ventilation, as it is not practical to shield the lots with a noise barrier.

Revised Figures

The revised figures are attached at the end of this report. *Figures 1 – 8* show the location of noise barriers for Existing Option: 148 lots, and *Figure 9* shows the barrier options for Revised Option: 154 lots.

Yours sincerely,
for Environmental Resources Management Australia Pty Ltd

Astra Peart
Acoustics and Vibration Consultant



Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 1

2005, dB(A), L_{eq} 15Hrs

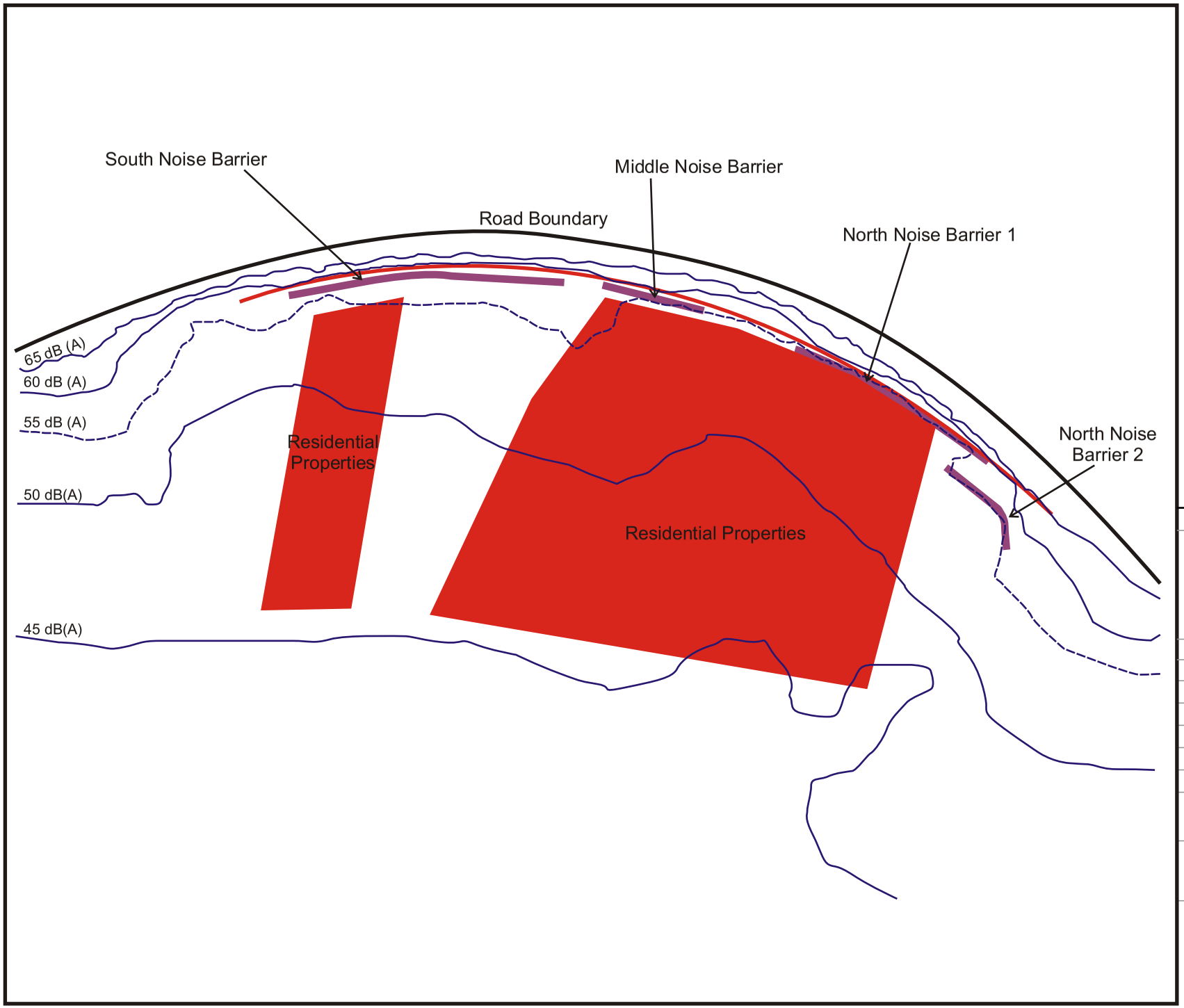
Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-001	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

N

0 150m

Environmental Resources Management Australia Pty Ltd
Level 1, 60 Leichhardt Street, Spring Hill, QLD 4000.
Telephone +61 7 38398393

ERM



Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 2

2005, dB(A), L_{eq} 15Hrs plus noise barriers

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-002	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

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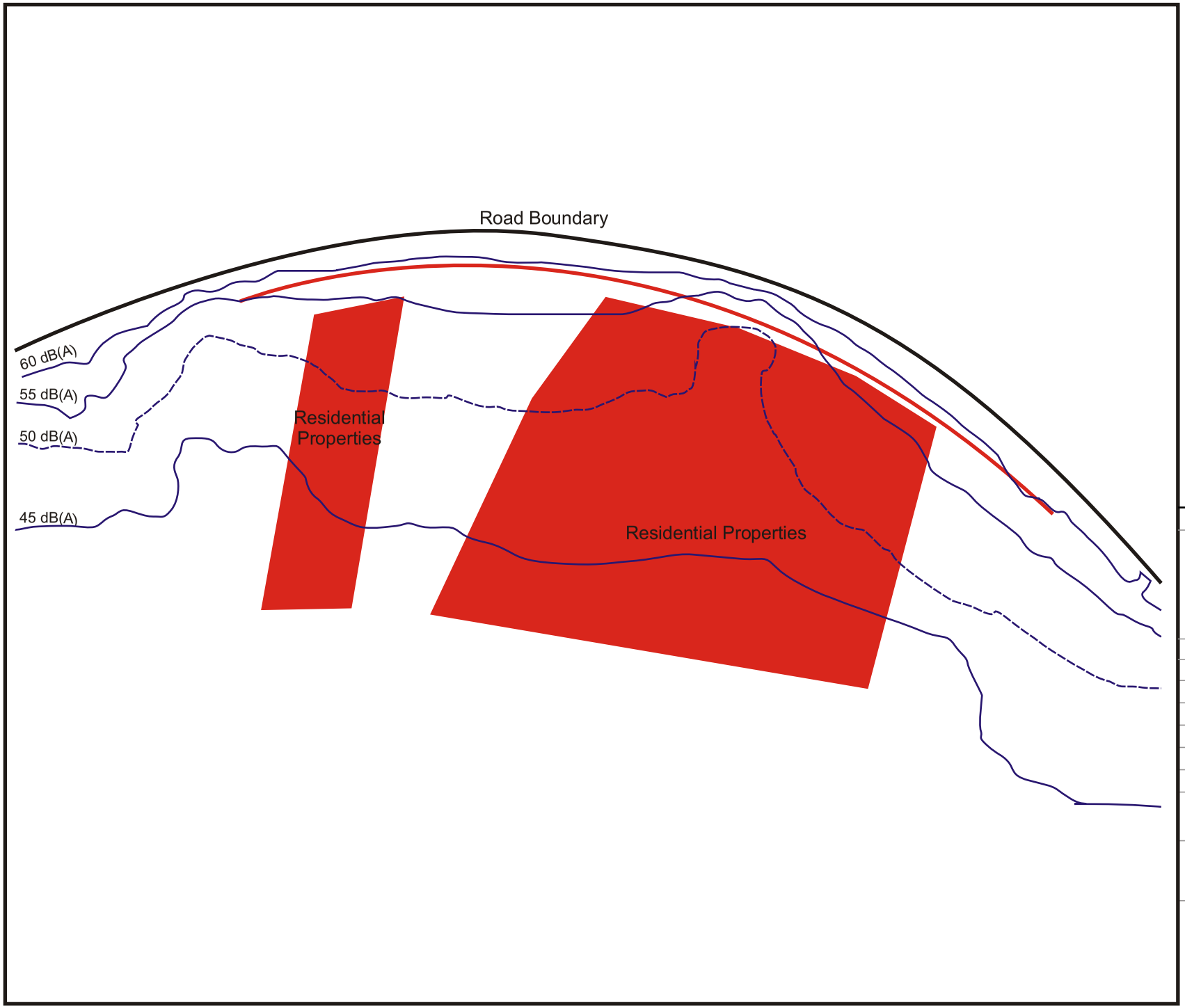

Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 3

2005, dB(A), L_{eq} 9Hrs

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-003	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

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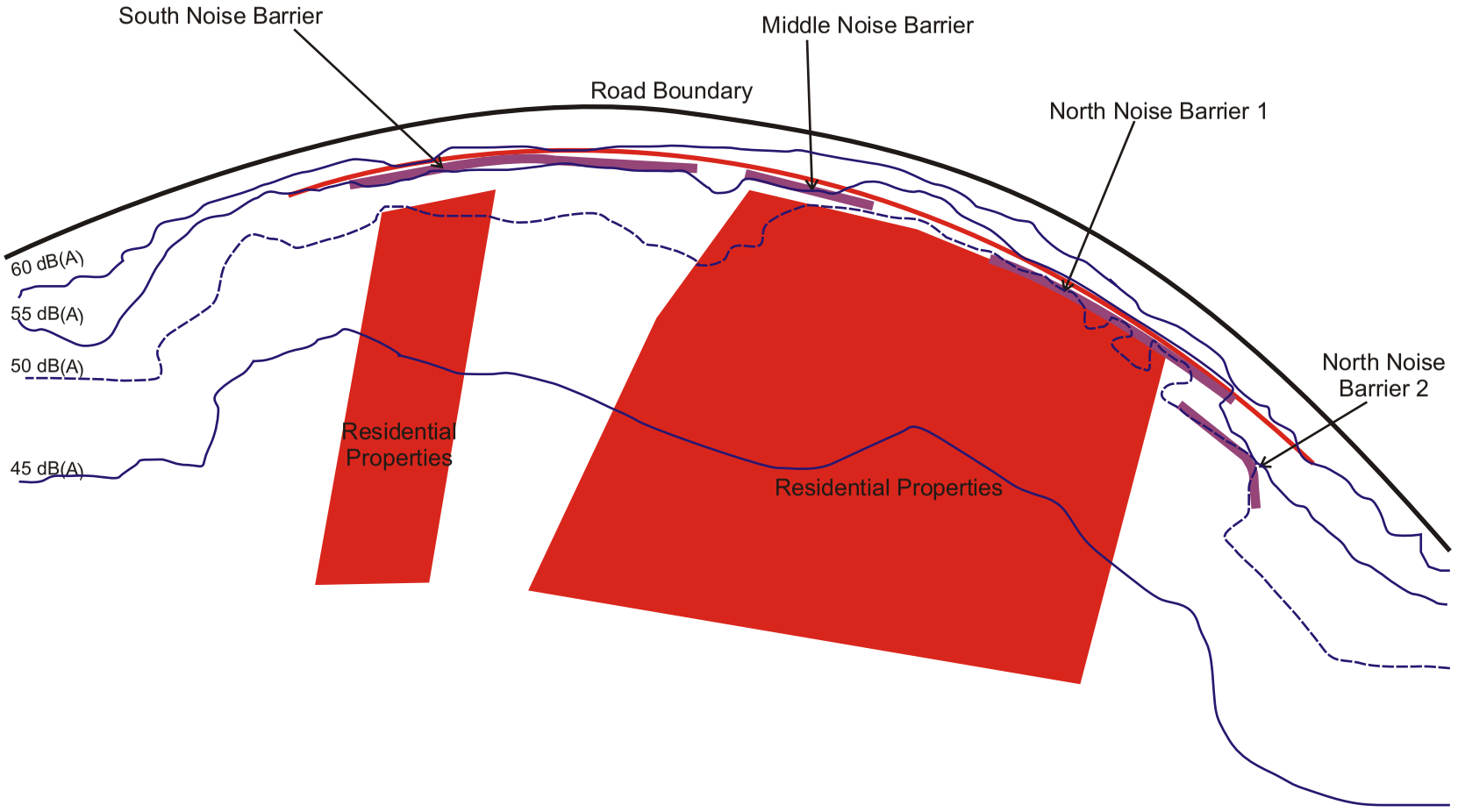

Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 4

2005, dB(A), L_{eq} 9Hrs plus Noise Barriers

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-004	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

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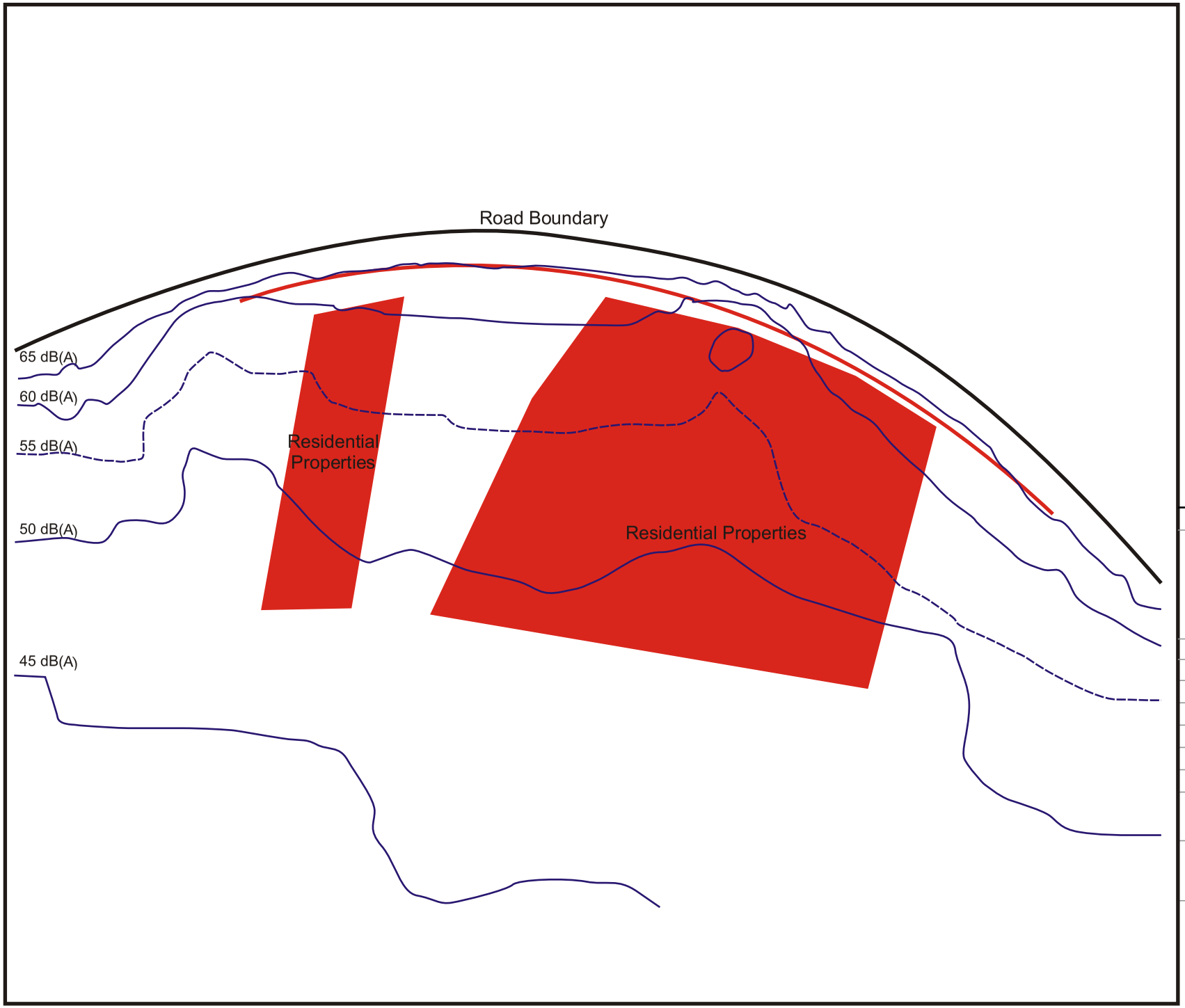

Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 5

2015, dB(A), L_{eq} 15 Hrs

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-005	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

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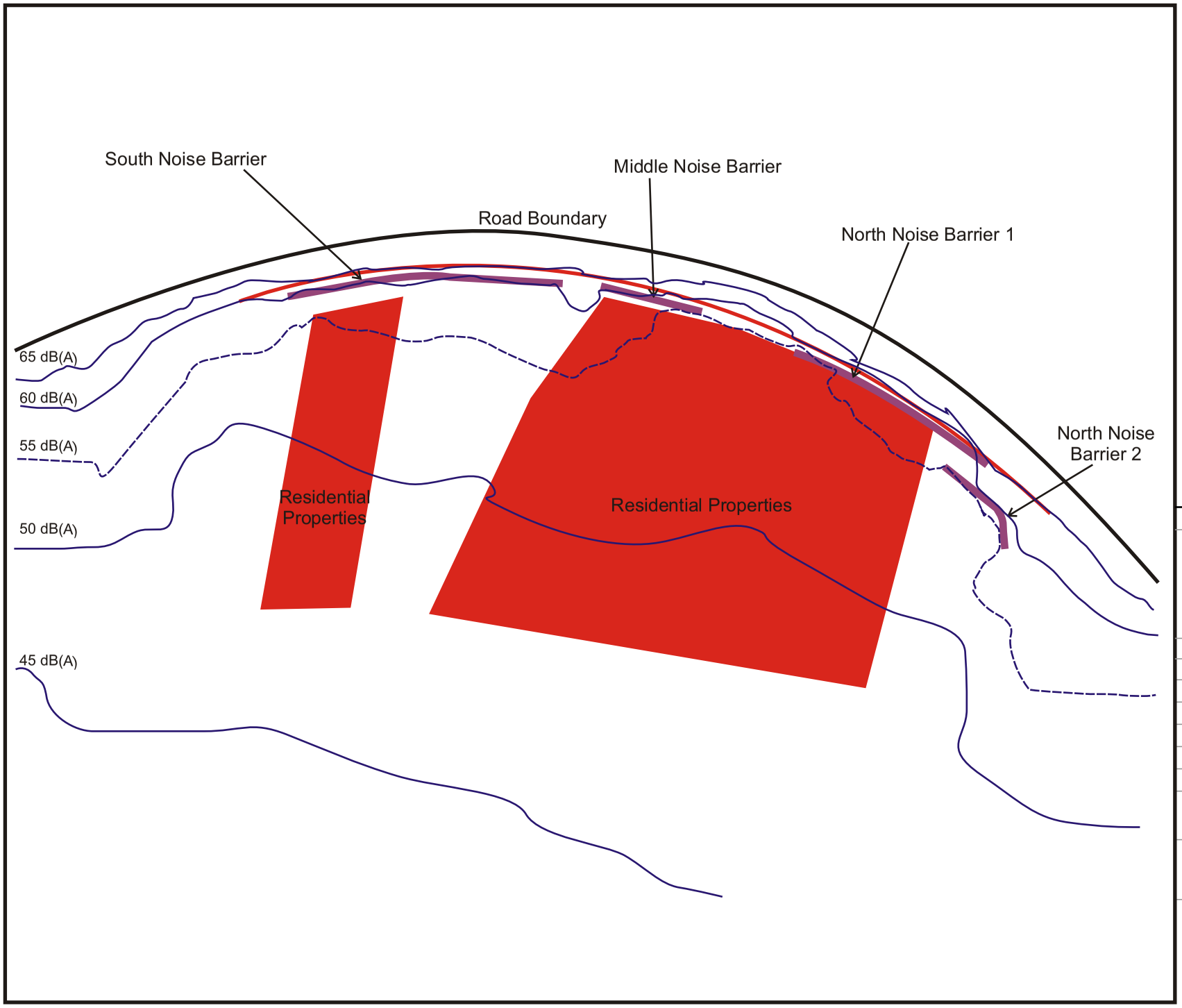

Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 6

2015, dB(A), L_{eq} 15 Hrs plus Noise Barriers

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-006	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

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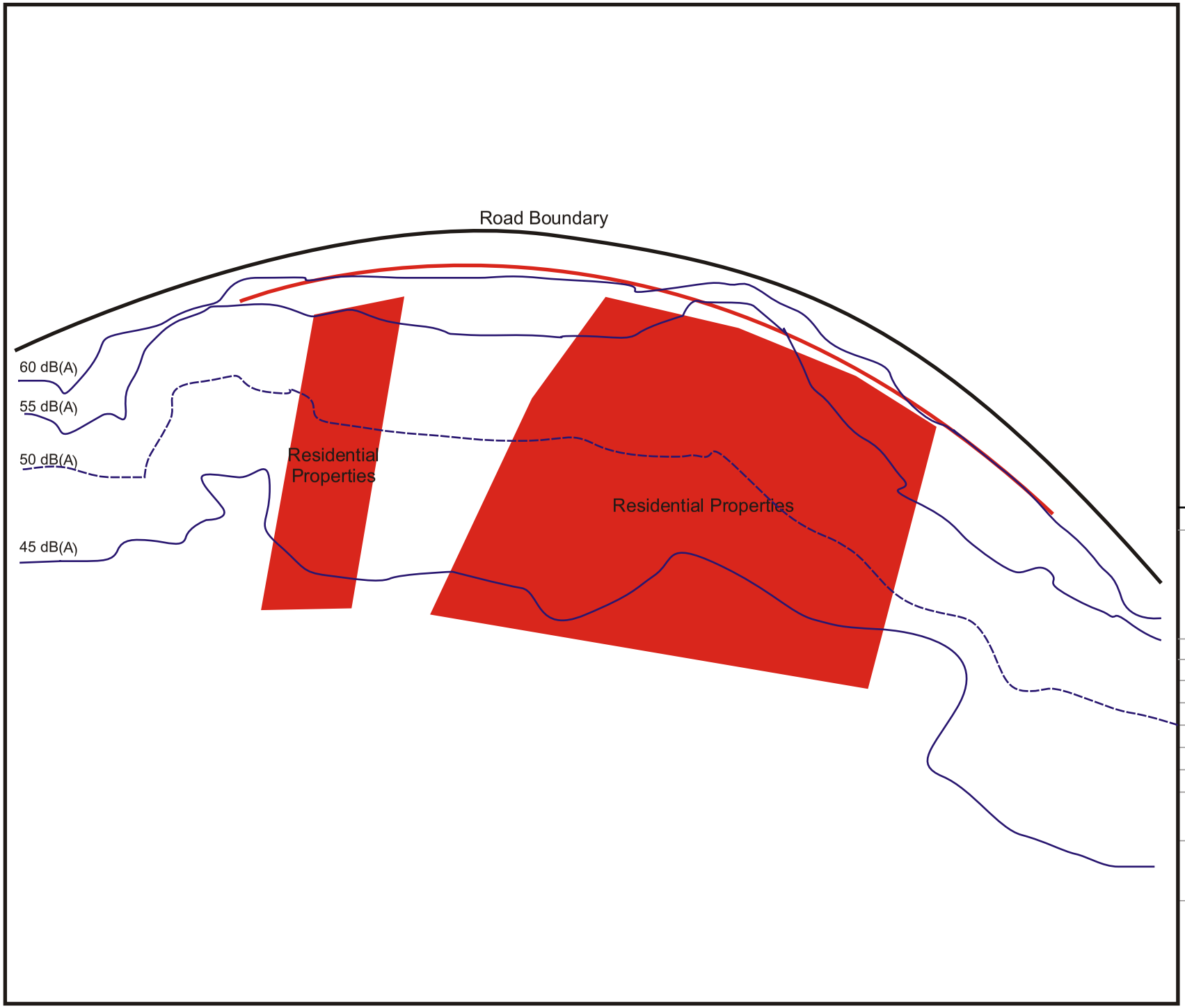

Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 7

2015, dB(A), L_{eq} 9 Hrs

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-007	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

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0 150m

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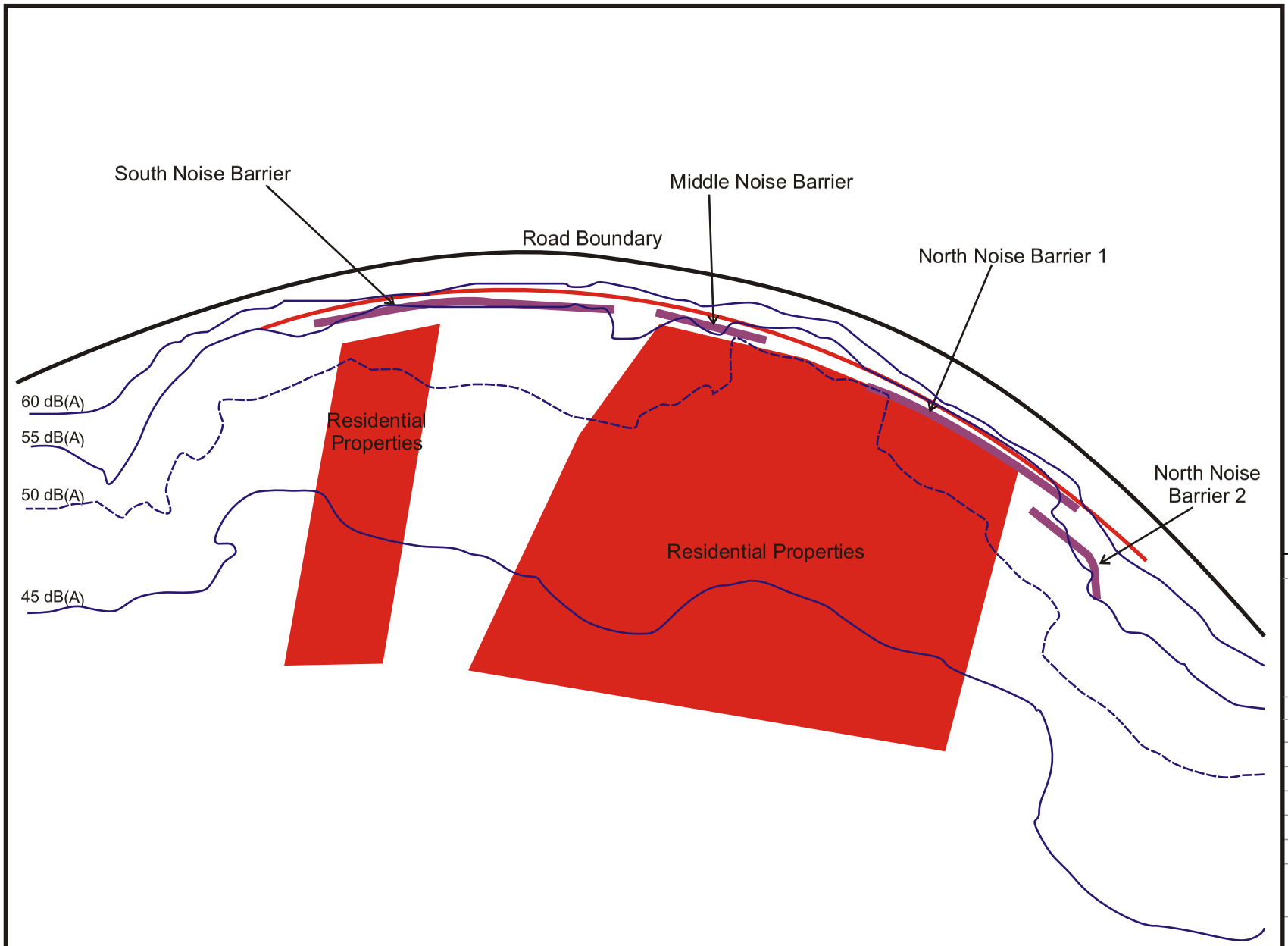

Legend

- Residential Lots
- Noise Barrier
- Noise Contour
- Noise Criteria
- Property Boundary

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 8

2015, dB(A), L_{eq} 9 Hrs plus Noise Barriers

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-008	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

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0 150m

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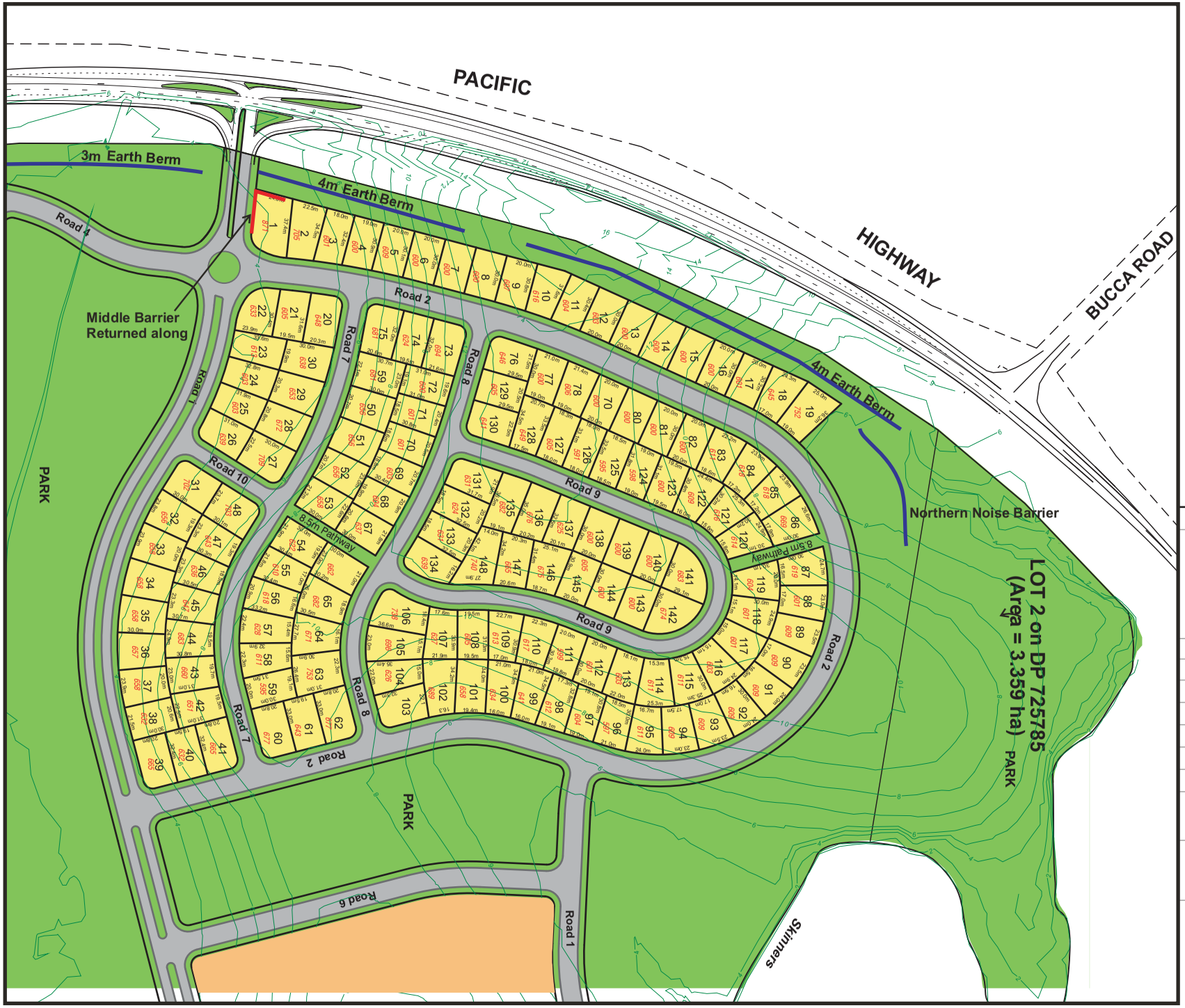

Legend

- Acoustic Barrier
- Earth Berm

Notes:

Suffix	*Revisions*	*Date*	*Init*
A0	Preliminary Issue	01-12-06	JM

Figure 9

Acoustic barrier options for extended lots

Client:	Rothwell Boys Pty Ltd		
Project:	The Glades, Moonee		
Drawing No:	0037659-009	Suffix No:	A0
Date:	01/12/2006	Drawing size:	A4
Drawn by:	JDM	Reviewed by:	AP
Source:	HK Clarke and Associates		
Scale:	Refer to Scale Bar		

N

0 100m

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ERM