APPENDIX A

NOISE IMPLICATIONS OF ALTERNATE RAIL SIDING LOCATION

Prepared by Wilkinson Murray
January 2009

ACOUSTICS AND AIR

PORT BOTANY CONTAINER TERMINAL EXPANSION

NOISE IMPLICATIONS OF ALTERNATE RAIL SIDING LOCATION

REPORT NO. 02053-B
VERSION B

WILKINSON MURRAY

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JANUARY 2009

PREPARED FOR

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TABLE OF CONTENTS

1 INTRODUCTION

Wilkinson Murray Report 02053 of May 2003 was a noise assessment for the proposed expansion of the container terminal facilities at Port Botany. As part of that expansion, the operational rail siding entered the Port Botany facility from the north. It is now proposed that the operational rail siding be relocated to run east-west, just to the north of the Patrick Stevedores site at Port Botany (where the rail storage siding were located as part of the approved development).

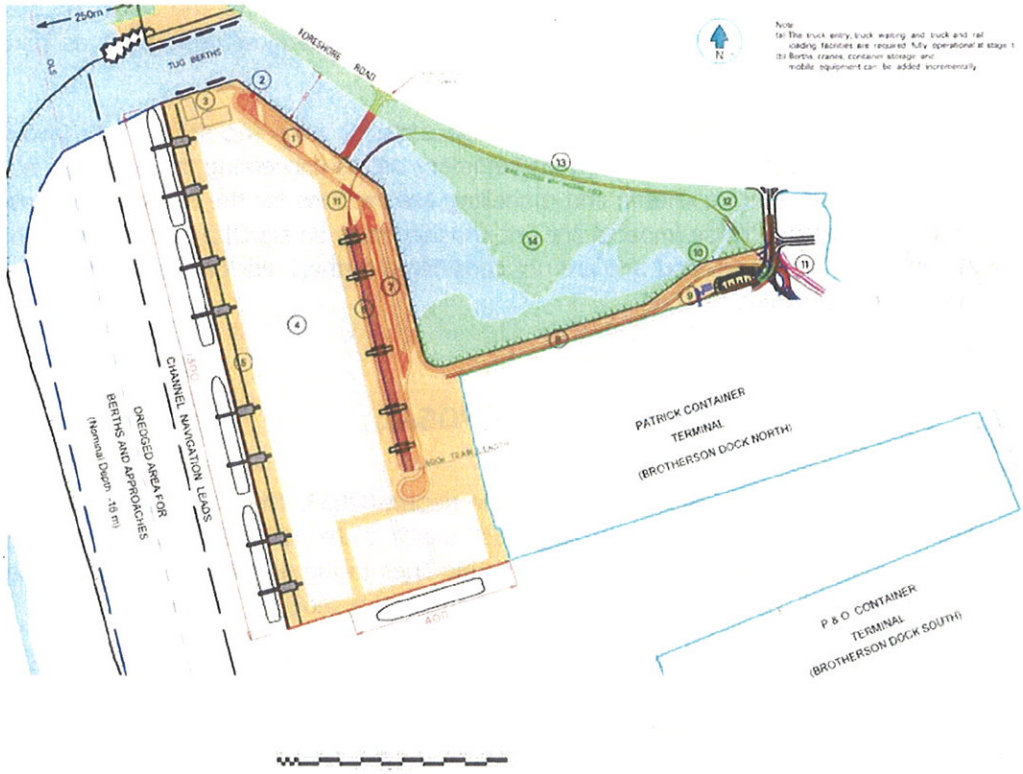
This report presents a comparison of the noise emission from the original rail layout to the proposed rail layout. This report provides summary details concerning the proposal, equipment details, derivation of noise criteria and modelling assumptions for the operational phase of the project. Construction noise impacts are not considered to be significantly different from those assessed in the previous report and are not considered further. For more complete descriptions of these items see Report 02053.

2 SITE DESCRIPTION AND PROPOSAL

The original proposal was described in detail in Report 02053. The proposal provides for a new terminal that operates 24-hours per day. Additionally a new rail link is to be constructed that enters the site from the east, joining the existing lines to the north-east of the existing Patrick container terminal. The layout of the approved proposal is shown in Figure 2-1.

Apart from the changed rail line location, there are no other significant changes to the approved project which would affect the noise impact from the project.

Figure 2-1 Layout of the Approved Port Botany Expansion



3 ASSESSMENT LOCATIONS AND ACOUSTIC PERFORMANCE CRITERIA

3.1 Assessment Locations

In order to set noise assessment criteria, noise monitoring was conducted at 6 locations as part of the original assessment. Those locations are listed in Table 3-1. Noise was also assessed at a further 3 residential locations in the proximity of Receiver 2, and the noise criteria for Receiver 2 were used for those extra locations. Table 3-1 also lists the 5 non-residential locations where noise was assessed. The receiver locations 1-6 are shown in Figure 3-1.

(Receiver 6 is noted in the previous report as a crematorium. There is a caretakers residence there, and that is why it is considered residential.)

Table 3-1 Assessment Locations

Receiver Number	Location
1	Chelmsford Avenue
2	Dent Street
	Livingstone Avenue
	Tupia Street
	Waratah Road
3	Jennings Street
4	Golf Club
5	Australia Avenue
6	Military Road
Non-residential	Church, Hannon
	Church, Rancon Street
	Banksmeadow Primary School
	Matraville Primary School
	Church, Bunnerong Rd
	Sir Joseph Banks Park/Golf course

Figure 3-1 Assessed Residential Receiver Locations

3.1 Adopted Noise Criteria

The full discussion of the noise criteria which were adopted for the study is contained in the previous report. The noise criteria for residences are summarised in Table 3-2. The sleep disturbance criteria are summarised in Table 3-3. The noise criteria for non-residential receivers are summarised in Table 3-4.

The noise criteria were established with reference to measurements of ambient and industrial noise carried out before 2003. Recent measurements by Baulderstone Hornibrook Jan de Nul JV found that the noise environment had not changed significantly since then except at Location 5 - Australia Avenue - where significantly lower levels were measured. The low levels of industrial noise measured could indicate that the amenity noise criterion had been set too low at that location.

However, Wilkinson Murray measured noise levels at that same location soon after the measurements were done by Baulderstone Hornibrook Jan de Nul JV. The Wilkinson Murray results (March 2008) showed higher noise levels than those measured by Baulderstone Hornibrook Jan de Nul JV, and higher than those measured in 2002, particularly during the night time period. Hence the low amenity criterion based on existing exposure to industrial noise is considered suitable.

At other locations the previously set criteria are also considered valid as the noise environment has not changed significantly.

Table 3-2 Adopted Noise Criteria for Residences

Location	Level of Existing Industrial Noise	Amenity Criterion L_{Aeq} For the new development only
Location 1 – Chelmsford Avenue	Not Measurable	40dBA
Location 2 - Dent Street	Not Measurable	40dBA
Location 3 – Jennings Street	44dBA	39dBA
Location 4 - North of Golf Club	48dBA	40dBA
Location 5 – Australia Avenue	48dBA	38dBA
Location 6 - Military Road	48dBA	40dBA

Table 3-3 Sleep Disturbance Criteria

Time Period	L_{A1} Sleep Disturbance Criteria (dBA)
	Night Time (10.00pm – 7.00am)
Location 1 - Chelmsford Avenue	51
Location 2 - Dent Street	51
Location 3 - Jennings Street	55
Location 4 - North of Golf Course	58
Location 5 - Australia Avenue	57
Location 6 - Military Road	60

Table 3-4 Noise Criteria for Non Residential Noise Sensitive Receivers

Receiver	Acceptable L_{Aeq}
School Classroom (Internal)	35 (1) (2)
Places of Worship	40 (1)
Passive Recreation Area (National Parks)	50
Active Recreational Area (School Playground, Golf Course)	55

Notes: (1) With windows open this corresponds to an external criterion 10dB higher.
(2) Where existing school classrooms are affected by existing industrial noise, the acceptable level may be increased to 40dBA.

3.2 Sleep Disturbance Noise Criteria

Between 10.00pm and 7.00am sleep disturbance from individual transient noise events such as container impacts from the proposed expansion should be considered.

To avoid sleep disturbance from industrial operations the EPA recommends in its *Environmental Noise Control Manual (ENCM)* that the $L_{A1,1min}$ of the intruding noise should not exceed the background noise level by more than 15dBA. The $L_{A1,1min}$ represents the typical maximum noise level of transient events such as container impacts and horns etc.

Based on the measured background L_{A90} levels (Rating Background Level values in Table 3-1) the *ENCM* night time sleep disturbance criteria at the residential locations are given in Table 4-3.

Table 3-5 L_{A1} Sleep Disturbance Criteria

Time Period	L_{A1} Sleep Disturbance Criteria (dBA) Night time (10.00pm – 7.00am)
Location 1 - Chelmsford Avenue	51
Location 2 - Dent Street	51
Location 3 - Jennings Street	55
Location 4 - North of Golf Course	58
Location 5 - Australia Avenue	57
Location 6 - Military Road	60

4 NOISE MODELLING

4.1 Summary of the Process

Noise was predicted using the ENM noise modelling software. This software takes into account attenuation due to distance, topographical features, air absorption and meteorological conditions.

To assess noise from the original proposal, a scenario that was expected to produce a worst-case assessment of noise emission was established. The assessment of the revised proposal is based on the same assumptions and information as was provided in the original report, with the exception of the noise source locations.

4.2 Noise Source Location

The location of noise sources included in the noise model in the Report 02053, and the changed locations for this study, are shown in Figure 4-1 and Figure 4-2. These were considered to represent a typical worst case (90th percentile operational day/night).

4.3 Noise Source Levels

Source noise levels were determined from noise measurements at similar facilities. The source levels used in the model are given in Table 4-1.

Table 4-1 Octave Band Sound Power Levels for Port Activities

Activity	A - Weighted	Octave Band Centre Frequency (Hz) (dB)							
		63	125	250	500	1K	2K	4K	8K
Ship Loading/Unloading	111	111	109	111	107	106	103	95	83
Straddle Carrier	108	113	109	108	105	103	101	95	87
Rail Loco Idle	94	100	96	91	89	89	87	82	75
Truck Processing Area	108	118	115	115	112	109	107	103	96
Truck/Train Loading/Unloading Area	108	108	106	108	104	103	100	92	80
Ship Auxiliary Power Units	106	118	110	107	103	102	94	83	83
Tugs	93	116	111	103	95	87	85	83	78

4.4 Assumed Noise Mitigation

In the previous report, 3 options for noise barriers were presented: a barrier on the north-east boundary of the site, and barriers either side of Foreshore Road. The barrier along the north-east boundary of the site is being constructed as part of the project. Its location is shown on Figure 4-3. For this study, a continuation of that barrier along the northern boundary next to the proposed rail siding was considered. The effect of that barrier is discussed in this report.

The previous report also proposed noise mitigation by installing noise control kits on all suitable equipment. These kits would include high performance exhaust silencers, internally lined engine enclosures or partial enclosures, and attenuation on ventilation openings. The attenuation expected from these kits is 6dBA. It has been assumed to be applied to all

operations and equipment except the ships, trains and road trucks.

4.5 Meteorology

Noise levels were calculated for still isothermal conditions, typical of a still warm night or daytime. Assessment of noise for a north-westerly wind at 3m/s has been included in this report in accordance with the *INP*. The derivation of this requirement is discussed in the previous report.

Figure 4-1 Noise Source Locations for Original Noise Model

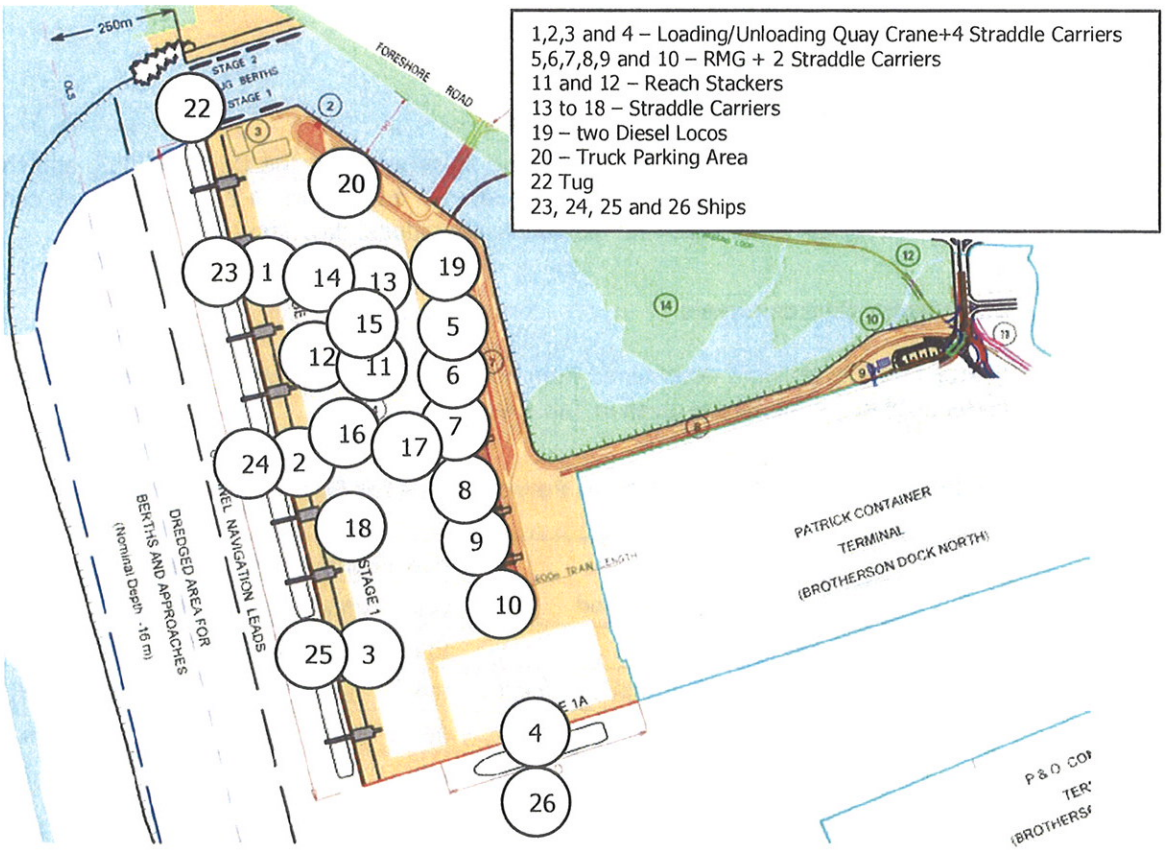


Figure 4-2 Noise Source Locations for Revised Rail Siding

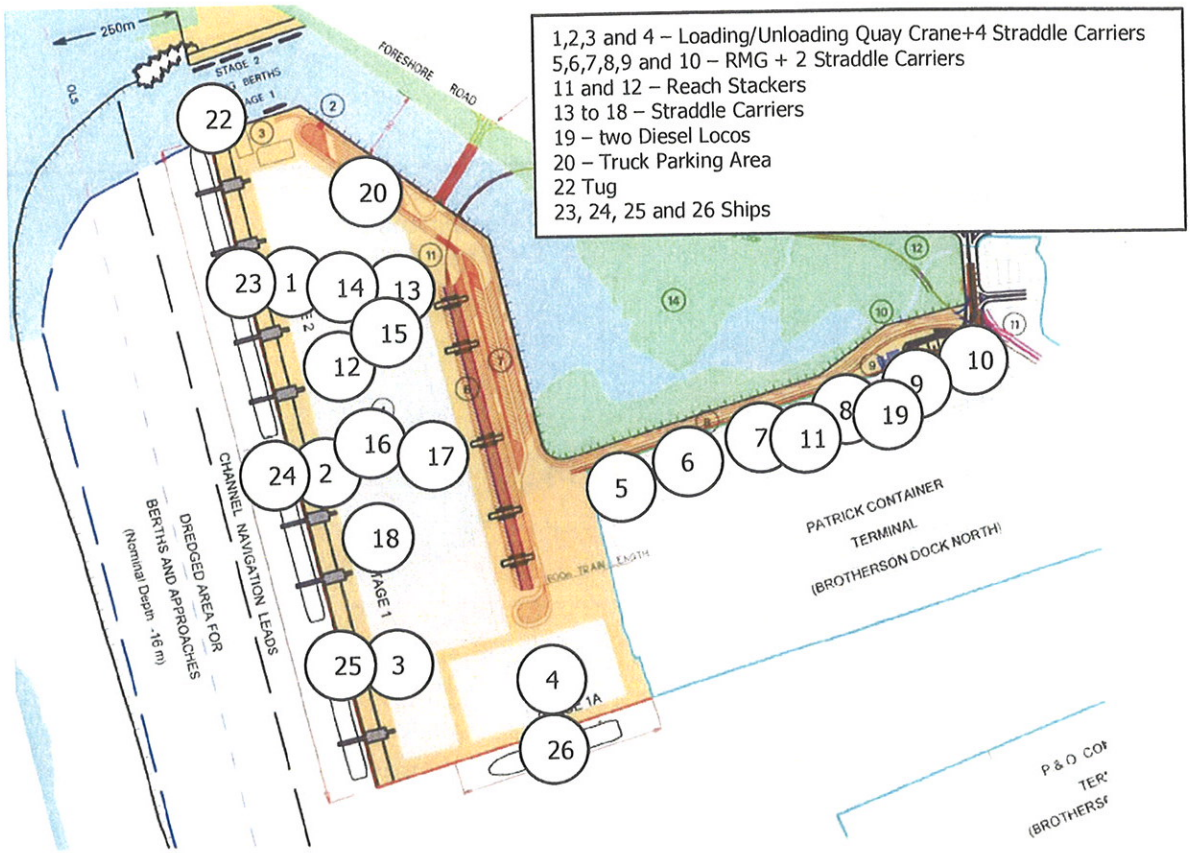
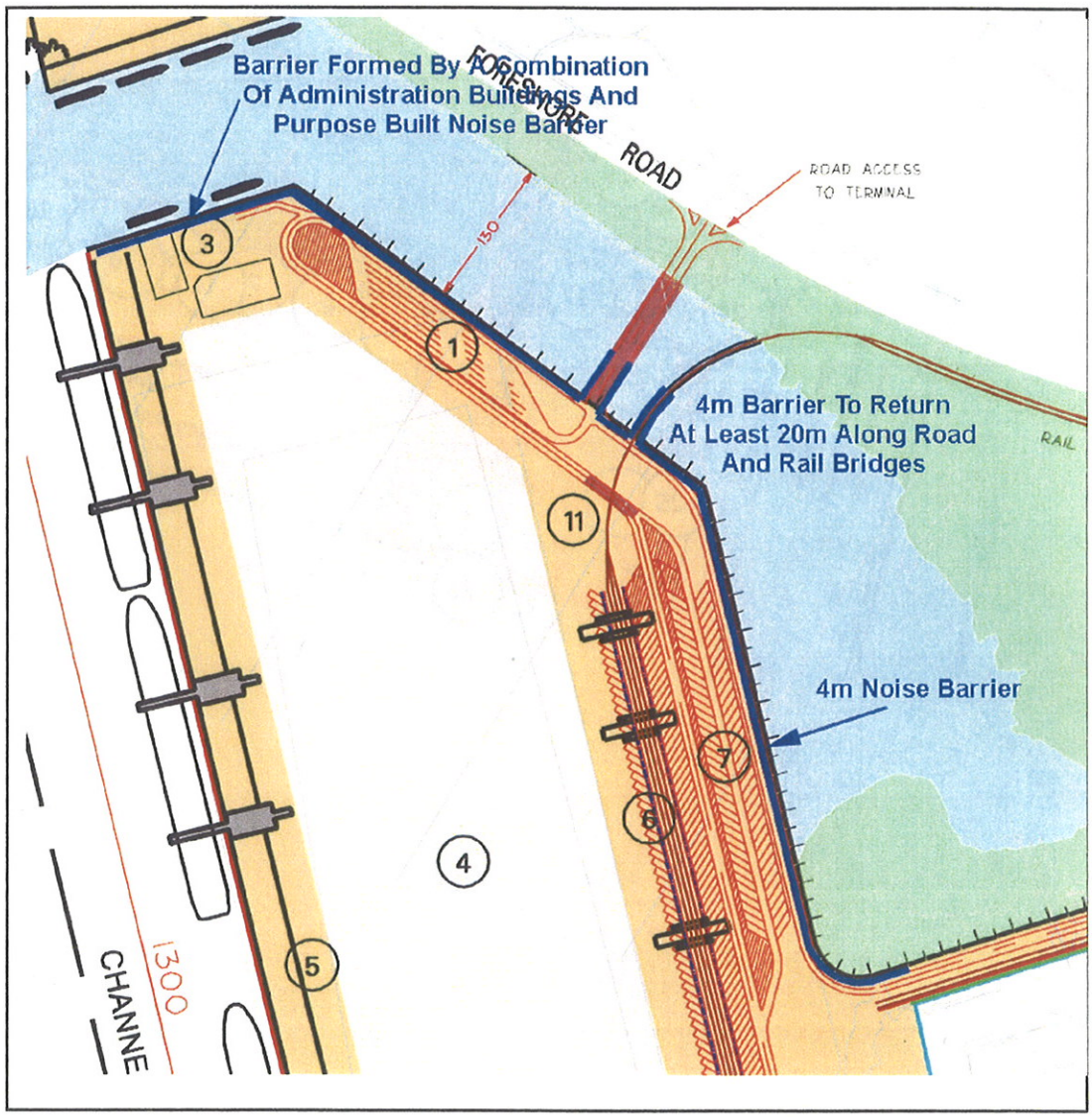


Figure 4-3 Location of Approved Noise Barrier



5 RESULTS

5.1 Predicted L_{Aeq} Noise Levels

The results of the noise prediction are given in Table 5-1. The results are in terms of $L_{Aeq,9hr}$ to be assessed against the amenity criterion for night time. In Wilkinson Murray Report 02053 it was shown that the $L_{Aeq,15min}$ was only 0.7dBA higher than the $L_{Aeq,9hr}$, yet the intrusiveness criteria were more than 1dBA higher than the amenity criteria.

Noise levels with the new noise source layout are shaded. In general, the predicted change was less than 1dBA in noise level due to the realignment of the rail siding. There was a slight decrease in some of the residences to the west of site, and a slight increase at residence nos. 5 and 6, to the east of the site. This makes sense in view of the change in source positions.

Next we consider the case of noise mitigated operations, that is with the barrier installed on the north-east boundary of the site and noise control kits fitted to all suitable equipment. In this case, it was found that there were in general a 1dBA increase in predicted noise levels at most receivers (compared to the noise mitigated original layout). This is because after noise mitigation there are more significant noise sources closer to the residences. In most cases, the noise levels are still below the criterion. Noise can be reduced at many locations by a further 1-2dBA by installation a 3m wall to the north of the alternate operational rail siding. The location and extend of the additional barrier assessed in the noise model is shown on Figure 5-1.

Figure 5-1 Location of Additional Assessed Barrier

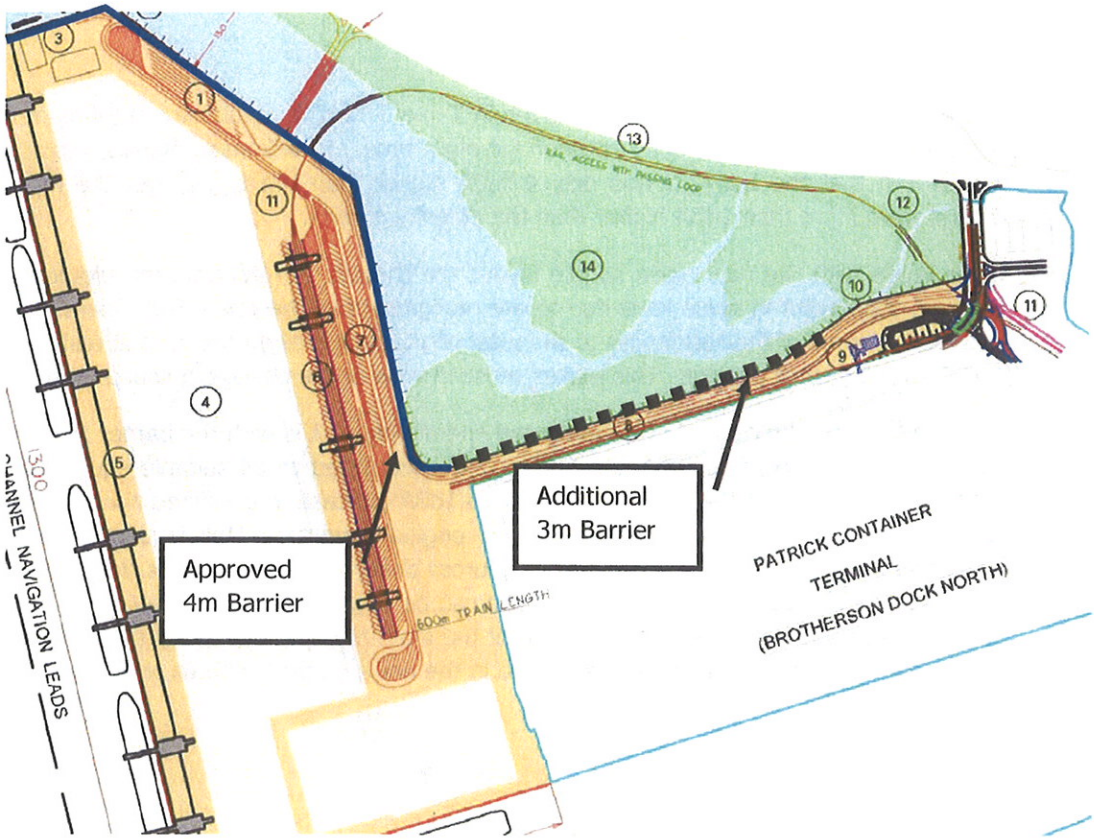


Table 5-1 Results at all Receivers

Original numbering	Label	Meteorology	Original, no mitigation	New, no mitigations	Change	Original with approved barrier and noise controls	New with approved barrier and noise controls	Change	New with original barrier and noise controls, plus extra northern barrier	Criterion
1	Chelmsford Avenue	Isothermal, calm	44	44	0	38	38	0	38	40
	Chelmsford Avenue	3m/s wind from NW	41	41	0	35	35	0	35	40
2	Dent Street	Isothermal, calm	49	49	0	43	44	1	43	40
	Dent Street	3m/s wind from NW	48	47	-1	41	42	1	41	40
	Livingstone Avenue	Isothermal, calm	46	46	0	41	41	0	41	40
	Livingstone Avenue	3m/s wind from NW	44	44	0	38	38	0	38	40
	Tupia Street	Isothermal, calm	47	46	-1	41	41	0	41	40
	Tupia Street	3m/s wind from NW	45	44	-1	39	39	0	39	40
	Waratah Road	Isothermal, calm	47	46	-1	42	42	0	42	40
	Waratah Road	3m/s wind from NW	46	45	-1	40	40	0	40	40
3	Jennings Street	Isothermal, calm	28	29	1	27	28	1	28	39
	Jennings Street	3m/s wind from NW	34	35	1	34	35	1	35	39
4	Golf Club	Isothermal, calm	49	49	0	43	46	3	43	40
	Golf Club	3m/s wind from NW	50	49	-1	45	46	1	45	40
5	Australia Avenue	Isothermal, calm	26	27	1	25	26	1	26	38
	Australia Avenue	3m/s wind from NW	36	36	0	33	34	1	34	38

Original numbering	Label	Meteorology	Original, no mitigation	New, no mitigations	Change	Original with barrier and noise controls	New with barrier and noise controls	Change	New with original barrier and noise controls, plus extra northern barrier	Criterion
6	Military Road	Isothermal, calm	32	33	1	31	31	0	31	40
	Military Road	3m/s wind from NW	41	43	2	40	41	1	41	40
	Church, Hannon	Isothermal, calm	39	39	0	38	38	0	38	50
	Church, Hannon	3m/s wind from NW	37	37	0	35	35	0	35	50
	Church, Rancon Street	Isothermal, calm	45	44	-1	40	40	0	40	50
	Church, Rancon Street	3m/s wind from NW	44	43	-1	38	38	0	38	50
	Banksmeadow Primary School	Isothermal, calm	45	45	0	41	42	1	42	55
	Banksmeadow Primary School	3m/s wind from NW	44	44	0	40	41	1	41	55
	Matraville Primary School	Isothermal, calm	27	27	0	26	27	1	27	55
	Matraville Primary School	3m/s wind from NW	33	33	0	33	33	0	33	55
	Church, Bunnerong Rd	Isothermal, calm	26	27	1	26	27	1	27	50
	Church, Bunnerong Rd	3m/s wind from NW	33	34	1	34	35	1	35	50
	Sir Joseph Banks Park/Golf course	Isothermal, calm	51	50	-1	45	46	1	45	50
	Sir Joseph Banks Park/Golf course	3m/s wind from NW	50	49	-1	43	43	0	42	50

5.2 Sleep Disturbance Levels

Compared to the approved project, the alternate rail siding would slightly increase L_{A1} noise levels from the Port Botany container terminal at receivers to the east and south, but would not exceed the criteria.

The impact at receivers to the north would be increased slightly if the extra noise wall was not built. Assuming container impact noise came from the rail siding area, the noise could increase by 3-4dBA compared with the approved project. Noise from container impacts within the approved area of operation would not be changed. With the extra wall in place the L_{A1} noise levels from the alternate rail siding area would be equivalent to those from the approved project.

Table 5-2 shows predicted noise levels from the approved project, the project with the alternate rail siding, and the project with alternate rail siding and extra noise wall.

Table 5-2 Typical Predicted L_{A1} Noise Levels from Container Handling at Proposed New Container Terminal

Original Numbering	Location	Predicted L_{A1} (dBA) – Approved project	Predicted L_{A1} (dBA) – Alternate rail siding	Predicted L_{A1} (dBA) – Alternate rail siding and extra barrier	Criterion (dBA)
1	Chelmsford Avenue	49 - 53	53 - 55	49 - 53	51
2	Dent Street	53 - 59	57 - 63	53 - 59	51
	Livingstone Avenue	52 - 57	56 - 61	52 - 57	51
	Tupia Street	52 - 58	54 - 62	52 - 58	51
	Waratah Road	52 - 59	56 - 63	52 - 59	51
3	Jennings Street	33 - 45	38 - 51	38 - 51	55
4	North of Golf Course	52 - 59	54 - 61	52 - 59	58
5	Australia Avenue	31 - 43	41 - 53	41 - 53	57
6	Military Road	18 - 35	20 - 37	20 - 37	60

The upper end of the range of L_{A1} levels expected will exceed the *ENCM* sleep disturbance criteria at a number of locations, particularly to the north and northwest. However, many of these locations are already subjected to industrial noise impacts of levels similar to those to be expected.

6 CONCLUSION

The previous study of noise emission from the proposed expansion of Port Botany included operational rail siding that entered from the north of the site. In a proposed variation, the alternate rail siding would enter from the east of the site and run along the north of the existing Patrick Stevedores site. This report presented a comparison of noise impact from the original proposal with the noise from the proposed variation.

It was found that the proposed variation would increase noise emission by 0-3dBA, depending on the receiver location. At most noise sensitive receivers, the increased noise emission would be, at most, 1dBA. This increase applies to both the base case in which no noise mitigation was implemented, and the noise mitigated case which included a noise barrier on the north-east of the site and installation of noise control kits on all suitable equipment. The L_{A1} noise levels would also be increased by up to 4dBA at some receivers.

With the inclusion of a 3m high noise barrier along the north of the alternate rail siding, noise impacts at receivers north and west of the proposal remain either below the criterion or are no greater than for the approved project. The barrier would also reduce L_{A1} noise levels to the levels from the approved project. At one receiver, the caretaker's residence at the crematorium on Military Road, there would be a 1dBA increase. This is predicted to increase noise to 1dBA above the criterion when there is a 3m/s wind from the northwest. During isothermal, calm conditions noise would be below the criterion at this location.

Construction noise, vibration, noise from trains and trucks outside the new terminal was not examined in this report; however it is not expected to change due to the revised proposal.

Version	Status	Date	Prepared by	Checked by
B	Final	19 January 2009	George Jenner	Adam Bioletti

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

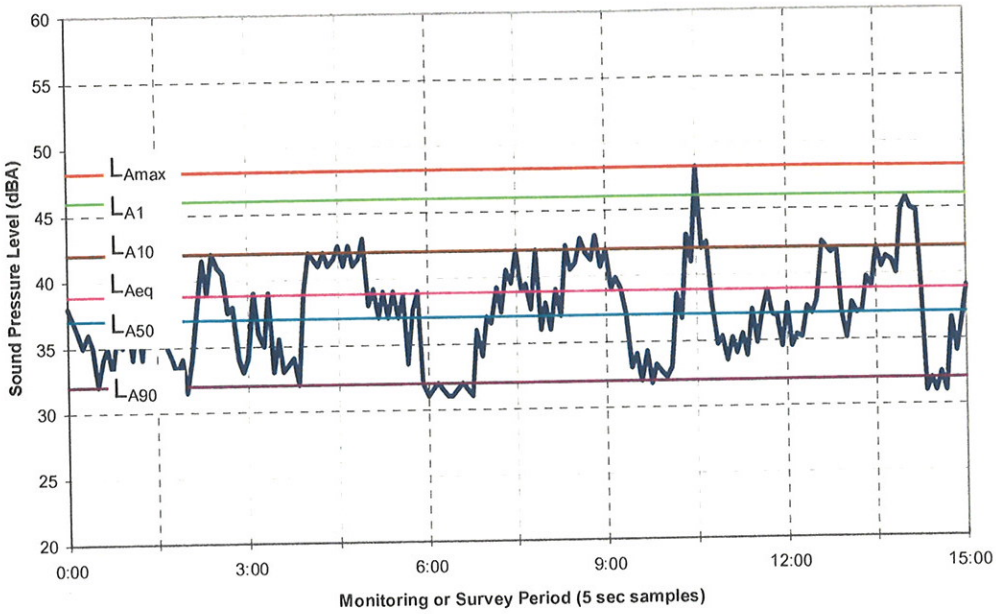
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)