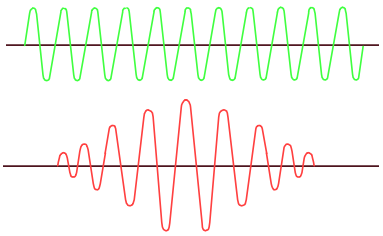
PACLIB MANAGEMENT PTY LTD

PASMINCO COCKLE CREEK SMELTER

- MASTER PLAN

Noise Impact Assessment



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EXECUTIVE SUMMARY

This Report provides the results, findings and recommendations from the Noise Impact Assessment of the proposed Development Master Plan for the Pasminco Cockle Creek Smelter, Boolaroo, NSW.

Traffic noise levels along Frith Avenue substantially exceed the relevant criteria. A noise wall enabling compliance with the criteria would be as high as 8m depending on the location of the nearest dwellings. As this is unrealistic, additional mitigation options will need to be investigated when designing the subdivision and dwellings layouts. This would involve creation of a buffer zone along Frith Avenue, the construction of a mound and/or 2-metre high noise barrier, and building design and landscaping measures, all of which will assist in minimising the noise impact on the most affected dwellings.

Traffic noise levels along Main and Munibung Road exceed the relevant criteria. The analysis indicates that a 2m high noise barrier constructed along the road corridors adjacent to residential lots will enable compliance with the criteria. This is reasonable and common for residential areas.

The assessment highlights that future traffic noise levels are predicted to exceed the noise criteria on parts of the proposed development site. We believe that residential development on those affected lots is acceptable, provided that satisfactory internal noise levels are achieved within the exposed dwellings. This implies façade treatments (eg. glazing, ceiling, wall insulation etc), which are normally determined from the requirements and procedures of *AS2107:2000 Recommended sound levels and reverberation times for building interiors* and *AS3671:1989 Road traffic noise intrusion – Building siting and construction*.

The required extent of façade treatment will be directed by the glazing area/floor area ratio in each room of the dwelling, which is undetermined at this early stage. However, given the traffic noise levels outlined in this report and the latest amendments to the site layout, we do not believe that any façade treatment will be unrealistic or cost prohibitive. Pending on design details, it is our expectation that, in the worst-case, glazing would be 6.38mm to 10.38mm laminated glass, which is commonly used in residential estates.

An acoustic report should accompany Development Applications for residential dwellings in the proposed subdivision, including assessment and recommendation of appropriate acoustic measures incorporated into the respective designs.

Noise impact from any commercial and industrial activities on the proposed Development Master Plan site should be assessed as detailed in sections 4.2 and 4.3 of this report.

In conclusion it is our opinion that development of a residential area on the subject land is possible provided the recommendations outlined in this report are implemented. This particularly includes façade treatment of the dwellings most affected by traffic noise and installation of 2metre high barriers adjacent to selected roadways.

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1. INTRODUCTION

This Report provides the results, findings and recommendations from the Noise Impact Assessment of the proposed Development Master Plan for the Pasminco Cockle Creek Smelter (PCCS), Boolaroo, NSW. The following scope of work was performed:

- Determine the traffic noise impact from Frith Avenue, Main Road and a proposed new road (Munibung Road extension) on the proposed residential and mixed-use development areas within the development area.
- Determine the rail noise impact from the main northern line on the proposed residential and mixed-use development areas within the development area.
- Establish project specific noise criteria for the proposed residential, commercial and industrial areas within the development.
- Establish project specific noise criteria for the existing and proposed residential receivers for noise from industrial receivers.

Currently the proposed re-development area is zoned Industrial (Core) as per Lake Macquarie City Council (LMCC) Local Environment Plan 2004 (LEP).

This assessment is carried out according to the criteria and guidelines of the Department of Environment and Climate Change's (DECC's) document *Environmental Criteria for Road Traffic Noise and (ECRTN*) and Industrial Noise Policy (INP), the RTA's document *Environmental Noise Management Manual (ENMM),* and the Rail Infrastructure Corporation's *Interim Guidelines for Applicants: Consideration of Rail Noise and Vibration in the Planning Process 2003* (RIC Guidelines).

2. GLOSSARY OF TERMS

Table 2-1 below contains the definitions of commonly used acoustical terms and is presented as an aid to understanding the Report.

Table 2-1: Definition of Acoustical Terms

Term	Definition
L_{Aeq}	Equivalent Continuous Noise Level - which, lasting for as long as a given noise event has the same amount of acoustic energy as the given event.
L_{A10}	The noise level, which is equalled or exceeded for 10% of the measurement period.
L_{A90}	The noise level, which is equalled or exceeded for 90% of the measurement period. An indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise.
$L_{Aeq,15hrs}$	The L_{eq} noise level for the period 7am to 10pm, as defined in the ECRTN
$L_{Aeq,9hrs}$	The L_{eq} noise level for the period 10pm to 7am, as defined in the ECRTN
$L_{Aeq,1hr}$	The highest tenth percentile hourly A-weighted L_{eq} during the period 7am to 10pm or the period 10pm to 7am (whichever is relevant).
$L_{A10,18hrs}$	The L_{10} noise level for the period 6am to midnight.
$L_{Amax\ (T)}$	The maximum A-weighted sound level within the applicable time period, T

3. NOISE MONITORING

Five noise loggers locations were used on site to measure the existing noise environment within and adjacent to the PCCS site. The monitoring locations are detailed in Table 3-1 and are shown on Figure 3-1.

Table 3-1: Monitoring locations

Location ID	Location Description	Instrument	Serial Number
1	Approximately 15m from the near lane of Main Road	ARL	194691
2	Pasminco redundant car park	ARL	194696
3	17 Third Street, Boolaroo	ARL	194657
4	Zone 2, approximately 30m from the near lane of Frith Avenue	LD870	1459
5	Adjacent to railway	ARL	194657

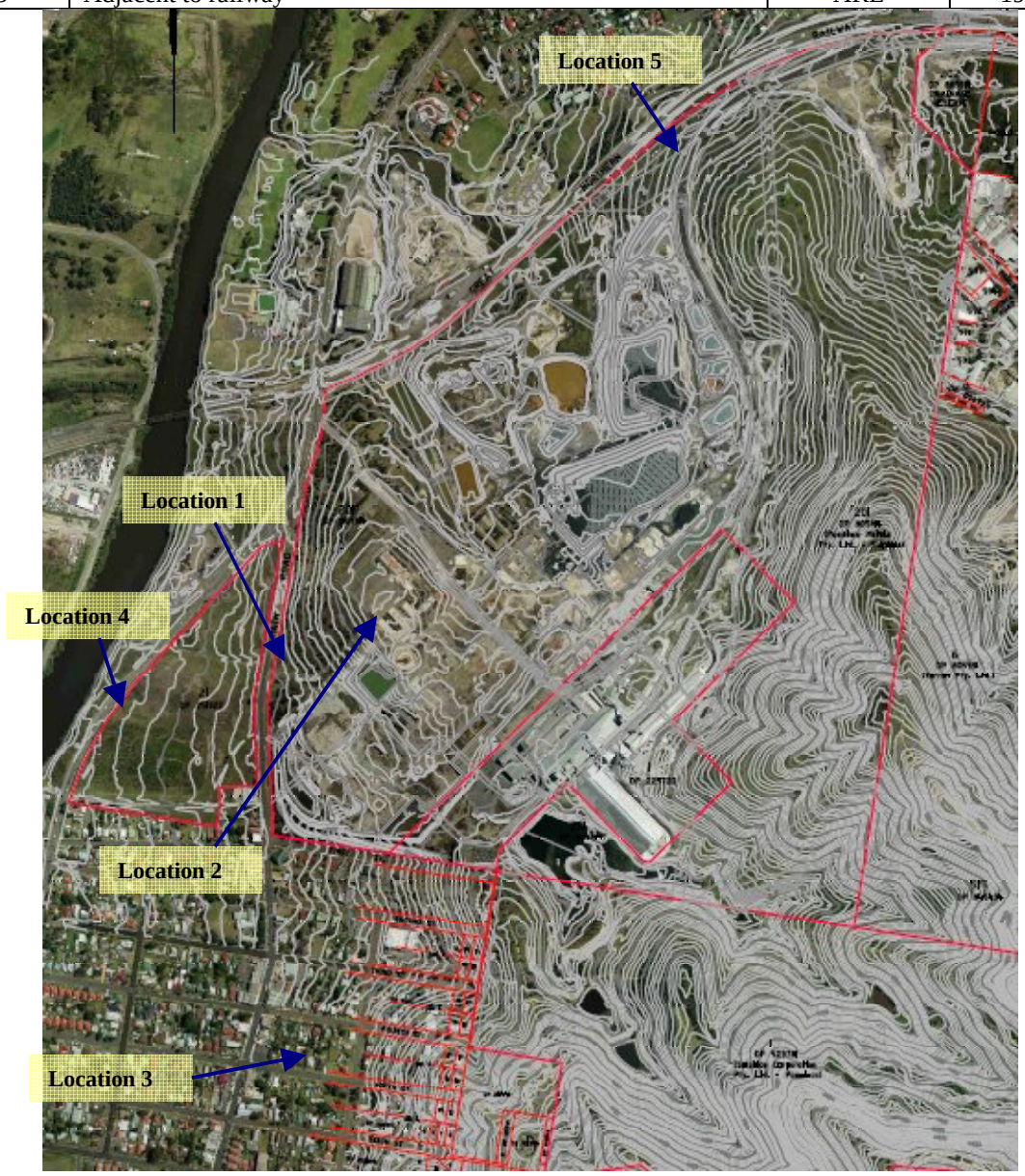


Figure 3-1: Monitoring locations

Noise monitoring was conducted between the 3rd and 11th January 2006 for monitoring Locations 1, 2 and 3. Location 4 monitoring was conducted during November 2004 as described in Pasminco assessment "Vipac Report Ref. 291448-TRP-001600-0". Location 5 rail noise monitoring was conducted between 28th September and 4th October 2007.

The instruments were programmed to accumulate noise data continuously over sampling periods of 15 minutes for the entire monitoring period. Internal software then calculated and stored the L_n percentile noise levels for each sampling period, which were later retrieved for detailed analysis.

The instrument was calibrated using a Rion NC-73 sound level meter immediately before and after monitoring and showed a maximum error of 0.5dB.

Data affected by adverse weather conditions has been excluded where necessary.

3.1 TRAFFIC NOISE

A summary of traffic noise data used to calibrate the noise model is shown in Table 3-2.

Table 3-2: Summary of measured traffic noise levels – dB(A)

Noise Parameter	Location	
	1 (Main Road)	4 (Frith Avenue)
$L_{A10,18hr}$	58.5	66.1
$L_{Aeq(15hr)}$	55.7	62.9
$L_{Aeq(9hr)}$	52.2	61.4
$L_{Aeq(1hrmax)}$ - Day	56.8	64.4
$L_{Aeq(1hrmax)}$ - Night	54.7	64.5

A summary of background noise measurements at the monitoring location is shown in Table 3-3. For background noise assessment purposes, the survey results were analysed in accordance with the DECC Industrial Noise Policy (INP) where the time periods are defined as:

- Day: 7am – 6pm
- Evening: 6pm – 10pm
- Night: 10pm – 7am

Table 3-3: Summary of Existing Ambient and Background Noise Levels

All Values in dB(A)

Location	Period	L_{Aeq}	RBL[1]
Location 2 Pasminco redundant car park	Day	57.0	44.5
	Evening	47.0	43.0
	Night	48.0	40.0
Location 3 17 Third Street Boolaroo	Day	52.0	38.5
	Evening	51.0	38.0
	Night	46.5	38.0

[1] Note: RBL is the median of the overall assessment background noise level calculated using DECC Industrial Noise Policy methodology.

3.2 RAIL NOISE ATTENDED MONITORING

Attended noise measurements were taken on site at *Location 5* as marked on Figure 3-1, approximately 18.5m from the rail centreline between 14:00hrs-1700hrs on the 4th October and between 10:00-12:30hrs on the 5th October 2007.

The following train pass-by's were monitored.

Table 3-4: Monitored Pass-by's

Train ID	Type	Date & Time	Train ID	Type	Date & Time
1	Country Link	10/4/07 14:31	14	Passenger	10/4/07 16:40
2	Passenger	10/4/07 14:33	15	Other	10/5/07 10:28
3	Passenger	10/4/07 14:45	16	Passenger	10/5/07 10:28
4	Country Link	10/4/07 14:49	17	Passenger	10/5/07 10:28
5	Passenger	10/4/07 15:11	18	Passenger	10/5/07 10:28
6	Passenger	10/4/07 15:22	19	Passenger	10/5/07 10:28
7	Freight	10/4/07 15:24	20	Freight	10/5/07 10:28
8	Passenger	10/4/07 15:38	21	Coal	10/5/07 11:20
9	Passenger	10/4/07 15:46	22	Passenger	10/5/07 11:36
10	Passenger	10/4/07 15:49	23	Passenger	10/5/07 11:38
11	Freight	10/4/07 15:51	24	Passenger	10/5/07 11:45
12	Passenger	10/4/07 16:16	25	Passenger	10/5/07 11:47
13	Passenger	10/4/07 16:34	26	Coal	10/5/07 11:53

Attended noise measurements were taken with A Brüel & Kjær (B&K) 2250 integrating sound level meter, fitted with a B&K 4189 ½ inch diameter electret microphone and a windshield. This instrument has performance characteristics within the requirements of Type 1 accuracy in accordance with AS1259, and has the capability to measure steady, fluctuating, intermittent and/or impulsive sound, and to compute and display percentile noise levels for the measuring period. During the attended surveys the B&K 2250 instrument was used to record a continuous 1/3 octave, one-second interval time trace for a series of consecutive 1-hour measurements and stored in the instrument for detailed analysis of the acoustic environment.

A Rion Sound Level Calibrator NC-73 was used to calibrate the SLM prior to measurement and checked at the conclusion. The difference in the two measurements was less than 0.5dB.

The SLM was supported with the microphone approximately 1.5m above the ground at the monitoring locations.

The time, type, and directions of the trains were noted during the survey and the noise levels (LAeq, Lmax) for each were extracted from the 1-hour duration time trace measurements for analysis of each pass-by.

For the purpose of calibrating the noise prediction model, unattended noise monitoring was conducted at the same location as the attended measurements from the 28th September to 5th October 2007. Instrumentation consisted of an ARL noise logger, located approximately 18.5m southeast of the track centreline (Serial Number 194657). The logger was programmed to accumulate environmental noise data continuously over sampling periods of fifteen (3) minutes duration for the entire monitoring period. The internal software of each logger is then capable of calculating and storing the L_n percentile noise levels, L_{max} and L_{eq} for the chosen sampling period, which can later be retrieved for detail analysis. The logged data is not attached to this report but remains available upon request.

Due to advances in rail technology noise levels from future train movements are expected to be lower than those at present. As such, taking the current noise levels takes a conservative approach to predicting the impact from train movements on the site.

4. CRITERIA

4.1 TRAFFIC NOISE

Relevant criteria are set out in the ECRTN. An extract of Table 2 of the ECRTN is presented in Table 4-1 below.

Table 4-1: Road traffic noise criteria for sensitive land uses

Type of development	Day (7am-10pm)	Night (10pm-7am)
2. New residential land use developments affected by freeway/arterial traffic noise	$L_{eq,15hrs}$ 55dB(A)	$L_{eq,9hrs}$ 50dB(A)
5. New residential developments affected by collector traffic noise	$L_{eq,1hr}$ 60dB(A)	$L_{eq,1hr}$ 55dB(A)

Where criteria are already exceeded, the ECRTN further advises that (where feasible and reasonable) existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Location, internal layouts, building materials and construction should be chosen so as to minimize noise impacts.

The ECRTN defines road categories as follows:

- **Freeway/arterial** includes sub-arterial roads and refers to road 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. This definition applies to **T.C. Frith Avenue**.

- **Collector road** refers to a road situated in a built-up area that collects local traffic leaving a locality and connects to a sub-arterial road. This definition applies to **Main Road and Munibung Road**.

4.2 MIXED-USE DEVELOPMENT NOISE EMISSIONS

The procedures detailed in the DECC Industrial Noise Policy (INP) have been followed to determine the limit of allowable noise emission from the mixed-use development area of the PCCS site. The assessment procedure has two requirements that must be met, namely:

- that the noise source not be 'intrusive'; and
- that the 'amenity' of the nearby land be preserved.

This policy sets out two separate noise criteria designed to ensure developments meet environmental noise objectives (See Table 4.2-1). The first criterion accounts for intrusive noise and the second criterion applies to protection of amenity of particular land uses. The new development is assessed for both criteria, with the more stringent of the two criteria adopted as the project specific noise levels. This ensures that intrusive noise is limited and the amenity is protected.

Site noise at the nearest residential receivers should not exceed the **Project Specific Level** criteria detailed in Table 4-2.

Table 4-2: Amenity Criteria, Intrusiveness Criteria and Project Specific Noise Levels at Noise Sensitive Receiver

All Values in dB(A)

Location	Period	Existing L_{Aeq}	Existing RBL	Recommended Acceptable L_{Aeq}[2]	Amenity Criteria Level	Intrusiveness Criteria Level	Project Specific Level
Residences in suburban area – Master Plan Development	Day	57.0	44.5	55	55.0	49.5	**49.5**
	Evening	47.0	43.0	45	45.0	48.0	**45**
	Night	48.0	40.0	40	40.0	45.0	**40**
Residences in suburban area – Boolaroo	Day	52.0	38.5	55	55.0	43.5	**43.5**
	Evening	51.0	38.0	45	45.0	43.0	**43**
	Night	46.5	38.0	40	40.0	43.0	**40**
Commercial	When in use	-	-	65	65	-	**65**
Industrial	When in use	-	-	70	70	-	**75**

4.3 SLEEP DISTURBANCE CRITERIA

Noise associated with the proposed development between the hours of 10pm and 7am should be assessed to gauge any potential to disturb neighbouring residents' sleep. Section 19 of the ENCM provides guidelines to prevent sleep disturbance in residences. This is also supported by DECC's 'Guideline for Local Governments'. The ENCM states:

> "*the L_{A1} level of any specific noise source should not exceed the background noise level by more than 15dB when measured outside the bedroom window.*"

Hence the noise limits in Table 4-3 should not be exceeded outside the affected receivers bedroom window:

Table 4-3: Noise Criteria for Sleep Disturbance

Location of Receiver	Limits of L_1 noise levels dB(A)
Residential – Master Plan Development	55.0
Residential – Boolaroo	53.0

[2] Recommended Acceptable L_{Aeq} noise level for residence in suburban areas from Table 2.1 in DECC Industrial Noise Policy

4.4 RAIL NOISE

4.4.1 Residential Buildings

External Noise Criteria

Under Chapter 163 of the DECC's ENCM, noise criteria for residential receivers are specified as a $L_{Aeq,\ 24\ hours}$ and as a maximum pass-by level, neither of which should be exceeded.

Table 4-4: External Rail Noise Criteria

Planning Level	Maximum Level
$L_{Aeq,\ 24\ hours}$ = 55dB(A)	$L_{Aeq,\ 24\ hours}$ = 60dB(A)
L_{Amax} = 80dB(A)	L_{Amax} = 85dB(A)

The above figures refer to external noise levels only.

Internal Noise Criteria

In assessing rail induced noise potential impacts on to the proposed development, the following guideline will be adhered to:

Rail Infrastructure Corporation and State Rail Authority NSW Interim Guidelines *'Consideration of Rail Noise and Vibration in the Planning Process' (November 2003).*

The guideline states that new residential buildings are to be designed to comply with criteria shown in Table 4-5 for habitable areas with the windows closed. If noise levels with windows or doors closed exceed the criteria by more than 10dB(A), the design of the ventilation system for these rooms should be such that occupants can leave windows closed, if they so desire.

Table 4-5: Internal Noise Level Criteria

Internal Space	Time Period	Railway Noise Level L_{Aeq} (1hr)
Living and sleeping areas	Day (7am to 10pm)	40dB(A)
	Night (10pm to 7am)	35dB(A)

4.4.2 Industrial & Commercial Buildings

The RIC guidelines do not provide set noise criteria for non-residential developments subject to rail noise. However, they refer to AS2107:2000 *Recommended design sound levels and reverberation times in building interiors* to assist in determining relevant noise targets.

AS/NZS 2107:2000 outlines acceptable internal noise levels such that a satisfactory acoustic environment within occupied spaces in new and existing buildings can be achieved. Typically, the recommended internal noise level L_{Aeq} for fully fitted out spaces in commercial and industrial buildings should meet the criteria presented in Table 4-6 below.

Table 4-6: Recommended Design Sound Levels for Different Areas of Occupancy in Non-Residential Buildings

Type of occupancy/activity	Recommended design sound level, L_{Aeq} in dB(A)
Industrial Buildings	
Assembly lines –	
Light machinery	55-70
Packaging and delivery	55-60
Control Rooms	50-60
Foremen's offices	45-50
Industrial processing or manufacturing	Compliant with OH&S noise requirements
Laboratories or test areas	40-50
Lunch rooms	40-55
Precision assemblies	40-50
Sick bays	40-50
Office Buildings	
Board and conference rooms	30-40
Cafeterias	45-50
Call centres	40-45
Computer rooms	45-50
Corridors and lobbies	45-50
Design offices	40-45
Draughting offices	40-50
General office areas	40-45
Private offices	35-40
Public spaces	40-50
Reception areas	40-45
Rest rooms and tea rooms	40-45
Toilets	50-55
Undercover carparks	55-65

5. TRAFFIC AND RAIL NOISE MODELLING

5.1 MODELLING SOFTWARE

Traffic noise single point calculations and colour noise contour maps were produced using the DECC approved SoundPLAN computer modelling software.

Braunstein & Berndt International developed SoundPLAN computer modelling software a leading firm of transportation and environmental engineers in Germany. The software is used worldwide by over 600 companies and is one of the leading software products available for road, rail and industry noise prediction. Version 6.4 was used in this assessment.

5.2 GEOGRAPHICAL DATA

Paclib Management supplied topographical details of the area in 3-dimensional DXF format.

5.3 TRAFFIC DATA

Traffic volumes used to predict traffic noise have been determined according to the road configurations indicated for Stage 3 (Year 2010) of the road development plans for the area. Details of the staged approach to the road development plans are contained in two Traffic Impact Assessment Reports issued by Traffix - traffic and transport planners, dated October 2005, and January 2006.

The only AADT traffic count available was for a position on Lake Rd (MR217), which is north of the train line. All other traffic volumes are derived from this AADT. AM and PM peak hour turning movements at intersection were used to calculate the traffic volumes on roads other than Lake Rd.

There is potentially some error in using the AM and PM peak hour turning movements as they may not exactly represent AADT traffic flows. This is especially the case for traffic volumes for the future Main Rd and future Frith Ave section south for the intersection with Main Rd. For these roads two multiplying factors have been applied to the Lake Rd AADT traffic volume to obtain traffic volumes (one multiplying factor for each intersection).

5.4 NOISE BARRIER AND RECEIVER POSITIONS

Based on Master Plan drawings (05055 SD 06e masterplan.dwg and 05055 Master plan Op5b.pdf) provided by Paclib Management indicating proposed future roads, the following distances from the road centre line were used:

- Noise Barriers – 10m from road centre line (Positioned to be on the lot boundary).
- Receivers – 18m from road centre line (Positioned to be at the façade of the closest future residences).

Barrier and receiver base heights are set at the current terrain height. Future changes to the current terrain to will change the barrier and receiver heights and may affect results to some degree.

The required acoustic barrier to achieve the noise criteria at all lots exceeds 8m in some locations. It is expected that this barrier is excessive. A barrier height of 2m is expected to be the maximum allowed and hence has been modelled in the noise contour maps.

The barrier runs were designed using the $L_{Aeq(15hr)}$ criteria for the Frith Road receivers and the Munibung Road receivers. The $L_{Aeq(1hr\ max\ DAY)}$ criteria was used for Main Road except within about 140m of Frith Ave where Frith Avenue is the dominant noise source.

Traffic volumes were extrapolated to the **Year 2017** resulting in the AADT figures shown in Table 5-1.

Table 5-1: 2017 AADT Volumes used for noise modelling

	2017 AADT
Lake Rd	31202
New Road (Munibung Rd)	12481
Frith Nth of Main	40563
Main	10952
Frith Sth of Main	29611

5.5 TRAFFIC NOISE MODEL CALIBRATION

The Calculation of Road Traffic Noise (CoRTN) method of traffic noise prediction was used which the DECC approves. The CoRTN method accommodates the following factors affecting traffic noise.

- Posted Speed (70km/h for Frith Avenue, 60km/h for all other roads);
- Heavy vehicle traffic (input as percentage heavy vehicles)
- Pavement surface;
- Gradient of roadway;
- Topographic features;
- Receiver/source distance and heights;
- Intervening ground cover;
- Roadside or topographic noise barriers;
- Reflections from buildings or roadside barriers, including multiple reflections;
- Contributed noise from other traffic sources likely to influence the overall noise environment;
- Facade reflections.

The noise model was calibrated with the logging data – the predicted $L_{10,18hrs}$ was compared with the $L_{10,18hrs}$ calculated from logging data, and a calibration constant was determined. Separate calibration constants were determined for all roads. Table 5-2 shows the measured and predicted $L_{10,18hrs}$ values used to calculate the calibration constants.

Table 5-2: Model calibration – dB(A)

	Frith Ave	Main Rd
Predicted $L_{A10,18hrs}$	63.7	59.8
Logging (measured) $L_{A10(18hr)}$	66.1	58.5
Difference	**-2.4**	**1.3**

Normally the acceptable difference between measured and predicted values is 2dB(A). In this case the exact AADT values for each road was not known, and a greater difference could be expected.

Traffic numbers were derived from the AADT of Lake Road. This traffic was distributed between Main Road and Frith Avenue based on proportions of traffic shown on turning movement diagrams for the peak 5hr periods. Thus the increased variation between measured and predicted values is likely due to traffic volume estimation process.

The differences were added to the road sources for Frith Avenue and Main Road respectively to calibrate the L_{10} prediction with the measured L_{10}.

The CoRTN method predicts the $L_{A10,18hrs}$ statistics. To determine the other required noise parameters logging data was used to calculate differences between noise parameters.

5.6 NOISE PARAMETER CONVERSION

The CoRTN method predicts the $L_{A10,18hrs}$ statistics. To determine the other required noise parameters logging data was used to calculate differences between noise parameters.

Correction factors are presented in Table 5-3 below.

Table 5-3: Parameters Calibration – dB(A)

	Frith Ave		Main Rd	
	Measured	**Difference with L_{10}**	**Measured**	**Difference with L_{10}**
L_{10}	66.1	0	58.5	0.0
$L_{Aeq,15hrs}$	62.9	-3.2	55.7	-2.8
$L_{Aeq,9hrs}$	61.4	-4.7	52.2	-6.3
$L_{Aeq,1hrmax}$ - Day	64.4	-1.7	56.8	-1.7
$L_{Aeq,1hrmax}$ - Night	64.5	-1.6	54.7	-3.8

The total noise source adjustment in the model to predict noise parameters, which includes the model calibration and the noise parameter conversion, is shown in Table 5-4 below.

Table 5-4: Summary of modelling adjustments – dB(A)

	Frith Ave			Main Rd			New Road (Munibung Rd)		
Parameter	**Model Cal**	**Parameter Cal**	**Total**	**Model Cal**	**Parameter Cal**	**Total**	**Model Cal**	**Parameter Cal**	**Total**
$L_{Aeq,15hrs}$	2.4	-3.2	-0.8	-1.3	-2.8	-4.1	0	-2.8	-2.8
$L_{Aeq,9hrs}$	2.4	-4.7	-2.3	-1.3	-6.3	-7.6	0	-6.3	-6.3
$L_{Aeq,1hrmax}$ - Day	2.4	-1.7	0.7	-1.3	-1.7	-3	0	-1.7	-1.7
$L_{Aeq,1hrmax}$ - Night	2.4	-1.6	0.8	-1.3	-3.8	-5.1	0	-3.8	-3.8

5.7 RAIL NOISE

The rail noise logger data was used to calibrate the noise model based upon 2 descriptors, the LAeq and the LAmax.

The highest 15 LAeq events were averaged energetically whereas the top 15 LAmax events were averaged arithmetically. This validation was based upon advice from rail authorities.

The Nordic Rail Prediction method (Kilde Rep.130) was used within the SoundPLAN program. SoundPLAN was used to predict the LAmax. The LAmax should be used in accordance with AS2021:2000 to determine the attenuation required through building construction.

Attended and unattended noise monitoring was conducted approximately 18.5m from the train line in order to capture noise from train passbys.

Noise measurements captured passenger, freight and coal trains passing by the site.

An average maximum sound power level of 80.2 dB(A) was calculated from the 15 highest noise measurements. This is considered a conservative approach and suitable for assessment purposes. An Average LAeq of 67.85 dB(A) was calibrated from the highest 15 noise measurements. This is expected to be a conservative approach.

6. RESULTS

6.1 NOISE CONTOUR MAPS

The following noise contour maps are presented in Appendix B:

- Year 2017 LAeq, (15hr)– no barriers;
- Year 2017 LAeq, (9hr)– no barriers;
- Year 2017 LAeq, (15hr) – 2m High Acoustic Barriers;
- Year 2017 LAeq, (9hr) – 2m High Acoustic Barriers;
- Year 2007 LAeq, (24hour) – no mitigation;
- Year 2007 LAmax, (24hour)– no mitigation.

Note that all noise contour maps show free-field noise levels. The criteria stated are for noise levels predicted at the façade of a building, which are 2.5dB(A) higher than free field levels. As such when comparing noise contour maps to the criteria 2.5dB(A) should be added to the noise level indicated on the noise contour map.

The train noise LAmax and LAeq were calculated by averaging the highest 15 train passby

6.2 TRAFFIC NOISE DISCUSSION

The model has been formulated using the following barrier heights:

- T.C. Frith Avenue: 2m high;
- Main Road: 2m high;
- Munibung Road 2m high;
- Lake Road 2m high.

To achieve the noise criteria using barrier mitigation alone, an 8m high barrier would be required on Frith Avenue, which is obviously unrealistic. Therefore, other measures need to be considered in combination with noise barriers to achieve a realistic solution. The criteria can be achieved by the considering the following:

- Façade design, which involves special glazing, roof/ceiling soundproofing and selection of particular construction materials. As facade design requires the building dimensions and layouts to be known, the extent of architectural implementations cannot be determined at this early stage. This would involve the placement of construction covenant on some lots, assessed individually ad DA stage;
- Judicious design of building layouts so as not to expose sensitive spaces to traffic noise. This provides buffering within the building and helps optimising the use of the site;

In light of the above points, an acoustic report should accompany Development Applications for residential dwellings in the proposed subdivision, including assessment and recommendation of appropriate acoustic measures incorporated into the respective designs.

6.3 PROJECT SPECIFIC NOISE LEVELS

The following is a summary of the project specific noise levels associated with The PCCS Masterplan development and the residential community of Boolaroo.

Table 6-1: Project Specific Noise Levels at Noise Sensitive Receivers

Location	Period	Project Specific Level L_{Aeq}
Residences in suburban area – Master Plan Development	Day	**49.5**
	Evening	**45**
	Night	**40**
Residences in suburban area – Boolaroo	Day	**43.5**
	Evening	**43**
	Night	**40**
Commercial	When in use	**65**
Industrial	When in use	**70**

7. CONCLUSION AND RECOMENDATIONS

An assessment of traffic and rail noise impacting on the Pasminco Cockle Creek Development Masterplan site has been conducted.

Conclusions are as follows:

- Traffic noise levels along Frith Avenue substantially exceed the relevant criteria. A noise wall enabling compliance with the criteria would be as high as 8m depending on the location of the nearest dwellings. As this is unrealistic, additional mitigation options will need to be investigated when designing the subdivision and dwellings layouts. This would involve creation of a buffer zone along Frith Avenue, the construction of a mound and/or 2metre high noise barrier, and building design and landscaping measures, all of which will assist in minimising the noise impact on the most affected dwellings.

- Traffic noise levels along Main and Munibung Road exceed the relevant criteria. The analysis indicates that a 2m high noise wall constructed along the road corridors adjacent to residential lots will enable compliance with the criteria. This is reasonable and common for residential areas.

The assessment highlights that future traffic noise levels are predicted to exceed the noise criteria on parts of the proposed development site. We believe that residential development on those affected lots is acceptable, provided that satisfactory internal noise levels are achieved within the exposed dwellings. This implies façade treatments (eg. glazing, ceiling, wall insulation etc), which are normally determined from the requirements and procedures of *AS2107:2000 Recommended sound levels and reverberation times for building interiors* and *AS3671:1989 Road traffic noise intrusion – Building siting and construction*.

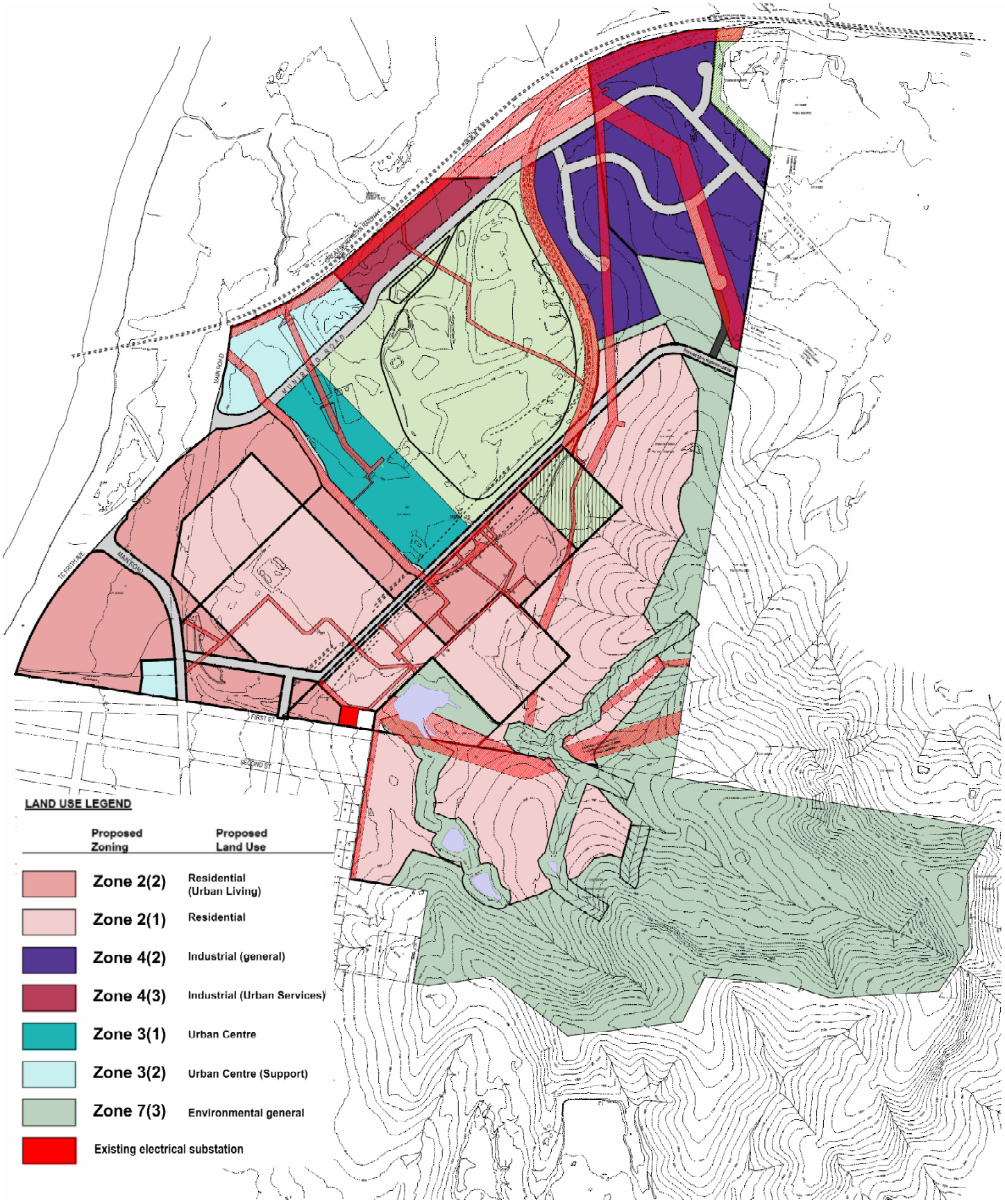
The extent of façade treatment is essentially depending on the glazing area/floor area ratio in each room of the dwelling, which has not been determined at this early stage. However, given the traffic noise levels outlined in this report and the latest amendments to the site layout, we do not believe that any façade treatment will be unrealistic or cost prohibitive. Pending on design details, it is our expectation that, in the worst-case, glazing would be 6.38mm to 10.38mm laminated glass, which is commonly used in residential estates.

An acoustic report should accompany Development Applications for residential dwellings in the proposed subdivision, including assessment and recommendation of appropriate acoustic measures incorporated into the respective designs.

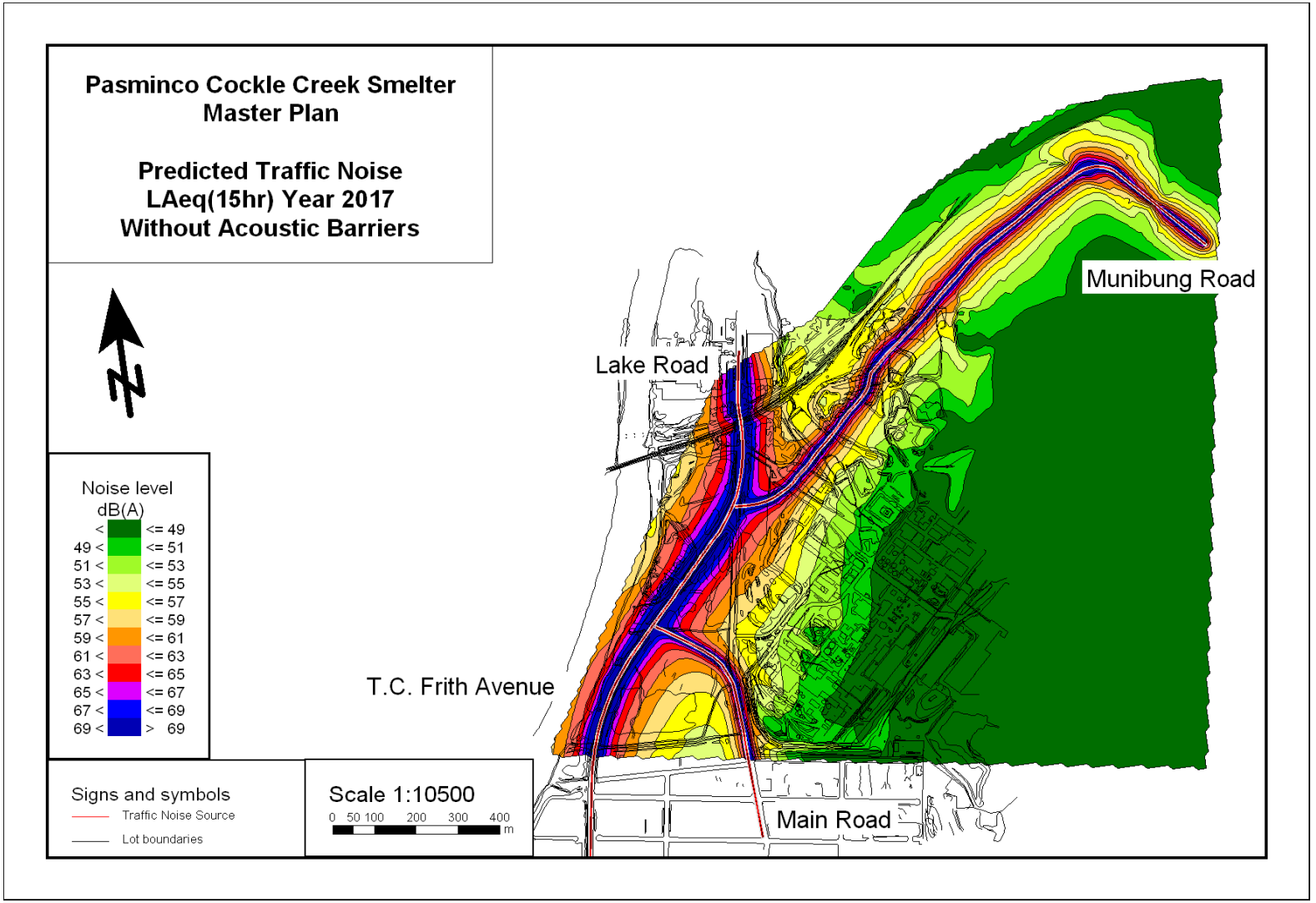
Noise impact from any commercial and industrial activities on the proposed Development Master Plan site should be assessed as detailed in sections 4.2 and 4.3 of this report.

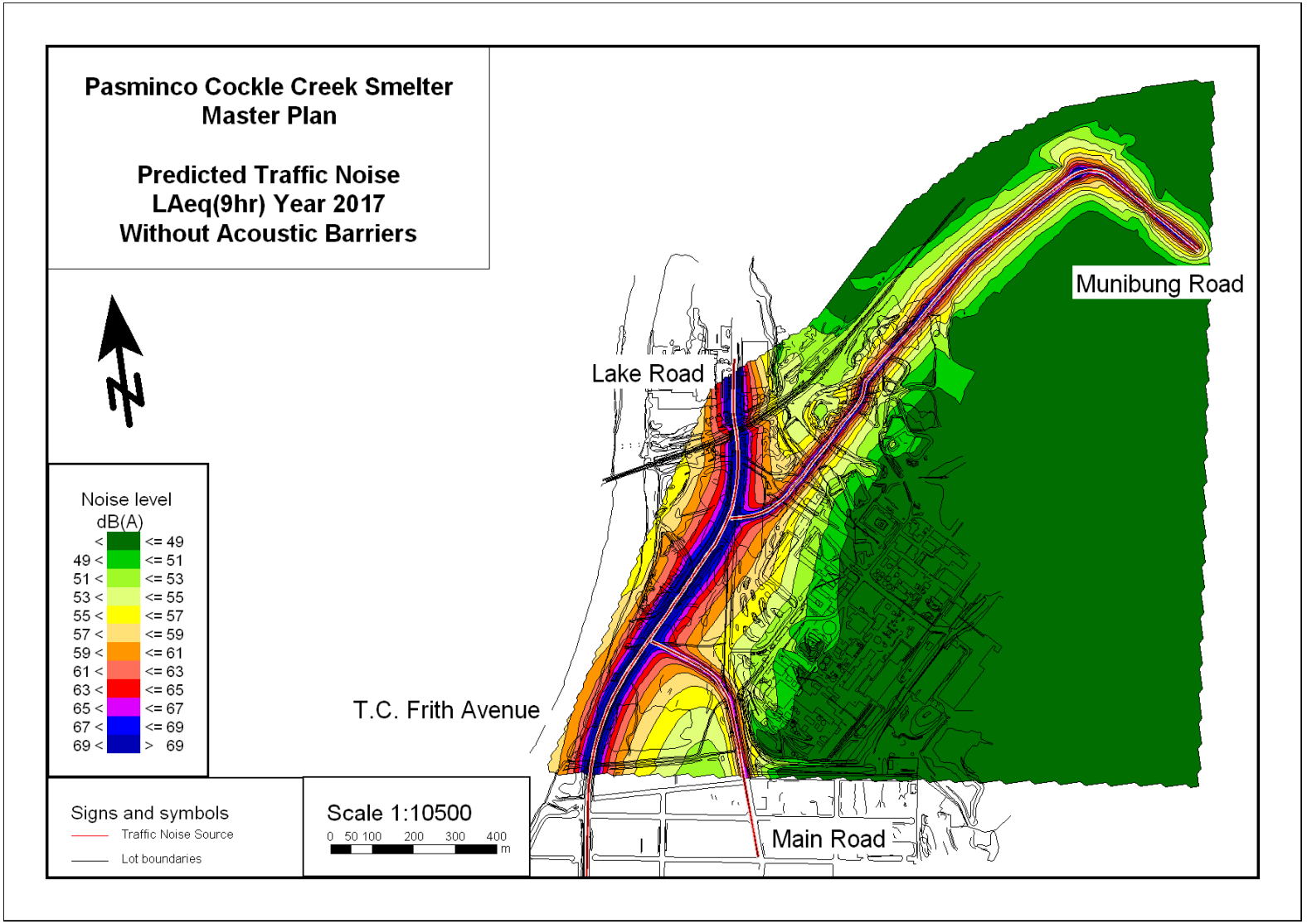
In conclusion it is our opinion that development of a residential area on the subject land is possible provided the recommendations outlined in this report are implemented. This particularly includes façade treatment of the dwellings most affected by traffic noise and installation of 2metre high barriers adjacent to selected roadways.

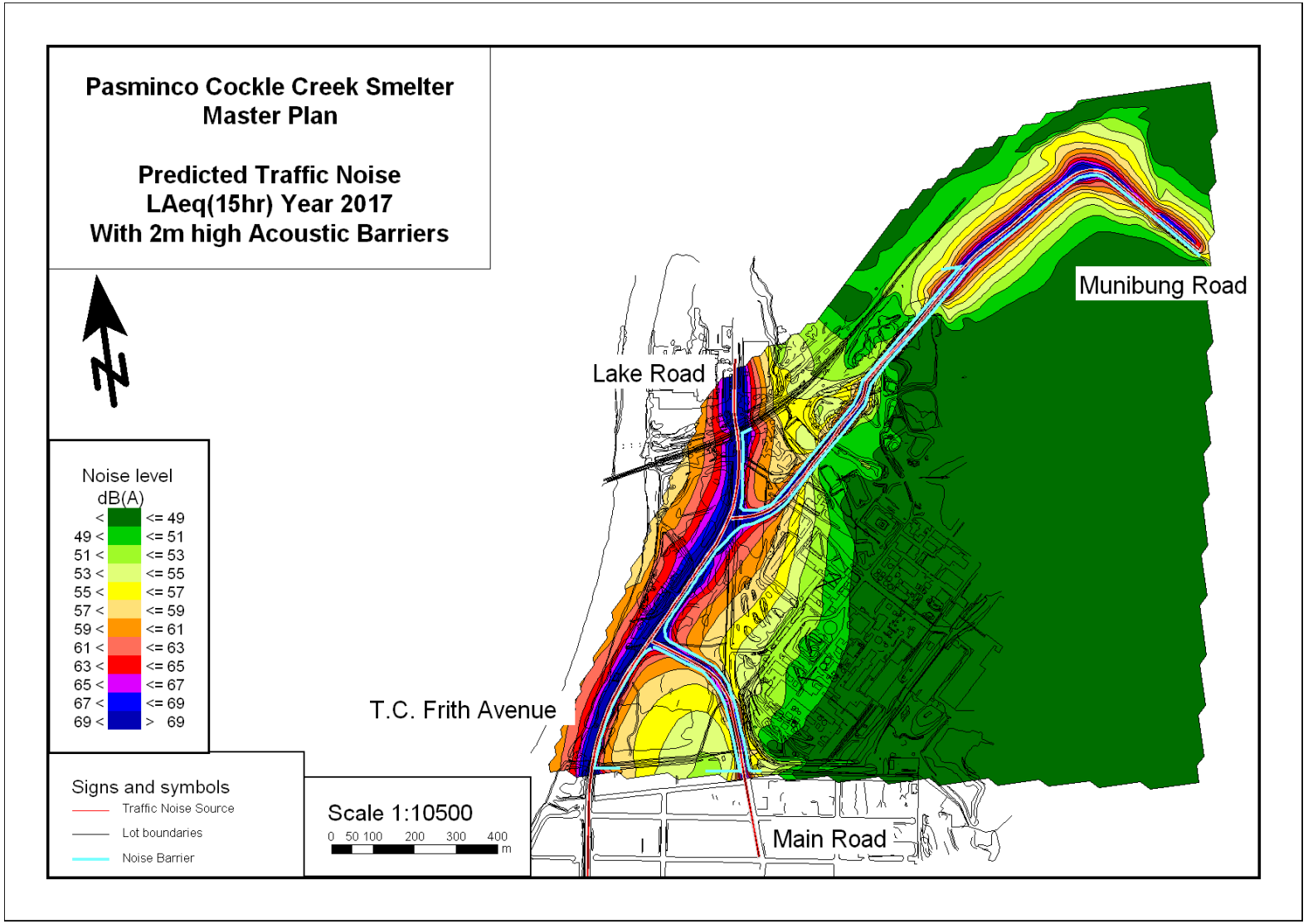
APPENDIX A – PROPOSED ZONING

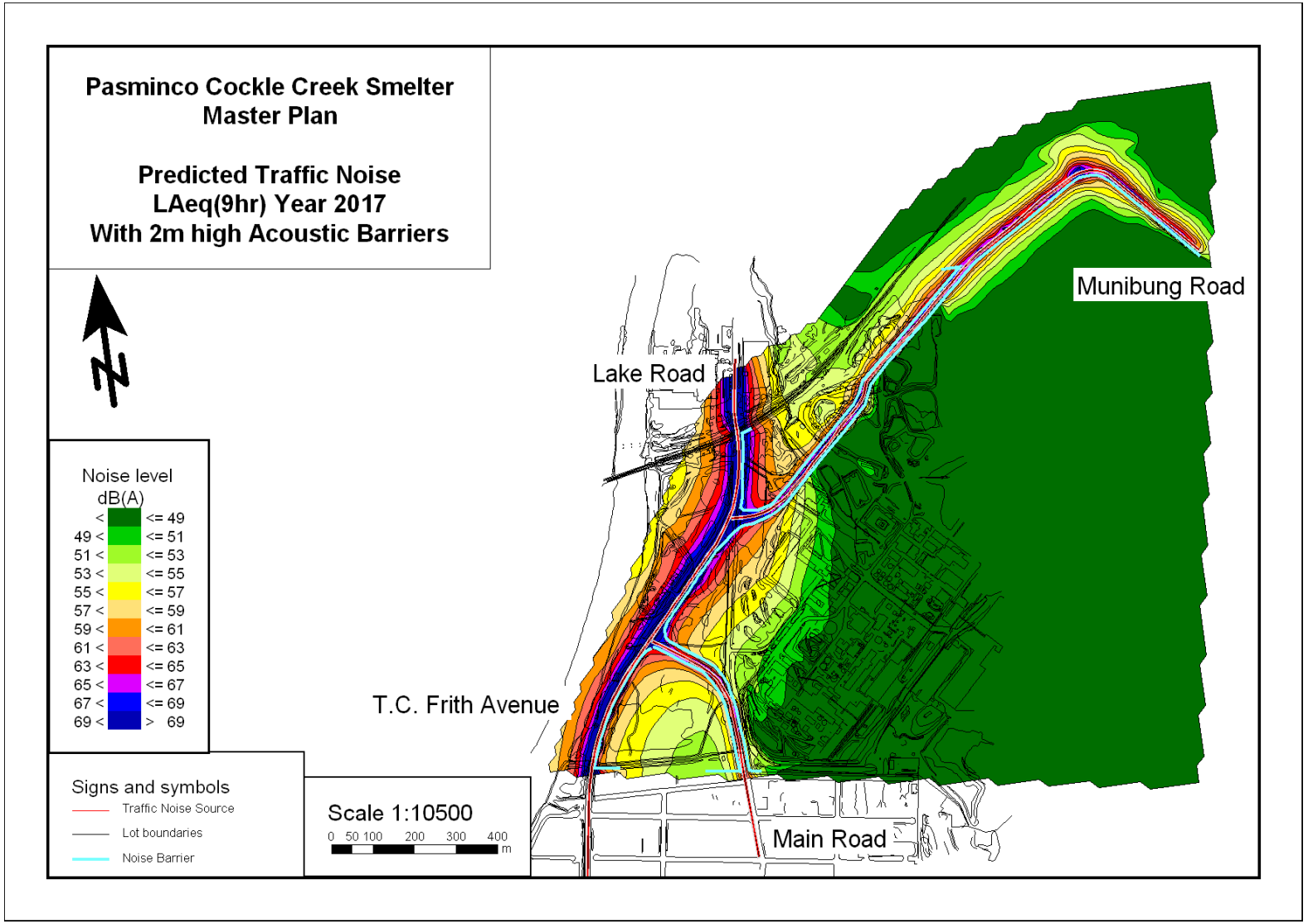


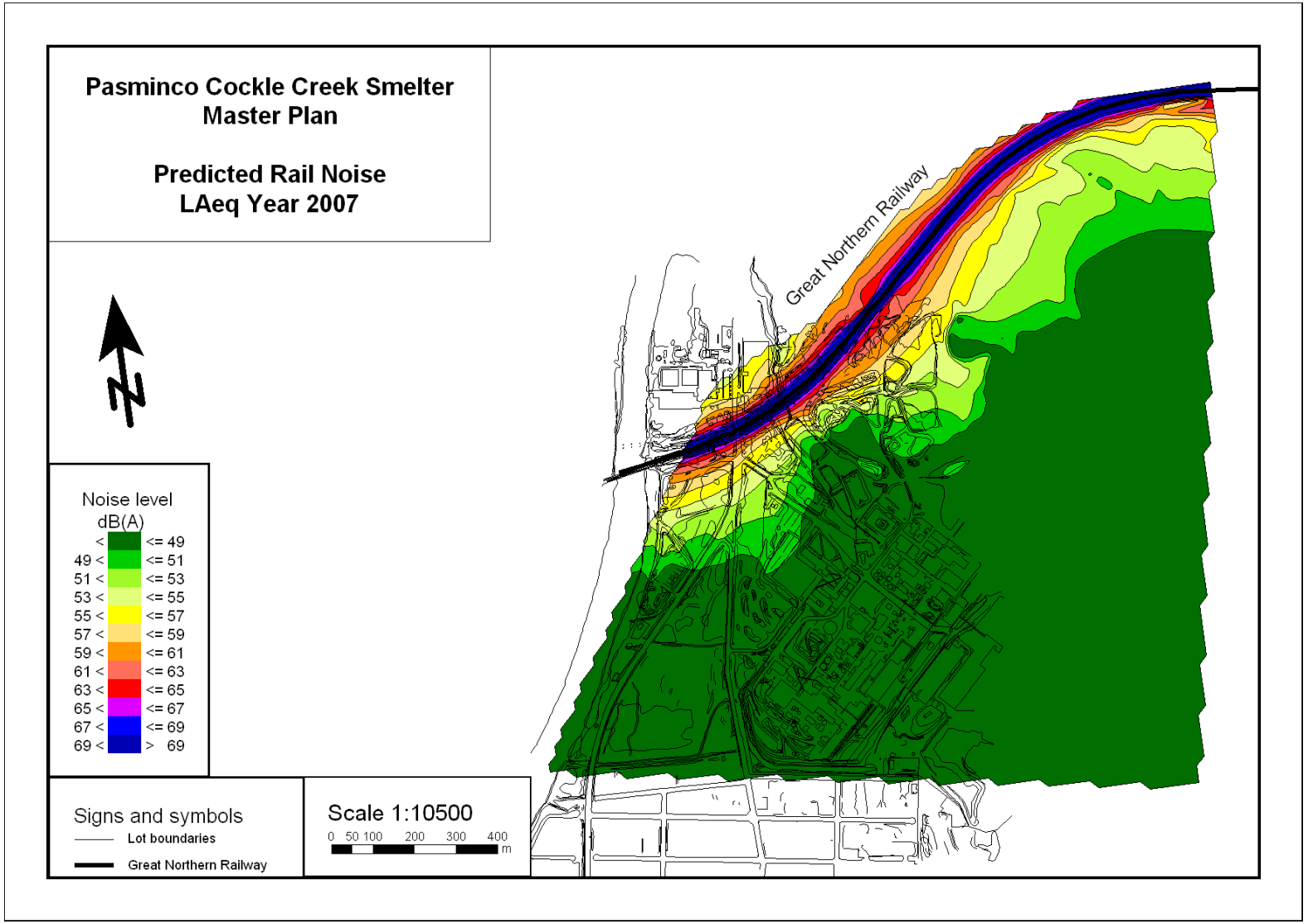
APPENDIX B – NOISE CONTOUR MAPS

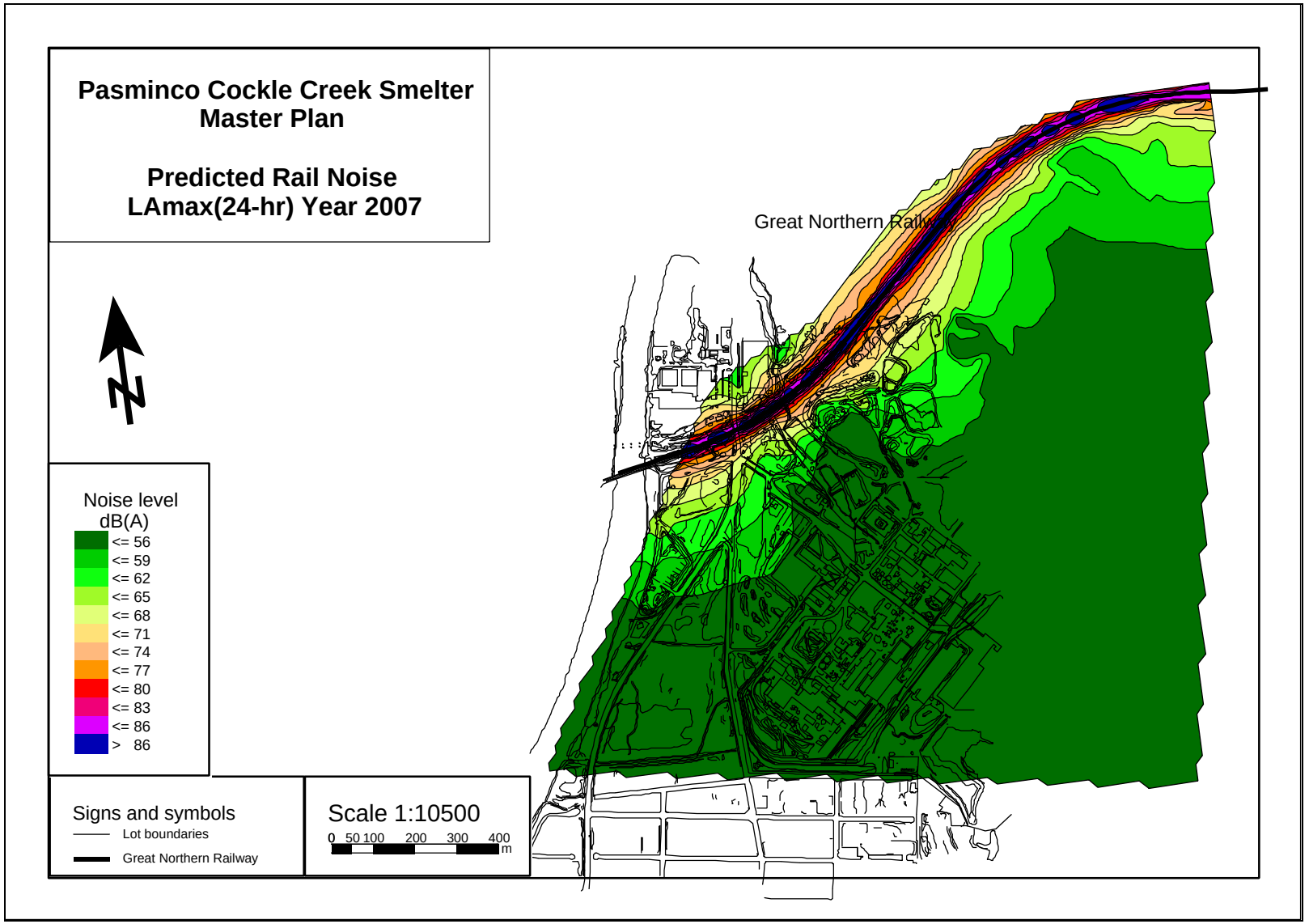

Pasminco Cockle Creek Smelter
Master Plan
Predicted Traffic Noise
LAeq(15hr) Year 2017
Without Acoustic Barriers
N
Noise level
dB(A)
< <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < > 69
Signs and symbols
Traffic Noise Source
Lot boundaries
Scale 1:10500
0 50 100 200 300 400 m
Munibung Road
Lake Road
T.C. Frith Avenue
Main Road


Pasminco Cockle Creek Smelter
Master Plan
Predicted Traffic Noise
LAeq(9hr) Year 2017
Without Acoustic Barriers
N
Noise level
dB(A)
< <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < > 69
Signs and symbols
Traffic Noise Source
Lot boundaries
Scale 1:10500
0 50 100 200 300 400 m
Munibung Road
Lake Road
T.C. Frith Avenue
Main Road


Pasminco Cockle Creek Smelter
Master Plan
Predicted Traffic Noise
LAeq(15hr) Year 2017
With 2m high Acoustic Barriers
N
Noise level
dB(A)
< <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < > 69
Signs and symbols
Traffic Noise Source
Lot boundaries
Noise Barrier
Scale 1:10500
0 50 100 200 300 400 m
Munibung Road
Lake Road
T.C. Frith Avenue
Main Road


Pasminco Cockle Creek Smelter
Master Plan
Predicted Traffic Noise
LAeq(9hr) Year 2017
With 2m high Acoustic Barriers
N
Noise level
dB(A)
< <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < > 69
Signs and symbols
Traffic Noise Source
Lot boundaries
Noise Barrier
Scale 1:10500
0 50 100 200 300 400 m
Munibung Road
Lake Road
T.C. Frith Avenue
Main Road


Pasminco Cockle Creek Smelter
Master Plan
Predicted Rail Noise
LAeq Year 2007
Great Northern Railway
N
Noise level
dB(A)
< <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < > 69
Signs and symbols
Lot boundaries
Great Northern Railway
Scale 1:10500
0 50 100 200 300 400
m


Pasminco Cockle Creek Smelter
Master Plan
Predicted Rail Noise
LAmax(24-hr) Year 2007
Great Northern Railway
N
Noise level
dB(A)
<= 56
<= 59
<= 62
<= 65
<= 68
<= 71
<= 74
<= 77
<= 80
<= 83
<= 86
> 86
Signs and symbols
Lot boundaries
Great Northern Railway
Scale 1:10500
0 50 100 200 300 400
m