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## **APPENDIX 5**

# **ACOUSTIC REPORT**

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# **EAST BALDIVIS DISTRICT STRUCTURE PLAN**

## **ACOUSTIC ASSESSMENT**

For

**RPS GROUP**

**DECEMBER 2009**

**OUR REFERENCE: 11350-2-09128**

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**ACOUSTIC ASSESSMENT**  
**EAST BALDIVIS STRUCTURE PLAN**

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## **EXECUTIVE SUMMARY**

RPS Group commissioned Herring Storer Acoustics to carry out a road traffic noise assessment for the proposed residential areas associated from the East Baldivis Structure Plan.

The purpose of this study was to assess noise received at future residences within the subdivision from vehicles travelling on the surrounding road network and where applicable, comment on possible noise attenuation measures that could control noise intrusion to acceptable levels. The traffic noise assessment has been carried out in accordance with the new WAPC State Planning Policy 5.4 *"Road and Rail Transportation Noise and Freight Consideration in Land Use Planning"*.

We note that under the Planning Policy, the appropriate acoustic criteria would be the "Noise Limits". Thus the acoustic criteria would be :

### **External**

Day	Maximum of 60 dB(A) $L_{Aeq}$
Night	Maximum of 55 dB(A) $L_{Aeq}$
Outdoor Living Areas	Maximum of 50 dB(A) $L_{Aeq}$

### **Internal**

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

The noise modelling indicates that without any noise amelioration, noise received at the residence from vehicles travelling along neighbouring roads would exceed the acoustic criteria. From current noise monitoring, for residence located adjacent to the Kwinana Freeway, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be less than 5 dB(A) and the night period is the critical period for compliance. However, for other residence located adjacent to the other major roads, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be greater than 5 dB(A) and the day period is the critical period for compliance.

Initial noise modelling indicates that for residence located adjacent to the Kwinana Freeway, compliance with the "Noise Limits" could be achievable with a 2.4m high barrier (either wall, earth bund or combination of both) constructed along the boundary of the road reserve. However, the height of the barrier is approximate only and would be depend on the final ground level within the development, and this should be determined as part of the local structure planning. For residences adjacent to the other roads, the use of "Quiet House" design is recommended.

Modelling has also included the ultimate development of Mundijong Road flyover of Baldivis Road. It is noted that such a modification to Mundijong Road would be considered as a major modification and under the Policy the infrastructure provider would need to achieve compliance with the "Noise Limits" at the ground floor of any residence. However, in this instance, given the elevation of the ultimate flyover compared to that of the residence, it is recommended that for future residence affected by the modification, that "Quiet House" design be used to achieve compliance with the internal acoustic criteria for the ultimate design; and the residence be designed such that the residence themselves can protect an outdoor living area, so that compliance with the acoustic criteria for an outdoor living area can be achieved.

Even with the inclusion of noise amelioration, under the planning policy for residences located adjacent to the Kwinana Freeway, Mundijong and Baldivis Roads, should be designed to comply with the internal noise criteria as outlined above. Outdoor entertainment areas should be designed or located such that they comply with an  $L_{Aeq(night)}$  noise level of 50 dB(A) by the implementation of "Quiet House" design. General information on "Quiet House" design is contained in Appendix E.

For the residence where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles.

## 1. INTRODUCTION

Herring Storer Acoustics was commissioned by RPS Group to undertake an acoustical assessment of noise received within the residential areas associated from the East Baldivis Structure Plan. As part of the study, the following was carried out:

- Determine by noise modelling the noise that would be received at residences within the development from vehicles travelling on the Kwinana Freeway, Mundijong and Baldivis Roads.
- Assess the predicted noise levels for compliance with the appropriate criteria.
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, a locality plan is attached in Appendix A.

## 2. SUMMARY

The results of the acoustic assessment indicate that noise received at residences located adjacent to the Kwinana Freeway, Mundijong and Baldivis Road in the year 2025 will exceed the "Noise Limits" as outlined in the Western Australian Planning Commission (WAPC) Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning". Under The SPP 5.4, the "Noise Limits" criteria which are applicable external to a residence are:

### **External**

Day	Maximum of 60 dB(A) $L_{Aeq}$
Night	Maximum of 55 dB(A) $L_{Aeq}$
Outdoor Living Areas	Maximum of 50 dB(A) $L_{Aeq}$

From current noise monitoring, for residence located adjacent to the Kwinana Freeway, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be less than 5 dB(A) and the night period is the critical period for compliance. However, for other residence located adjacent to other roads, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be greater than 5 dB(A) and the day period is the critical period for compliance.

The policy states that the outdoor criteria applies to the ground floor level only, however, it also states that noise mitigation measures should be implemented with a view to achieving the target levels in least one outdoor living area. For residential premises above the ground floor level, the Policy states the following acceptable internal noise levels:

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

Initial noise modelling indicates that for residence located adjacent to the Kwinana Freeway, compliance with the "Noise Limits" could be achievable with a 2.4m high barrier (either wall, earth bund or combination of both) constructed along the boundary of the road reserve. However, the height of the barrier is approximate only and would be depend on the final ground level within the development, and this should be determined as part of the local structure planning. For residences adjacent to the other roads, the use of "Quiet House" design is recommended.

Modelling has also included the ultimate development of Mundijong Road flyover of Baldivis Road. It is noted that such a modification to Mundijong Road would be considered as a major modification and under the Policy the infrastructure provider would need to achieve compliance with the "Noise Limits" at the ground floor of any residence. However, in this instance, given the elevation of the ultimate flyover compared to that of the residence, the following is recommended that for future residences affected by this modification:

1. "Quiet House" design be used to achieve compliance with the internal acoustic criteria for the ultimate design.
2. The residence be designed such that the residence themselves can protect an outdoor living space, so that compliance with the acoustic criteria can be achieved.

Even with the inclusion of noise amelioration, under the planning policy for residences located adjacent to the Kwinana Freeway, Mundijong and Baldivis Roads should be designed to comply with the internal noise criteria of  $L_{Aeq(Night)}$  of 35 dB(A) in a bedroom and an  $L_{Aeq(Day)}$  of 40 dB(A) in a living space. Outdoor entertainment areas should be designed or located such that they comply with an  $L_{Aeq(night)}$  noise level of 50 dB(A) by the implementation of "Quiet House" design. General information on "Quiet House" design is contained in Appendix E.

For the residence where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles.

Note: The noise amelioration is normally only required to the first row of residences, as these houses provide an adequate barrier between the road and the other residences.

### 3. CRITERIA

#### 3.1 STATE PLANNING POLICY 5.4

The Western Australian Planning Commission (WAPC) released on 22 September 2009 State Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations In Land Use Planning". Section 5.3 – Noise Criteria, which outlines the acoustic criteria, states:

##### "5.3 - NOISE CRITERIA

*Table 1 sets out the outdoor noise criteria that apply to proposals for new noise-sensitive development or new major roads and railways assessed under this policy.*

*These criteria do not apply to—*

- *proposals for redevelopment of existing major roads or railways, which are dealt with by a separate approach as described in section 5.4.1; and*
- *proposals for new freight handling facilities, for which a separate approach is described in section 5.4.2.*



The outdoor noise criteria set out in Table 1 apply to the emission of road and rail transport noise as received at a noise-sensitive land use. These noise levels apply at the following locations—

- for new road or rail infrastructure proposals, at 1 m from the most exposed, habitable façade of the building receiving the noise, at ground floor level only; and
- for new noise-sensitive development proposals, at 1 m from the most exposed, habitable façade of the proposed building, at each floor level, and within at least one outdoor living area on each residential lot.

Further information is provided in the guidelines.

**Table 1: Outdoor Noise Criteria**

Time of day	Noise Target	Noise Limit
Day (6 am–10 pm)	$L_{Aeq(Day)} = 55 \text{ dB(A)}$	$L_{Aeq(Day)} = 60 \text{ dB(A)}$
Night (10 pm–6 am)	$L_{Aeq(Night)} = 50 \text{ dB(A)}$	$L_{Aeq(Night)} = 55 \text{ dB(A)}$

The 5 dB difference between the outdoor noise target and the outdoor noise limit, as prescribed in Table 1, represents an acceptable margin for compliance. In most situations in which either the noise-sensitive land use or the major road or railway already exists, it should be practicable to achieve outdoor noise levels within this acceptable margin. In relation to greenfield sites, however, there is an expectation that the design of the proposal will be consistent with the target ultimately being achieved.

Because the range of noise amelioration measures available for implementation is dependent upon the type of proposal being considered, the application of the noise criteria will vary slightly for each different type. Policy interpretation of the criteria for each type of proposal is outlined in sections 5.3.1 and 5.3.2.

The noise criteria were developed after consideration of road and rail transport noise criteria in Australia and overseas, and after a series of case studies to assess whether the levels were practicable. The noise criteria take into account the considerable body of research into the effects of noise on humans, particularly community annoyance, sleep disturbance, long-term effects on cardiovascular health, effects on children's learning performance, and impacts on vulnerable groups such as children and the elderly. Reference is made to the World Health Organization (WHO) recommendations for noise policies in their publications on community noise and the Night Noise Guidelines for Europe. See the policy guidelines for suggested further reading.

#### 5.3.1 Interpretation and application for noise-sensitive development proposals

In the application of these outdoor noise criteria to new noise-sensitive developments, the objective of this policy is to achieve –

- acceptable indoor noise levels in noise-sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and
- a reasonable degree of acoustic amenity in at least one outdoor living area on each residential lot<sup>1</sup>.

<sup>1</sup> For non residential noise-sensitive developments, (e.g. schools and child care centres) consideration should be given to providing a suitable outdoor area that achieves the noise target, where this is appropriate to the type of use.

*If a noise-sensitive development takes place in an area where outdoor noise levels will meet the noise target, no further measures are required under this policy.*

*In areas where the noise target is likely to be exceeded, but noise levels are likely to be within the 5dB margin, mitigation measures should be implemented by the developer with a view to achieving the target levels in at least one outdoor living area on each residential lot<sup>1</sup>. Where indoor spaces are planned to be facing any outdoor area in the margin, noise mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces. In this case, compliance with this policy can be achieved for residential buildings through implementation of the deemed-to-comply measures detailed in the guidelines.*

*In areas where the outdoor noise limit is likely to be exceeded (i.e. above  $L_{Aeq(Day)}$  of 60 dB(A) or  $L_{Aeq(Night)}$  of 55 dB(A)), a detailed noise assessment in accordance with the guidelines should be undertaken by the developer. Customised noise mitigation measures should be implemented with a view to achieving the noise target in at least one outdoor living or recreation area on each noise-sensitive lot or, if this is not practicable, within the margin. Where indoor spaces will face outdoor areas that are above the noise limit, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces, as specified in the following paragraphs.*

*For residential buildings, acceptable indoor noise levels are  $L_{Aeq(Day)}$  of 40 dB(A) in living and work areas and  $L_{Aeq(Night)}$  of 35 dB(A) in bedrooms<sup>2</sup>. For all other noise-sensitive buildings, acceptable indoor noise levels under this policy comprise noise levels that meet the recommended design sound levels in Table 1 of Australian Standard AS 2107:2000 Acoustics—Recommended design sound levels and reverberation times for building interiors.*

*These requirements also apply in the case of new noise-sensitive developments in the vicinity of a major transport corridor where there is no existing railway or major road (bearing in mind the policy's 15-20 year planning horizon). In these instances, the developer should engage in dialogue with the relevant infrastructure provider to develop a noise management plan to ascertain individual responsibilities, cost sharing arrangements and construction time frame.*

*If the policy objectives for noise-sensitive developments are not achievable, best practicable measures should be implemented, having regard to section 5.8 and the guidelines."*

The Policy, under Section 5.7, also provides the following information regarding "Notifications on Titles":

#### "5.7 - NOTIFICATION ON TITLE"

*If the measures outlined previously cannot practicably achieve the target noise levels for new noise-sensitive developments, this should be notified on the certificate of title.*

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<sup>2</sup> For residential buildings, indoor noise levels are not set for utility spaces such as bathrooms. This policy encourages effective "quiet house" design, which positions these non-sensitive spaces to shield the more sensitive spaces from transport noise (see guidelines for further information).

*Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from major road and rail corridors can be effective in warning people who are sensitive to the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need to reduce the impact of noise through sensitive design and construction of buildings and the location of outdoor living areas.*

*The notification is to ensure that prospective purchasers are advised of –*

- the potential for transport noise impacts; and*
- the potential for quiet house design requirements to minimise noise intrusion through house layout and noise insulation (see the guidelines).*

*Notification should be provided to prospective purchasers and be required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development as well as planning approval involving noise-sensitive development, where noise levels are forecast or estimated to exceed the target outdoor noise criteria, regardless of proposed noise attenuation measures. The requirement for notification as a condition of subdivision and the land area over which the notification requirement applies, should be identified in the noise management plan in accordance with the guidelines.*

*An example of a standard form of wording for notifications is presented in the guidelines.”*

### 3.2 APPROPRIATE CRITERIA

Based on the above, the following criteria is proposed for this development:

#### **External**

Day	Maximum of 60 dB(A) $L_{Aeq}$
Night	Maximum of 55 dB(A) $L_{Aeq}$
Outdoor Living Areas (Night)	Maximum of 50 dB(A) $L_{Aeq}$

#### **Internal**

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

## 4. MEASUREMENTS

As part of the initial acoustical assessment, noise modelling was based on monitoring carried out in 2005, prior to the extension of the Kwinana Freeway south of Safety Bay Road and construction of the Forrest Highway. Monitoring was carried out at the following locations and a summary of the monitoring results is listed in Table 4.1. The monitoring locations of are shown in Figure A1 in Appendix A.

Location 1	-	Adjacent to Kwinana Freeway
Location 2	-	Adjacent Mundijong (Bodman) Road

**TABLE 4.1 – SUMMARY OF 2005 MONITORING**

Location	Measured Noise Level (dB(A))		
	L <sub>10,18hour</sub>	L <sub>eq,16hour</sub>	L <sub>eq,8hour</sub>
1	58.5	56.5	51.9
2	56.3	54.7	50.0

As part of this noise assessment, additional noise monitoring was carried out in February 2011, after the extension of the Kwinana Freeway south of Safety Bay Road and construction of the Forrest Highway. Monitoring was carried out at the following locations and a summary of the monitoring results is listed in Table 4.2. The monitoring locations of are shown in Figure A1 in Appendix A.

- Location A - Adjacent to Kwinana Freeway, north of Mundijong Road
- Location B - Adjacent to Kwinana Freeway, south of Mundijong Road
- Location C - Adjacent Baldivis Road, near Mundijong Road

**TABLE 4.2 – SUMMARY OF 2011 MONITORING**

Location	Measured Noise Level (dB(A))		
	L <sub>10,18hour</sub>	L <sub>eq,16hour</sub>	L <sub>eq,8hour</sub>
A	64.3	62.4	57.6
B	67.6	65.9	61.7
C	67.3	64.6	56.2

The results of the noise monitoring are shown graphically in Appendix B.

Based on the 2011 noise monitoring results, the relationship between the L<sub>A10(18 hour)</sub> and the L<sub>Aeq(16hour)</sub> and L<sub>Aeq(8hour)</sub> are as listed in Table 4.3.

**TABLE 4.3 – RELATIONSHIP BETWEEN ACOUSTIC PARAMETERS**

Road	Parameter	Measured Level dB(A)*	Difference between L <sub>10(18hour)</sub> and L <sub>Aeq(parameter)</sub> dB(A)
Kwinana Freeway (North of Mundijong Rd)	L <sub>A10</sub> (18 hour)	64.2	N/A
	L <sub>Aeq, day</sub> (6am to 10pm)	62.4	= L <sub>A10</sub> (18 hour) – 1.8
	L <sub>Aeq, night</sub> (10pm to 6am)	57.6	= L <sub>A10(18 hour)</sub> – 6.6
Kwinana Freeway (South of Mundijong Rd)	L <sub>A10</sub> (18 hour)	67.6	N/A
	L <sub>Aeq, day</sub> (6am to 10pm)	65.7	= L <sub>A10</sub> (18 hour) – 1.9
	L <sub>Aeq, night</sub> (10pm to 6am)	61.7	= L <sub>A10(18 hour)</sub> – 5.9
Baldivis Road	L <sub>A10</sub> (18 hour)	67.3	N/A
	L <sub>Aeq, day</sub> (6am to 10pm)	64.6	= L <sub>A10</sub> (18 hour) – 2.7
	L <sub>Aeq, night</sub> (10pm to 6am)	56.2	= L <sub>A10(18 hour)</sub> – 11.1

\* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

## 5. MODELLING

Current and future road traffic volumes were based on information previously supplied and used in the previous 2005 noise study. This and other information relevant to the calculations are shown below in Table 5.1.

**TABLE 5.1 - NOISE MODELLING INPUT DATA**

Parameter	Value	
	Current	2025
Traffic flows		
Freeway	28670 – 29340	75310 – 80890
Baldivis Road	1710 – 2370	8790 – 12450
Mundijong Road	2490	17040 - 19090
Heavy Vehicles (%)	8.0	

Additional to the above, from information received on another project, we understand that after the opening of the Kwinana Freeway Extension and the Forrest Highway, traffic volumes along this section of the Kwinana Freeway increased by approximately 20000vpd. Using this increase, the noise levels monitored in 2011 correlate with those recorded in 2005.

Other input data for the model included:

- Topographical data, with the ground level within the subdivision from information supplied by client;
- For future traffic, volumes supplied by Main Roads, as listed in Table 5.1.
- A +2.5 dB adjustment to allow for façade reflection.

To determine the noise that would be received within the development from the surrounding road network, acoustic modelling was carried out using the computer program 'SoundPlan'. Acoustic modelling was carried out for road traffic flows in the year 2025. Calibration of the noise model was based on the results of noise monitoring carried out in 2011.

The contour plots for the day and night periods are shown on the attached in Appendices C and D respectively.

We note that noise received at residence located adjacent to the Kwinana Freeway, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be less than 5 dB(A) and the night period is the critical period for compliance. However, for other residence located adjacent to other roads, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be greater than 5 dB(A) and the day period is the critical period for compliance.

## 6. DISCUSSION / RECOMMENDATION

Under the WAPC State Planning Policy 5.4, for this development, the "Noise Limits" as listed in Table 1 are the appropriate noise levels for to be achieved for this development. Under The SPP 5.4, the "Noise Limits" criteria which are applicable external to a residence are:

<b>External</b>	
Day	Maximum of 60 dB(A) $L_{Aeq}$
Night	Maximum of 55 dB(A) $L_{Aeq}$
Outdoor Living Areas	Maximum of 50 dB(A) $L_{Aeq}$

From current noise monitoring, for residence located adjacent to the Kwinana Freeway, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be less than 5 dB(A) and the night period is the critical period for compliance. However, for other residence located adjacent to other roads, the difference between the  $L_{Aeq(16hr)}$  and the  $L_{Aeq(8hr)}$  would be greater than 5 dB(A) and the day period is the critical period for compliance.

The policy states that the outdoor criteria applies to the ground floor level only, however, it also states that noise mitigation measures should be implemented with a view to achieving the "Noise Target" levels in least one outdoor living area. For residential premises above the ground floor level, the Policy states the following acceptable internal noise levels:

**Internal**

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

The results of the acoustic assessment indicate that noise received at residences located adjacent to the Kwinana Freeway, Mundijong and Baldivis Road in the year 2025 will exceed the "Noise Limits" as outlined in the Western Australian Planning Commission (WAPC) Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning".

Initial noise modelling indicates that for residence located adjacent to the Kwinana Freeway, compliance with the "Noise Limits" could be achievable with a 2.4m high barrier (either wall, earth bund or combination of both) constructed along the boundary of the road reserve. However, the height of the barrier is approximate only and would be depend on the final ground level within the development, and this should be determined as part of the local structure planning. For residences adjacent to the other roads, the use of "Quiet House" design is recommended.

Modelling has also included the ultimate development of Mundijong Road flyover of Baldivis Road. It is noted that such a modification to Mundijong Road would be considered as a major modification and under the Policy the infrastructure provider would need to achieve compliance with the "Noise Limits" at the ground floor of any residence. However, in this instance, given the elevation of the ultimate flyover compared to that of the residence, the following is recommended for future residences affected by this modification:

1. "Quiet House" design be used to achieve compliance with the internal acoustic criteria for the ultimate design.
2. The residence be designed such that the residence themselves can protect an outdoor living space, so that compliance with the acoustic criteria can be achieved.

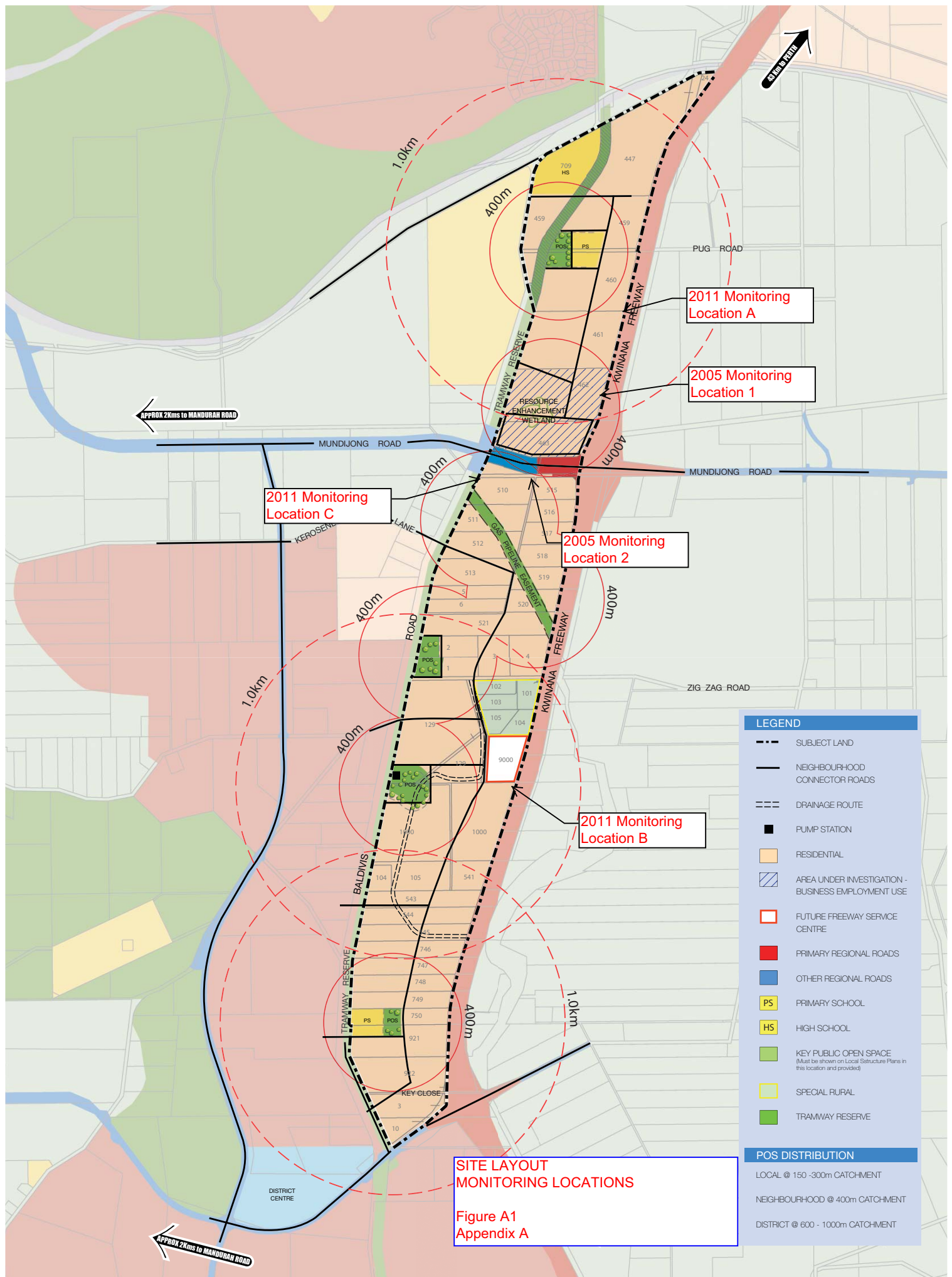
Even with the inclusion of noise amelioration, under the planning policy for residences located adjacent to the Kwinana Freeway, Mundijong and Baldivis Roads, should be designed to comply with the internal noise criteria of  $L_{Aeq(Night)}$  of 35 dB(A) in a bedroom and an  $L_{Aeq(Day)}$  of 40 dB(A) in a living space. Outdoor entertainment areas should be designed or located such that they comply with an  $L_{Aeq(night)}$  noise level of 50 dB(A) by the implementation of "Quiet House" design. General information on "Quiet House" design is contained in Appendix E.

For the residence where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles.

Note: The noise amelioration is normally only required to the first row of residences, as these houses provide an adequate barrier between the road and the other residences.

## **APPENDIX A**

FIGURE A1 – SITE LAYOUT

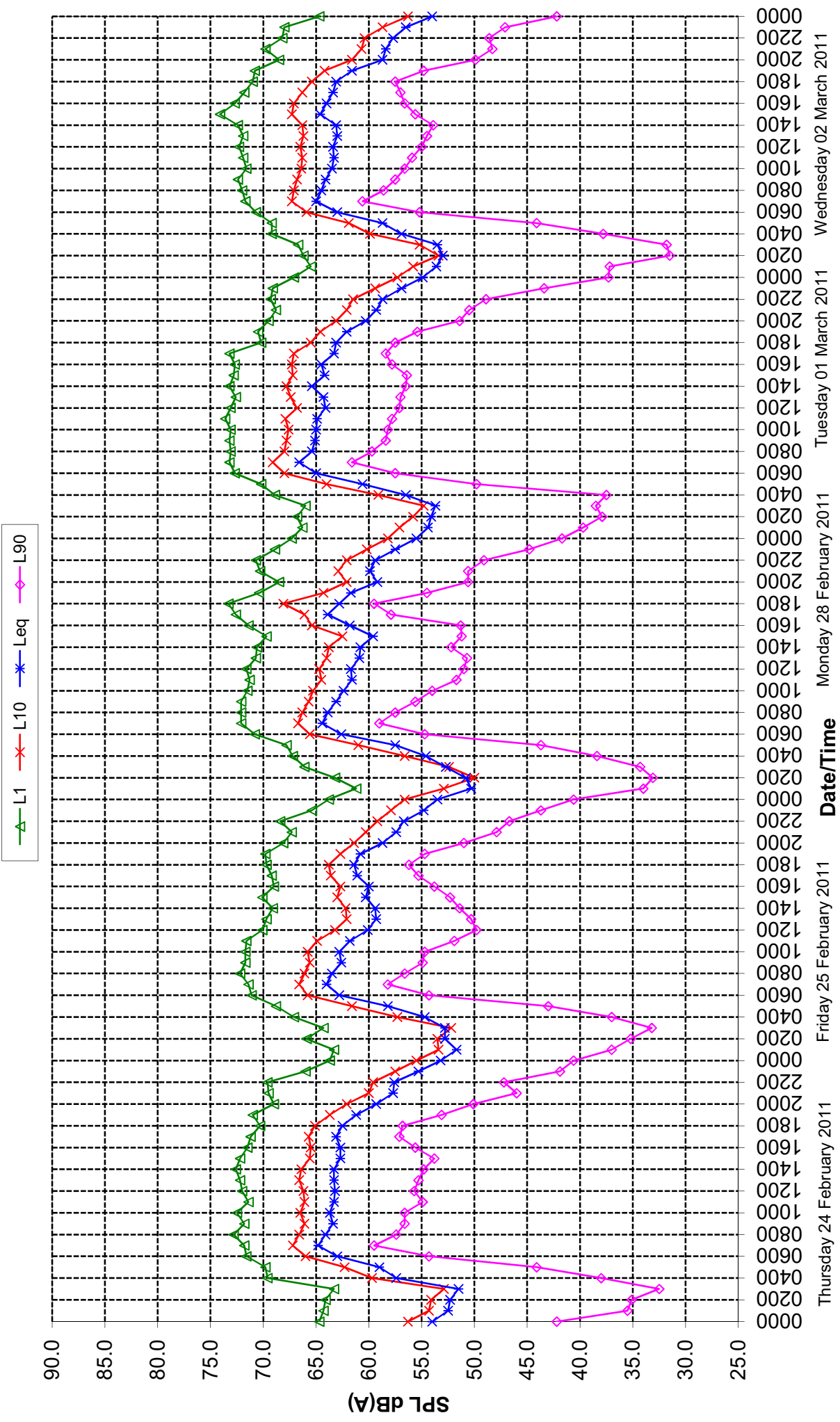




## **APPENDIX B**

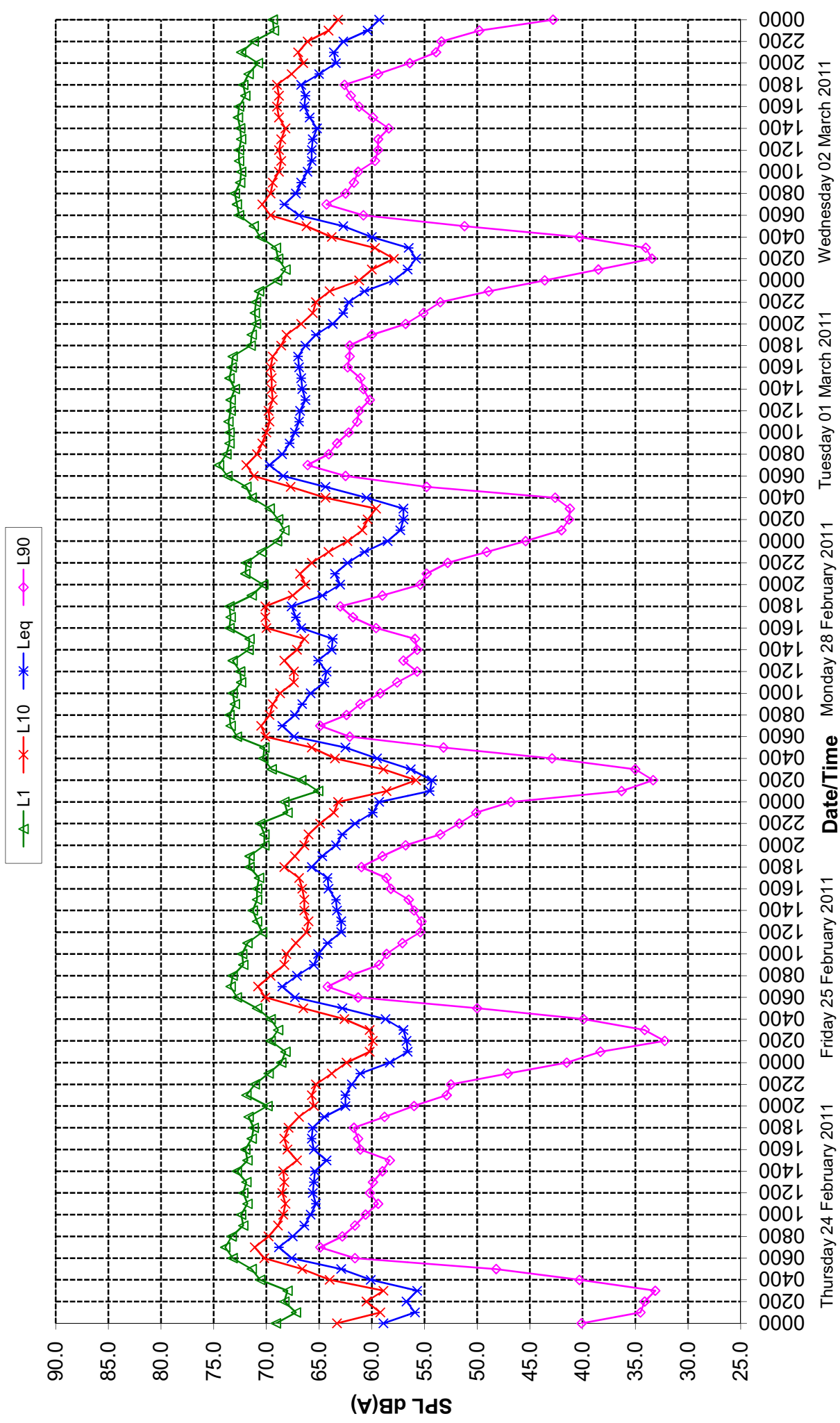
RESULTS – NOISE MONITORING (FEBRUARY 2011)

**MONITORING LOCATION A : KWINANA FREEWAY - NORTH OF MUNDIJONG ROAD**  
**Noise Monitoring : 24 February to 02 March 2011**

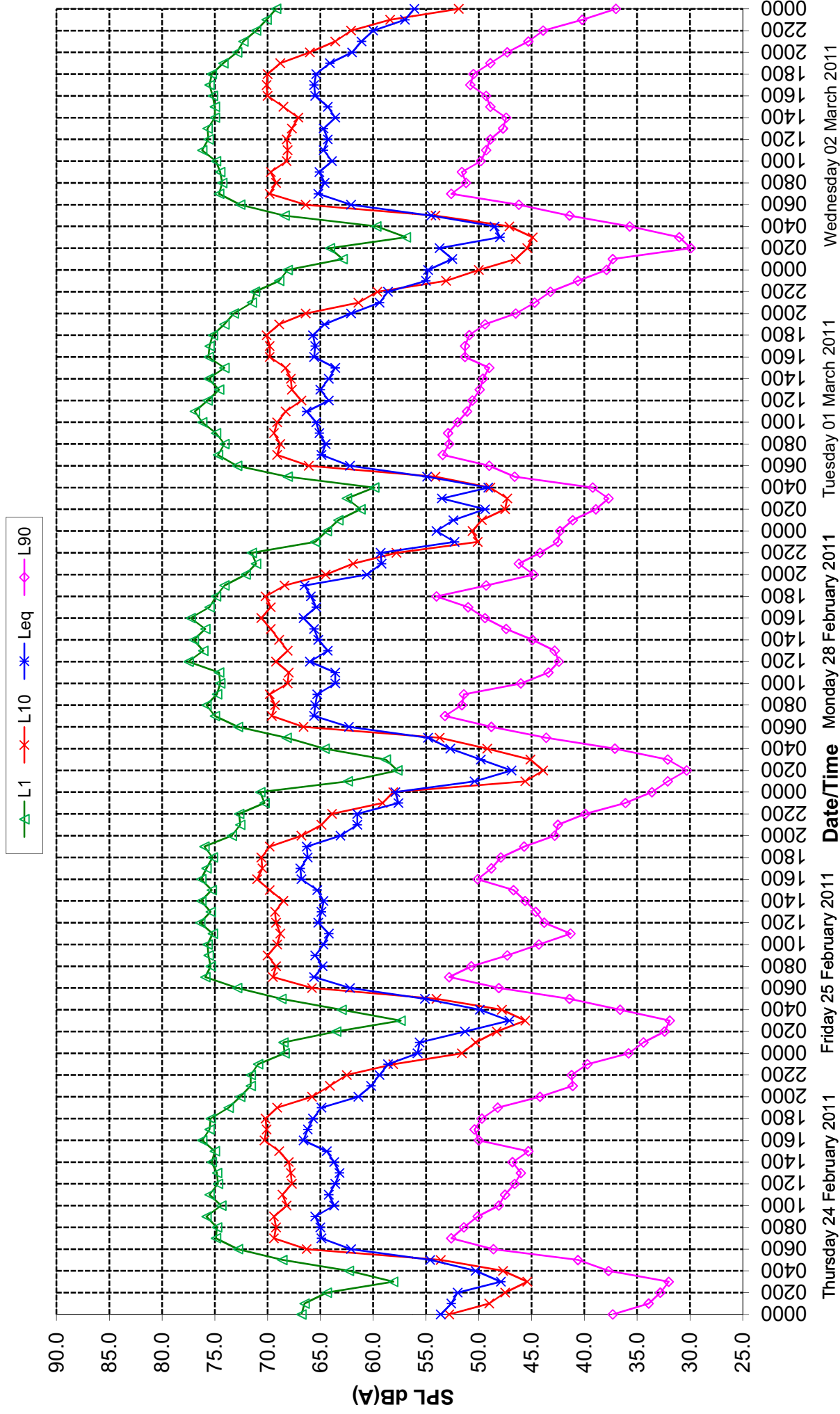


# MONITORING LOCATION B : KWINANA FREEWAY - SOUTH OF MUNDIJONG ROAD

Noise Monitoring : 24 February to 02 March 2011



# **MONITORING LOCATION C : BALDIVIS ROAD - SOUTH OF MUNDIJONG ROAD** **Noise Monitoring : 24 February to 02 March 2011**



## **APPENDIX C**

FIGURES C1 to C2 –  $L_{Aeq(16hr)}$  NOISE CONTOURS – (DAY)

Scale 1:12500

0 50 100 200 300 400  
m

Noise level  
LAeq (16hr)  
in dB(A)

55.0  
57.5  
60.0  
62.5  
65.0  
67.5  
70.0



NOISE CONTOURS  
DAY PERIOD  
LAeq (16hr) NOISE LEVEL  
WITHOUT NOISE  
AMELIORATION

Herring Storer Acoustics

April 2011  
Job No : 09128

Figure C1

Scale 1:12500

0 50 100 200 300 400  
m

Noise level  
LAeq (16hr)  
in dB(A)

55.0  
57.5  
60.0  
62.5  
65.0  
67.5  
70.0



NOISE CONTOURS  
DAY PERIOD  
LAeq (16hr) NOISE LEVEL  
WITHOUT NOISE  
AMELIORATION

Herring Storer Acoustics

April 2011  
Job No : 09128

Figure C2

## **APPENDIX D**

FIGURE D1 to D2 -  $L_{Aeq(8hr)}$  NOISE CONTOURS – (NIGHT)



Scale 1:12500

0 50 100 200 300 400  
m

Noise level  
LAeq (8hr)  
in dB(A)

55.0  
57.5  
60.0  
62.5  
65.0  
67.5  
70.0



NOISE CONTOURS  
NIGHT PERIOD  
LAeq (8hr) NOISE LEVEL  
WITHOUT NOISE  
AMELIORATION

Herring Storer Acoustics

April 2011  
Job No : 09128

Figure D1

Scale 1:12500

0 50 100 200 300 400  
m

Noise level  
LAeq (8hr)  
in dB(A)

- █ = 55.0
- █ = 57.5
- █ = 60.0
- █ = 62.5
- █ = 65.0
- █ = 67.5
- █ = 70.0



NOISE CONTOURS  
NIGHT PERIOD  
LAeq (8hr) NOISE LEVEL  
WITHOUT NOISE  
AMELIORATION

Herring Storer Acoustics

April 2011  
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Figure D2

## **APPENDIX E**

“QUIET HOUSE” DESIGN – GENERAL INFORMATION

Treatment to houses in the form of double glazing, door seals and roof / ceiling treatment can give reductions of up to 10 dB(A) over and above that of closed windows. However, this requires that one is inside with the windows shut and often necessitates the use of mechanical ventilation or air conditioning. Also, such reductions tend to reduce mid to high frequency noise leaving the sometimes more annoying low frequency noise.

The following provides some techniques that can be incorporated in “Quiet House” designs:-

- Locating bedrooms on opposite side of residence from road.
- Locating of laundries / bathrooms on same side of road.
- Protecting main entrance from road noise.
- Enclosing eaves.
- Roof insulation.
- Use of thicker glazing, with casement windows using winders.
- Double brick construction.

Australian Standard AS 2021-1994 “Acoustics - Aircraft noise intrusion - Building siting and construction”, can also provide guidance on construction requirements for various maximum noise levels.

The barriers should be solid in nature, with no gaps. However, their construction can range from a close timber or compressed cement sheet fence to a masonry wall. Landscaped earth bunds could also be used in this instance.

Some specific building guidelines that can be included in the quiet house design requirements, include:

- Double brick or tilt up concrete construction.
- Casement windows in timber or commercial steel frames and compressible seals (windows visible from Freeway only).
- First floor glazing to bedrooms to be 10.38mm thick laminated glass. Other glazing on side(s) of residence visible from Freeway to be minimum of 6.38mm laminated glass to bedrooms and 6mm float glass to living spaces.
- Eaves to be enclosed using 6mm thick compressed cement sheeting or equivalent.
- Sliding doors are only acceptable on the face, which is on the opposite side to the road.
- Roofs to be colourbond (or equivalent) with 50mm anticon, with ceilings on top floor to be one layer of 13mm plasterboard and 50mm thick (minimum 32 kg/m<sup>3</sup>) insulation laid over the top.
- No recessed light fittings allowed in bedroom ceilings (on top storey).

Additionally, residences are to be designed to achieve an  $L_{Aeq}$  of 50 dB(A) at outdoor living areas, by either the layout / orientation of the residence and / or construction of fencing.

Note: An acceptable solution to the top storey is to allow lofts. These spaces can have higher noise levels, and so long as the floor is concrete and there is a door to the loft then noise would be acceptable.

Notifications of vehicle traffic noise and the above requirements are to be placed on titles.

For these residences, designs are to be checked by an acoustical consultant with a report stating that the construction adequately attenuates vehicle traffic noise to achieve the following noise levels:

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)
Outdoor living Area	$L_{Aeq(night)}$ of 50 dB(A)

The above building criteria are for the first row of residences, as these residences will provide the barrier to the residences behind.

