Railway Noise Assessment

Jack Hills to Oakajee

DRAFT FOR REVIEW

Prepared For

Oakajee Port and Rail

June 2010

Reference: 9091365-01 draft 2

LLOYD GEORGE Acoustics

Report: 9091365-01 draft 2

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Date:	15 June 2010

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APPENDICES

1 INTRODUCTION

Oakajee Port and Rail Pty Ltd (OPR) proposes to construct an open-access rail network from the proposed port at Oakajee to the mine sites east of Geraldton, terminating at the Jack Hills mine site. The proposed railway will incorporate a mainline of approximately 530km, and two spur lines; a 21km spur to join or crossover the existing WestNet (Mullewa) line for future connection of mines south of Mullewa and a 10 km to 15km spur line to the Weld Range.

Noise resulting from operation of the rail network has been predicted to noise sensitive premises located within 10 km of the proposed alignment and the results compared against relevant Western Australian transport noise criteria. In addition, comment on the likely impact of ground-borne vibration resulting from train passbys is provided.

Noise from the railway once it passes into the port area is addressed in the assessment of noise from the port.

Appendix C contains a description of some of the terminology used throughout this report.

2 CRITERIA

Noise from the operation of railways is exempt from the *Environmental Protection (Noise) Regulations 1997*. For noise sensitive premises adjacent to railways, the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP 5.4) produced by the Western Australian Planning Commission (WAPC) are the most relevant criteria. In addition, the Environmental Protection Authority (EPA) may consider the preliminary draft *EPA Statements for EIA No. 14 - Road and Rail Transportation Noise Version 3 (May 2000)* [draft EPA Guidance No.14], for areas with particularly low existing background noise levels. Both documents are described below.

2.1 State Planning Policy 5.4

The criteria contained within the SPP 5.4 are shown below in *Table 2.1*

Table 2.1 - External Noise Exposure Criteria for Noise Sensitive Land Uses

Time Period	External Noise Exposure Level Criteria (dB)	
	Noise "Target"	Noise "Limit"
Day Time 6.00am – 10.00pm	$L_{Aeq,16hour}$ 55dB	$L_{Aeq,16hour}$ 60dB
Night Time 10.00pm – 6.00am	$L_{Aeq,8hour}$ 50dB	$L_{Aeq,8hour}$ 55dB

Note: The 5 dB difference between the outdoor noise "Target" and the outdoor noise "Limit", as prescribed by *Table 2.1*, represents an acceptable "margin" for compliance, provided that best practical efforts have been made to reduce noise. Normally, it is practicable to achieve outdoor noise levels within this acceptable margin.

The implementation of noise control measures is determined to be reasonable and practicable with reference to:

- The effectiveness of the proposed measure(s) including a comparison of predicted noise levels with or without the specified measure(s);
- The estimated cost of the measure(s) and, if applicable, the distribution of such costs between the owner/developer and the agency responsible for the relevant transport infrastructure;
- The amenity impacts of the measure(s) including appearance, access, surveillance and security, landscape/streetscape, vegetation etc;
- Traffic safety;
- Community acceptance; and
- Practicability of proposed amelioration measure(s) also requires that there are no unreasonable physical, legal or financial impediments to their implementation.

2.2 Draft EPA Guidance No. 14

Under the draft EPA Guidance No. 14, a noise rating is applied depending on existing noise levels at the noise sensitive receiver. The noise ratings are reproduced below in *Table 2.2*

Table 2.2 – Draft EPA Guidance No. 14 Noise Amenity Ratings

Rating	Existing $L_{Aeq,T}$ (Day) (0700 to 2200)	Existing $L_{Aeq,T}$ (Night) (2200 to 0700)
N0	≤ 50	≤ 40
N1	51 - 55	41 - 45
N2	56 - 60	46 - 50
N3	61 - 65	51 - 55
N4	66 - 70	56 - 60
N5	≥ 70	≥ 60

Section 5.1 of the draft guidance identifies the acceptable land uses for each noise amenity rating (N) and these are presented in *Table 2.3*.

Table 2.3 Acceptable Land Uses - Section 5.1 of Draft EPA Guidance No. 14

Rating	Acceptable	Conditionally Acceptable	Unacceptable
N0	Residential	None	None
N1	Residential	None	None
N2	Open space	Residential, Open space	None
N3	None	Residential units, Open space	Residence + yard
N4	None	Residential units, Open space	None
N5	None	None	Open space

The objectives of the draft EPA Guidance No. 14 are -

(i) that the noise levels inside noise-sensitive premises associated with the proposed traffic should meet acceptable levels, or that the degree of increase in noise levels should be of low significance; and

(ii) that the noise emissions of the vehicles associated with a specific proposal should comply with "best practice".

3 METHODOLOGY

3.1 Site Measurements

The purpose of background noise measurements are to identify the impact of noise level increases over low background noise levels.

Ambient noise measurements were carried out between the 14 and 27 November 2009 using un-manned noise data loggers. These dates did not include any activity related to the proposal. The measurements were conducted outdoors with the microphone at least 3 metres from any reflecting surface other than the ground, and at a height of at least 1.2 metres above the ground. The noise levels were logged continuously over a period of two weeks, which included two weekends, using sample periods of 15 minutes duration.

Measurements and analysis were conducted in accordance with the *Environmental Protection Authority: Guidance for the Assessment of Environmental Factors - Draft Guidance No. 8: Guidance for Environmental Noise* (EPA Guidance No. 8).

The measurement locations, detailed below and shown graphically in *Figure 3.1,* were chosen to represent the changing conditions along the railway.

- Location 1 Lot 429 White Peak Road, Oakajee
- Location 2 Lot 328, 210 Wells Road, Oakajee
- Location 3 Lot 3062, 2499 North West Coastal Highway, Oakajee
- Location 4 1183 East Chapman Rd, East Chapman..

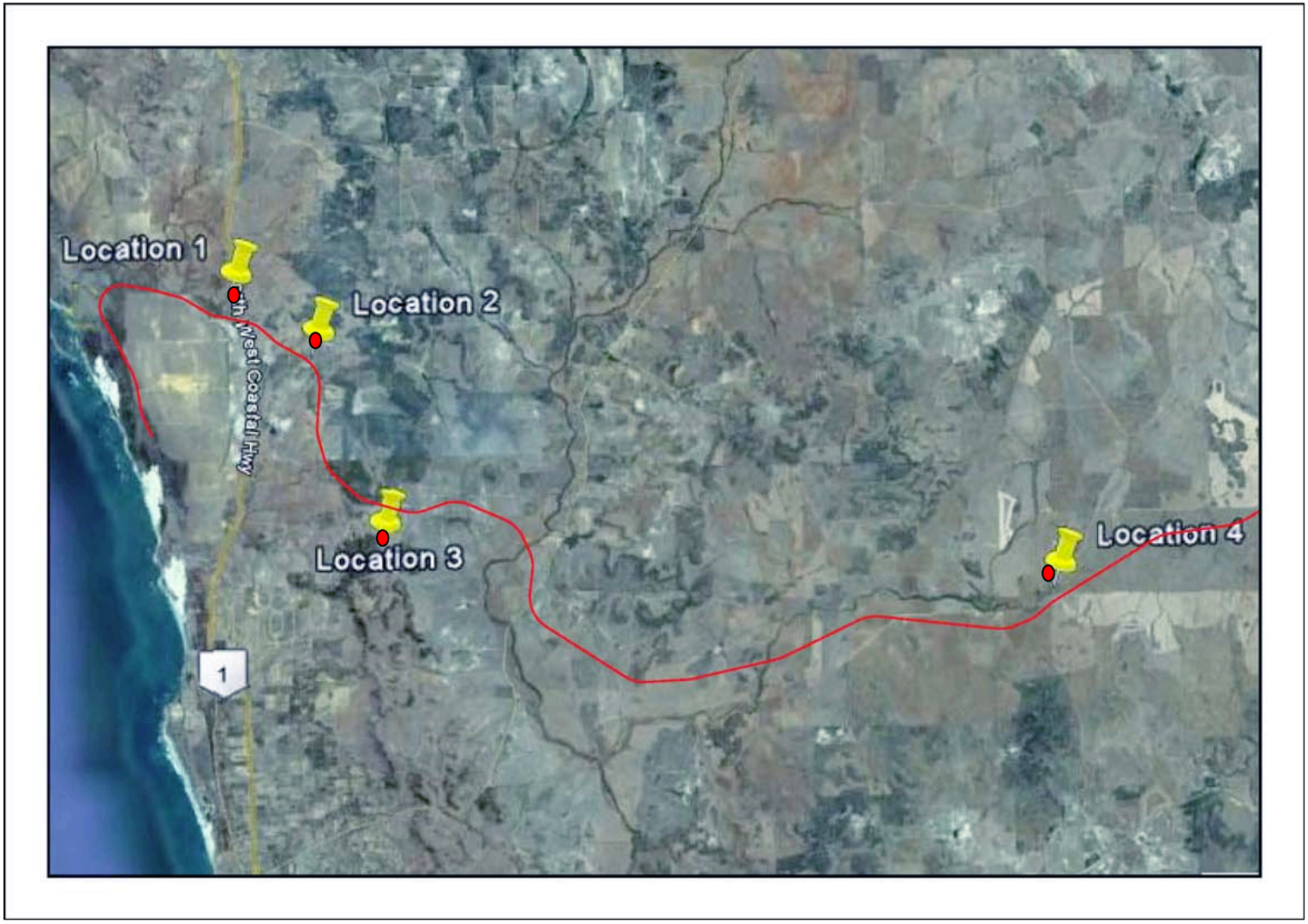


Figure 3.1 Noise Monitoring Locations

3.2 Noise Modelling

Railway noise has been predicted using a modified version of the Nordic Rail Prediction Method (Kilde Rep. 130) algorithm. The Nordic Rail Prediction Method (Kilde Rep. 130) algorithm is for generic train types in Europe and requires modification to align with measured noise levels of locomotives and wagons used in the Pilbara. In addition, to accurately predict the effect of barriers (hills or buildings), the noise source height of the locomotive was raised from the standard 0.5 metres above the railhead to 4.0 metres.

Input data required in the model are:

- 3-dimentional topographical data;
- Location of noise sensitive premises;
- Railway alignment; and
- Train Configuration.

3.2.1 Topographical Data

Topographical data was provided by OPR. The contours are in 5-metre intervals and cover the noise sensitive premises 10 km either side of the alignment.

3.2.2 Train Configuration

The variables used to predict the noise level from the operation of the railway are provided in *Table 3.1.*

Table 3.1 Input Data for Assessment of Railway Noise

Parameter	Value
Locomotive maximum noise level at 15m	92 dB(A)
Wagons maximum noise level at 15m	86 dB(A)
Locomotives	3
Train Speed	80 km/h on main line
Height of Locomotive	4 metres above rail head
Number of Wagons (10.5m overall length)	240
Number of Train Movements per day	Oakajee Port to Chainage 88000 = 16 Movements Chainage 88000 to Mt Weld Junction = 10 Movements Mt Weld Junction to Jack Hills = 4 Movements

Note: Trains assumed to be evenly distributed throughout a 24-hour period.

The noise level used for the locomotives is equivalent to full power (Notch 8). Although the locomotives alone have minimal influence on the $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$ levels, assuming full power would be considered as a conservative approach. However, for receivers located

within 100 metres of the railway, the locomotive power setting used in the modelling would be more critical and may be adjusted for assessments to individual premises, particularly for the assessment of the L_{Amax} level.

4 RESULTS

4.1 Background Noise Measurements

The background noise level data, presented graphically in *Figures 4.1 to 4.4,* shows the L_{Aeq}, and L_{A90} noise levels, together with the wind direction relative to the measurement location and the railway.

As required under EPA Guidance No. 8, background noise levels have been determined by extracting from the full data the "L_{90}" of the L_{A90} noise levels. This is used to determine whether the noise from the project is likely to be audible over the background noise level at a particular receiver location during a particular time period. From analysis of the results the following "L_{90}" of the L_{A90} noise levels have been determined:

Location 1 Lot 3062, 2499 North West Coastal Highway, Oakajee

- 0600-2200 hours (Day)= L_{A90} 30 dB
- 2200-0600 hours (Night) = L_{A90} 26 dB

Location 2 Lot 328, 210 Wells Road, Oakajee

- 0600-2200 hours (Day) = L_{A90} 28 dB
- 2200-0600 hours (Night) = L_{A90} 24 dB

Location 3 Lot 429 White Peak Road, Oakajee

- 0600-2200 hours (Day) = L_{A90} 27 dB
- 2200-0600 hours (Night) = L_{A90} 26 dB

Location 4 1183 East Chapman Rd, East Chapman

- 0600-2200 hours (Day) = L_{A90} 29 dB
- 2200-0600 hours (Night) = L_{A90} 23 dB

It can be seen that the noise levels vary throughout the day and are influenced by such things as wind in trees, local noise sources (noise from general activities) and road traffic. For example, the wind conditions on the 18 November 2009, were reported as being as high as 63 km/h, and this can be seen at all locations as a significant increase in noise levels.

The lowest background levels (the "L_{90}" of the L_{A90} noise levels) occur during the night-time period of 2200-0600 and the results indicate that background levels at all locations are relatively low, which is consistent for a rural setting.

Figure 4.1

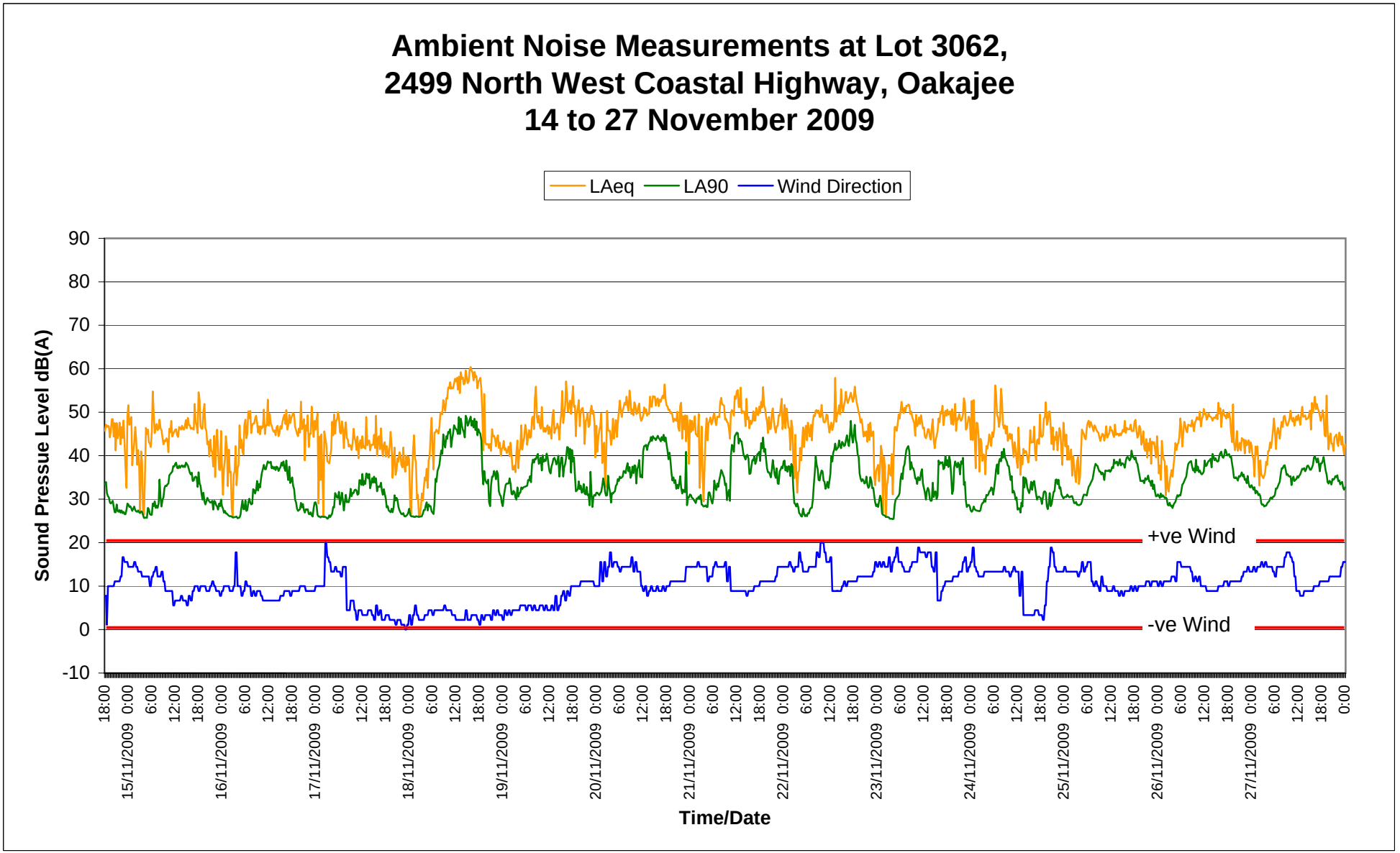

Ambient Noise Measurements at Lot 3062,
2499 North West Coastal Highway, Oakajee
14 to 27 November 2009
LAeq
LA90
Wind Direction
Sound Pressue Level dB(A)
90
80
70
60
50
40
30
20
10
0
-10
+ve Wind
-ve Wind
18:00
0:00
6:00
12:00
15/11/2009
16/11/2009
17/11/2009
18/11/2009
19/11/2009
20/11/2009
21/11/2009
22/11/2009
23/11/2009
24/11/2009
25/11/2009
26/11/2009
27/11/2009
Time/Date

Figure 4.2

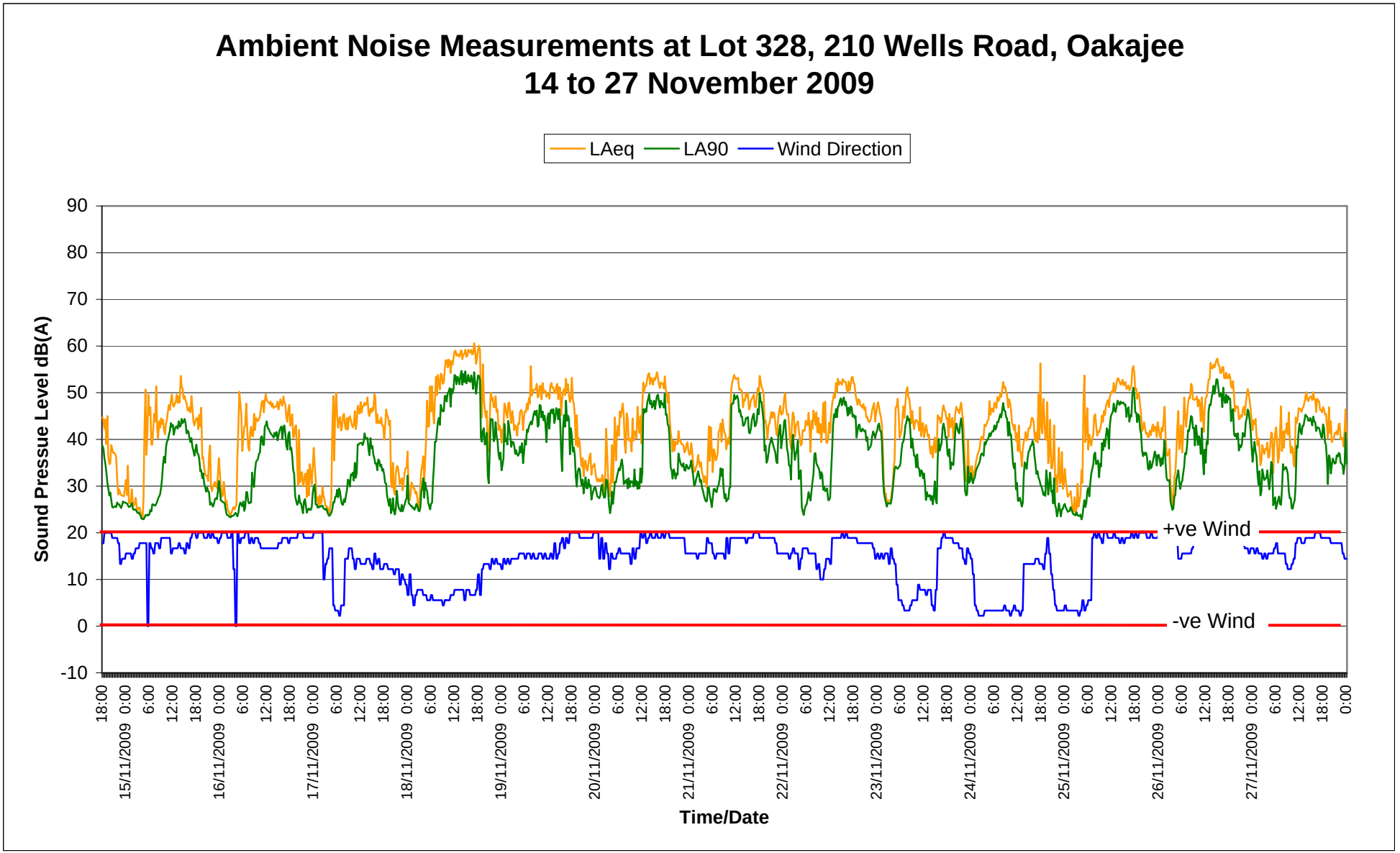

Ambient Noise Measurements at Lot 328, 210 Wells Road, Oakajee
14 to 27 November 2009
LAeq
LA90
Wind Direction
Sound Pressue Level dB(A)
90
80
70
60
50
40
30
20
10
0
-10
+ve Wind
-ve Wind
18:00
0:00
6:00
12:00
15/11/2009
16/11/2009
17/11/2009
18/11/2009
19/11/2009
20/11/2009
21/11/2009
22/11/2009
23/11/2009
24/11/2009
25/11/2009
26/11/2009
27/11/2009
Time/Date

Figure 4.3

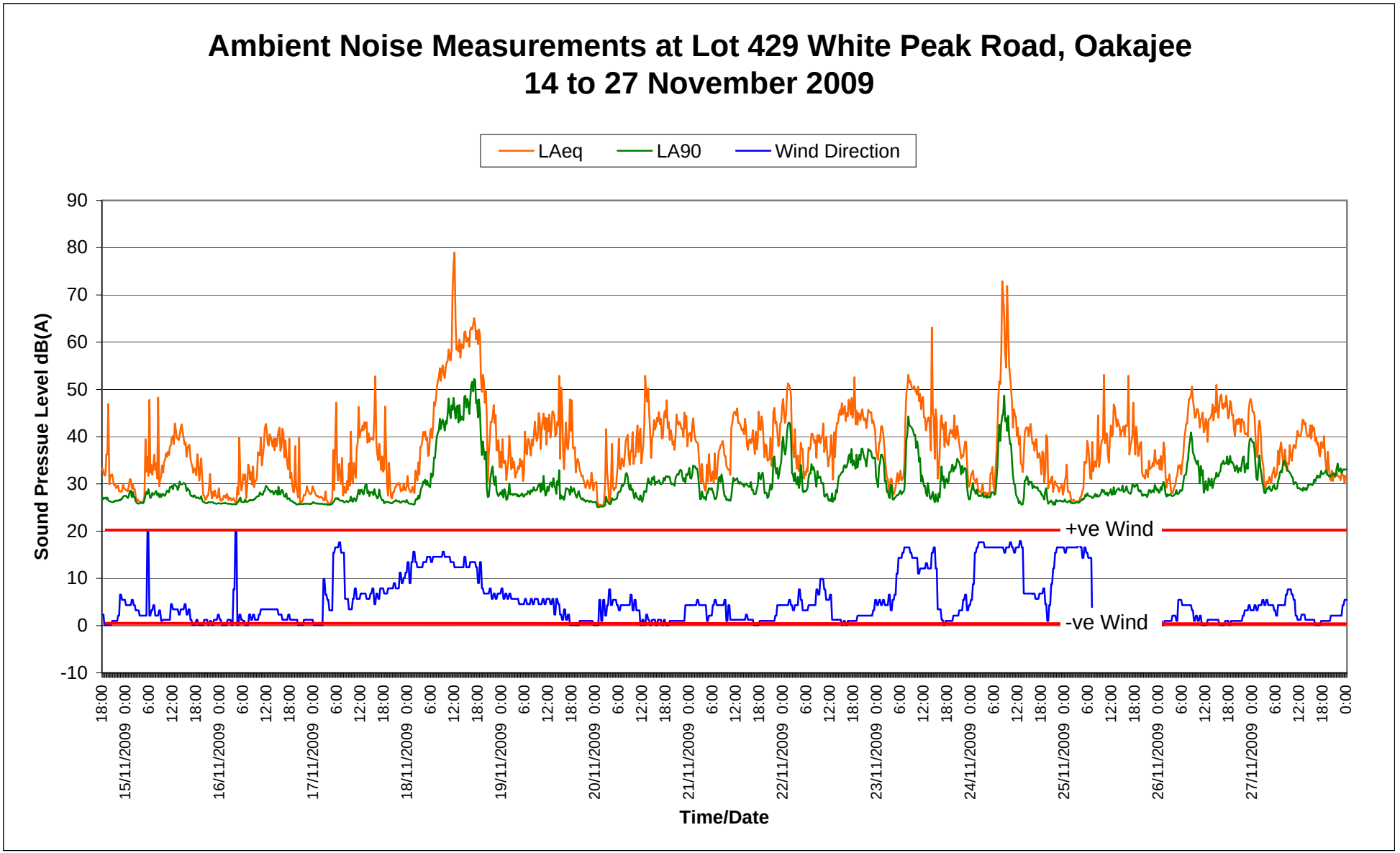
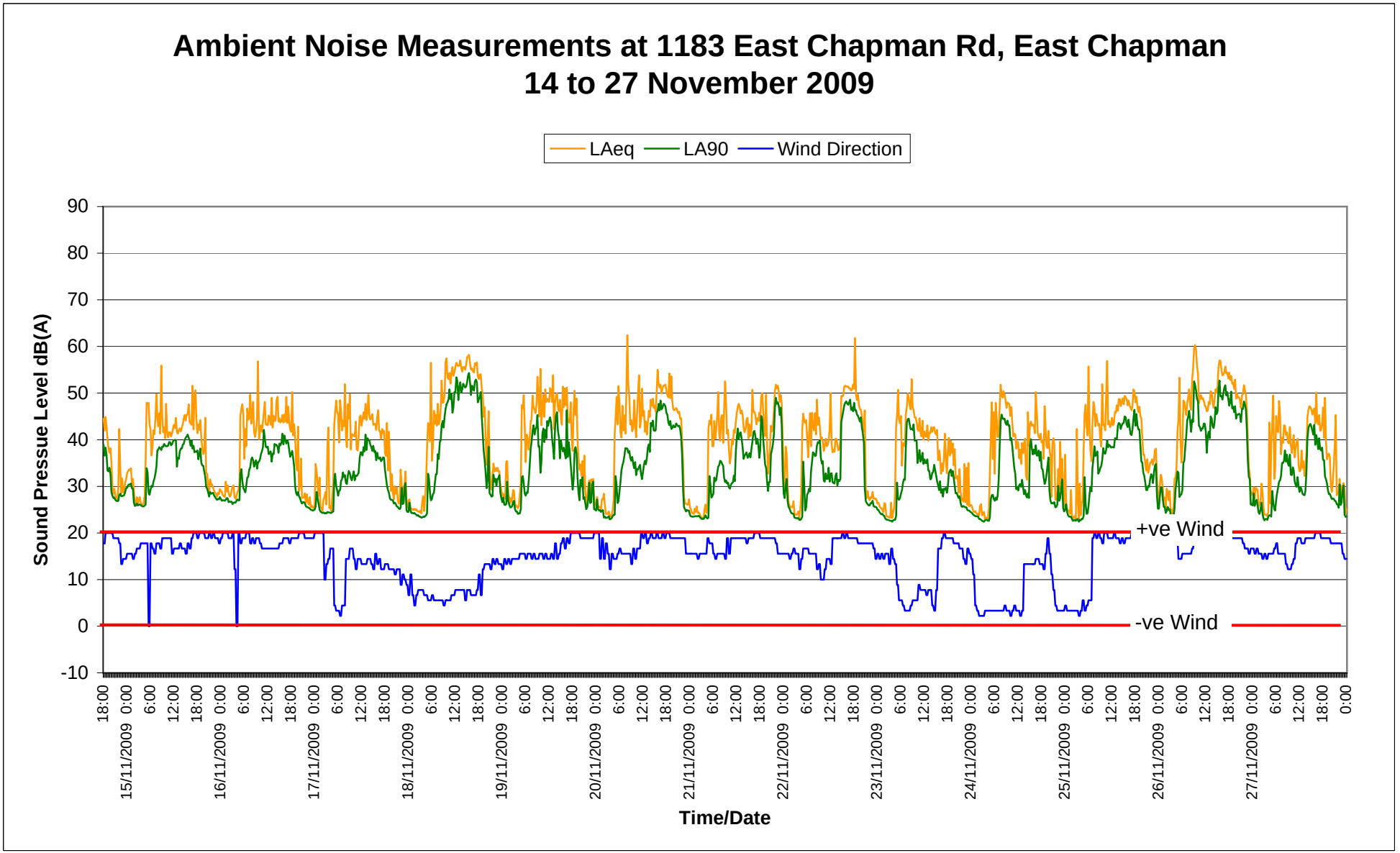

Ambient Noise Measurements at Lot 429 White Peak Road, Oakajee
14 to 27 November 2009
LAeq
LA90
Wind Direction
Sound Pressue Level dB(A)
90
80
70
60
50
40
30
20
10
0
-10
+ve Wind
-ve Wind
18:00
0:00
6:00
12:00
18:00
15/11/2009
16/11/2009
17/11/2009
18/11/2009
19/11/2009
20/11/2009
21/11/2009
22/11/2009
23/11/2009
24/11/2009
25/11/2009
26/11/2009
27/11/2009
Time/Date

Figure 4.4


Ambient Noise Measurements at 1183 East Chapman Rd, East Chapman
14 to 27 November 2009
LAeq
LA90
Wind Direction
Sound Pressue Level dB(A)
90
80
70
60
50
40
30
20
10
0
-10
+ve Wind
-ve Wind
18:00
0:00
6:00
12:00
15/11/2009
16/11/2009
17/11/2009
18/11/2009
19/11/2009
20/11/2009
21/11/2009
22/11/2009
23/11/2009
24/11/2009
25/11/2009
26/11/2009
27/11/2009
Time/Date

4.2 Noise Modelling

The results of the noise modelling to noise sensitive premises adjacent to the proposed rail alignment are compared against the SPP 5.4 criteria and presented in *Table 4.1.*

It should be noted that due to the limitations of GIS data, the building use (residential or otherwise) associated with the noise receivers included in this assessment would require verification by a visual survey.

Although the SPP 5.4 does not consider the maximum noise level (L_{Amax}), it is often used to assess the risk of sleep disturbance from train pass-bys. Sleep disturbance is a complex subject, however, it is generally not considered to be a significant risk for external maximum noise levels below L_{Amax} 75 dB.

In addition to the results presented in *Table 4.1,* the $L_{Aeq\ (Night)}$ noise level contours are provided for the overall alignment and within the Chapman Valley area, which has a denser population than the rest of the railway. These are presented in *Figures 4.5 and 4.6.*

To ensure that the chosen railway alignment is the best option in terms of minimising impacts to existing noise sensitive receivers. It was determined that the proposed railway alignment (centre alignment) results in the least number of noise sensitive receivers predicted to exceed the SPP 5.4 criteria. This assessment is included in *Appendix A*.

Table 4.1 Predicted Noise Levels to Noise Sensitive Receivers

Receiver ID	Predicted Noise Levels		Location		Coordinates (GDA 94)		Comment
	$L_{Aeq\ (Night)}$	L_{Amax}	Address	Suburb	X	Y	
1	62	82	LOT 6088	YUNA	337014	6854031	**Exceeds** SPP 5.4 "**Limit**" Criteria
2*****	62	82	148 CAREY RD	WHITE PEAK	270513.9	6831992	Owned by WA Land Authority
3*	59	77	144 CAREY RD	WHITE PEAK	270720.2	6831810	Owned by WA Land Authority
4	58	75	59 EASTOUGH-YETNA RD	YETNA	275922.2	6829671	**Exceeds** SPP 5.4 "**Limit**" Criteria
5	56	79	479 CHAPMAN RD	EAST CHAPMAN	282442.2	6826303	**Exceeds** SPP 5.4 "**Limit**" Criteria
6*	56	73	3325 WHITE PEAK RD	WHITE PEAK	270603.1	6833155	Owned by WA Land Authority
7*	55	78	LOT 328		270143.6	6834782	Owned by WA Land Authority
8	54	71	12 NEWMARRACARRA RD	KOJARENA	290515.6	6828470	**Exceeds** SPP 5.4 "**Target**" Criteria
9	54	70	2134 VALENTINE RD	NORTH ERADU	313813.7	6839175	**Exceeds** SPP 5.4 "**Target**" Criteria
10	53	69	150 LORIMER RD	DURAWAH	297349	6832089	**Exceeds** SPP 5.4 "**Target**" Criteria
11*	52	70	327 WHITE PEAK RD	WHITE PEAK	271176.5	6830860	Owned by WA Land Authority
12	51	66	LOT 14		535743.4	6997657	**Exceeds** SPP 5.4 "**Target**" Criteria
13*	51	68	2499 NORTH WEST COASTAL HWY	OAKAJEE	267937.4	6836395	Owned by WA Land Authority
14	51	66	694 BADGEDONG RD	WANDANA	346022.2	6874640	**Exceeds** SPP 5.4 "**Target**" Criteria

**** Denotes properties owned by the WA Land Authority. Residential use of these properties will be restricted if transportation noise levels are considered to be unacceptable.***

Table 4.1 (cont) Predicted Noise Levels to Noise Sensitive Receivers

Receiver ID	Predicted Noise Levels		Location		Coordinates (GDA 94)		Comment
	$L_{Aeq\ (Night)}$	L_{Amax}	Address	Suburb	X	Y	
15	51	67	1682 VALENTINE RD	NORTH ERADU	311420.7	6835696	**Exceeds** SPP 5.4 "**Target**" Criteria
16*	51	67	LOT 9782		270194.3	6834387	Owned by WA Land Authority
17	51	66	1183 CHAPMAN RD	EAST CHAPMAN	288299.1	6827925	**Exceeds** SPP 5.4 "**Target**" Criteria
18	50	66	1829 PETER RD	AMBANIA	324958.3	6841937	**Complies** SPP 5.4 "Target" Criteria
19	50	66	145 SCOTT RD	EAST CHAPMAN	284793.5	6828138	**Complies** SPP 5.4 "Target" Criteria
20	50	65	1065 CHAPMAN RD	EAST CHAPMAN	287184.6	6828282	**Complies** SPP 5.4 "Target" Criteria
21*	50	67	LOT 2		269111.4	6835137	Owned by WA Land Authority
22	50	66	278 MORRELL RD	NARRA TARRA	277427.1	6827593	**Complies** SPP 5.4 "Target" Criteria
23	50	64	LOT 9372		344801.9	6871461	**Complies** SPP 5.4 "Target" Criteria
24	50	65	LOT 1081		340859.4	6864903	**Complies** SPP 5.4 "Target" Criteria
25*	50	65	289 WHITE PEAK RD	WHITE PEAK	270778.8	6830780	Owned by WA Land Authority
26	50	64	LOT 27		558834.2	7020679	**Complies** SPP 5.4 "Target" Criteria
27	49	64	282 BURTON WILLIAMSON RD	NORTH ERADU	319960.4	6840611	**Complies** SPP 5.4 "Target" Criteria
28*	49	65	291 CAREY RD	WHITE PEAK	269757.7	6833941	Owned by WA Land Authority

**** Denotes properties owned by the WA Land Authority. Residential use of these properties will be restricted if transportation noise levels are considered to be unacceptable.***

Table 4.1 (cont) Predicted Noise Levels to Noise Sensitive Receivers

Receiver ID	Predicted Noise Levels		Location		Coordinates (GDA 94)		Comment
	$L_{Aeq\ (Night)}$	L_{Amax}	Address	Suburb	X	Y	
29	49	62	LOT 6093		332516.9	6843678	**Complies** SPP 5.4 “Target” Criteria
30	49	66	60 EASTOUGH-YETNA RD	YETNA	276504.4	6830359	**Complies** SPP 5.4 “Target” Criteria
31	49	64	290 WHITE PEAK RD	WHITE PEAK	270939.1	6830635	**Complies** SPP 5.4 “Target” Criteria
32	48	65	360 WHITE PEAK RD	WHITE PEAK	271520.1	6830422	**Complies** SPP 5.4 “Target” Criteria
33	48	62	469 WANDINA RD	NUNIERRA	365092	6888054	**Complies** SPP 5.4 “Target” Criteria
34	48	62	LOT 9557		344211.6	6870979	**Complies** SPP 5.4 “Target” Criteria
35	48	64	7856 GERALDTON-MOUNT MAGNET RD	TENINDEWA	341349.7	6832714	**Complies** SPP 5.4 “Target” Criteria
36	48	63	242 WHITE PEAK RD	WHITE PEAK	270724.9	6830439	**Complies** SPP 5.4 “Target” Criteria
37	48	62	177 SCOTT RD	EAST CHAPMAN	284415.3	6828559	**Complies** SPP 5.4 “Target” Criteria
38	48	62	400 ANGELS RD	EAST CHAPMAN	282379.6	6827261	**Complies** SPP 5.4 “Target” Criteria
39	47	61	119 BURTON WILLIAMSON RD	NORTH ERADU	316135.2	6841070	**Complies** SPP 5.4 “Target” Criteria
40	47	61	675 CHAPMAN RD	EAST CHAPMAN	283958.8	6827786	**Complies** SPP 5.4 “Target” Criteria
41	47	63	404 CHAPMAN RD	EAST CHAPMAN	281634.4	6825224	**Complies** SPP 5.4 “Target” Criteria
42	47	63	1172 CHAPMAN VALLEY RD	NARRA TARRA	275592.9	6827015	**Complies** SPP 5.4 “Target” Criteria

**** Denotes properties owned by the WA Land Authority. Residential use of these properties will be restricted if transportation noise levels are considered to be unacceptable.***

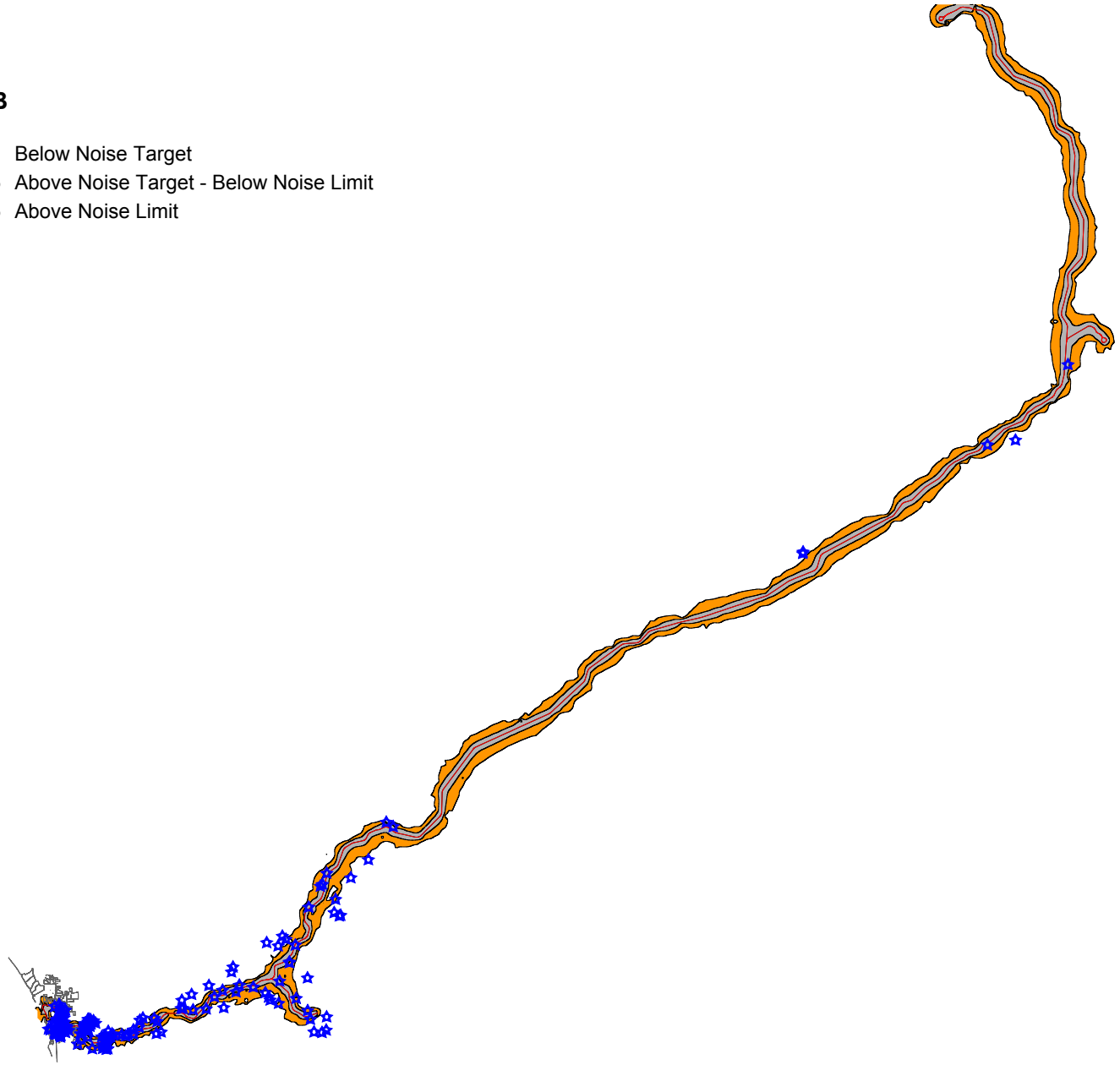
Table 4.1 (cont) Predicted Noise Levels to Noise Sensitive Receivers

Receiver ID	Predicted Noise Levels		Location		Coordinates (GDA 94)		Comment
	$L_{Aeq\ (Night)}$	L_{Amax}	Address	Suburb	X	Y	
43	47	64	53 NEWMARRACARRA RD	EAST CHAPMAN	288897.9	6828339	**Complies** SPP 5.4 “Target” Criteria
44	47	64	111 CHAPMAN VALLEY RD	NARRA TARRA	276827	6830263	**Complies** SPP 5.4 “Target” Criteria
45	47	63	581 CHAPMAN RD	EAST CHAPMAN	283200.4	6825821	**Complies** SPP 5.4 “Target” Criteria
46	47	60	1803 TENINDEWA RD	TENINDEWA	335320.3	6849176	**Complies** SPP 5.4 “Target” Criteria
47	47	63	275 NEWMARRACARRA RD	EAST CHAPMAN	290550.2	6829670	**Complies** SPP 5.4 “Target” Criteria
48	47	61	187 TENINDEWA RD	TENINDEWA	340544.3	6835200	**Complies** SPP 5.4 “Target” Criteria
49	46	61	422 NEWMARRACARRA RD	NORTHERN GULLY	292155.4	6830447	**Complies** SPP 5.4 “Target” Criteria
50	46	62	61 EASTOUGH-YETNA RD	YETNA	276426.7	6830688	**Complies** SPP 5.4 “Target” Criteria
51	46	60	LOT 1		269426	6836033	**Complies** SPP 5.4 “Target” Criteria
52	46	62	372 BURTON RD	AMBANIA	320958.1	6842540	**Complies** SPP 5.4 “Target” Criteria
53	46	59	1801 TENINDEWA RD	TENINDEWA	335292.4	6848940	**Complies** SPP 5.4 “Target” Criteria
54	46	61	1116 DURAWAH NORTHERN GULLY RD	DURAWAH	296502.6	6832987	**Complies** SPP 5.4 “Target” Criteria
55	46	59	426 WHITE PEAK RD	YETNA	271983	6829540	**Complies** SPP 5.4 “Target” Criteria

Figure 4.5

Noise level
$L_{Aeq\ (night)}$ dB

- <= 50 Below Noise Target
- <= 55 Above Noise Target - Below Noise Limit
- > 55 Above Noise Limit



Signs and symbols

- Point receiver
- Railway line

N

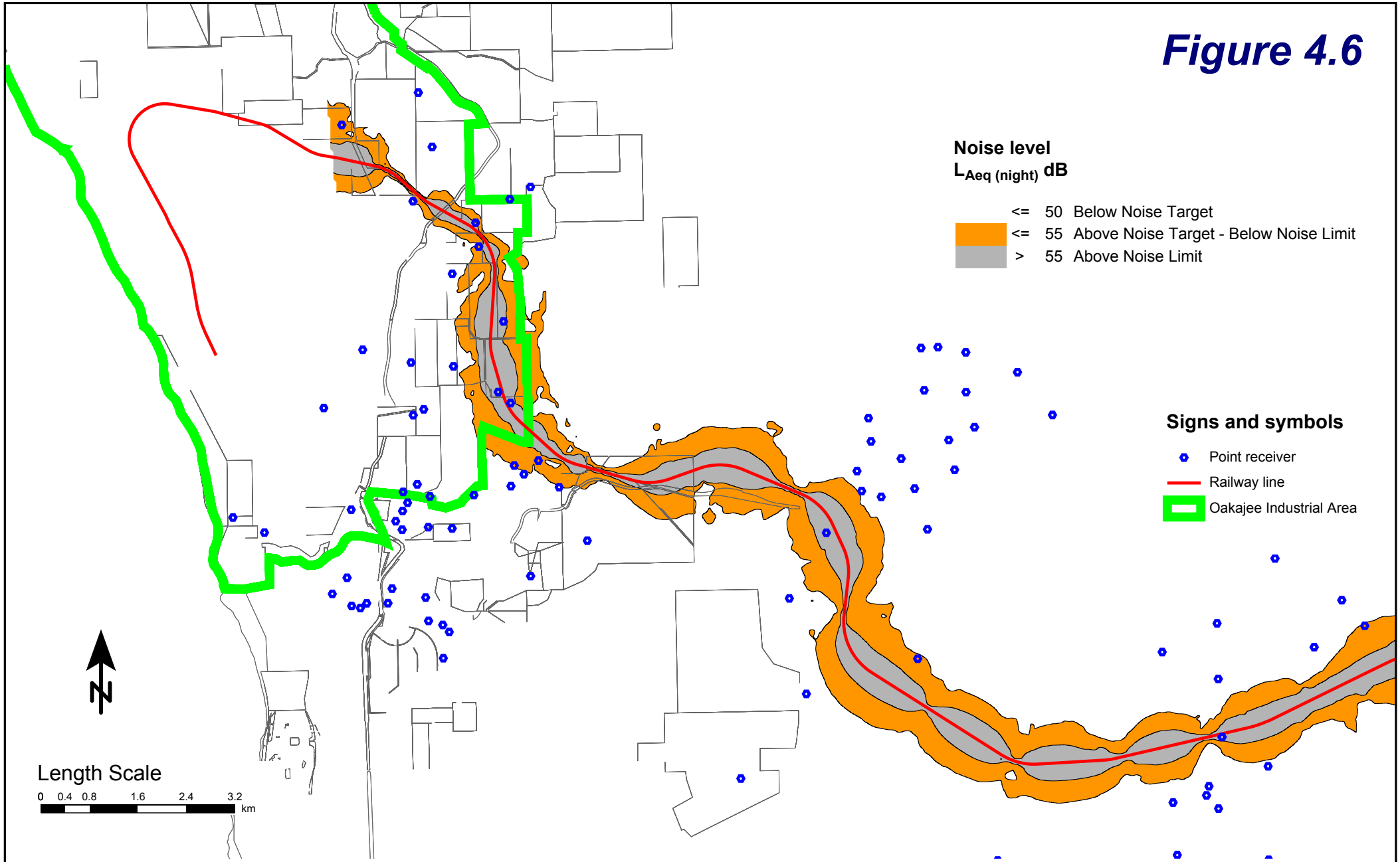
Length Scale

0 10 20 40 60 80 km

Oakajee Railway $L_{Aeq(night)}$ Noise Level Contours - Overall Alignment

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.6



Oakajee Railway $L_{Aeq(night)}$ Noise Level Contours - Chapman Valley

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by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

4.3 Ground Vibration

The propagation of vibration energy through the ground is highly dependent on ground types and in particular, the presence of rock formations. The closest premises to the proposed railway is located at a distance of 57 metres from the track. From ground-borne vibration measurements undertaken in the Pilbara region (Figure 4.7), which consisted of sand soil types, Lloyd George Acoustics considers that the risk of annoyance from vibration is minimal at this distance. Therefore annoyance from ground-borne vibration is unlikely to occur for this proposed railway.

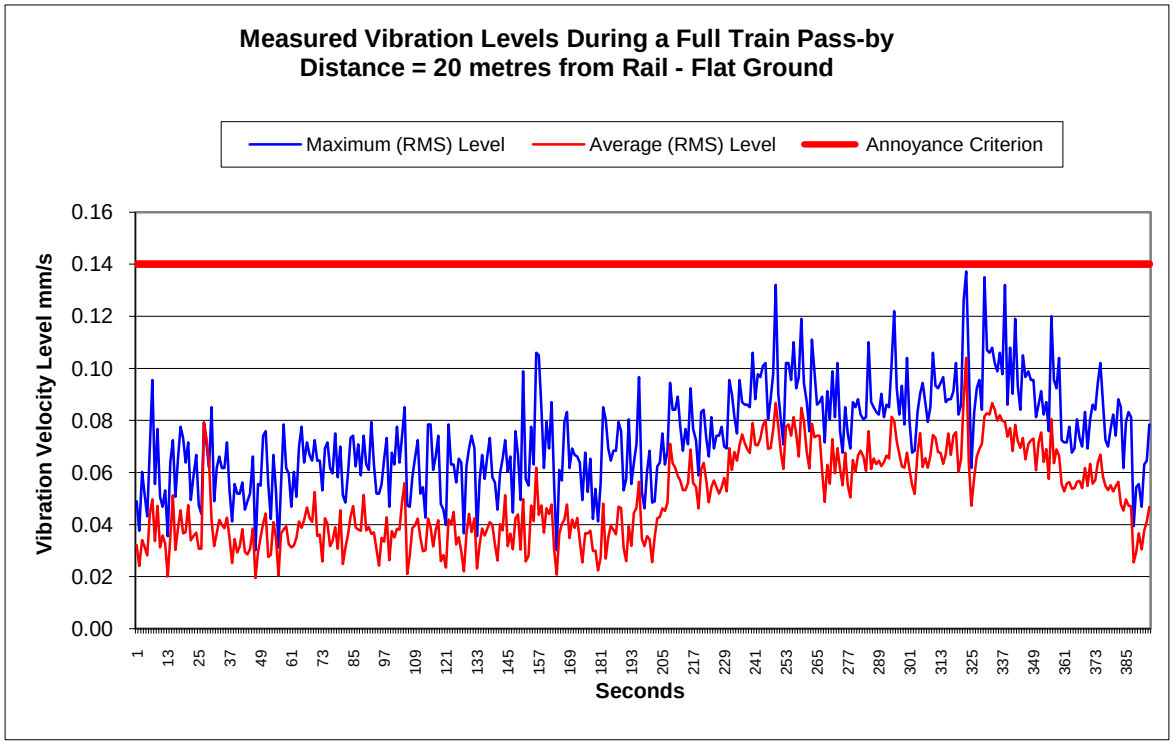

Figure 4.7 Results of Vibration Measurements Undertaken in the Pilbara

5 DISCUSSION

The results show that three noise sensitive receiver locations are predicted to exceed the SPP 5.4 “Limit” criteria and seven receivers are predicted to be within the margin between the “Target” and “Limit” criteria. All other receivers are predicted to comply with the SPP 5.4 “Target” criteria and require no further action.

For the residential premises predicted to exceed the SPP 5.4 “Limit” criteria, mitigation measures to reduce the external noise levels will be thoroughly investigated. These measures will take the form of barriers to reduce the external noise level to, at least, below the “Limit” criteria and upgrades to the facade of the house to achieve acceptable internal noise levels. Suitable upgrades to building facades are detailed in the SPP 5.4 guidelines and these “deemed to comply” treatments have been reproduces in *Appendix B* of this assessment.

Should it be determined that it is not practicable to achieve an external noise level below the SPP 5.4 “Limit” criteria, then other management measures such as property purchase, “deemed to comply package B” or specifically designed building facade upgrades will be investigated.

For residential premises predicted to exceed the SPP 5.4 “Target” criteria but still below the “Limit” criteria, the use of the “deemed to comply package A” facade upgrades will be investigated.

It is anticipated that any noise control management will be determined following a visual assessment of the property and discussions with the property owners.

Although not policy in Western Australia, where receivers are situated in very quiet environments, the impact of transportation noise levels may be assessed against the draft EPA Guidance No. 14. For rural residential premises, “acceptable” night noise levels are stated as a Noise Amenity Rating N0, or less than $L_{Aeq\ (Night)}$ 40 dB. Residential premises receiving a noise levels up to a Noise Amenity Rating N3 (equal or less than $L_{Aeq\ (Night)}$ 50 dB) would be “conditionally acceptable” providing acceptable internal noise levels are achieved. The Transportation noise levels would be considered as “unacceptable” above $L_{Aeq\ (Night)}$ 50 dB. Based on these criteria, 10 noise sensitive premises would receive transportation noise levels considered as “unacceptable” and would require purchase. All remaining noise sensitive premises assessed (and probably more) would be considered “conditionally acceptable” and may require facade treatments to ensure acceptable internal noise levels.

When considering the maximum noise levels, the three receivers predicted to exceed the SPP 5.4 “Limit” criteria are also predicted to receive a maximum noise level above L_{Amax} 75 dB. Although a highly subjective response, these residents may experience sleep disturbance issues. However, these high maximum noise levels are likely to be addressed through any treatment used under the SPP 5.4.

6 REFERENCES

Environmental Protection (Noise) Regulations 1997

Environmental Protection Authority (2000), - Draft *EPA Statements for EIA No. 14 (Version 3) - Road and Rail Transportation Noise,* May 2000.

Environmental Protection Authority (2007), - *Guidance for the Assessment of Environmental Factors Draft Guidance No. 8: - Environmental Noise*, May 2007.

Western Australian Planning Commission (WAPC), - *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning*

APPENDIX A

Comparison of Alternative Railway Alignments

Lloyd George Acoustics

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Ocean Reef
Padbury
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Email Report

To:	Oakajee Port and Rail	From:	Daniel Lloyd
Attention:	Gavin Edwards	Date:	17 May 2010
Email:	gedwards@prestonconsulting.com.au	Pages:	5
Our Ref:	9091365-03		
Re:	Noise Assessment of Rail Options		

Lloyd George Acoustics have predicted the railway noise levels to noise sensitive receivers adjacent to the Jack Hills to Oakajee railway. Three rail alignments have been considered in the assessment. These being:

- The original alignment (Jan 10);
- Alignment to the north of the original alignment; and
- Alignment to the south of the original alignment.

The predicted $L_{Aeq\ (Night)}$ level for each of the alignment options are presented in *Table 1*. The contours lines for the north and south options will be sent as dxf files.

The assessment found that when compared to *the State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning*:

- For the original railway alignment, 6 receivers were over the Limit criteria and 11 receivers were over the Target criteria;
- For the northern railway alignment, 17 receivers were over the Limit criteria and 19 receivers were over the Target criteria; and
- For the southern railway alignment, 8 receivers were over the Limit criteria and 12 receivers were over the Target criteria.

Regards,

Daniel Lloyd

Table 1 - $L_{Aeq(night)}$ Noise Level Predictions Jack Hills to Oakajee

Name	$L_{Aeq(night)}$ dB Orginial	$L_{Aeq(night)}$ dB North Option	$L_{Aeq(night)}$ dB South Option	Address	Suburb	Postcode	Owner_1		X m	Y m	Z m
6	62	51	48	LOT 6088		0	HARVARD NOMINEES PTY LTD		337014	6854031	214.84
151	62	46	46	148 CAREY RD	WHITE PEAK	6532	WA LAND AUTHORITY		270513.9	6831992	87.23
152	59	55	50	144 CAREY RD	WHITE PEAK	6532	WA LAND AUTHORITY		270720.2	6831810	116.5
26	58	49	44	59 EASTOUGH-YETNA RD	YETNA	6532	BENNIER, TESSERENA MAY		275922.2	6829671	89.17
19	56	54	48	479 CHAPMAN RD	EAST CHAPMAN	6532	SUCKLING, CATHRINE RUBY		282442.2	6826303	94.69
32	56	65	38	3325 WHITE PEAK RD	WHITE PEAK	6532	WA LAND AUTHORITY		270603.1	6833155	102.61
35	55	52	30	LOT 328		0	WA LAND AUTHORITY		270143.6	6834782	113.54
81	54	71	46	12 NEWMARRACARRA RD	KOJARENA	6532	GRANT, ALEXANDER DAVID		290515.6	6828470	116.5
11	54	47	45	2134 VALENTINE RD	NORTH ERADU	6532	CLUNE, JEREMIAH BERNARD		313813.7	6839175	198.55
13	53	47	46	150 LORIMER RD	DURAWAH	6532	PIGGOTT, DIANNE FLORENCE		297349	6832089	187.42
154	52	56	51	327 WHITE PEAK RD	WHITE PEAK	6532	WA LAND AUTHORITY		271176.5	6830860	89.69
2	51	44	47	LOT 14		0	WARK, KERRY RAYMOND		535743.4	6997657	451.5
39	51	47	26	2499 NORTH WEST COASTAL HWY	OAKAJEE	6532	WA LAND AUTHORITY		267937.4	6836395	71.89
46	51	50	47	694 BADGEDONG RD	WANDANA	6532	GOULD, PETER RAY		346022.2	6874640	230.5
12	51	47	50	1682 VALENTINE RD	NORTH ERADU	6532	COBLEY, RICHARD NORMAN		311420.7	6835696	209.1
34	51	53	39	LOT 9782		0	WA LAND AUTHORITY		270194.3	6834387	129.96
83	51	73	47	1183 CHAPMAN RD	EAST CHAPMAN	6532	GRANT, ALEXANDER DAVID		288299.1	6827925	106.82
7	50	43	58	1829 PETER RD	AMBANIA	6632	RADISLE PTY LTD		324958.3	6841937	180.53
16	50	61	45	145 SCOTT RD	EAST CHAPMAN	6532	GOULD, JENNIFER KAYE		284793.5	6828138	97.96
15	50	64	46	1065 CHAPMAN RD	EAST CHAPMAN	6532	ROYCE, ELDRED GRAEME		287184.6	6828282	104.06
114	50	50	38	LOT 2		0	WA LAND AUTHORITY		269111.4	6835137	116.5
93	50	57	46	278 MORRELL RD	NARRA TARRA	6532	SPENCER-LAITT, GRAHAM ST JOHN		277427.1	6827593	103.48
47	50	52	47	LOT 9372		0	EXCELL, JOAN PATRICIA		344801.9	6871461	229.68
49	50	54	45	LOT 1081		0	EXTEN, KEVIN ARTHUR RUSSELL		340859.4	6864903	227.23
153	50	52	55	289 WHITE PEAK RD	WHITE PEAK	6532	WA LAND AUTHORITY		270778.8	6830780	91.5
1	50	46	47	LOT 27		0	DAY, JOAN ELIZABETH		558834.2	7020679	486.66
9	49	44	59	282 BURTON WILLIAMSON RD	NORTH ERADU	6532	BURTON, PETER CLARENCE		319960.4	6840611	171.5
33	49	51	42	291 CAREY RD	WHITE PEAK	6532	WA LAND AUTHORITY		269757.7	6833941	121.5
59	49	49	52	LOT 6093		0	CHARLIE MESSINA PTY LTD		332516.9	6843678	229.49
109	49	55	40	60 EASTOUGH-YETNA RD	YETNA	6532	HIPPER, LEANNE BERYL		276504.4	6830359	91.5
29	49	52	56	290 WHITE PEAK RD	WHITE PEAK	6532	WEIR, KADE		270939.1	6830635	93.41
28	48	53	58	360 WHITE PEAK RD	WHITE PEAK	6532	RADAICH, DEANNE MAREE		271520.1	6830422	120.76
45	48	61	45	469 WANDINA RD	NUNIERRA	6630	(TALLERING PEAK MINE SITE)		365092	6888054	255.59
48	48	60	46	LOT 9557		0	EXCELL, JOAN PATRICIA		344211.6	6870979	237.07
65	48	48	48	7856 GERALDTON-MOUNT MAGNET RD	TENINDEWA	6632	CRITCH, JUDITH ANNE		341349.7	6832714	200.54
30	48	50	64	242 WHITE PEAK RD	WHITE PEAK	6532	VINTON, KATHLEEN MAY		270724.9	6830439	102.99
87	48	51	45	177 SCOTT RD	EAST CHAPMAN	6532	SCOTT, MARGARET LYNETTE		284415.3	6828559	111.5
18	48	51	45	400 ANGELS RD	EAST CHAPMAN	6532	WHITE, BELINDA LOUISE		282379.6	6827261	109.61
10	47	74	47	119 BURTON WILLIAMSON RD	NORTH ERADU	6532	BURTON, STANLEY BENJAMIN		316135.2	6841070	223.29
17	47	62	44	675 CHAPMAN RD	EAST CHAPMAN	6532	EDWARDS, BARRY CHARLES		283958.8	6827786	91.5
23	47	47	59	404 CHAPMAN RD	EAST CHAPMAN	6532	HOPKINS, CASEY MAJELLA		281634.4	6825224	81
24	47	47	51	1172 CHAPMAN VALLEY RD	NARRA TARRA	6532	SMITH, MARJORIE		275592.9	6827015	77.33
82	47	50	46	53 NEWMARRACARRA RD	EAST CHAPMAN	6532	R APPLEYARD FARMS PTY LTD		288897.9	6828339	111.5
107	47	52	40	111 CHAPMAN VALLEY RD	NARRA TARRA	6532	MOSTAFANEJAD, KAROLA		276827	6830263	91.04
20	47	47	55	581 CHAPMAN RD	EAST CHAPMAN	6532	EDWARDS, FIONA MICHELLE		283200.4	6825821	91.03
56	47	51	47	1803 TENINDEWA RD	TENINDEWA	6632	MCCARTNEY NOMINEES PTY LTD		335320.3	6849176	209.07
80	47	46	45	275 NEWMARRACARRA RD	EAST CHAPMAN	6532	MARTIN, ANDREW PETER		290550.2	6829670	146.5
149	47	46	46	187 TENINDEWA RD	TENINDEWA	6632	KEEFFE, CLEMENT THOMAS		340544.3	6835200	217.45
14	46	49	44	422 NEWMARRACARRA RD	NORTHERN GULLY	6532	R APPLEYARD FARMS PTY LTD		292155.4	6830447	136.5

Table 1 - $L_{Aeq(night)}$ Noise Level Predictions Jack Hills to Oakajee

Name	$L_{Aeq(night)}$ dB Orginial	$L_{Aeq(night)}$ dB North Option	$L_{Aeq(night)}$ dB South Option	Address	Suburb	Postcode	Owner_1		X m	Y m	Z m
110	46	51	36	61 EASTOUGH-YETNA RD	YETNA	6532	MCKAY, DOREEN JUDITH		276426.7	6830688	91.5
113	46	59	36	LOT 1		0	WA LAND AUTHORITY		269426	6836033	129.41
8	46	52	41	372 BURTON RD	AMBANIA	6632	THOMAS, BARBARA IRENE		320958.1	6842540	171.6
57	46	50	46	1801 TENINDEWA RD	TENINDEWA	6632	MCCARTNEY NOMINEES PTY LTD		335292.4	6848940	207.9
79	46	60	43	1116 DURAWAH NORTHERN GULLY RD	DURAWAH	6532	ANDERSON, DONNA MARIE		296502.6	6832987	202.67
27	46	49	52	426 WHITE PEAK RD	YETNA	6532	WALLACE, HEATHER JEANE		271983	6829540	157.52
31	45	46	44	LOT 2815		0	WA LAND AUTHORITY		269777.7	6832415	88.91
25	45	47	49	1329 CHAPMAN VALLEY RD	YETNA	6532	COLLINGWOOD, JOHN PHILIP		275313.1	6828589	97.91
105	45	49	42	1556 CHAPMAN VALLEY RD	NARRA TARRA	6532	PIKE, IAN LESLIE		277375.8	6830399	115.32
36	45	53	33	LOT 2594		0	WA LAND AUTHORITY		270706.1	6835171	129.71
90	45	44	49	72 JORDAN RD	EAST CHAPMAN	6532	WOODS, CECIL THOMAS		281705.1	6824358	96.33
21	45	46	60	471 CHAPMAN RD	EAST CHAPMAN	6532	BOOTH, THOMAS WILLIAM		282226	6825492	81.5
22	45	46	65	472 CHAPMAN RD	EAST CHAPMAN	6532	MALEY, KENNETH JOHN		282186.7	6825340	81.5
73	45	58	45	1339 VALENTINE RD	VALENTINE	6532	CLUNE, FRANCIS MICHAEL		307654.3	6835412	253.92
106	45	47	39	1494 CHAPMAN VALLEY RD	NARRA TARRA	6532	LANGLEY, PAMELA ANNE		277587.7	6829728	116.28
91	45	46	55	32 CHAPMAN RD	EAST CHAPMAN	6532	CAMERON, REBECCA ANNE		282384.8	6825123	81.5
92	44	43	49	982 NARRA TARRA RD	NARRA TARRA	6532	SPENCER-LAITT, GRAHAM ST JOHN		278744.3	6824268	66.5
38	44	68	28	122 OLSEN RD	HOWATHARRA	6532	WA LAND AUTHORITY		269198.3	6836929	104.06
63	44	44	45	184 KEMP RD	TENINDEWA	6632	PEET, BEVERLEY JANICE		332220.3	6837296	192.72
5	44	43	46	LOT 8284		0	BACOPAK PTY LTD		348545.4	6867178	226.5
44	43	45	43	469 WANDINA RD	NUNIERRA	6630	(TALLERING PEAK MINE SITE)		363105.7	6889314	281.5
108	43	47	40	1625 CHAPMAN VALLEY RD	NARRA TARRA	6532	ROYCE, HANNAH MARIE		277154.4	6830894	95.22
4	43	43	44	LOT 6633		0	NETHERCOTT, JOHN		352933.4	6873383	248
94	43	44	48	1093 CHAPMAN VALLEY RD	YETNA	6532	SILVERGLADE PTY LTD		274513.8	6825619	102.97
111	43	48	37	62 EASTOUGH-YETNA RD	YETNA	6532	DUBOULAY, DENISE CHRISTINE		276658.5	6831178	93.43
84	43	47	43	363 ANGELS RD	EAST CHAPMAN	6532	FRY, DAVID LLOYD		281454.9	6827705	109.29
104	43	45	41	1626 CHAPMAN VALLEY RD	NARRA TARRA	6532	NEWTON, JULIE ANN		278035.4	6830710	139.71
112	43	46	38	LOT 6839		0	CROASDALE, GRAHAM		276615.2	6831561	99.74
117	43	44	50	2017 NORTH WEST COASTAL HWY	OAKAJEE	6532	WA LAND AUTHORITY		267641	6831728	90.65
61	43	43	45	LOT 6520		0	KOORINYA PTY LTD		329332.3	6839103	188.37
51	42	47	43	2543 TENINDEWA RD	EAST YUNA	6532	POYNER, KAREN JANICE		334305.8	6855710	200.98
131	42	44	50	8 ROYCE PL	WHITE PEAK	6532	WHITFIELD, GARY		268939.8	6830030	70.98
118	42	44	44	2097 NORTH WEST COASTAL HWY	OAKAJEE	6532	WA LAND AUTHORITY		268282.2	6832688	70.49
127	42	43	51	62 WHITE PEAK RD	WHITE PEAK	6532	JEEVES, STEPHEN CHARLES		269021.6	6830167	66.79
130	42	43	51	1 DIXON PL	WHITE PEAK	6532	SUMPTION, NORMAN ARTHUR		268948.3	6830345	58
147	42	44	41	LOT 14		0	WARK, KERRY RAYMOND		482723	6966483	346.5
50	42	44	41	LOT 5892		0	POYNER, GEOFFREY ALLAN		333298.2	6856614	211.26
129	42	42	52	8 DIXON PL	WHITE PEAK	6532	KILCAIRN HOLDINGS PTY LTD		269180.6	6830470	56.31
74	42	42	47	275 CANT RD	AMBANIA	6632	GH CANT & CO PTY LTD		316474.8	6836069	164.08
126	42	41	51	95 WHITE PEAK RD	WHITE PEAK	6532	TURNER, NARELLE KRISTY		269389.8	6830272	57.74
146	41	44	40	LOT 14		0	WARK, KERRY RAYMOND		482785.5	6966910	346.5
60	41	42	43	90 BRENKLEY RD	TENINDEWA	6632	CHARLIE MESSINA PTY LTD		328394.8	6840376	181.29
72	41	66	41	695 STATION VALENTINE RD	VALENTINE	6532	BARNDON, GRAEME KEVIN		304241.7	6835867	252.74
150	41	81	40	695 STATION VALENTINE RD	VALENTINE	6532	BARNDON, GRAEME KEVIN		304793.4	6835844	246.21
119	41	43	46	4 REWELL RD	WHITE PEAK	6532	WA LAND AUTHORITY		269077.8	6832477	71.5
40	41	41	41	1709 NUBBEROO RD	NUNIERRA	6630	BACOPAK PTY LTD		348179.4	6863370	235.84
86	41	42	39	817 URCH RD	NARRA TARRA	6532	PETER SCOTT PTY LTD		283314.8	6829248	101.87
89	41	44	45	492 CHAPMAN RD	EAST CHAPMAN	6532	WENDT, CRAIG LAWRENCE		282713.3	6824097	88.99
62	41	42	42	50 WEIR RD	TENINDEWA	6632	KOORINYA PTY LTD		329786.8	6838283	180.11

Table 1 - $L_{Aeq(night)}$ Noise Level Predictions Jack Hills to Oakajee

Name	$L_{Aeq(night)}$ dB Orginial	$L_{Aeq(night)}$ dB North Option	$L_{Aeq(night)}$ dB South Option	Address	Suburb	Postcode	Owner_1		X m	Y m	Z m
85	41	41	41	21 ANGELS RD	EAST CHAPMAN	6532	BILBE, BRENDAN KEVIN		282359.5	6828178	117.71
78	40	40	42	84 FORRESTER RD	DURAWAH	6532	FORRESTER, ROGER ERNEST		293237.3	6833099	216.5
37	40	48	35	LOT 3324		0	GANNON, BRETT EDWARD		271048.3	6835372	138.56
123	40	41	50	216 WHITE PEAK RD	WHITE PEAK	6532	ASMUSSEN, VOLLERT ERICH		270115.8	6830293	75.66
3	40	41	40	LOT 6374		0	NEU, KAREN LEE		358002.7	6878562	256.5
88	40	40	43	556 CHAPMAN RD	EAST CHAPMAN	6532	EDWARDS, BARRY CHARLES		283210.8	6824278	95.38
133	40	39	47	46 ROYCE PL	WHITE PEAK	6532	RUSSELL, HAROLD HERBERT		268932.5	6829721	76.5
103	40	43	40	1668 CHAPMAN VALLEY RD	NARRA TARRA	6532	CRYSTALUNA NOMINEES PTY LTD		277939.1	6831201	115.91
42	40	40	39	1709 NUBBEROO RD	NUNIERRA	6630	BACOPAK PTY LTD		349652.2	6862374	244.43
64	40	40	41	3 DOOGUE RD	TENINDEWA	6632	KEEFFE, CLEMENT THOMAS		337238.4	6838742	246.5
121	40	40	48	14 LACEY RD	WHITE PEAK	6532	WA LAND AUTHORITY		269289	6831706	66.8
100	39	43	38	112 CHAPMAN VALLEY RD	NARRA TARRA	6532	HEINRICH, ROSS MERVAN		277534.7	6832020	104.49
95	39	39	38	12 URCH RD	NARRA TARRA	6532	WARD, SUZANNE JOY		279646.6	6831614	184.75
135	39	39	41	243 ELIZA SHAW DR	WHITE PEAK	6532	SMITH, TERRENCE JAMES		269708.1	6828036	108.19
120	39	40	51	12 LACEY RD	WHITE PEAK	6532	WA LAND AUTHORITY		269114.4	6831611	62.27
137	39	38	42	165 ELIZA SHAW DR	WHITE PEAK	6532	WALTON, KAREN MICHELLE		269320.4	6828604	77.52
136	39	38	42	206 ELIZA SHAW DR	WHITE PEAK	6532	DAWSON, SHIRELLE MAREE		269366.8	6828219	88.66
53	38	41	38	LOT 9745		0	ATROX NOMINEES PTY LTD		332109.2	6853791	192.56
41	38	39	37	1730 NUBBEROO RD	NUNIERRA	6630	BACOPAK PTY LTD		350051.9	6862595	236.5
97	38	41	38	1812 CHAPMAN VALLEY RD	NARRA TARRA	6532	FELLOWS, ANTHONY BENJAMIN		278218.3	6832646	124.41
138	38	41	41	LOT 95		0	HILL, SHANE ROBIN		269602.3	6828152	99.41
96	38	40	38	127 URCH RD	NARRA TARRA	6532	MEREDITH, PATRICIA ANNE		279070.5	6832318	144.92
43	38	36	45	LOT 142		0	(POONA MINE - SHUTDOWN)		543770.3	6999009	482.53
101	38	41	38	74 URCH RD	NARRA TARRA	6532	GAUNT, GARY RONALD		278223.2	6831991	113.21
148	38	37	38	?		0			342386.5	6829090	204.58
54	38	41	38	LOT 6789		0	WILLIAMSON, ROBERT GEORGE		318689.9	6846295	230.99
76	37	37	44	23 DURAWAH NORTHERN GULLY RD	NORTHERN GULLY	6532	ATROX NOMINEES PTY LTD		298490.1	6829072	167.3
99	37	40	34	1823 CHAPMAN VALLEY RD	NARRA TARRA	6532	MURPHYL PASTORAL CO PTY LTD		277481.7	6832717	101.5
98	37	41	37	1824 CHAPMAN VALLEY RD	NARRA TARRA	6532	MURPHYL PASTORAL CO PTY LTD		277761	6832732	108.33
128	37	40	46	1836 NORTH WEST COASTAL HWY	BULLER	6532	WA LAND AUTHORITY		268093	6830052	40.47
102	37	41	39	1702 CHAPMAN VALLEY RD	NARRA TARRA	6532	NEWPRIDE NOMINEES PTY LTD		278362.8	6831413	121.5
66	37	37	37	LOT 1923		0	BRIAN THOMAS NOMINEES PTY LTD		346011.5	6833413	226.5
139	37	38	44	163 ELIZA SHAW DR	WHITE PEAK	6532	FRANK, ANNEMARIE EVELYN		268765.8	6828751	66.5
75	37	37	44	678 DURAWAH NORTHERN GULLY RD	NORTHERN GULLY	6532	WOODS, WAYNE JOHN		297149.3	6828583	164.35
69	37	45	36	2501 VALENTINE RD	VALENTINE	6532	SMART NOMINEES PTY LTD		312224	6842414	245.94
124	36	38	42	130 WHITE PEAK RD	WHITE PEAK	6532	NAPIER, MEGAN EMMA		269755.4	6829743	69.2
143	36	36	42	69 ELIZA SHAW DR	BULLER	6532	NELSON, MARK STEVEN		268100	6828464	54.17
141	36	38	44	1714 NORTH WEST COASTAL HWY	BULLER	6532	GODDARD, CLIVE WILLIAM		267780.5	6828662	52.32
55	36	39	35	250 WILLIAMSON RD	EAST YUNA	6532	WILLIAMSON, ROBERT GEORGE		319114.8	6847727	219.14
122	36	30	43	5 HESTER PL	WHITE PEAK	6532	DAVIES, THOMAS DAVID		271049.2	6828957	140.24
71	35	44	37	726 STATION VALENTINE RD	DURAWAH	6532	LEY, BRUCE VINCENT		304428.9	6838184	256.5
52	35	37	37	547 CAMPBELLS RD	EAST YUNA	6532	TUNBRIDGE, BRADLEY NORMAN		328805.9	6854744	206.5
70	35	42	36	LOT 10654		0	SCOTT, COLIN WILLIAM		307244	6839852	260.04
67	35	35	35	736 MENANG RD	TENINDEWA	6632	MENDON PTY LTD		345871.2	6829612	221.5
77	35	35	38	LOT 56		0	STONE, JAMES BARRYMORE		292385.2	6832498	174.84
125	35	36	40	128 WHITE PEAK RD	WHITE PEAK	6532	BELL, BEVERLEY MERLE		269363.3	6829763	63.6
145	35	38	41	77 ELIZA SHAW DR	BULLER	6532	GELL, CHERYL ANN		268244.1	6828431	55.81
68	34	34	34	313 OLMAN RD	TENINDEWA	6632	CHARLIE MESSINA PTY LTD		344694.7	6828964	211.5
134	34	33	37	LOT 111		0	IVES, DAVID STEPHEN		269610.5	6827603	97.82

Table 1 - $L_{Aeq(night)}$ Noise Level Predictions Jack Hills to Oakajee

Name	$L_{Aeq(night)}$ dB Orginial	$L_{Aeq(night)}$ dB North Option	$L_{Aeq(night)}$ dB South Option	Address	Suburb	Postcode	Owner_1		X m	Y m	Z m
144	33	37	38	85 ELIZA SHAW DR	BULLER	6532	KELLY, SUSAN JANE		268348.7	6828509	53.57
140	32	35	41	135 ELIZA SHAW DR	WHITE PEAK	6532	MAY, SHARYN ANNE		268697.2	6828510	58.83
115	32	28	47	1789 NORTH WEST COASTAL HWY	OAKAJEE	6532	WA LAND AUTHORITY		266145.4	6829922	6.5
142	32	33	42	1730 NORTH WEST COASTAL HWY	BULLER	6532	FORTH, DARRELL GRAEME		268024.5	6828929	45.07
58	31	32	36	1154 TENINDEWA RD	TENINDEWA	6632	THOMAS, BARBARA IRENE NAYLOR		340513.1	6844615	235.52
116	31	29	44	LOT 180		0	WA LAND AUTHORITY		266663.7	6829674	27.14
132	30	29	35	42 ROYCE PL	WHITE PEAK	6532	THOMAS, TROY HOANI		268825.1	6829861	57.09
	Number	Over SPP 5.4 Limit criteria									
	Number	Over SPP 5.4 Target criteria									

APPENDIX B

Deemed-to-Satisfy Construction Standards

Noise insulation – "Deemed to Comply" packages for residential development

The following "deemed-to-comply" Packages outline noise insulation measures that are designed to ensure that the indoor noise standards in the Policy are achieved for residential developments in areas where outdoor noise levels will exceed the *target* noise levels by up to 8 dB(A).

The deemed-to-comply specifications are intended to simplify compliance with the noise criteria, and the relevant Package should be required as a condition of development. However, this should not remove the option to pursue alternative measures or designs. Departures from the deemed-to-comply specifications need to be accompanied by acoustic certification from a competent person, to the effect that the development will achieve the requirements of the Policy.

Superior construction standards, such as those specified in the "deemed-to-comply" packages, are now becoming more prevalent in residential buildings; and do not significantly increase the cost of building. A similar standard of construction has been recommended by the Western Australian Planning Commission for new housing in areas forecast to be seriously affected by aircraft noise.[1] That recommendation followed a comprehensive assessment of the efficacy and costs of noise attenuation measures, taking into account the recent changes in industry building standards as well as changes to the *Building Code of Australia*.

Where transport noise levels are more than 8 dB above the noise *target*, i.e. 3 dB above the noise *limit*, or where noise-sensitive development other than residential is proposed, a Detailed Assessment should be prepared by a competent person. The report should specify the level of noise reduction required and the noise insulation measures needed to comply with the Policy. The approval may require that the construction drawings be checked for compliance with the Detailed Assessment, and that follow-up verification be carried out to certify compliance.

[1] Statement of Planning Policy No 5.1, *Land Use Planning in the Vicinity of Perth Airport* and the accompanying report on *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport,* February 2004.

Package A: Noise levels within the *margin*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where noise levels exceed the noise *target* but are within the *limit*.

Area type	Orientation	Package A measures
Indoors		
Bedrooms	Facing road/rail corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[2]
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[3]	Facing corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 35mm (minimum) solid core external doors with acoustic seals[4] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[5]	Facing corridor	• Minimum 2.0m high solid fence (e.g. Hardifence, pinelap, or Colorbond) • Picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[2] See section on Mechanical ventilation/airconditioning for further details and requirements.

[3] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

[4] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

[5] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Package B: Noise within 3 dB above the *limit*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where transport noise levels exceed the noise *limit* but by no more than 3 dB (See Table 1 in the Policy).

Area type	Orientation	Package B measures
Indoors		
Bedrooms	Facing road/rail corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[6]
	Side-on to corridor	• 10mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[7]	Facing corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 40mm (minimum) solid core external doors with acoustic seals[8] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[9]	Facing corridor	• Minimum 2.4m solid fence (e.g. brick, limestone or Hardifence) • Colorbond and picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[6] See section on Mechanical ventilation/airconditioning for further details and requirements.

[7] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

[8] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

[9] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Mechanical ventilation/airconditioning

Where outdoor noise levels are above the "target", both Packages A and B require mechanical ventilation or airconditioning to ensure that windows can remain closed in order to achieve the indoor noise standards.

In implementing Packages A and B, the following need to be observed:

- evaporative airconditioning systems will not meet the requirements for Packages A and B because windows need to remain open;
- refrigerative airconditioning systems need to be designed to achieve fresh air ventilation requirements;
- air inlets need to be positioned facing away from the transport corridor where practicable;
- ductwork needs to be provided with adequate silencing to prevent noise intrusion.

Notification

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

Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development or planning approval involving noise-sensitive development, where external noise levels are forecast or estimated to exceed the "target" criteria as defined by the Policy. In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under section 12A of the Town Planning and Development Act and section 70A of the Transfer of Land Act. An example of a suitable notice is given below.

Notice: This property is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise. Further information about transport noise, including development restrictions and noise insulation requirements for noise-affected property, are available on request from the relevant local government offices.

APPENDIX C

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)

The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Pressure Level (L_p)

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{ASlow}

This is the noise level in decibels, obtained using the A frequency weighting and the S time weighting as specified in AS1259.1-1990. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}

This is the noise level in decibels, obtained using the A frequency weighting and the F time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.

L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{Aeq}

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

L_{A90}

An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

Background Noise

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings,

etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise

Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

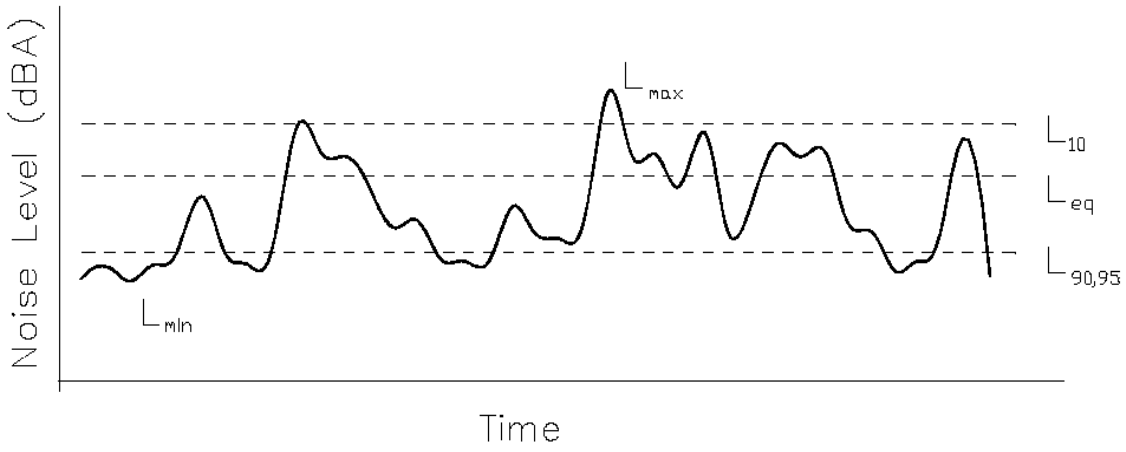
RMS

The root mean square level. This is used to represent the average level of a wave form such as vibration.

Vibration Velocity Level

The RMS velocity of a vibration source over a specified time period. Units are mm/s.

Chart of Noise Level Descriptors



Typical Noise Levels