Noise Impact Assessment

Oakajee Deepwater Port and Terrestrial Iron-Ore Handling Facility

DRAFT FOR REVIEW

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APPENDICES

1 INTRODUCTION

Oakajee Port and Rail Pty Ltd (OPR) propose to construct a deepwater port and terrestrial iron-ore handling facilities at Oakajee. The site is located 24km north of Geraldton, within the proposed Oakajee Industrial Estate, between the Oakajee and Buller Rivers. The terrestrial facilities proposed that are of interest to this study include the port rail system, access and service corridors, a car dumper, stockpiles, ore in-loading and out-loading infrastructure, and supporting facilities

Noise resulting from operation of the port and iron-ore handling facilities has been predicted to noise sensitive premises and the results compared against the relevant noise level criteria.

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

2 CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

Regulation 7 defines the prescribed standard for noise emissions as follows:

> "7. (1) Noise emitted from any premises or public place when received at other premises –
>
> (a) Must not cause or *significantly contribute to*, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and
>
> (b) Must be free of –
>
> i. Tonality;
>
> ii. Impulsiveness; and
>
> iii. Modulation".

A "…noise emission is taken to *significantly contribute to* a level of noise if the noise emission exceeds a value which is 5dB below the assigned level…"

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics if:

(a) The characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) The noise emission complies with the standard after the adjustments of *Table 2.1* are made to the noise emission as measured at the point of reception.

Table 2.1 – Adjustments For Intrusive Characteristics

Tonality	Modulation	Impulsiveness
+ 5dB	+ 5dB	+ 10dB

Note: The above are cumulative to a maximum of 15dB.

The Regulations are based on allowable noise levels for different times of the day, determined by a combination of a "base noise level" and an "influencing factor", which is added to the base noise level. The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown below in *Table 2.2*. The influencing factor is determined for each receiver location by considering the land use within two circles having a radius of 100 metres and 450 metres from the noise sensitive premises of concern. It takes into consideration the amount of industrial and commercial land and the presence of major and secondary roads. Refer to *Appendix A* for more detail on the influencing factor calculation.

As the receiver locations are not near to commercial or Industrial land uses or within 450 metres of a major road, the influencing factor is assumed to be zero for all locations, so it is the baseline levels that are the assigned levels for this assessment.

Table 2.2 – Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise Sensitive[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise Sensitive[2]	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial	All hours	65	80	90

1. Applies within 15metres of a building associated with a noise sensitive use, as defined in Schedule 1, Part C.
2. Applies at a noise sensitive premises greater than 15metres from a building associated with a noise sensitive use.

3 METHODOLOGY

3.1 Background Noise Measurements

The purpose of background noise measurements are:

- To identify the impact of noise level increases over low background noise levels;
- To identify the likelihood of noise exceedances resulting from the combination of the background noise with that of the proposal; and
- To enable assessment of the likely audibility of any tonal, modulation or impulsive components in the noise from the proposal.

Ambient noise measurements were carried out using un-manned noise data loggers, at three representative receiver locations between the 14 and 27 November 2009. 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* (*Guidance No. 8*).

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

- 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

Figure 3.1 Noise Monitoring Locations

3.2 Noise Modelling

The noise from the port has been predicted using the software program *SoundPLAN 7.0* with the CONCAWE algorithms selected. These algorithms have been selected as they are one of the few that include the influence of wind and atmospheric stability. Input data required in the model are:

- Meteorological Information;
- Topographical data;
- Ground absorption
- Noise sources; and
- Source sound power levels.

3.2.1 Meteorological Information

Meteorological information utilised is based on that specified in EPA *Guidance for the Assessment of Environmental Factors No.8 Environmental Noise draft*, and are shown below in *Table 3.1*.

Table 3.1 –Modelling Meteorological Conditions

Parameter	Night (1900-0700)	Day (0700-1900)
Temperature (^{o}C)	15	20
Humidity (%)	50	50
Wind Speed (m/s)	3	4
Wind Direction*	All & Prevailing	All & Prevailing
Pasquil Stability Factor	F	E

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

Note that the above conditions approximate the typical worst-case for enhancement of sound propagation. The EPA policy is that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

At wind speeds greater than those shown above, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

3.2.2 Topographical Data

Topographical data was based on that provided by OPR, which is from the Department of Land Information (DLI). The contours are in 5 metre intervals and cover the noise sensitive premises of concern.

3.2.3 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. grass). In this instance, a value of 0.8 has been used as an average for the land area of the study area and 0.0 for the water.

3.2.4 Noise Sources Considered

Table 3.2 Number of Port Noise Sources Considered in the Assessment

Plant Item	Number of Sources
Train Unloader	1
Idling Locomotive	1
Front-end Loaders	2
Secondary Crusher	1
Vibrating Screens	6
Desalinations Pumps	5
Process Water Pumps	4
Water Treatment Pumps	2
Stackers	2
Reclaimers	2
Product Conveyors, Drives and Transfers	9
Ship Loader and Drives	1

Note: The modelling assumes all plant will operate simultaneously, which although is a worst-case scenario, is expected to occur on occasions.

3.2.5 Source Sound Power Levels

Sound power levels for the plant considered in this assessment were derived from measured noise levels of similar plant in the Pilbara region.

Details of the sound power levels, in one-third-octave bands, used in the noise level predictions are presented below in *Table 3.3* and are representative of the L_{A10} noise levels.

Table 3.3 Sound Power Levels Used in Noise Modelling (dB)

Source/Quantity	One-Third-Octave Band Centre Frequency (Hz)								Overall, dB(A) per Unit
	25 31.5 40	50 63 80	100 125 160	200 250 315	400 500 630	800 1k 1.25k	1.6k 2k 2.5k	3.15k 4k 5k	
Train Unloader		101	105	97	94	89	84	81	98
	103	111	100	93	90	86	84	77	
	103	107	98	91	88	85	82	75	
Train Unloader Wagon Locator		94	93	93	97	91	91	84	101
	93	93	93	92	96	93	89	82	
	98	95	95	94	91	90	89	82	
Wagon Shunt at Unloader	-	111	109	107	101	100	99	94	109
	111	110	110	105	98	98	94	89	
	110	108	109	103	98	99	96	86	
Idling Locomotive*	100	103	103	99	104	98	93	90	104
Conveyor Drive*	108	98	96	94	94	92	90	88	97
Product Conveyor at 5.5m/s	-	45	62	71	80	80	80	72	88/m
	38	49	67	71	81	77	75	67	
	40	54	69	75	83	76	73	66	
Transfer Stations (Enclosed)		100	97	97	97	92	87	81	100
	97	99	97	94	93	85	83	77	
	100	96	98	95	93	86	82	75	
Re-crusher	115	106	105	106	108	106	101	95	115
	111	106	108	109	112	108	98	93	
	108	105	106	104	105	101	96	93	
Vibrating Screen (Typical)	105	101	100	98	94	92	92	90	103
	110	101	101	93	93	93	93	88	
	101	99	101	95	92	92	91	87	

* Centre octave spectra only

Table 3.3 (cont) Sound Power Levels Used in Noise Modelling (dB)

Source/Quantity	One-Third-Octave Band Centre Frequency (Hz)								Overall, dB(A) per Unit
	25	**50**	**100**	**200**	**400**	**800**	**1.6k**	**3.15k**	
	31.5	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	
	40	**80**	**160**	**315**	**630**	**1.25k**	**2.5k**	**5k**	
Front-End Loader (CAT 950)	93	110	100	103	102	98	93	89	109
	94	111	96	106	101	95	92	88	
	96	110	99	99	99	94	93	88	
Process Pumps	100	90	94	92	91	97	95	89	106
	90	97	98	93	95	98	95	85	
	91	100	90	89	97	99	89	83	
Stackers		96	102	102	102	98	97	91	106
	95	97	98	99	101	98	97	89	
	94	100	99	102	101	101	94	87	
Reclaimers		111	112	110	113	107	106	96	116
	112	115	112	108	111	104	100	91	
	111	113	110	112	109	103	98	87	
Ship Loader (Tail Drive)		93	99	99	97	94	90	86	102
	87	96	97	96	95	92	89	82	
	91	96	93	96	94	91	88	81	

4 RESULTS

4.1 Background Noise Measurements

The noise level data, presented graphically in *Figures 4.1 to 4.3,* shows the L_{A1}, L_{A10} and L_{A90} noise levels, together with the wind direction relative to the measurement location and the port.

Figure 4.1

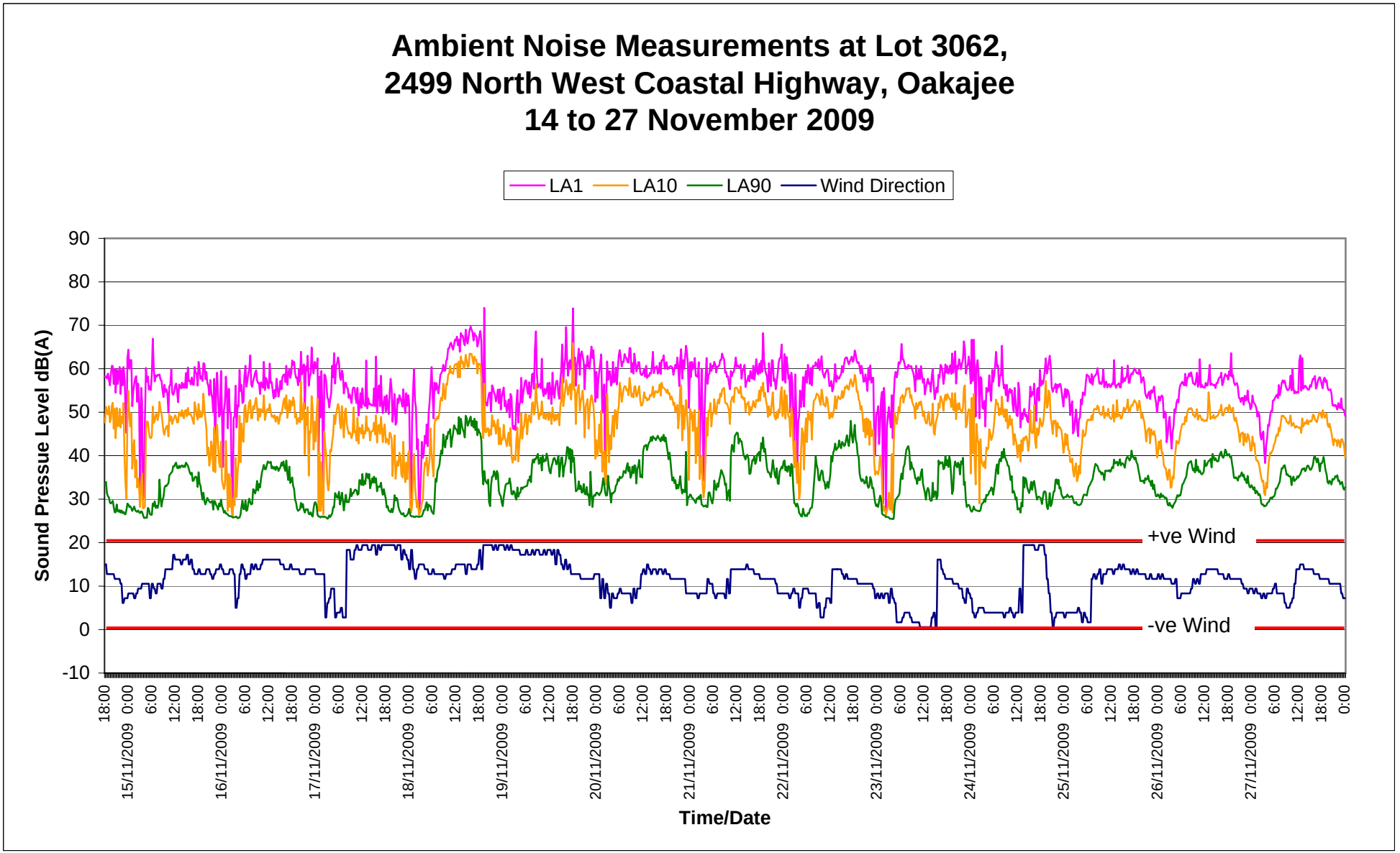

Ambient Noise Measurements at Lot 3062,
2499 North West Coastal Highway, Oakajee
14 to 27 November 2009
LA1
LA10
LA90
Wind Direction
Sound Pressue Level dB(A)
90
80
70
60
50
40
30
20
10
0
-10
+ve Wind
-ve Wind
18:00
0:00
6:00
12:00
15/11/2009
16/11/2009
17/11/2009
18/11/2009
19/11/2009
20/11/2009
21/11/2009
22/11/2009
23/11/2009
24/11/2009
25/11/2009
26/11/2009
27/11/2009
Time/Date

Figure 4.2

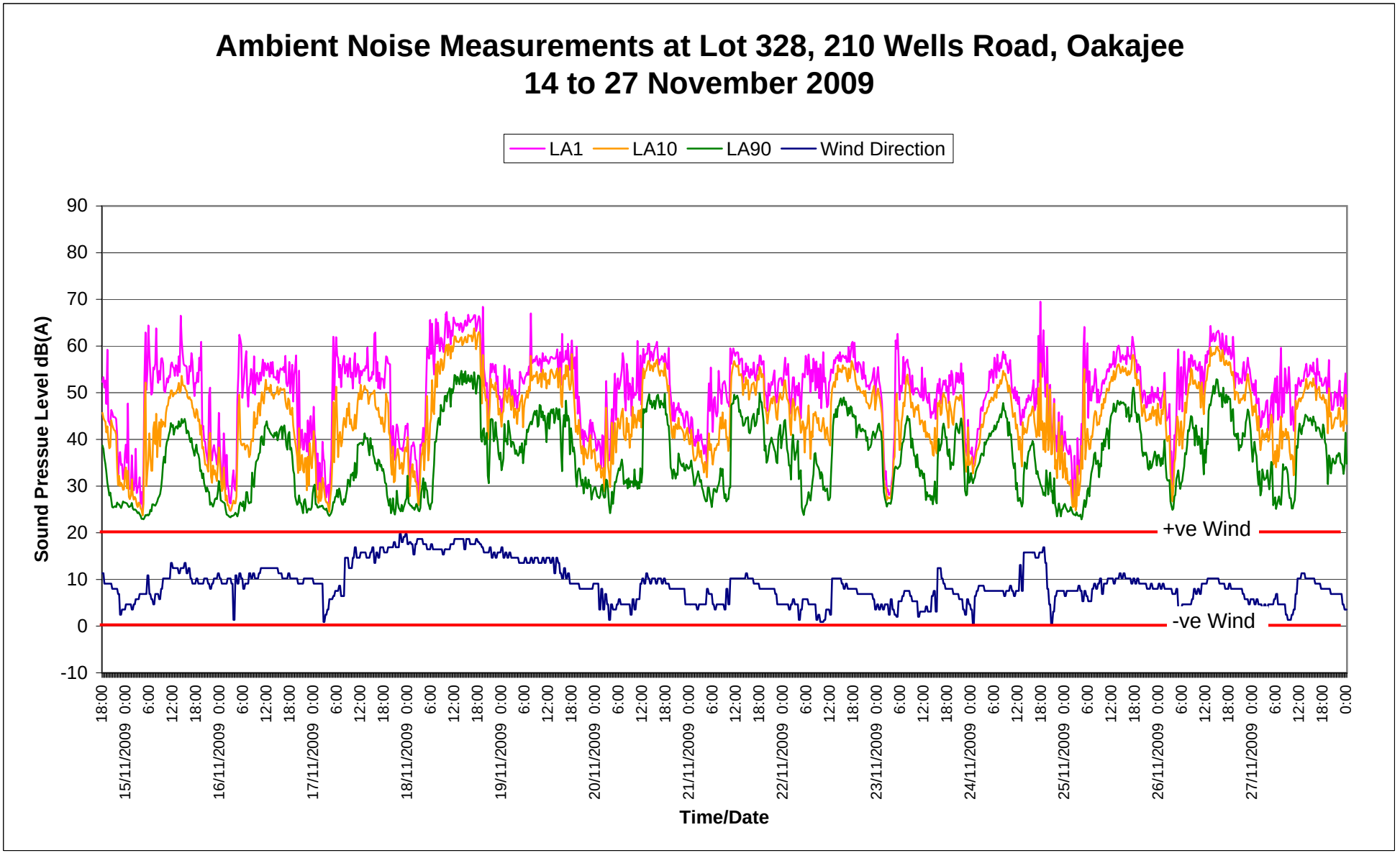
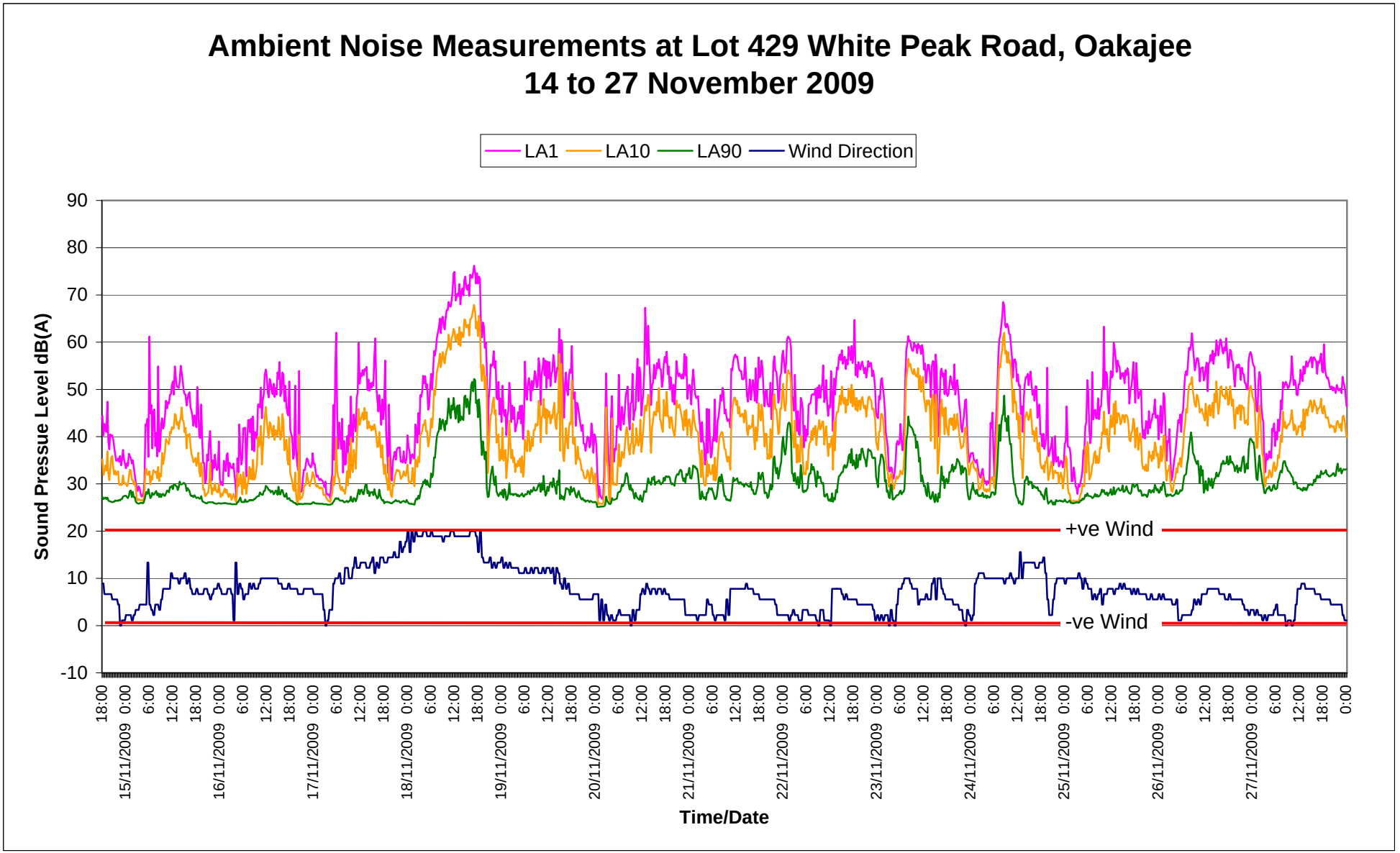

Ambient Noise Measurements at Lot 328, 210 Wells Road, Oakajee
14 to 27 November 2009
LA1
LA10
LA90
Wind Direction
Sound Pressue Level dB(A)
90
80
70
60
50
40
30
20
10
0
-10
+ve Wind
-ve Wind
18:00
0:00
6:00
12:00
18:00
15/11/2009
16/11/2009
17/11/2009
18/11/2009
19/11/2009
20/11/2009
21/11/2009
22/11/2009
23/11/2009
24/11/2009
25/11/2009
26/11/2009
27/11/2009
Time/Date

Figure 4.3


Ambient Noise Measurements at Lot 429 White Peak Road, Oakajee
14 to 27 November 2009
LA1
LA10
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

As required under *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

- 0700-1900 hours Monday to Saturday = L_{A90} 32 dB
- 1900-2200 hours Monday to Saturday and 0900-2200 hours on Sundays and public holidays = L_{A90} 28 dB
- 2200-0700 hours Monday to Saturday and 2200-0900 hours on Sundays and public holidays = L_{A90} 26 dB

Location 2 Lot 328, 210 Wells Road, Oakajee

- 0700-1900 hours Monday to Saturday = L_{A90} 30 dB
- 1900-2200 hours Monday to Saturday and 0900-2200 hours on Sundays and public holidays = L_{A90} 26 dB
- 2200-0700 hours Monday to Saturday and 2200-0900 hours on Sundays and public holidays = L_{A90} 25 dB

Location 3 Lot 429 White Peak Road, Oakajee

- 0700-1900 hours Monday to Saturday = L_{A90} 27 dB
- 1900-2200 hours Monday to Saturday and 0900-2200 hours on Sundays and public holidays = L_{A90} 26 dB
- 2200-0700 hours Monday to Saturday and 2200-0900 hours on Sundays and public holidays = L_{A90} 26 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. As expected the short-term measurements (L_{A1} and L_{A10}) are influenced by local noise sources much more than the background (L_{A90}) levels.

The most important measurements for this assessment are the background levels (L_{A90}) and these can be seen to vary during a 24-hour period. The lowest background levels (the "L_{90}" of the L_{A90} noise levels) occur during the night-time period of 2200-0700 and are fairly consistent at all locations at approximately L_{A90} 26 dB.

Daytime levels range from L_{A90} 27 to 32 dB, with the higher levels likely to result from the influence of traffic on North West Coastal Highway (Location 1). These results indicate that background levels at all locations are relatively low, which is consistent for a rural setting.

4.2 Noise Modelling

The results of the noise modelling are summarised below in *Table 4.1*.

Table 4.1 – Summary of Noise Modelling

Receiver ID	Receiver Location	Predicted Noise Level L_{A10} dB Worst-Case Downwind
1	2017 North West Coastal Hwy	33
2	2499 North West Coastal Hwy	33
3	2097 North West Coastal Hwy	33
4	Lot 2 North West Coastal Hwy	29
5	1789 North West Coastal Hwy	29

Table 4.2 below provides a noise source ranking for Location 1.

Table 4.2 – Noise Source Ranking at Location 1

Noise Source	Predicted Noise Level dB, L_{A10}
Reclaimer	25 dB
Conveyors	17 to 24 dB
Reclaimer – Future Expansion	22 dB

From *Table 4.1*, it can be seen that the most affected noise sensitive premises is predicted to receive a noise level from the port of L_{A10} 33 dB. The noise sources that are most influential are the reclaimers and conveyors (*Table 4.2*).

Whilst the Port is the only significant industry in the Industrial Park, noise emissions may be considered tonal at the nearest residences. If this is the case, a 5 dB penalty is applicable. For instance, the predicted noise levels at Locations 1 to 3 would be adjusted to 38 dB L_{A10} and therefore exceed the night-time assigned level by 3 dB.

As the Industrial Park develops and other industries begin to contribute to the noise emissions, the Port would be considered a significant contributor during the night, since its calculated noise levels at Locations 1 to 3 are within 5 dB of the assigned night-time noise level. With more industries contributing to the overall noise level at a residence, it is unlikely that an individual industry would be considered tonal. As such, levels would no longer need to be adjusted by 5 dB, however, it is a requirement for each industry to be at least 5 dB less than the assigned level so as to not significantly contribute to an exceedance.

Summarising the above, the Port may be considered tonal and subject to a +5 dB adjustment, or as the Industrial Park develops may be considered a significant contributor where it needs to be at least 5 dB less than the assigned level. In either case, where the predicted noise level is above 30 dB L_{A10}, there may be an exceedance of the regulations during the night.

All premises predicted to exceed a noise level of L_{A10} 30 dB are located within the Oakajee buffer area and are owned by LandCorp (WA Land Authority). In the event of noise impact, these premises will either be vacated or, subject to approval by the Department of Environment and Conservation, will have notification of possible noise impacts included in their lease agreements.

Figure 4.4 shows the extent of the L_{A10} 30 dB noise prediction and the receiver locations considered in *Table 4.1.*

5 CONCLUSION

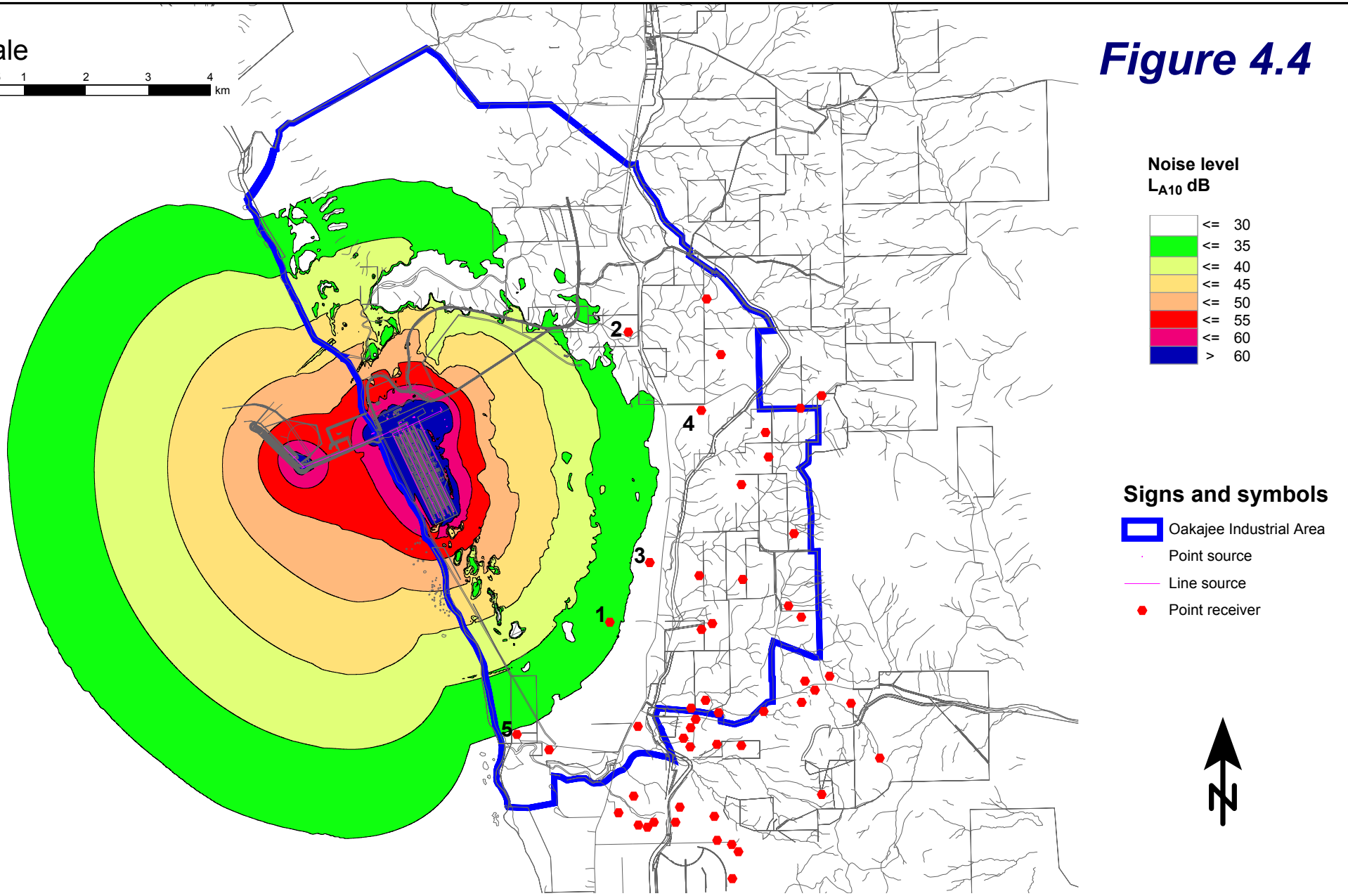
The results of the assessment show that the Port may exceed the assigned night-time noise levels if it is either tonal or considered a significant contributor at three noise sensitive premises. However, these premises are located within the Oakajee buffer area and are owned by LandCorp (WA Land Authority). In the event of noise impact, these premises will either be vacated or, subject to approval by the Department of Environment and Conservation, will have notification of possible noise impacts included in their lease agreements.

6 REFERENCES

Environmental Protection (Noise) Regulations 1997

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

Figure 4.4



Oakajee Deepwater Port and Terrestrial Iron Ore Facility
Predicted Noise Levels Assuming All Plant Operating - Wind from All Directions

L_{A10} Noise Level Contours

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APPENDIX A

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 Power Level (L_w)

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

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_{APeak}

This is the maximum reading in decibels using the A frequency weighting and P time weighting AS1259.1-1990.

L_{Amax}

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

L_{A1}

An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

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.

One-Third-Octave Band

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20 000 Hz inclusive.

L_{Amax} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded at any time.

L_{A1} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.

L_{A10} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% of the representative assessment period.

Tonal Noise

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

the presence in the noise emission of tonal characteristics where the difference between —

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

Modulating Noise

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of tonality is:

> a variation in the emission of noise that —
>
> (a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;
>
> (b) is present for at least 10% of the representative

Impulsive Noise

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of tonality is:

> a variation in the emission of a noise where the difference between $L_{A\ peak}$ and $L_{A\ Max\ slow}$ is more than 15 dB when determined for a single representative event;

Major Road

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

Secondary / Minor Road

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Influencing factor

$$= \frac{1}{10}\left(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}\right) + \frac{1}{20}\left(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450}\right)$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a 100m radius of the premises receiving the noise

$\%\ \text{Type A}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a 100m radius of the premises receiving the noise

$\%\ \text{Type B}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

Representative Assessment Period

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

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.

Satisfactory Design Sound Level

The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.

Maximum Design Sound Level

The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.

Reverberation Time

Of an enclosure, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the enclosure to decrease by 60 decibels.

RMS

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

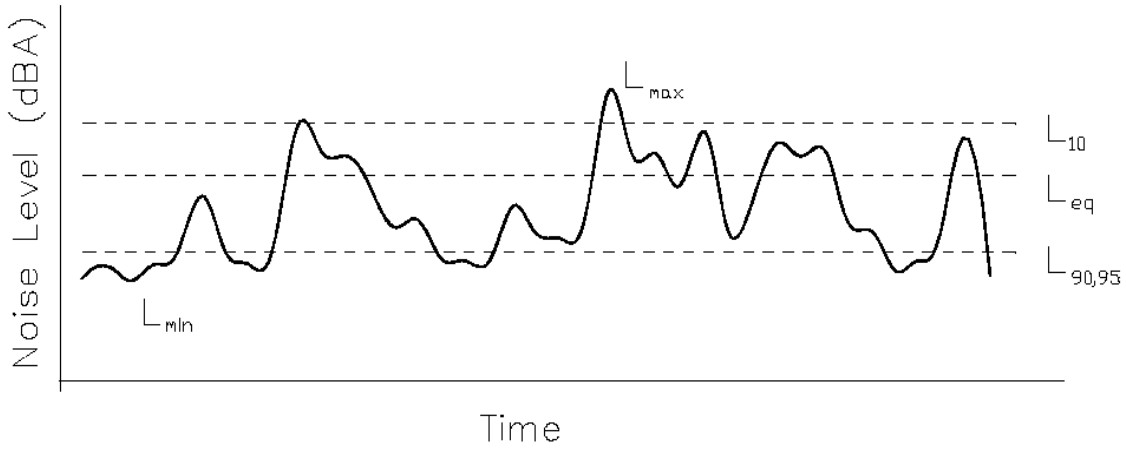
Vibration Velocity Level

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

Peak Velocity

Level of vibration velocity measured as a non root mean square (r.m.s.) quantity in millimetres per second (mm/s).

Chart of Noise Level Descriptors



Typical Noise Levels