# Noise Monitoring Report

## Esperance Port
## June 2011

**Prepared For**

ESPERANCE PORTS
Sea & Land

**August 2011**

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LLOYD GEORGE
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# Report: 11061868-01


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| **Position:** | Project Director |
| **Date:** | 2 August 2011 |

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# APPENDICES

# 1 INTRODUCTION

Esperance Ports Sea & Land (the Port) was granted a variation to the assigned noise levels under regulation 17 of the *Environmental Protection (Noise) Regulations 1997* (the Regulations). This variation was originally granted in July 2001 and has since been regranted being cited as the *Environmental Protection (Port of Esperance Operations Noise Emissions) Approval 2009* (the Approval). The new Approval is valid for a period of 10 years and requires that monitoring be undertaken. This report provides the results of monitoring undertaken during June 2010.

Two monitoring sessions were undertaken between 10pm and 11pm on 22 June 2010 and 2.30am to 3.30am on 23 June 2010.

During the monitoring sessions, the following activities occurred:

- Stella El Tanin vessel located at Berth 1 (wheat). This vessel was scheduled to arrive at 1600 on 22 June 2011 and depart on 24 June 2011 in the afternoon;
- King Wheat vessel located at Berth 2 (bulk nickel). This vessel was scheduled to arrive at 6am on 22 June and depart at 6am 23 June 2011;
- Bulk nickel loading commenced at approximately 6pm on 22 June 2011 and finished at approximately 4am on 23 June 2011;
- An iron ore train movement occurred during the 10pm measurement session.

Weather conditions during the measurements were obtained from the Bureau of Meteorology's Esperance weather station as follows:

| Time | Temperature ($^{o}$C) | Relative Humidity (%) | Wind Direction | Wind Speed (km/hr) |
|---|---|---|---|---|
| 2200 | 8.1 | 87 | N | 11 |
| 0230 | 9.0 | 79 | N | 11 |

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

# 2 CRITERIA

The *Environmental Protection (Port of Esperance Operations Noise Emissions) Approval 2009* is derived from regulation 17 of the Regulations, and varies the assigned noise levels specified under regulation 8. The assigned noise levels of regulation 8 are shown below in *Table 2.1*.

***Table 2.1 – Assigned Noise Levels – Regulation 8***

| Type of Premises Receiving Noise | Time of Day | Assigned Level (dB) | | |
|---|---|---|---|---|
| | | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ |
| Noise Sensitive – within 15 metres of a noise sensitive building | 0700 to 1900 hours Monday to Saturday | 45 + I.F. | 55 + I.F. | 65 + I.F. |
| | 0900 to 1900 hours Sunday and public holidays | 40 + I.F. | 50 + I.F. | 65 + I.F. |
| | 1900 to 2200 hours all days | 40 + I.F. | 50 + I.F. | 55 + I.F. |
| | 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays | 35 + I.F. | 45 + I.F. | 55 + I.F. |
| Noise Sensitive – further than 15 metres from a noise sensitive building | All hours | 60 | 75 | 80 |
| Commercial | All hours | 60 | 75 | 80 |
| Industrial and Utility | All hours | 65 | 80 | 90 |

The I.F. is calculated by the following equation:

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

*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

The Approval varies the assigned noise levels by + 5 dB during the night, over the assigned noise levels of regulation 8 (*Table 2.1*) as shown in *Table 2.2*.

***Table 2.2 – Assigned Noise Levels – Approval***

| Type of Premises Receiving Noise | Time of Day | Assigned Level (dB) | | |
|---|---|---|---|---|
| | | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ |
| Noise Sensitive – within 15 metres of a noise sensitive building | 0700 to 1900 hours Monday to Saturday | 45 + I.F. | 55 + I.F. | 65 + I.F. |
| | 0900 to 1900 hours Sunday and public holidays | 40 + I.F. | 50 + I.F. | 65 + I.F. |
| | 1900 to 2200 hours all days | 40 + I.F. | 50 + I.F. | 55 + I.F. |
| | 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays | 40 + I.F. | 50 + I.F. | 55 + I.F. |
| Noise Sensitive – further than 15 metres from a noise sensitive building | All hours | 60 | 75 | 80 |
| Commercial | All hours | 60 | 75 | 80 |
| Industrial and Utility | All hours | 65 | 80 | 90 |

The following are not required to meet the requirements of *Table 2.2*.

1. Trains, aircraft, emergency vehicles and safety warning devices needed to comply with occupational safety and health laws (these are exempt under regulation 3 of the Regulations).
2. Construction work.
3. Noise emissions from Cooperative Bulk Handling Ltd (CBH).
4. Noise received at the premises occupied by CBH.

Also, as part of the Approval, Item 6(2) encourages the Port to purchase properties where noise levels are above those of *Table 2.1*.

Furthermore, noise originating from the Port must be free from annoying characteristics (tonality, modulation and impulsiveness) for at least 99% of any 4-hour period.

Previous assessments have identified 13 locations used to determine the noise compliance status of the Port. These locations are listed below and shown in *Appendix A*.

*Location 1 – End of Bostock Street (Lot 16):*
The Port has purchased the majority of properties on the north side of Bostock Street (and some on the south side). Lot 16 is not owned by the Port and has a dwelling on the property. It is understood by the Port that the resident does not consider noise to be an issue. A conversation, at the time of previous measurements, between the resident and the author verified this. The silos of CBH typically shield noise from the Port to this residence and CBH noise emissions would be more dominant at this location.

*Location 2 - Lot 10 Bostock Street:*
This is a vacant lot owned by the Port, has line of sight to a number of the Port operations and is a location where Port and CBH noise is dominant above background noise. It is considered that this location is representative of Lot 14, which is a vacant lot not owned by the Port. As there is no dwelling on this Lot, it is the 'further than 15 metres' criteria that currently applies (i.e. 60 dB(A) $L_{A10}$). However, the Port should be aware that the criteria would change to the 'within 15 metres' assigned levels should a dwelling be constructed on this lot.

*Location 3 - Lot 40 Panorama Place:*
This lot is currently vacant and is representative of a number of lots with dwellings that are not owned by the Port (both on the south side of Bostock Street and on Panorama Place).

*Location 4 - Lot 34 Panorama Place:*
This is a vacant lot not owned by the Port but again, representative of dwellings located in this area. A new residence has been constructed immediately east of this lot.

*Location 5 – Lot 4 Bostock Street:*
This is a vacant lot owned by the Port, but can be used for guidance as to the type of noises that may be heard at non-port owned houses further away.

*Location 6 - Lot 8 Bostock Street:*
This house is now owned by the Port and occupied by one of their employees. The measurement location is no longer used as an Air Quality Station has been installed at this property and dominates the noise levels in the immediate area.

L*ocation 7 - Southeast corner of Hardy Street and The Esplanade:*
Measurements were recorded closer to the Port than the dwellings, which are located further south, up a hill. For the scenario where loaders are working in Sheds 1 and 2, the noise reduction between the measurement location and houses is expected to be 3 – 5 dB.

*Location 8 - Caravan Park:*
Located on the corner of Harbour Road and The Esplanade, a fence has been constructed around the park, by the Port, to minimise any impact from road traffic (particularly grain trucks). Measurements are recorded on the Port side of the fence and thus any attenuation of Port noise provided by the fence (considered minimal) has not been taken into account.

*Location 9 – Corner of Taylor Street and The Esplanade:*
There are some noise sensitive properties in this area and some commercial properties. Noise from the ocean (wave noise) can influence measurements at this location.

*Location 10 - Tea Rooms:*
A commercial property located towards the jetty opposite Taylor Street. Esperance Bay separates the Tea Rooms from the Port. Ocean noise is generally the dominant source at this location.

*Location 11 - Lot 8 Bostock Street (House):*
As per Location 6, except further north to represent the closest part of the house to the Port. This was used in the noise modelling as an assessment location, rather than a measurement location.

*Location 12 - Corner of Corry and Hardy Streets:*
To the west of the Port at a location where the I.F. is at a minimum.

*Location 13 - Lot 6 The Esplanade:*
Located between William Street and Andrew Street, again a location where the influencing factor I.F. was low.

Note that only the most relevant locations were utilised as measurement locations in this instance.

*Table 2.3* shows the I.F. and night-time assigned noise levels for each of the above locations.

***Table 2.3 – Night-Time Assigned Noise Levels***

| Location | I.F., dB | Assigned Level (dB) | | |
|---|---|---|---|---|
| | | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ |
| 1# | 13 | 53 | 63 | 68 |
| 2* | N/A (9) | 60 (49) | 75 (59) | 80 (64) |
| 3 | 9 | 49 | 59 | 64 |
| 4 | 8 | 48 | 58 | 63 |
| 5# | 8 | 48 | 58 | 63 |
| 6# | 8 | 48 | 58 | 63 |
| 7 | 5 | 45 | 55 | 60 |
| 8 | 4 | 44 | 54 | 59 |
| 9 | 2 | 42 | 52 | 57 |
| 10 | N/A | 60 | 75 | 80 |
| 11 | 8 | 48 | 58 | 63 |
| 12 | 0 | 40 | 50 | 55 |
| 13 | 1 | 41 | 51 | 56 |

* The levels shown are for those of a vacant lot not owned by the Port (i.e. further than 15 metres from building directly associated with a noise sensitive use). Those shown in brackets are for the scenario of a building being constructed on the vacant lot (not owned by the Port).

\# These specific measurement locations are properties owned by the Port and hence the assigned noise levels are not applicable. However, the location may be used to assess noise levels to surrounding, non-port owned residences.

# 3 METHODOLOGY

Noise level measurements were undertaken using a Bruel & Kjaer Type 2260 Observer, which satisfies regulation 22 of the Regulations. The meter was hand held at least 1.2 metres above the ground and was positioned at least 3 metres from reflecting facades, satisfying Regulation 20.

Noise levels were recorded in two sessions being from 10pm to 11pm on 22 June 2011 and from 2.30am to 3.30am on 23 June 2011.

Each of the assessment locations was attended, however, noise levels were not always recorded. Where measurements were undertaken, one-third-octave band information was obtained for the relevant parameters being the $L_{A10}$, $L_{A1}$, $L_{Amax}$, $L_{A90}$, and $L_{Aeq}$. Obtaining these parameters allows assessment against the assigned noise levels as well as determining the presence of annoying characteristics.

Observations were made during the measurements including types of noise audible and the weather conditions.

# 4 MEASUREMENT RESULTS

As discussed in *Section 1*, the nickel vessel had already departed prior to the measurements and as such only the vessel at Berths 1 and 3 were present. Results of the measurements are tabulated below in *Table 4.1*.

***Table 4.1 – Noise Level Measurements***

| Location | Time (hrs) | Parameter | | | | Comments |
|---|---|---|---|---|---|---|
| | | $L_{A90}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | |
| 1. East End of Bostock St | 2210 | 40 | 41 | 41 | 41 | CBH not operating. Negligible noise at this location. |
| | 0251 | 34 | 36 | 36 | 36 | Negligible noise. |
| 2. Lot 10 Bostock St | 2200 | 50 | 51 | 52 | 53 | Measured as train leaving. |
| | 2205 | 46 | 47 | 47 | 47 | Train departed. Dominant noise is from air quality monitoring devices. |
| | 0250 | 41 | 42 | 42 | 43 | Dominant noise is from air quality monitoring devices. |
| | 0309 | 45 | 53 | 57 | 59 | Train entering Port. |
| 3. Lot 40 Panorama Pl | 2226 | 40 | 40 | 40 | 40 | Minimal noise. May be some fan noise or possible air quality device on Bostock Street audible. |
| | 0257 | 43 | 44 | 45 | 45 | General Port noise – fans or conveyors. |
| 4. Lot 34 Panorama Pl | 2217 | 47 | 52 | 57 | 60 | Train leaving port with wheel squeal. |
| | 2222 | 40 | 42 | 42 | 42 | Train departed. Distant traffic and alarms from Port audible. |
| | 0300 | 42 | 42 | 43 | 43 | General Port noise – fans or conveyors. |

| Location | Time (hrs) | Parameter | | | | Comments |
|---|---|---|---|---|---|---|
| | | $L_{A90}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | |
| 5. Lot 4 Bostock Street | 2229 | 40 | 41 | 42 | 43 | Alarms audible from Port. |
| | 2231 | 40 | 42 | 42 | 42 | No alarms with some general Port noise. |
| | 0248 | 38 | 39 | 39 | 39 | Some general Port noise audible. |
| 6. Lot 8 Bostock St | 2232 | 38 | 39 | 39 | 39 | Air quality device dominant with some distant road traffic. |
| 7. CBH Entry | 2237 | 36 | 38 | 38 | 38 | Negligible noise from Port. Distant road traffic and distant dog barking. |
| | 2239 | 38 | 43 | 44 | 45 | Short term measurement of shunt noise as wagons move into rotary car dumper. |
| | 0243 | 35 | 36 | 37 | 37 | Negligible noise. |
| 8. Caravan Park | 2242 | 37 | 39 | 39 | 40 | Port inaudible. Tonal noise from air quality monitoring device. |
| 9. Cnr Taylor & The Esplanade | 0240 | 37 | 38 | 38 | 38 | Ocean noise and air quality device audible at this location. |
| 10. Tea Rooms | 2249 | 44 | 45 | 46 | 47 | Ocean lap noise dominant. Some vessel engine noise and also a high pitched noise – unidentified. |
| | 0237 | 38 | 42 | 43 | 44 | Ocean lap noise dominant. |

# 5 DISCUSSION & ASSESSMENT

Wind conditions were relatively calm, with the Esperance weather station recording winds of around 3m/s from the north, meaning that for those locations on Bostock Street and Panorama Place, noise propagation would be worst case.

Given that for the closest residences, weather conditions were worst-case and noise levels are less than permitted in *Table 2.3*, it is concluded that bulk nickel loading complies at all times.

Wheel squeal noise from the trains was clearly audible at the residences. Consideration could be given to installing an automatic lubricant to minimise the flanging noise as the train moves around the Port.

Audible warning alarms are also audible at the residences, although at a relatively low level. Alternatives such as broadband type alarms can be considered, provided a safe workplace can still be maintained.

The air quality monitoring devices are in close proximity to residences and due to the tonal nature of the noise are clearly audible. Noise control has already been undertaken to these by way of installing some silencers. Construction of a barrier is unlikely to be permissible as this may affect the air quality sampling. Given the relatively low levels and impracticality of further noise control, no further work is required.

# 6 REMEDIAL ACTIONS

From the results of this monitoring, no remedial action is mandatory. Nevertheless, EPSL will:

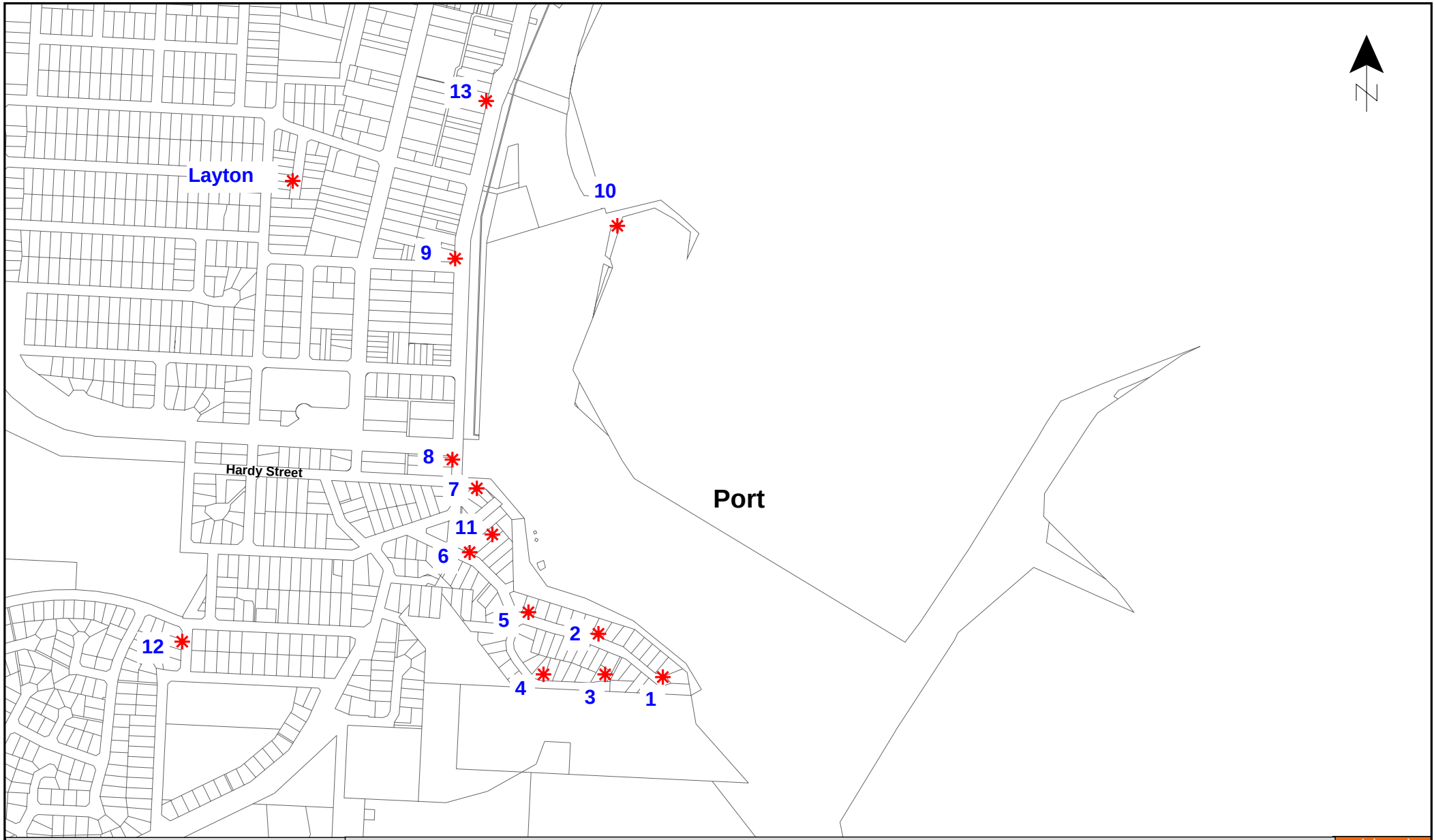
- Investigate the possible replacement of the existing alarms on shiploaders and possibly conveyors with broadband alarms; and
- Request the train operator look into the possibility of an automatic lubricant to minimise wheel flanging noise.

# 7 COMPLAINTS

We are not aware of any noise related complaints since the previous March 2011 monitoring report.

# APPENDIX A

Measurement Locations




Length scale 1:10000

0 50 100 200 300 400 500 m

***ESPERANCE PORT AUTHORITY***
***Locality Map***

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**FIGURE A01**

# APPENDIX B

Terminology

# APPENDIX B

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*

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

*where*:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = 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 a100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = 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.

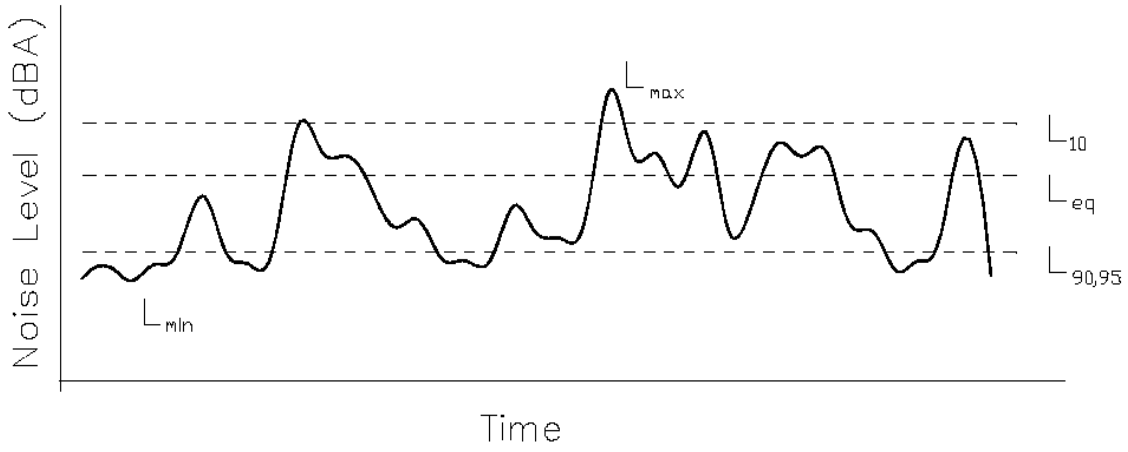
### *Vibration Velocity Level*

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*