



**PORT of TOWNSVILLE**  
Nexus North Queensland

## **Appendix K Noise and Vibration Assessment**

**Townsville Marine Precinct Project**  
Environmental Impact Statement





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## Glossary

<b>Term</b>	<b>Definition</b>
dB	Unit of measurement for Sound Pressure Level.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels.
$L_N$	Statistical sound measurement recorded on the linear scale.
$L_{AN}$	Statistical sound measurement recorded on the "A" weighted scale.
$L_{A10}$ (Time)	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
$L_{A10}$ (1 hour)	The $L_{A10}$ level measured over a 1-hour period.
$L_{A10}$ (18 hour)	The arithmetic average of the $L_{A10}$ levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.
$L_{Aeq}$ (Time)	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. This is considered to represent ambient noise.
$L_{Aeq}$ (15 hr)	The $L_{Aeq}$ noise level for the period 7 am to 10 pm.
$L_{Aeq}$ (9 hr)	The $L_{Aeq}$ noise level for the period 10 pm to 7 am.
$L_{Aeq}$ (1 hr)	The $L_{Aeq}$ noise level for a one-hour period. It represents the highest tenth percentile hourly A-weighted $L_{eq}$ during the period 7 am to 10 pm, or 10 pm to 7 am, (whichever is relevant).
$L_{A90}$ (Time)	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90}$ (15 min)
$L_{AMax}$ (Time)	The maximum sound level recorded during a specified time interval.
$L_{AMin}$ (Time)	The minimum sound level recorded during a specified time interval.



Noise Sensitive  
Place

*Noise sensitive place* means any of the following places:

- (a) a dwelling;
- (b) a library, childcare centre, kindergarten, school, college, university or other educational institution;
- (c) a hospital, surgery or other medical institution;
- (d) a protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest, under the *Nature Conservation Act 1992*;
- (e) a marine park under the *Marine Parks Act 1982*;
- (f) a park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment.

Rating Background  
Level (RBL)

The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24 hour period used for the assessment background level). This is the level used for assessment purposes. It is defined as the median value of:

All the day assessment background levels over the monitoring period for the day (7 am to 6 pm);

All the evening assessment background levels over the monitoring period for the evening (6 pm to 10 pm); or

All the night assessment background levels over the monitoring period for the night (10 pm to 7 am).

Sound Pressure  
Level (SPL)

20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level of 20 micropascals.



## Executive Summary

Port of Townsville Limited (POTL) commissioned GHD to assess the potential noise and vibration impacts resulting from the construction and operation of the Townsville Marine Precinct Project.

The assessment has been conducted with consideration to the following Queensland legislation and guideline:

- » *Environmental Protection Act 1994*; and
- » Queensland Environmental Protection Agency (EPA) Planning for Noise Control Guidelines, 2000.

The results of the assessment suggest that construction related noise and vibration from the Townsville Marine Precinct Project will not significantly impact on the amenity of sensitive receivers provided appropriate management procedures as outlined in this report are implemented.

Noise levels from construction activities will likely exceed sleep disturbance criteria during pile driving and it is expected that some impact will occur on the sleep patterns of occupants of berthed fishing trawlers. Occupants of trawlers should be notified of the proposed construction timing and programme.

Limited information is available at this time on the occupants of the Precinct. Sound power levels were sourced for several noise generating activities that may be located on site. The power levels were then distance attenuated from the proposed Precinct to predict possible noise impact on nearby sensitive receivers. During the Precinct operations, the average noise level experienced at nearby residences is expected to be around 46 dB(A) under worse case conditions and around 49 dB(A) within the Precinct at the fishing trawler berths. This is similar to existing noise levels in the area and it is expected that further noise attenuation will likely occur.

Locating the proposed types of industry within the Precinct should not impact on the amenity of noise sensitive receivers with appropriate planning, design and management procedures in place.

It is recommended that development approvals for individual sites should be subject to a noise assessment to ensure that all industrial premises on the Precinct cumulatively comply with the criteria outlined in this report.

Road traffic along Boundary Street, which is not a state-controlled road, is considered to have the highest potential impact on noise sensitive receivers due to associated road traffic due to the marine precinct and has been assessed with consideration to the Code of Practice, and the noise criterion applicable at dwellings located on an existing road with no roadworks is  $L_{A10(18h)}$  68 dB.

Increase in road traffic due to the marine precinct has the potential to increase road traffic noise in the local road network. Boundary Street is not a state-controlled road, however has been assessed with consideration to the DMR Road Traffic Noise Management: Code of Practice 2008. Townsville City Council may choose to manage traffic noise in accordance with the Code of Practice. Road traffic noise modelling for the year 2017 indicates that noise levels at a receiver on Boundary Street with the marine precinct operational will potentially be 3.5 dB(A) higher than if the marine precinct was not developed. Road traffic noise modelling suggests that noise levels will exceed the Code of Practice criteria with or without the marine precinct. Treatments for noise attenuation may to be considered within the road corridor or alternative Precinct traffic routes considered with the aim of reducing levels to 68 dB(A) or less.



Therefore based on the information provided, assumptions made and assessment of results it is expected that the Townsville Marine Precinct Project can meet its relevant noise goals.



# 1. Introduction

## 1.1 Project Description

The Port of Townsville is a seaport located in Townsville, North Queensland. The Port is the third largest seaport in Queensland handling exports and imports including, but not limited to, mineral ores, fertiliser, sugar and motor vehicles.

The Townsville Marine Precinct Project (TMPP or the 'Precinct') is proposed to be located on intertidal land to the south-east of existing Port operations. The Precinct seeks to provide a dedicated industrial Marine Precinct facility at the mouth of the Ross River in the Port of Townsville.

The TMPP will address the ongoing and increasing demand for industrial marine facilities in the region by providing a sheltered, purpose-built precinct for the co-location of similar marine-dependant industries and public facilities currently spread around Ross Creek and South Townsville (DIP 2008).

The facilities to be provided within the industrial precinct may include:

- » Marine industry allotments including maritime infrastructure and vessel fabrication;
- » Berth facilities including for 50 trawlers, scientific and tourism vessels, provisioning activities, refueling and for commercial and recreational users;
- » Commercial and recreational chandlery;
- » Defence force marine activities, including vessel maintenance
- » Seafood industry cold storage and distribution facility;
- » Small scale eateries to service industry within Precinct;
- » Marine industry training facilities; and
- » Public and recreational use facilities including provision for 40 pile moorings and a recreational marina.

To provide the dedicated Marine Precinct facility it is proposed to reclaim approximately 32 hectares of currently intertidal Strategic Port Land (SPL) located to the south-east of existing port operational facilities. Industrial facilities will then be constructed on this reclaimed land. A breakwater will be positioned offshore from the facility to protect it from incident wave activity. In addition to needs for land reclamation and breakwater construction, dredging activities will be required to create an inner harbour and swing basin for the facility.

## 1.2 Subject Site

A map showing the location of the proposed development site is shown in Figure 1.

The Port of Townsville is located approximately 3 km east of the city centre of Townsville, Queensland. The port currently covers an area of approximately 4 km<sup>2</sup> and includes a harbour, port and docking facilities.



The Precinct development site is located just beyond the mouth of the Ross River and is divided into two main development areas; the Marine Precinct area (Lot 773) west of the main shipping channel for the Ross River (around 0.5 km south east of the main port facilities) and the breakwater/offshore area to the east of the shipping channel (around 1 km south east of the main port facilities). Lot 773 lies immediately east and south of existing reclaimed land owned by POTL including the Eastern Reclamation Area.

A new access road and bridge for the Port of Townsville from the east bank of Ross River are proposed and planned to pass immediately to the west of the development site. Routine maintenance dredging of the shipping channel is regularly carried out to remove accumulated sediment to ensure Ross River can remain operational as a navigational waterway.



1:140,000 (at A4)

0 1 2 3 4 5 Kilometers

Map Projection: Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 55

Port of Townsville Marine Precinct EIS

Job Number: 42-15399  
Revision: A  
Date: 11 Dec 2008

Local Context **Figure 1**

G:\4215399\GIS\Projects\EIS\42-15399\_004\_rev\_a.mxd 2/100 Goonoon Street Gladstone QLD 4680 Australia T 61 7 4972 6377 F 61 7 4972 6236 E ghma@ghd.com.au W www.ghd.com.au

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Data source: DCDB - ©The State of Queensland (Department of Natural Resources and Water) November 2007; 250K Topo Data - ©Commonwealth of Australia (Geoscience Australia) 2006. Created by: T Hatfield

**Figure 1 Project Location**



### **1.3 Scope of Works**

The scope of works for the noise and vibration assessment comprised:

- » Review photographs of the existing site including the surrounding area;
- » Identify sensitive receivers using available aerial photography and planning maps;
- » Undertake long term unattended noise monitoring in the vicinity of the proposed project at potentially impacted residences for a period of one week;
- » Undertake short-term attended noise monitoring at the unattended noise monitoring locations during day, evening and night-time periods;
- » Based on unattended noise measurements, determine existing background and ambient noise levels for the day, evening and night time periods;
- » Comment on any current activities near the Project area which may contribute to the background level of noise and ground vibration;
- » Establish project specific noise levels with consideration to the Queensland EPA publications Environmental Protection (Noise) Policy 2008, Noise Measurement Manual 2000, Planning for Noise Control 2004, and Australian Standard AS 1055.2:1997 – Acoustics – Description and measurement of environmental noise;
- » Undertake a desktop review of client supplied information detailing noise levels for proposed construction and operation of plant, equipment and other activities at the proposed Precinct; and
- » Comment on the potential noise impact on sensitive receivers from construction and operation of the Precinct.

### **1.4 Limitations**

This report has been prepared for POTL. The purpose of the report is to provide an independent review of the proposed Precinct.

It is not the intention of the assessment to cover every element of the acoustical environment, but rather to conduct the assessment with consideration to the prescribed work scope.

The findings of the noise assessment represent the findings apparent at the date and time of the monitoring and the conditions of the area at that time. It is the nature of environmental monitoring that not all variations in environmental conditions can be accessed and all uncertainty concerning the conditions of the ambient noise environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

In conducting this assessment and preparing the report, current guidelines for noise were referred to. This work has been conducted in good faith with GHD's understanding of the client's brief and the generally accepted consulting practice.

No other warranty, expressed or implied, is made as to the information and professional advice included in this report. It is not intended for other parties or other uses.



## 2. Existing Conditions

### 2.1 Description of Environmental Values

The environmental values to be enhanced or protected under the Queensland Environmental Protection (Noise) Policy 2008 are the qualities of the environment that are conducive to:

- » Protecting the health and biodiversity of ecosystems;
- » Human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn and be involved in recreation, including relaxation and conversation; and
- » Protecting the amenity of the community.

The *Environmental Protection Act 1994* outlines how to protect Queensland's environment from environmental nuisance. This includes noise disturbance from regulated devices such as air-conditioning systems and also building work that includes excavating or filling.

For industrial developments there is another mechanism to assist in achieving a balance between the social and economic amenity of the community, and the needs of the individual for sleep and relaxation. The Queensland EPA has a guideline for setting conditions related to noise emitted from industrial premise, which are intended for planning purposes, *Ecoaccess Guideline Planning for Noise Control*, 2004. The guideline also includes criteria for estimating the probability of sleep disturbance from transient noise.

### 2.2 Sensitive Receivers

Sensitive receivers were identified using aerial photography, a site visit and liaison with GHD's local office. The nearest sensitive receivers are listed in Table 1 below.

**Table 1 Sensitive Receivers**

Residential	Residential	Commercial	Industrial	Health/Recreation
Sixth Street	Boundary Street	Victoria Park Hotel	Benwell Road	Victoria Park
Fourth Avenue	Fifth Avenue	Commonwealth Hotel	Hubert Street	
Sixth Avenue	Eighth Avenue	Toms Fruit and Mini Mart		
Morey Street	Allen Street	Cibo Espresso		
Cannan Street	Archer Street	Ross Island Hotel		
Hubert Street	Nelson Street			
Bell Street	Macrossan Street			

## 2.3 Existing Noise Environment

### 2.3.1 Noise Monitoring Methodology

Unattended noise monitoring was undertaken from 3 December 2008 to 10 December 2008 at one representative location (27 Hubert Street, South Townsville) near the subject site. Unattended noise logging was conducted at this location to establish typical noise levels in the area of the potentially most affected receivers. Unattended noise measurements were conducted using a RION-NL21 (#00376386) sound level meter set up for long-term noise logging. This SLM is capable of measuring continuous sound pressure levels and is able to record  $L_{Amin}$ ,  $L_{A90}$ ,  $L_{A10}$ ,  $L_{Amax}$  and  $L_{Aeq}$  noise descriptors. The SLM was set to an A frequency weighting and Fast time weighting.

Prior to deployment, the meter was calibrated using a Rion NC-73 calibrator with a sound pressure level of 94 dB at 1kHz. Calibration was checked again at completion of the measurement.



**Figure 2** Noise Monitoring Location - 27 Hubert Street, South Townsville



**Figure 3** Looking along Hubert Street, South Townsville



**Figure 4 Noise Monitoring Locations**



### 2.3.2 Noise Monitoring Results

Unattended monitoring results are summarised in Table 2 and are presented in graphical format in Appendix A. Data was removed from the tabulated data during periods in which wind speeds were over 5 m/s or rainfall occurred, as previously mentioned. The day, evening and night-time periods, defined by the Ecoaccess Planing for Noise Control are as follows:

- » Day: 7 am to 6 pm;
- » Evening: 6 pm to 10 pm;
- » Night: 10 pm to 7 am; and
- » On Sundays and public holidays, daytime is defined as from 9 am to 6 pm.

**Table 2 Summary of Noise Monitoring Results dB(A) – 27 Hubert Street**

Logger	Background L <sub>A90</sub> dB(A)			Ambient L <sub>Aeq</sub> dB(A)		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Wednesday 3 Dec	39.8	36.5	- <sup>1</sup>	55.2	48.8	-
Thursday 4 Dec	39.8	35.8	32.8	52.3	45.7	47.3
Friday 5 Dec	39.0	34.5	32.3	49.9	44.7	45.3
Saturday 6 Dec	37.2	34.2	34.1	49.0	48.3	49.2
Sunday 7 Dec	38.2	38.0	34.7	49.2	43.8	44.9
Monday 8 Dec	39.7	38.4	36.9	52.6	49.6	-
Tuesday 9 Dec	40.3	38.8	37.7	51.4	48.1	47.3
Wednesday 10 Dec	41.6	-	35.9	50.2		47.6
<b>RBL and L<sub>eq</sub> Overall</b>	<b>39.7</b>	<b>36.5</b>	<b>34.7</b>	<b>51.7</b>	<b>47.5</b>	<b>47.2</b>

### 2.4 Attended Noise Monitoring

Attended measurements were taken at the unattended monitoring location to supplement logger data as well as several locations (refer to Figure 4) around the existing subject site that may be affected by the proposal. Results of attended noise monitoring are presented in Table 3.

Attended noise measurements were conducted on December 2 and December 3 using a Larson Davis 831 Sound Level Meter (SLM). This SLM is capable of measuring continuous sound pressure levels and is able to record L<sub>Amin</sub>, L<sub>A90</sub>, L<sub>A10</sub>, L<sub>Amax</sub> and L<sub>Aeq</sub> noise descriptors.

Prior to deployment, the meter was calibrated using a Rion NC-73 calibrator with a sound pressure level of 94 dB at 1kHz. Calibration was checked during the measurement period and at completion of the measurements.

<sup>1</sup> Note: '-' refers to invalid data that has been excluded from the data set.



**Table 3 Attended Noise Monitoring Results**

Location	Time and Duration	L <sub>A90</sub>	L <sub>Aeq</sub>	L <sub>A10</sub>	Comment
282 Boundary Street	Day – 3/12/08 9 am 15 mins	52.6	64.3	66.8	Road Traffic Noise (RTN), birds and insects, industrial noise such as reversing alarm
282 Boundary Street	Evening – 2/12/08 9 pm 15 mins	51.0	62.9	65.8	RTN, birds and insects, dogs, distant hum from port
282 Boundary Street	Night – 3/12/08 4.15 am 15 mins	46.3	54.6	56.1	RTN on Boundary St, birds and insects, traffic in distance
76 Allen Street	Day – 3/12/08 7.20 am 15 mins	47.5	52.0	55.2	Port noise, distant RTN, construction noise
76 Allen Street	Night – 3/12/08 4.20 am 15 mins	43.7	51.3	54.9	RTN on distant streets, birds and insects
5 Nelson Street	Day – 3/12/08 7.45 am	43.6	51.9	55.8	RTN on Boundary Road, birds and insects, domestic noise i.e. doors slamming
5 Nelson Street	Evening – 2/12/08 8.12 pm	42.4	49.1	53.2	RTN on Boundary Road, birds and insects, domestic noise.
5 Nelson Street	Night – 3/12/08 4.50 am	42.3	48.3	52.4	Birds and insects, some traffic on Boundary Street, dogs
50 Sixth Street	Evening – 2/12/08 9.37 pm	45.7	51.2	53.0	Birds and insects, domestic noise (television) RTN from surrounding streets
50 Sixth Street	Night – 3/12/08 6.55 am	45.7	50.4	51.2	Birds and insects, industrial noise (impulsive) from nearby boat yard, construction noise, distant RTN noise
50 Bell Street	Day – 3/12/08 8.14 am	42.8	49.4	52.2	Heavy vehicles, distant construction noise, birds and insects, RTN on Bell Street
50 Bell Street	Evening – 2/12/08 8.24 pm	41.3	46.4	49.9	RTN in surrounding streets, birds and insects, dogs
50 Bell Street	Night – 3/12/08 5.14 am	40.9	46.3	48.9	Birds and insects, RTN on surrounding streets, distant heavy vehicles, motorbike
27 Hubert Street	Day – 3/12/08 8.41 am	50.8	56.3	59.7	Lawn mower at nearby church dominant noise source, birds and insects, RTN and distant heavy traffic from port
27 Hubert	Evening – 2/12/08 7.42 pm	48.9	55.9	58.7	RTN from local streets, distant port noise, birds and insects, some domestic noise from houses.



<b>Location</b>	<b>Time and Duration</b>	<b>L<sub>A90</sub></b>	<b>L<sub>Aeq</sub></b>	<b>L<sub>A10</sub></b>	<b>Comment</b>
27 Hubert Street	Night – 3/12/08 5.37 am	46.7	50.1	50.9	Distant RTN, birds, dog
Ergon Energy Substation	Night – 3/12/08 6.28 am	46.6	64.4	65.0	RTN including heavy vehicles (b doubles) and light vehicles. Industrial noise including reversing alarm, forklift, bulldozer, and domestic noise and wind in leaves
9 Eighth Avenue	Day – 3/12/08 9.17 am	44.4	53.6	55.7	Birds and insects, light and heavy vehicles on Boundary Road, domestic noise including children and dogs, intermittent blower and alarm, construction noise from easterly direction
9 Eighth Avenue	Evening – 2/12/08 8.48 pm	43.9	52.9	55.0	RTN from Boundary Street, domestic noise, birds and insects, distant reversing/safety alarm
9 Eighth Avenue	Night – 3/12/08 6.00 am	43.1	50.2	50.6	Birds and insects, construction related noise from harbour cold stores, domestic noise, distant alarms, RTN from Eighth Avenue



## 3. Noise and Vibration Criteria

### 3.1 Construction Noise Criteria

In Queensland, construction activities should be in accordance with general building work hours as described under Section 440R – “Building Work” of the QLD *Environmental Protection Act 1994*. Under the regulation, no audible noise is permitted:

- » 6.30 pm to 6.30 am – Monday to Saturday; and
- » Sundays and public holidays.

The time restrictions are designed to strike a balance between protecting noise amenity and the need to start construction activities early in the morning.

### 3.2 Operational Noise Criteria

Guidance on the assessment of operational noise impacts is provided within the QLD Environment Protection Agency (EPA) *Planning for Noise Control (PNC) guideline, 2004*. The guideline includes both noise criteria that are designed to protect sensitive receivers from noise significantly louder than the background level and to limit the total noise level from all sources near a receiver, hence protecting the amenity.

In line with the abovementioned guidelines, noise from continuous sources should be limited to 3 dB(A) above the background noise level, unless the combined (ambient plus site contribution) noise level would exceed the recommended ambient noise level for the receiver zone. In that case, the noise limit for the site is set so that the combined noise level for the receiver zone does not exceed the recommended level. The specific noise level ( $L_{Aeq, 1\text{ hr}}$ ) can be calculated from Equation 1.

#### Equation 1

Specific noise level:  $L_{Aeq, 1\text{ hr}} = \min L_{A90, 1\text{ hr}} + 3$

The Planning noise level can then be calculated according to Equation 2.

#### Equation 2

Planning noise level =  $L_{Aeq, 1\text{ hr}} - K_1 - K_2$

Where,

$L_{Aeq, 1\text{ hr}}$  – Derived from Equation 1;

$K_1$  – Tonal adjustment; and

$K_2$  – Impulse adjustment.

The recommended PNL's and project specific noise goals for the residential area (South Townsville) are presented in Table 4. A Z2 noise area category [Negligible transport. Less than 80 vehicles per hour] has been selected for determining the Planning Noise Level (PNL) at the unattended logger location. This is assumed to be a representative category for the residential areas surrounding the proposed site.



Specific noise goals for occupants of the Precinct, such as occupants of fishing trawlers have been estimated based on noise monitoring undertaken at 27 Hubert Street, South Townsville. The original project scope did not include impact assessment on occupants of the Precinct. Noise criteria for the trawlers have been assessed assuming the land use as an industrial area (Z4 noise category). The recommended PNL's and project specific noise goals for the Precinct trawler berths are presented in Table 5.

The applicable project criteria are the lowest of the Specific Noise Level and Adjusted PNL for each assessment period (day, evening and night).

**Table 4 Project Specific Noise Goals – Logger 1, 27 Hubert Street, South Townsville**

Criterion	Time Period		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Measured Background (RBL), $L_{A90 \text{ min, 1hr}}$	40	37	35
Recommended Background, $\text{min}L_{A90}$ (PNC Table 1)	45	40	35
Adjusted Background, $\text{min}L_{A90}$ (PNC Table 2)	43	37	25
<i>Specific Noise Level, <math>L_{Aeq}</math></i>	46	40	28
Measured Existing Level, $L_{Aeq}$	52	48	47
Recommended PNL, $L_{Aeq}$ (PNC Table 3, Cat Z2)	50	45	40
<i>Adjusted PNL, <math>L_{Aeq}</math> (PNC Table 4)</i>	42	38	37
<b>Project Specific Level, <math>L_{Aeq}</math></b>	<b>42</b>	<b>38</b>	<b>28</b>

**Table 5 Project Specific Noise Goals – Marine Precinct Trawler Berths**

Criterion	Time Period		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Measured Background (RBL), $L_{A90 \text{ min, 1hr}}$	40	37	35
Recommended Background, $\text{min}L_{A90}$ (PNC Table 1)	50	45	40
Adjusted Background, $\text{min}L_{A90}$ (PNC Table 2)	45	42	38
<i>Specific Noise Level, <math>L_{Aeq}</math></i>	48	45	41
Measured Existing Level, $L_{Aeq}$	52	48	47
Recommended PNL, $L_{Aeq}$ (PNC Table 3, Cat Z4)	60	55	50
<i>Adjusted PNL, <math>L_{Aeq}</math> (PNC Table 4)</i>	60	55	47
<b>Project Specific Level, <math>L_{Aeq}</math> [min <math>L_{A90, 1 \text{ hr}} + 3</math>]</b>	<b>48</b>	<b>45</b>	<b>41</b>



### 3.2.1 Sleep Disturbance Criteria

Maximum noise levels over the night-time period should be restricted to prevent sleep disturbance. Current QLD EPA policy (Planning for Noise Control Guideline, 2004) is to limit the external maximum noise impact level according to the number of occurrences likely to occur and the potential noise reduction from outside – inside.

The policy recommends that instantaneous internal sound pressure levels do not exceed in the order of 45 dB(A)  $L_{max}$  more than 10-15 times per night as a rule in planning for short-term or transient events.

On this basis, a “mid range” external noise level of 55 dB(A)  $L_{max}$  more than 10-15 times per night is considered appropriate for assessment purposes, as a 10 dB outside – inside reduction in noise level through a partially open window is typical.

### 3.3 Road Traffic Noise Criteria

Road traffic noise criteria for state-controlled roads within Queensland are provided in the DMR document Road Traffic Noise Management: Code of Practice January 2008. The noise criterion applicable is dependent on the type of road proposed (i.e. the construction of a new road, or upgrading of an existing road, or existing roads). The Townsville Port Access Road has been assessed separate to this study however the marine precinct may still impact on traffic in the local area. Road traffic along Boundary Street, which is not a state-controlled road, is considered to have the highest potential impact on noise sensitive receivers due to associated road traffic noise and has been assessed with consideration to the Code of Practice, and the noise criterion applicable at dwellings located on an existing road with no roadworks is  $L_{A10(18h)}$  68 dB.

Although the DMR criteria relates to state-controlled roads, the criteria may be used as a means by Townsville City Council to assess and manage potential road traffic noise impacts on other roads, such as Boundary Street. Where the criteria for an existing road with no road works is exceeded, the DMR Code of Practice states that treatments for noise attenuation will be considered within the road corridor with the aim of reducing levels to 68 dB(A) or less. Special treatment may also be given in cases where there is a sudden increase in traffic volumes, or a high percentage of heavy vehicles (greater than 20%), particularly at night.

### 3.4 Vibration Criteria

#### 3.4.1 General

In the absence of specific QLD guidelines addressing vibration issues, consideration was given to the following publications for the determination of monitoring sites and appropriate measurement parameters:

- » NSW Department of Environment and Climate Change (DECC) Assessing Vibration: A Technical Guideline, 2006;
- » British Standard BS6472:1992 Guide to evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz); and
- » British Standard BS7385-2:1993 Evaluation and Measurement for Vibration in Buildings, Part 2 - Guide to damage levels from ground borne vibration.



The above standards are typically adopted by industry in Australia for the assessment of construction and operational vibration impacts.

### 3.4.2 Effect of Vibration on Structures

Transient and continuous vibration guidelines in order to ensure a minimal risk of cosmetic damage to residential and other sensitive buildings are presented in Table 6. These guide values are conservative, as the actual degree of tolerance of a building depends on the structural characteristics and frequency spectrum of the vibration. In the case of continuous vibration, BS7385-2:1993 recommends that targets outlined below be reduced to 50%.

**Table 6 Transient vibration guidelines for cosmetic damage (BS7385 – 2:1993 – Evaluation and measurement for vibration in buildings)**

Vibration Type	Peak Particle Velocity		
	Reinforced or framed structures Industrial and heavy commercial buildings	Unreinforced or light framed structures Residential or light commercial type buildings	
Transient vibration	50 mm/s at 4 Hz and above	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Continuous vibration	25 mm/s at 4 Hz and above	7.5 mm/s at 4 Hz increasing to 10 mm/s at 15 Hz	10 mm/s at 15 Hz increasing to 25 mm/s at 40 Hz and above

### 3.4.3 Human Comfort

Acceptable values of human exposure to continuous and impulsive vibration are dependent on the time of day and the activity taking place in the occupied space.

When assessing intermittent vibration, the Vibration Dose Value (VDV) is used as a reference. Acceptable VDV's, as sourced from BS6472:1992 and outlined in the Technical Guideline, are presented in Table 7. The VDV accumulates the vibration energy received over the daytime and night-time periods.

**Table 7 Acceptable Vibration Dose Values for Intermittent Vibration (m/s<sup>1.75</sup>)**

Location	Daytime <sup>2</sup>		Night-time	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas <sup>3</sup>	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26

<sup>2</sup> Daytime is 7:00 to 22:00 and Night-time is 22:00 to 7:00

<sup>3</sup> Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These goals are only indicative, and there may be need to assess intermittent values against the continuous or impulsive goals for critical areas y



Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

When assessing continuous vibration, weighted root-mean-squared (rms) acceleration in the 1-80 Hz range is used as a reference. Acceptable weighted rms acceleration levels, as sourced from BS6472:1992 and outlined in the Technical Guideline, are presented in Table 8.

**Table 8 Preferred and Maximum Weighted RMS Values for Continuous Vibration Acceleration ( $m/s^2$ ) 1 – 80Hz**

Location	Assessment Period	Preferred Values		Maximum Values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Critical areas <sup>5</sup>	Day or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
Workshops	Day or night-time	0.040	0.029	0.080	0.058



## 4. Assessment of Noise and Vibration Impacts

Construction of the Precinct will occur over a number of years.

Major construction activities may include:

- » Capital dredging (mechanical backhoe dredger and cutter suction dredger);
- » General earthworks (including topsoil stripping, excavation, filling, compaction);
- » Building construction, including piling of foundations; and
- » Drainage installation (including, where required, measures to protect water quality and groundwater flows).

During construction the following activities may increase volumes of traffic:

- » Truck movements for delivering fill to the site;
- » Construction worker vehicles entering and leaving the site;
- » General car traffic;
- » Trucks entering and leaving the site removing spoil; and
- » Heavy vehicle carriers delivering the mobile plant at the start and end of construction.

### 4.1 Construction Noise

Typical noise levels produced by construction plant anticipated to be used on site were sourced from AS2436 – 1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites and from GHD's internal database.

The power levels were then distance attenuated from the proposed construction site. Propagation calculations take into account sound intensity losses due to hemispherical spreading, with additional minor losses such as atmospheric absorption, directivity and ground absorption ignored in the calculations. As a result, predicted received noise levels are expected to slightly overstate actual received levels and thus provide a measure of conservatism.

The Townsville Port Access Road when built, will also offer some degree of attenuation of noise generated onsite. A solid embankment will be located from the bridge crossing and grades down to ground level on Benwell Road. This will likely reduce any noise impacts on residents located to the south of Boundary Street.

Received noise produced by anticipated activities, during the construction of the proposal is shown in Table 9 for a variety of distances, with no noise barriers or acoustic shielding in place and with each plant item operating at full power. The sound pressure levels shown are maximum levels produced when machinery is operated under full load.



**Table 9 Predicted Plant Item Noise Levels dB(A)**

Plant Activity/ dB(A) $L_w$	Distance of Source to Receiver (m)						
	50	250 <sup>4</sup>	350 <sup>5</sup>	500	750	1000	2000
Backhoe dredger 108	66	52	49	46	43	40	34
Crane 110	68	54	51	48	45	42	36
Backhoe 108	66	52	49	46	43	40	34
Compressor 100	58	44	41	38	35	32	26
Concrete Pump 109	67	53	50	47	44	41	35
Dump Truck 108	66	52	49	46	43	40	34
Water Tanker 109	67	53	50	47	44	41	35
Compactor 110	68	54	51	48	45	42	36
Pile Driving 130	88	74	71	68	62	56	50

Anticipated noise levels compare to existing daytime ambient noise levels at residential receivers outside the Precinct for all plant activity except pile driving.

Due to the distance between the construction works and the sensitive receivers, noise generating activities should be, where possible, limited to week days between 6:30 am and 6:30 pm.

It is understood that some dredging and associated activities may be undertaken 24 hours a day. It should be noted that dredging activities will predominantly be undertaken during Stage 1 and Stage 2 of the project, which are located at least 800m from the nearest noise sensitive receivers and the associated noise impact will be less than during general day time construction activities expected during Stage 3.

Construction of the Precinct will be undertaken in three stages and it is anticipated that fishing trawlers will be located onsite during construction of remaining stages. Noise impact on the fishing trawlers have been considered in terms of sleep disturbance. Due to the nature of trawling operations, occupants may be asleep at any time of the day, so greatest impact on sleep may occur during the daytime period during construction activities. Referring to Section 3.2.1, an external noise level of 55 dB(A)  $L_{max}$  no more than 10-15 times per night is considered appropriate for assessment purposes.

<sup>4</sup> Approximate distance to nearest internal (fishing trawlers) noise sensitive receiver

<sup>5</sup> Approximate distance to nearest external noise sensitive receiver



Noise levels from construction activities will likely exceed sleep disturbance criteria during pile driving and some other activities and it is expected that some impact will occur on the sleep patterns of occupants of berthed fishing trawlers. Occupants of trawlers should be notified of the proposed construction timing and methodology.

## 4.2 Construction Vibration

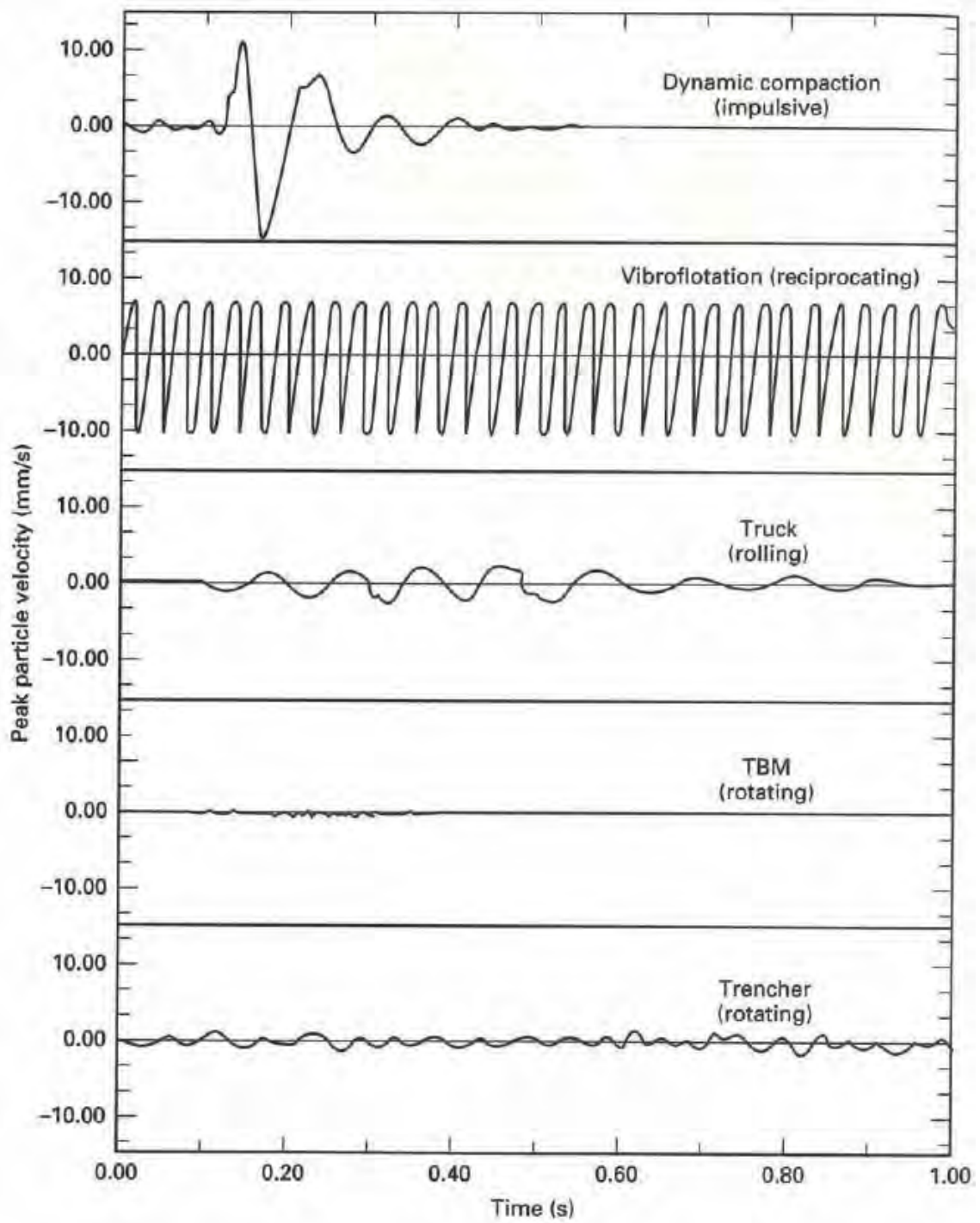
It is possible that construction vibration will be perceived at times by local sensitive receivers. However, the level of annoyance will depend on individuals. Such issues are practically best managed by site monitoring. Circumstances where vibration monitoring should be undertaken are outlined in the construction-related recommendations (refer to Section 5 of this report).

Distance between the potentially most impacted receivers and site construction activities will generally be in excess of 100 m. However, it is possible that some infrastructure and road works be carried out at smaller distances.

The nature and levels of vibration emitted by the site will vary with the activities being carried out on site. Table 10 lists down the types of vibrations that may be generated by the site. These are further represented in Figure 5, for informative purposes.

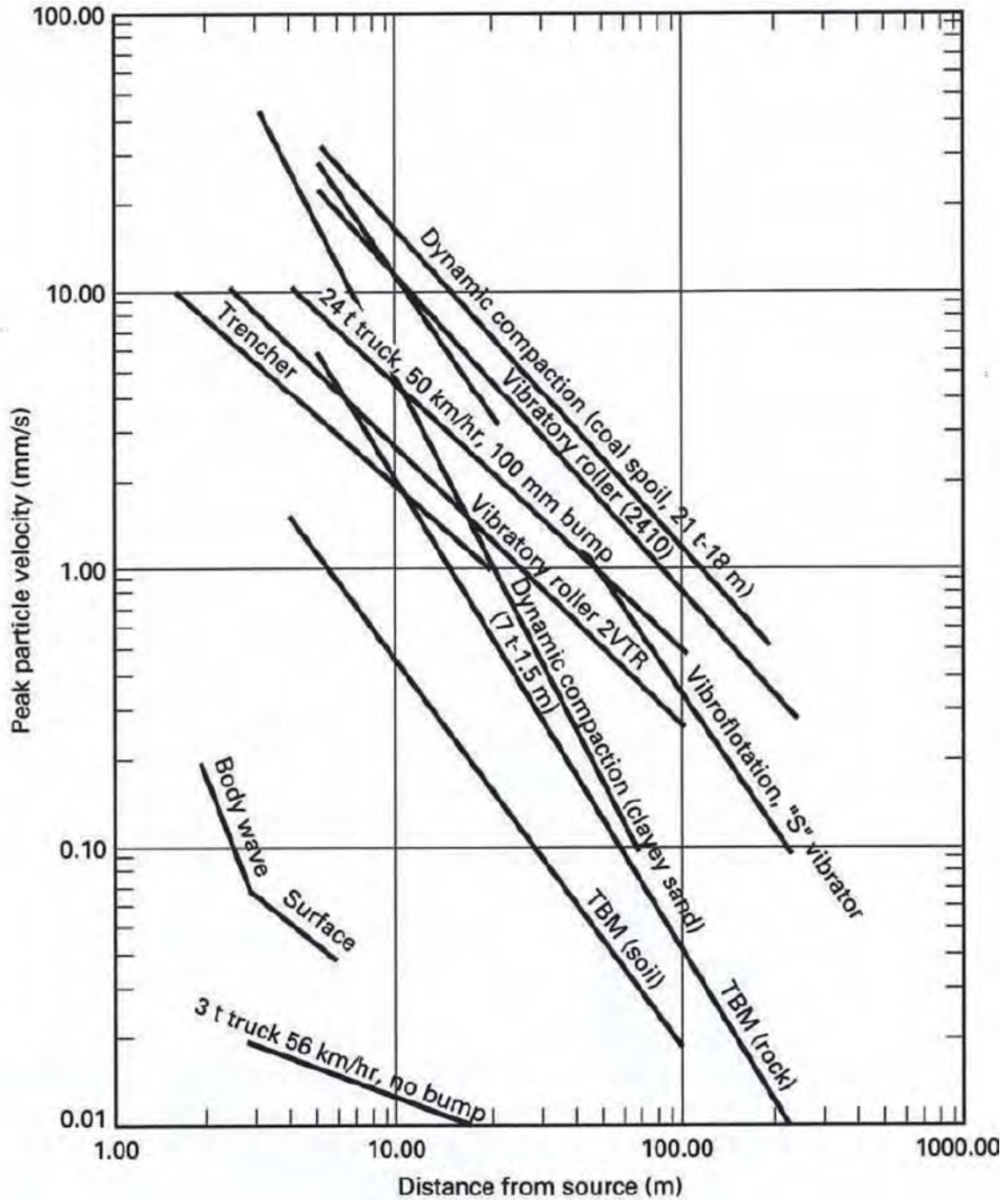
**Table 10 Type of Construction Vibrations**

<b>Vibration Type</b>	<b>Energy Type</b>	<b>Equipment Type</b>
Transient or impact vibrations	Impulsive	Dynamic compaction
		Pavement breaker
Steady-state vibrations	Reciprocating	Vibration roller
		Vibroflotation
Pseudo-steady state vibrations	Rotating	Trencher
		Tunnel boring machine
	Rolling	Heavy vehicles



**Figure 5** Typical Waveforms Associated with Various Construction Activities  
(Source: Dowding)

Figure 6 below presents estimates of the vibration levels generated by common construction activities/equipment at various distances.



**Figure 6 Typical Vibration Levels of Common Construction Activities**  
(Source: Dowding)

As can be seen in the above figure, the building damage 7.5 mm/s lower limit (as outlined in Section 3.4.2) is normally not exceeded by general construction activities at distances greater than 20 m from the nearest sensitive receivers.



In the context of the Project, the nearest sensitive residential receivers will be located further than 350 m of the construction activities and as such no appreciable impact is expected. The nearest commercial receiver is located at least 50 m from the Precinct and as such no appreciable impact is expected.

### 4.3 Construction Road Traffic Noise

The Traffic Impact Assessment (GHD, 2009) states observed traffic counts for the existing road network, including Boundary Street, Saunders Street, Benwell Road and Archer Street. Predicted 2011 traffic volumes with and without construction traffic in the report reveal that the greatest traffic increases will be on Boundary Street and will represent an increase in traffic of less than 15%. Most of this traffic will be during the AM and PM peak periods and, as this will occur during the day time, such a small increase in road traffic noise is not considered to be significant.

### 4.4 Operation

The occupants of the marine precinct are expected to include industrial activities such as boat building, abrasive blasting, surface coating, workshops, storage of goods, and packaging. Other noise generating activities associated with this will include trucks and forklifts, trawlers and boats.

Sound power levels were sourced for several noise generating activities that may be located onsite. Although this list is not exhaustive, it includes some operations that could be considered as worse case. The power levels were then distance attenuated from the proposed Precinct. Propagation calculations take into account sound intensity losses due to hemispherical spreading, with additional minor losses such as atmospheric absorption, directivity and ground absorption ignored in the calculations. As a result, predicted received noise levels are expected to slightly overstate actual received levels and thus provide a measure of conservatism.

Received noise produced by anticipated activities, during operation is shown in Table 11 for a variety of distances, with no noise barriers or acoustic shielding in place and with each plant item operating at full power. The sound pressure levels shown are maximum levels produced when machinery is operated under full load.

**Table 11 Predicted Operational Item Noise Levels dB(A)**

Plant Activity/dB(A) L <sub>w</sub>	Distance of Source to Receiver (m)						
	50	250 <sup>6</sup>	350 <sup>7</sup>	500	750	1000	2000
Sheet metal forming 105	63	49	46	43	39	37	31
Water jet pump 92	50	36	33	30	27	24	18
Forklift 85	43	29	26	23	20	17	11
Heavy Vehicle 104	62	48	45	42	39	36	30

<sup>6</sup> Approximate distance to nearest internal (fishing trawlers) noise sensitive receiver

<sup>7</sup> Approximate distance to nearest external noise sensitive receiver



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Shunting 94	52	38	35	32	29	26	20
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During the Precinct operations, the average sound level experienced at nearby residence is expected to be around 46 dB(A) under worst case conditions. This is similar to existing noise levels in the area and equal to the daytime project specific noise criteria. It is expected that further noise attenuation will likely occur due to the following:

- » Some of these worse case activities will be located within buildings;
- » Noise sources may be blocked from a direct line of site to receivers by Precinct infrastructure such as buildings, walls and barriers; and
- » Many of these activities will be located further than 350 m from the nearest sensitive receivers.

Locating these types of industry within the Precinct should not impact on the amenity of noise sensitive receivers with appropriate planning, design and management procedures in place.

Not enough detail is known to assess evening and night-time impacts of the potential Precinct users on the nearby sensitive receivers, however night time operations may include loading and unloading of trawlers and some delivery trucks. Without management or mitigation, some activities may exceed the project specific criteria. It is recommended that each user of the Precinct be subject to a noise assessment if planned operations are outside the day-time period.

#### 4.4.1 Impact on Marine Precinct Users

Potential noise impact on occupants of the Precinct (namely occupants who live aboard fishing trawlers) has been considered as part of this assessment. Noise criteria are expected to be slightly higher than for residential area of South Townsville due to this being an industrial area, however the proposed trawler berths are located closer to significant noise sources. Without detailed information on the Precinct users, it is difficult to assess potential impact. Noise levels identified in Table 11, are similar to the developed day time criteria of 48 dB(A) for the trawler location, however it must be noted that as addressed in Section 4.4 noise predictions are on the conservative side.

Noise sources should not exceed sleep disturbance criteria of 55 dB(A) as discussed in Section 4.1.

It is recommended that each user of the Precinct be subject to a noise assessment if planned operations are outside the daytime period.

#### 4.4.2 Cumulative Impacts

Cumulative noise impacts from the proposal and the Townsville Port Access Road corridor development have been considered. To that effect GHD reviewed the Townsville Port Access Road – Eastern Access Corridor Operational Road Traffic Noise Impact Assessment (Department of Main Roads, 2009), which assessed likely future noise conditions for a ten year traffic planning horizon. Sensitive receivers in the reviewed report were the same as receivers addressed in this assessment, including houses along Eighth Avenue, Sixth Street and Boundary Street.

Predicted noise levels at the nearby sensitive receivers ranged from 46 dB(A) to 54 dB(A)  $L_{A10(18Hr)}$ . The AUSTRROADS Research Report, Modelling, Measuring and Mitigating Road Traffic Noise (2005), states that the  $L_{A10(18Hr)}$  descriptor can be converted equally to the  $L_{Aeq(1Hr)}$  descriptor, which remains as 46 dB(A) to 54 dB(A)  $L_{Aeq(1Hr)}$ . These predicted road traffic noise levels are equal or higher than unmitigated predicted noise levels from the Precinct. Most operational activities within the Precinct will also be



located further than the worse case 350 m used in the predictions, and hence it is considered that cumulative impacts of the Precinct and the Townsville Port Access Road corridor development will not be a significant issue.

#### 4.4.3 Operational Road Traffic Noise

An assessment of operational road traffic noise has been undertaken to determine potential increases in road traffic noise along Boundary Street as a result of the marine precinct. The Traffic Impact Assessment (GHD, 2009) outlines predicted 2017 traffic with and without the marine precinct. Road traffic along Boundary Road (between Benwell Road and Saunders Street) is expected to increase by 130% when comparing the 2017 traffic with and without the marine precinct. Table 6 of the Traffic Impact Assessment identifies a peak AM and PM traffic level of 572 without the development and a level of 1314 with the development. An Annual Average Daily Traffic (AADT) has been estimated by assuming that the peak hourly value represents 10% of the total daily traffic.

A road traffic model was created in Cadna-A. This noise modelling software implements the Calculation of Road Traffic Noise 1988 (CoRTN) algorithms to predict road traffic noise emissions. The road traffic noise assessment has been undertaken with consideration to the DMR Road Traffic Noise Management: Code of Practice January 2008. The Townsville Port Access Road – Eastern Access Corridor Operational Traffic Noise Impact Assessment (DMR, 2009) includes noise monitoring on Boundary Street and traffic counts for 2008.

**Table 12 2008 and 2017 Traffic Parameters**

Scenario	18 Hr Traffic Flow	Posted Speed km/hr	Percentage Heavy Good Vehicle	Road Surface Type
2008	2377	60	37	5-14mm Bitumous Seal (BS)
2017 No Development	5720	60	37	5-14mm Bitumous Seal (BS)
2017 Development	13140	60	37	5-14mm Bitumous Seal (BS)

DMR has published road traffic noise corrections for different pavement types. As in the DMR report for the Townsville Port Access Road, a +1 dB(A) road surface correction was applied for the 5-14mm bituminous seal roads existing on Boundary Street. A -1.7 dB(A) calibration factor was applied for Queensland Road conditions for densely graded asphalt sites. CoRTN also specifies that for a noise level 1m in front of a façade a correction of +2.5dB(A) has to be made. Verification of the 2008 road traffic noise model is shown in Table 13 below. The measured road traffic noise level comes from the DMR Operational Traffic Noise Assessment (2009).



**Table 13 Measured and Calculated Road Traffic Noise Level**

Address	Noise Source	Position	Measured L <sub>A10</sub> (18hr)	Calculated L <sub>A10</sub> (18hr)	Accuracy
282 Boundary Street	Boundary Street	Façade	64.6 dB(A)	65.7 dB(A)	+1.1 dB(A)

Using the calibrated model predicted road traffic volumes were assessed for the 2017 year with and without the marine precinct using the same assumptions as the 2008 model. Results are presented in Table 14.

**Table 14 Predicted Road Traffic Noise Levels for 2017**

Scenario	Address	Noise Source	Position	Calculated L <sub>A10</sub> (18hr)
2017 without development	282 Boundary Street	Boundary Street	Façade	69.5
2017 with development	282 Boundary Street	Boundary Street	Façade	73.1

Noise modelling suggests that noise levels in 2017 along Boundary Street will potentially be above the DMR criteria of 68 dB(A), both without and with the marine precinct. Noise levels have been predicted to be approximately 3.5 dB(A) higher along Boundary Street with the development. Treatments for noise attenuation may to be considered within the road corridor or alternative Precinct traffic routes considered with the aim of reducing levels to 68 dB(A) or less.



## 5. Recommended Mitigation Measures

### 5.1 Construction Phase

Construction activities have the potential to impact on the amenity of nearby noise sensitive receivers without appropriate management procedures in place.

The following management and mitigation measures should be implemented to minimise potential noise impacts:

- » Noise generating construction activities should be, as much as possible, undertaken between the hours of 6.30 am to 6.30 pm Monday to Saturday. Any works outside these hours should be managed appropriately with actions listed below; Where practical, all vehicular movements to and from the construction site must be made only during normal working hours;
- » Long term fixed plant such as generators should be located appropriately so as to minimise noise impacts on nearest sensitive receivers. This can include locating plant behind storage containers, stockpiles or other objects that may act as a barrier to the sound;
- » Residents to be notified of the construction timetable, with extra emphasis on noisy activities such as pile driving;
- » Vehicles to be kept properly serviced and fitted with appropriate mufflers; and
- » Machines found to produce excessive noise compared to industry best practice should be removed from the site or stood down until repairs or modifications can be made.

Construction noise and vibration monitoring should be undertaken by a qualified professional and with consideration to the relevant standards and guidelines. Attended noise and vibration monitoring should be undertaken in the following circumstances:

- » Upon receipt of a noise and/or vibration complaint. Monitoring should be undertaken and reported within three to five working days. If exceedances are detected, the situation should be reviewed in order to identify means to reduce the impact to acceptable levels. In case of vibration complaints, both building damage and human perception issues should be considered with regards to the vibration limits outlined in Section 3.4.

### 5.2 Operations

Operation of the Precinct has the potential to impact on the amenity of nearby noise sensitive receivers in South Townsville and occupants of the Precinct (fishing trawlers) without appropriate management procedures in place. In order to protect the amenity of nearby sensitive receivers, any user of the Precinct shall ensure operational noise levels do not exceed the project specific noise criteria of  $L_{Aeq\ 1hr}$  day – 42dB,  $L_{Aeq\ 1hr}$  evening – 38dB, and  $L_{Aeq\ 1hr}$  night – 28dB for South Townsville and of  $L_{Aeq\ 1hr}$  day – 48dB,  $L_{Aeq\ 1hr}$  evening – 45dB, and  $L_{Aeq\ 1hr}$  night – 41dB for the trawler berths.

The following management measures are available to ameliorate noise impacts:

- » Locate the noisiest Precinct users the furthest away from the nearby sensitive receivers;
- » Where practicable, limit operating times of noisy industries using the site (i.e. day time only);
- » Public awareness for recreational boat users accessing the site outside day time period; and



- » Development approvals for individual sites should be subject to a noise assessment to ensure that all industrial premises on the Precinct cumulatively comply with the criteria.



## 6. Conclusion

The results of the assessment suggest that construction related noise and vibration from the Port of Townsville Marine Precinct will not significantly impact on the amenity of sensitive receivers in South Townsville, provided the noise management measures outlined in this report are implemented.

Noise levels from construction activities will likely exceed sleep disturbance criteria during pile driving and it is expected that some impact will occur on the sleep patterns of occupants of berthed fishing trawlers. Occupants of trawlers should be notified of the proposed construction timing and methodology.

Limited information is available at this time on the occupants of the Precinct. Sound power levels were sourced for several noise generating activities that may be located onsite. The power levels were then distance attenuated from the proposed Precinct to predict possible noise impact on nearby sensitive receivers. During the Precinct operations, the average sound level experienced at nearby residence is expected to be around 46 dB(A) under worse case conditions and around 49 dB(A) within the Precinct at the fishing trawler berths. This is similar to existing noise levels in the area and it is expected that further noise attenuation will likely occur.

Locating these types of industry within the Precinct should not impact on the amenity of noise sensitive receivers with appropriate planning, design and management procedures as outlined in this report in place.

It is recommended that development approvals for individual sites should be subject to a noise assessment to ensure that all industrial premises on the Precinct cumulatively comply with the criteria.

Increase in road traffic due to the marine precinct has the potential to increase road traffic noise in the local road network. Road traffic noise modelling for the year 2017 has indicated that noise levels at a receiver on Boundary Street with the marine precinct operational will potentially be 3.5 dB(A) higher than if the marine precinct was not developed. Road traffic noise modelling suggests that noise levels will exceed the DMR Road Traffic Noise Management: Code of Practice 2008 criteria with or without the marine precinct. Treatments for noise attenuation may to be considered within the road corridor or alternative Precinct traffic routes considered with the aim of reducing levels to 68 dB(A) or less.

Therefore based on the information provided, assumptions made, and assessment of results it is expected that the Townsville Marine Precinct can meet its relevant noise goals.



## 7. References

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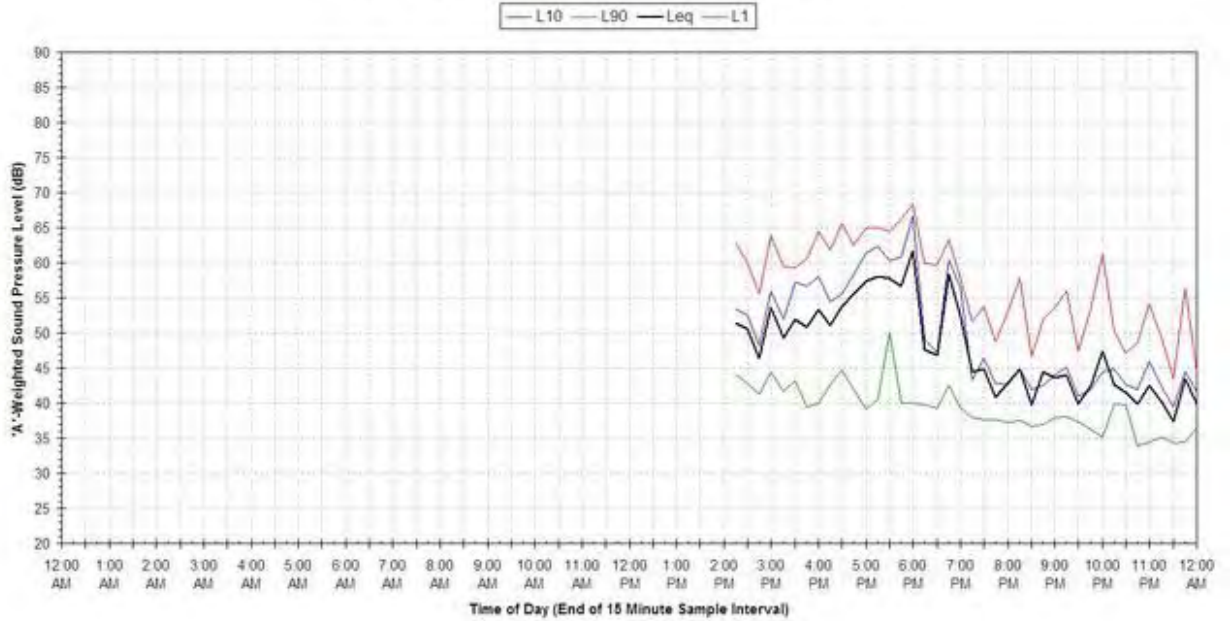


Appendix A  
**Details of Ambient Noise Monitoring**

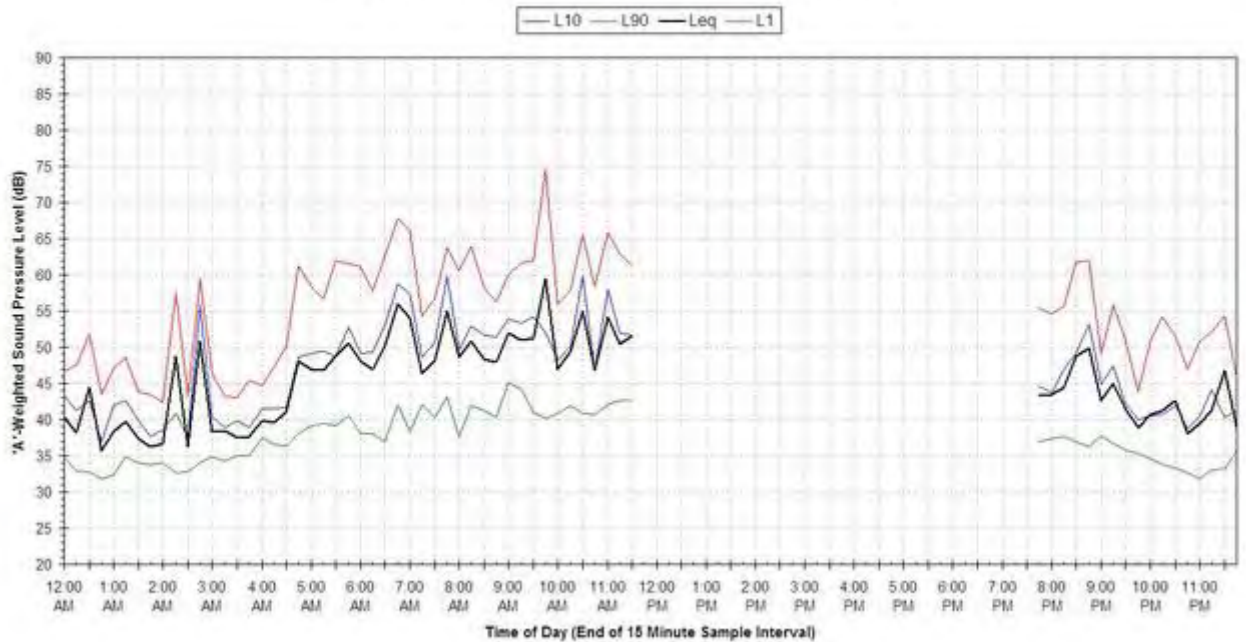
Noise Logger Data Graph



Statistical Ambient Noise Levels  
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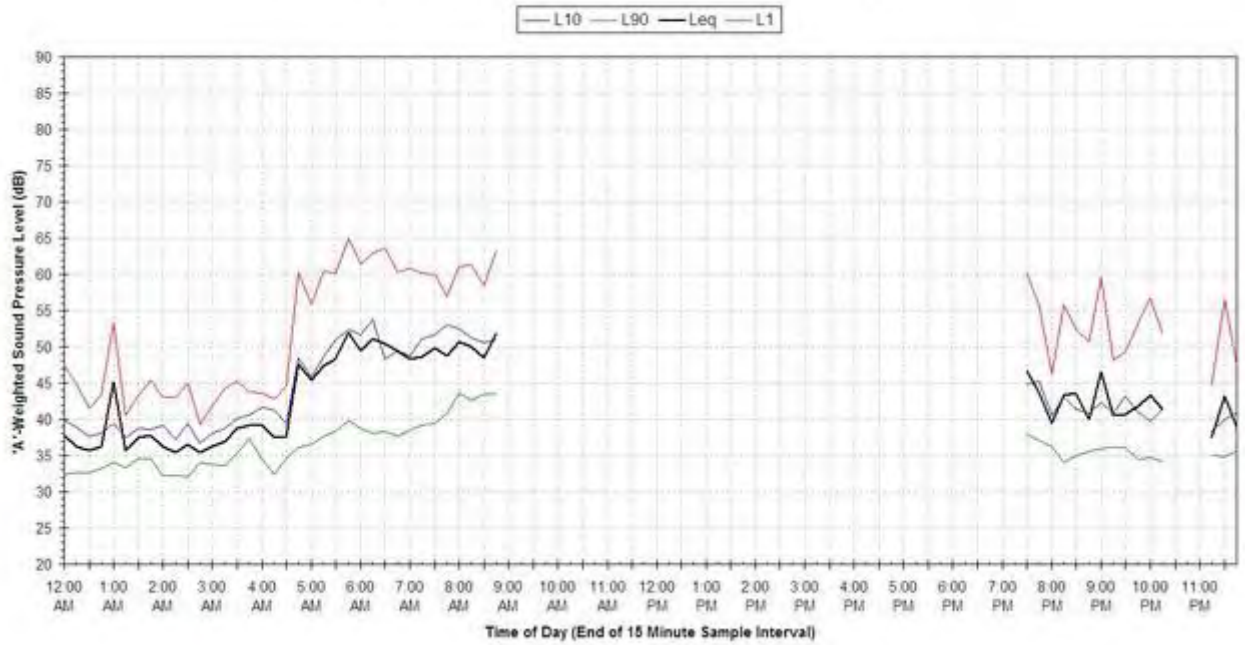


Statistical Ambient Noise Levels  
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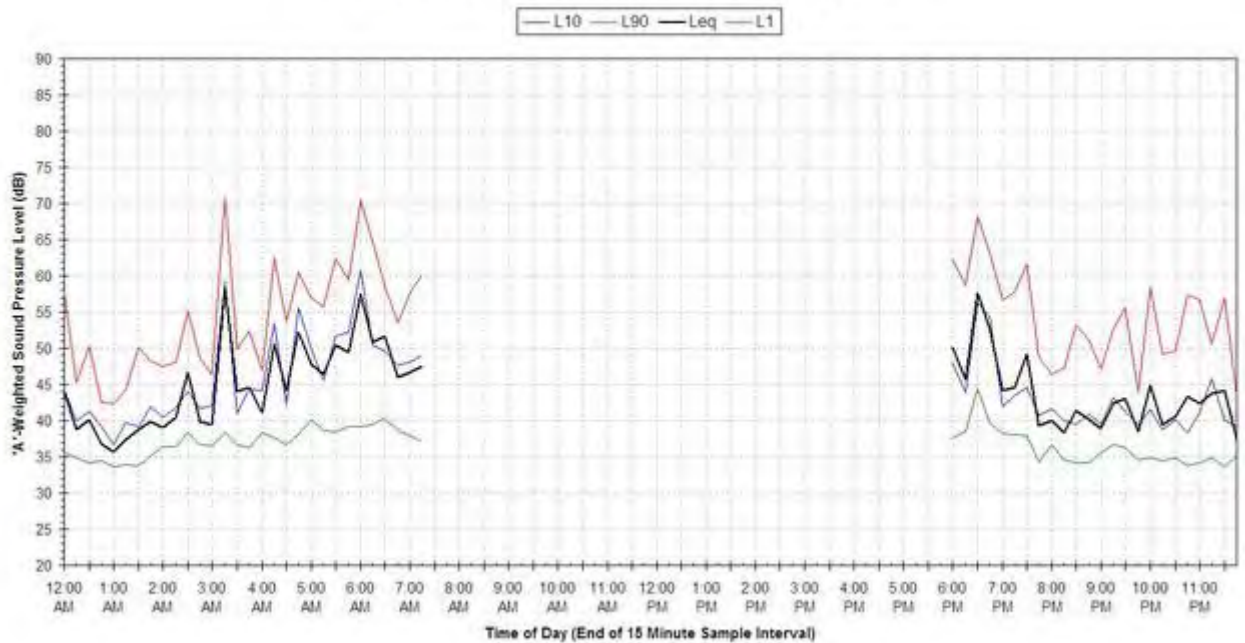




Statistical Ambient Noise Levels  
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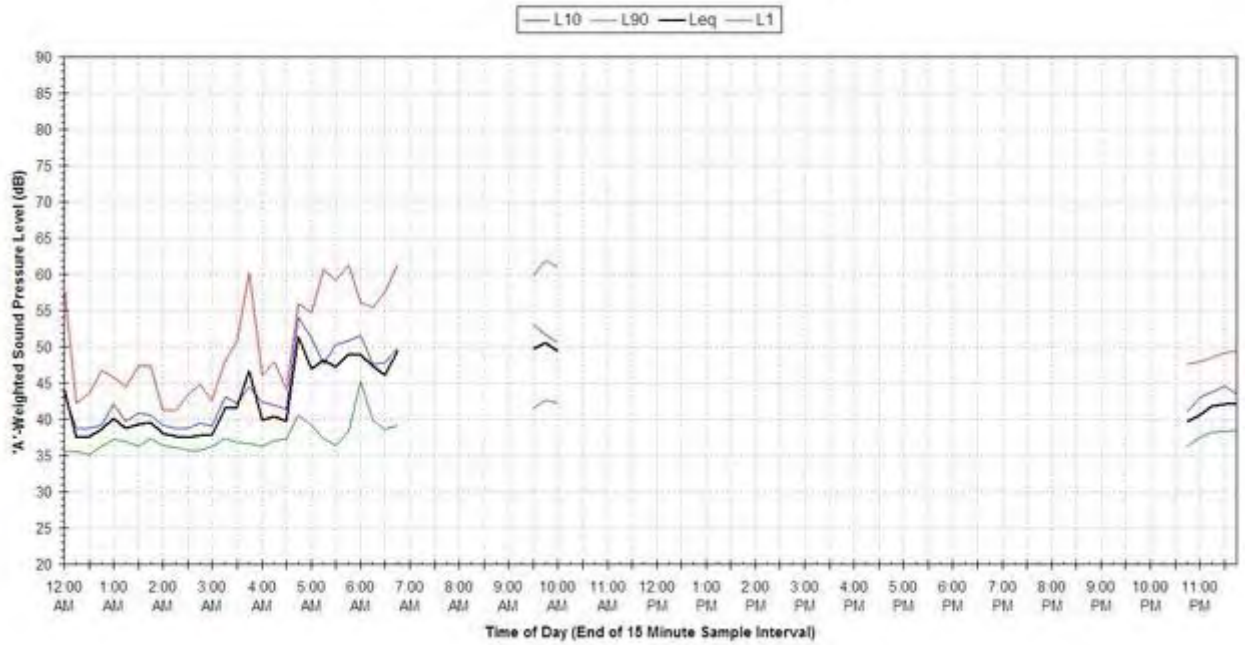


Statistical Ambient Noise Levels  
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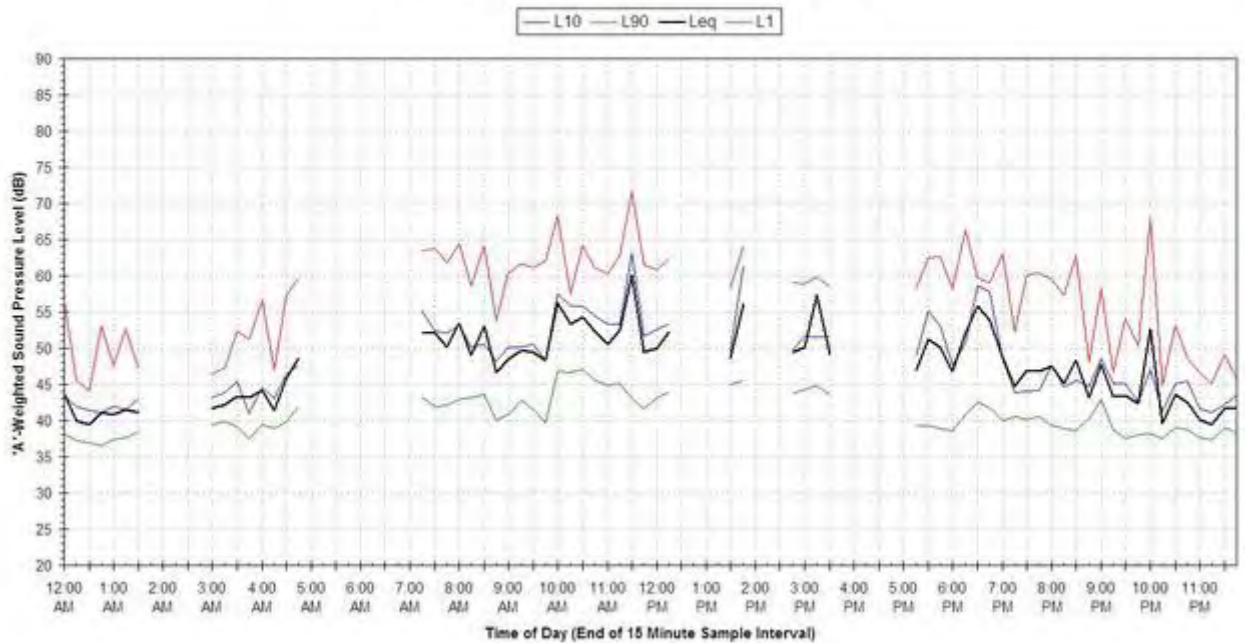




Statistical Ambient Noise Levels  
27 Hubert Street, South Townsville - Sunday 7/12/2008

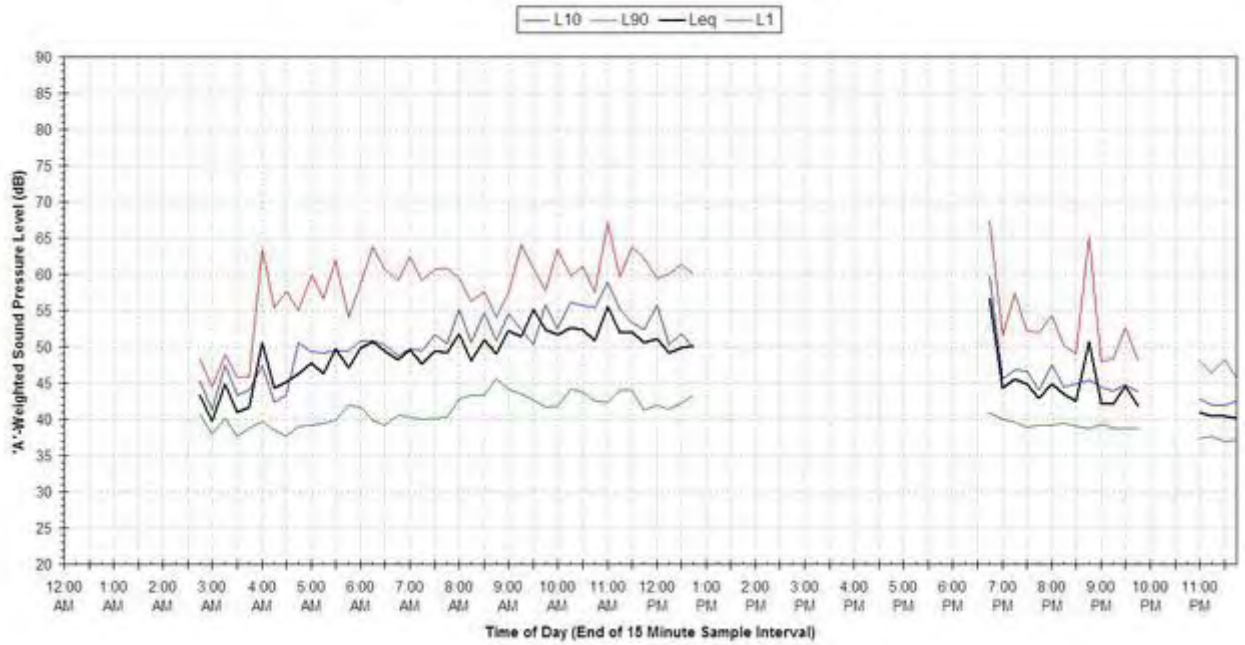


Statistical Ambient Noise Levels  
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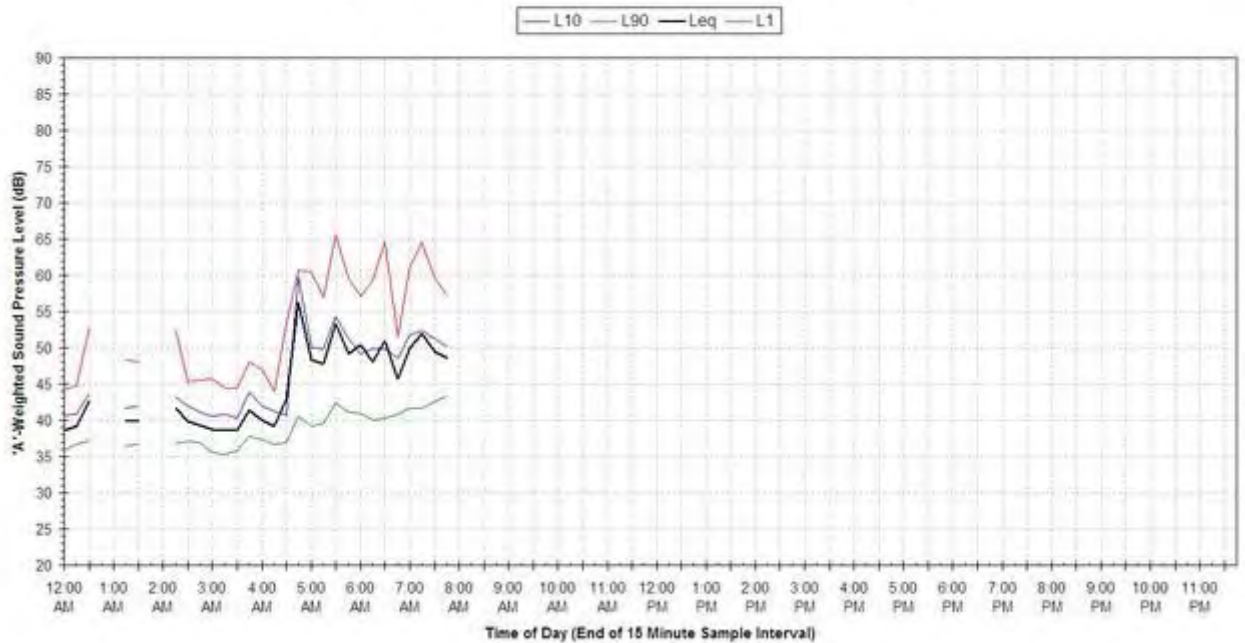




Statistical Ambient Noise Levels  
27 Hubert Street, South Townsville - Tuesday 9/12/2008



Statistical Ambient Noise Levels  
27 Hubert Street, South Townsville - Wednesday 10/12/2008





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