



**City Pacific Limited**

**TOWNSVILLE OCEAN TERMINAL -  
SUPPLEMENTARY REPORT: DEPOSITED  
DUST**

**June 2008**

Prepared by:

**AIR NOISE ENVIRONMENT PTY LTD**

3/4 Tombo Street

Capalaba, Queensland 4157

07 3245 7808 (ph) 07 3245 7809 (fax)

Web: [www.ane.com.au](http://www.ane.com.au) E-mail: [ane@ane.com.au](mailto:ane@ane.com.au)



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## **CONTENTS**

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
<b>1.1</b>	<b>OVERVIEW</b>	<b>1</b>
<b>1.2</b>	<b>THIS REPORT</b>	<b>1</b>
<b>2</b>	<b>ASSESSMENT CRITERIA</b>	<b>2</b>
<b>3</b>	<b>DEPOSITED DUST MONITORING</b>	<b>3</b>
<b>3.1</b>	<b>SCOPE OF THE MONITORING</b>	<b>3</b>
<b>3.2</b>	<b>MONITORING METHODOLOGY</b>	<b>4</b>
<b>3.3</b>	<b>METEOROLOGICAL CONDITIONS</b>	<b>4</b>
<b>3.3.1</b>	<b>Typical Townsville Meteorology</b>	<b>4</b>
<b>3.3.2</b>	<b>Meteorological Conditions During Monitoring Period</b>	<b>6</b>
<b>3.4</b>	<b>MONITORING RESULTS</b>	<b>9</b>
<b>4</b>	<b>CONCLUSIONS AND RECOMMENDATIONS</b>	<b>14</b>

### **APPENDIX A: GLOSSARY OF TERMS**



# 1 INTRODUCTION

## 1.1 OVERVIEW

Air Noise Environment Pty Ltd (ANE) were commissioned by City Pacific Limited to undertake an air quality assessment for the Townsville Ocean Terminal (TOT) development proposed to be constructed in Townsville.

The proposal will provide Townsville with:

- a dedicated cruise terminal and wharf for cruise ships and military vessels, located on the Port Western Breakwater, adjacent to the Port of Townsville;
- an integrated residential and tourism development providing residential land parcels of mixed density for development;
- extended public access to the Breakwaters and provide future open space areas to land to be reclaimed to the north of the existing Townsville Hotel and Casino Complex and the Townsville Entertainment Centre; and
- increased marina berths for the marine industry, general recreational vessels, and provide berthing facilities for superyachts.

The Air Quality Assessment (AQA) undertaken by ANE<sup>1</sup> and included in the Environmental Impact Statement (EIS) for the Project incorporated modelling of future emissions from the Port of Townsville. In addition, monitoring of existing air quality at (or near) the Project Site was undertaken for a range of determinants including oxides of nitrogen, sulphur dioxide, organic hydrocarbons and deposited dust. Monitoring data collected by the Queensland Environmental Protection Agency (EPA) and the Townsville Port Authority (TPA) was also considered in the assessment.

This supplementary report presents the complete results of the deposited dust monitoring program undertaken for the TOT, and reviews available datasets from the EPA and TPA.

## 1.2 THIS REPORT

This report provides a summary of the results of deposited dust monitoring undertaken in the area and forms part of the following series of supplementary air quality assessment reports prepared for the project:

- Townsville Ocean Terminal: Supplementary Report - Responses to EIS Comments
- Townsville Ocean Terminal: Supplementary Report – Suspended Particulates
- Townsville Ocean Terminal: Supplementary Report – Gaseous Emissions
- Townsville Ocean Terminal: Supplementary Report – Metals Emissions

<sup>1</sup> Townsville Ocean Terminal – Air Quality Assessment (October 2007) prepared by Air Noise Environment Pty Ltd on behalf of City Pacific Limited



## 2 ASSESSMENT CRITERIA

The Terms of Reference for the project EIS nominated the following air quality criteria:

- The National Health and Medical Research Council (NHMRC) national guidelines (1985) for control of emissions from stationary sources.
- Environmental Protection Air Policy (1997) (EPP Air) and the Environmental Protection Act (1994).
- National Environmental Protection Measure (NEPM) for Ambient Air Quality (1998).

The Project does not include stationary sources (e.g. industrial stacks), hence application of the NHMRC criteria is not relevant.

For the assessment of deposited dust impacts on the proposed development, the EPA provides a guideline for deposited dust of 120 mg/m<sup>2</sup>/day. This guideline, while not referenced in the legislation, is provided as a condition on the environmental authorities of a large number of industrial activities throughout Queensland including a number of Port operators as follows:

- Southern Cross Fertilisers;
- Shell Company of Australian;
- Australian Marshalling Services; and
- Incitec Fertilisers



### 3 DEPOSITED DUST MONITORING

#### 3.1 SCOPE OF THE MONITORING

Deposited dust monitoring has been undertaken in the Townsville Port area by a number of organisations in the past. This report includes the monitoring undertaken by ANE and the TPA and compares the results to historic EPA data for the Townsville area. Table 3.1 provides a summary of monitoring undertaken in the area. It is possible that additional monitoring data has also been collected in the area however the Project Team is not aware of this information.

**Table 3.1: SUMMARY OF PARTICULATE MONITORING IN TOWNSVILLE AREA**

Organisation	Monitoring Undertaken
Air Noise Environment (Project Team)	<ul style="list-style-type: none"> <li>▪ deposited dust monitoring undertaken for 12 months (November 2006 – October 2007) five monitoring sites as follows: <ul style="list-style-type: none"> <li>▪ Breakwater wall 1 – located at the eastern boundary of the Project Site on the existing breakwater wall;</li> <li>▪ Breakwater wall 2 – located at the eastern boundary of the Project Site on the existing breakwater wall;</li> <li>▪ Casino carpark – located in the carpark located to the west of the Casino and on the southern border of the Project Site;</li> <li>▪ Mariner's Peninsula – located at the northern tip of the Mariner's Peninsular site and at the south-western corner of the Project Site; and</li> <li>▪ Jezzine Army Barracks – existing background monitoring station at the western end of the esplanade waterfront area.</li> </ul> </li> </ul>
TPA	<ul style="list-style-type: none"> <li>▪ On-going monitoring of deposited dust at a total of 13 sites within the Port area including: <ul style="list-style-type: none"> <li>▪ Rail Loop</li> <li>▪ Entrance</li> <li>▪ Administration building</li> <li>▪ Breakwater</li> <li>▪ Berth 1</li> <li>▪ Berth 3</li> <li>▪ Berth 4</li> <li>▪ Berth 6</li> <li>▪ Berth 8</li> <li>▪ Berth 10</li> <li>▪ Jetty Road</li> <li>▪ Tully Street</li> <li>▪ Ross Street</li> </ul> </li> </ul>

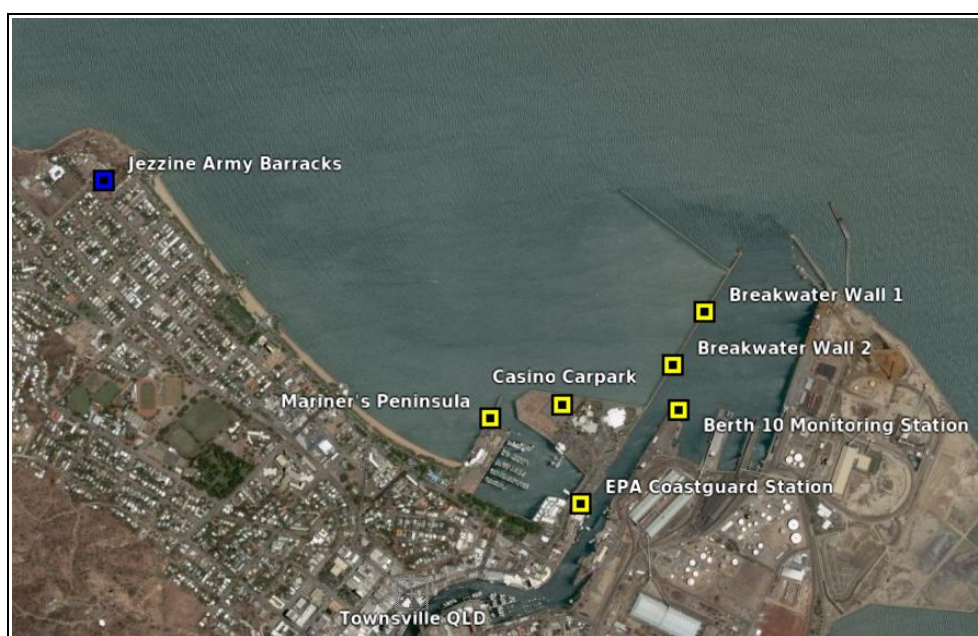
Of the monitoring undertaken to date the following stations are likely to provide a reasonable representation of concentrations likely to be experienced at the Project Site:

- Project Team monitoring stations:



- Breakwater Wall 1
  - Breakwater Wall 2
  - Casino Carpark; and
  - Mariner's Peninsular.
- TPA monitoring stations:
    - Berth 10 deposition monitoring station.

In addition, the Jezzine Army Barracks monitoring station is expected to represent typical ambient deposited dust levels in the Townsville waterfront area. Figure 1 presents the location of these monitoring stations in relation to the Project Site and surrounding landuses.



**Figure 1: Deposited Dust Monitoring Station Locations**

## 3.2 MONITORING METHODOLOGY

All project specific deposited dust monitoring was undertaken in accordance with AS 3580.10 Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method.

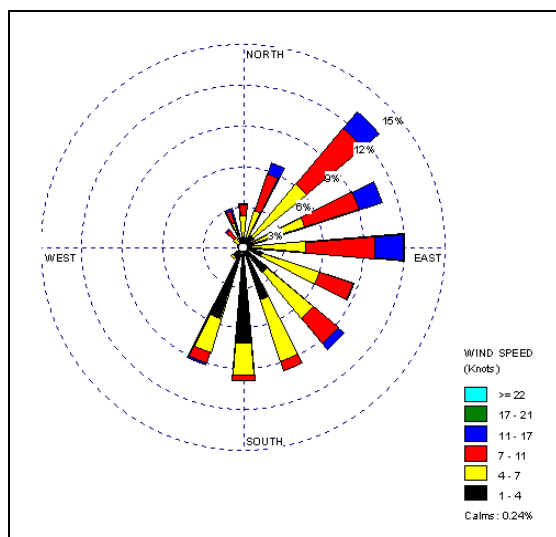
## 3.3 METEOROLOGICAL CONDITIONS

### 3.3.1 Typical Townsville Meteorology

The climatology in the Townsville area is typical of a tropical environment, however, due to its geographical location, rainfall is not as high as elsewhere in the tropics. Winter months are dominated by SE trade winds and mostly fine weather. The summer months are hot and humid with "build-up" thunderstorms starting in late October or November. Bursts of monsoon rains from late December through until early April deliver the highest rainfall.



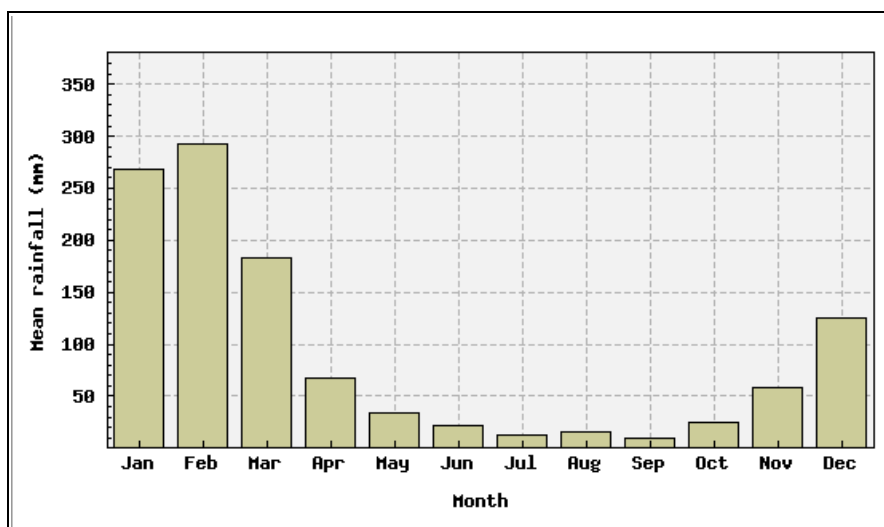
Figure 2 presents a wind rose for the Townsville Port Authority meteorological station located at Berth 10 of the Port of Townsville (located to the east of the Project Site) for the period January 2004 – December 2006.



**Figure 2: Windrose for Townsville Port Berth 10 Monitoring Station (2004 – 2007)**

Winds are noted to be predominantly easterly and north-easterly during the wet season and easterly to south south westerly in the dry season. For all periods the occurrence of calms in the Project Site area is low with less than 1 % calms recorded in any season of available monitoring data.

The average annual rainfall recorded at the Bureau of Meteorology monitoring station located at Townsville Airport is 1143 mm for an average of 91 rain days, most of which falls in the six month "wet season" November to April. Figure 3 presents a summary of average rainfall per month across a typical year.



**Figure 3: Typical Rainfall Patterns for Townsville Region (average over all years of recorded data)**





### 3.3.2 Meteorological Conditions During Monitoring Period

Table 3.2 provides a summary of wind conditions during the monitoring of nuisance deposited particulates at each of the ANE monitoring positions. Review of this data confirms that for a considerable portion of the monitoring periods, winds were from easterly sectors. Thus, for much of the monitoring period, winds were blowing from the major sources at the Port to the monitoring station. Furthermore, review of the figures presented indicates that for all measurement positions, similar wind profiles (in terms of direction and speed) were included in the available monitoring data.

**Table 3.2: SUMMARY OF WIND CONDITIONS DURING DEPOSITED DUST MONITORING**

Station	Wind Rose	Wind Class Frequency Distribution
Berth 10	<p>WIND SPEED (Knots)</p> <ul style="list-style-type: none"> <li>&gt;= 22</li> <li>17 - 21</li> <li>11 - 17</li> <li>7 - 11</li> <li>4 - 7</li> <li>1 - 4</li> </ul> <p>Calm: 0.24%</p>	<p>Wind Class Frequency Distribution</p> <p>Wind Class (Knots)</p> <p>%</p>
Breakwater Wall 1 & Breakwater Wall 2	<p>WIND SPEED (Knots)</p> <ul style="list-style-type: none"> <li>&gt;= 22</li> <li>17 - 21</li> <li>11 - 17</li> <li>7 - 11</li> <li>4 - 7</li> <li>1 - 4</li> </ul> <p>Calm: 0.27%</p>	<p>Wind Class Frequency Distribution</p> <p>Wind Class (Knots)</p> <p>%</p>



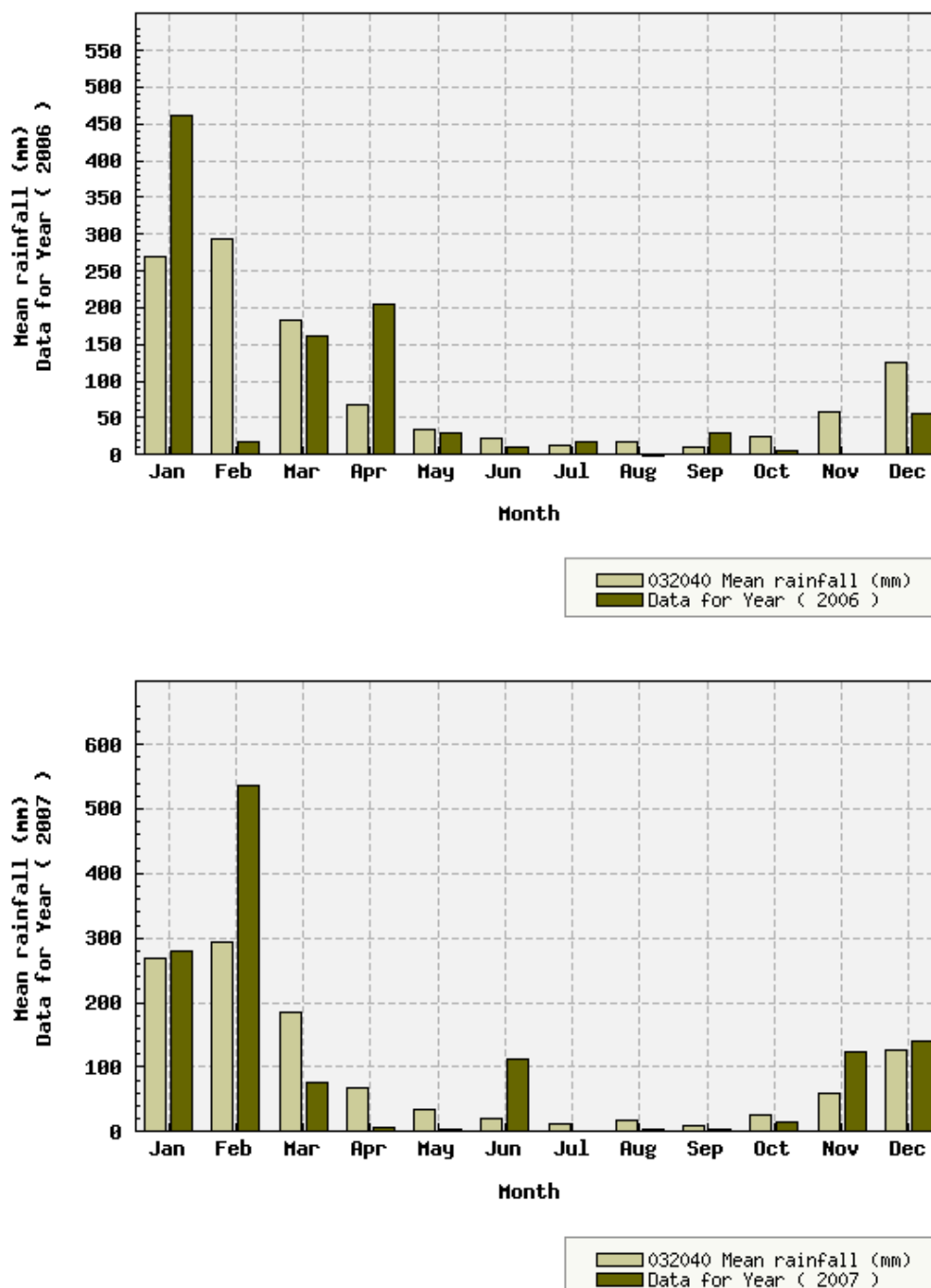
Station	Wind Rose	Wind Class Frequency Distribution
Casino Carpark		
Mariner's Peninsula		
Jezzine Army Barracks (Background Position)		

Note: Presented wind profiles vary by station dependant on the months for which valid monitoring data was collected.

Review of the rainfall intensity data presented in Figure 4 identifies that rain periods during the monitoring period were typical of average rainfall patterns in Townsville with the exception of November, February and June. For November 2006, Townsville experienced significantly less rainfall than is typical for that time of year based on historical monitoring data. February and June



2007 however experienced higher than average rainfall with February in particular representing the wettest month by a significant margin.



**Figure 4: Rainfall Distribution for Deposited Dust Monitoring Period (11/06 – 10/07)**

Given the comparability of meteorological conditions throughout most of the monitoring period to those typical for the Townsville region, monitoring results for nuisance deposited particulates are



expected to provide a reasonable representation of typical conditions at the Project Site.

### 3.4 MONITORING RESULTS

Townsville Port Authority undertakes routine monitoring of dust deposition at a number of locations around the Port site. In addition, a further five monitoring stations were also established by ANE to gain a better understanding of nuisance dust levels at the Project Site as discussed in Section 5.2.3 and shown on Figure 10 of the AQA.

Table 3.3 presents a summary of total insoluble deposited dust monitoring results for the Townsville Port Authority monitoring stations and those established for the purposes of the Project. As can be seen, limited monitoring data is available for the Breakwater Wall 1, Breakwater Wall 2 and Casino Carpark positions. This is due to vandalism of the monitoring stations which prevented data from being collected during some months.

**Table 3.3: SUMMARY OF TOTAL INSOLUBLE DEPOSITED DUST RESULTS (mg/m<sup>2</sup>/day)**

Monitoring Station	2006						2007											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rail Loop	30	20	37	79	75	162	100	65	-	-	43	27	38	60	72	100	179	28
Entrance	18	29	26	38	104	54	43	92	76	21	36	18	28	33	25	67	72	38
Admin Bld	9	26	63	32	82	62	314	219	88	46	121	24	45	77	38	63	79	53
Breakwater	18	17	93	6	18	32	64	223	12	5	21	32	14	17	13	20	97	19
Berth 1	103	74	93	32	68	57	314	96	80	51	46	97	79	67	50	43	-	47
Berth 3	52	74	48	94	211	127	79	96	88	39	93	74	66	70	91	200	69	59
Berth 4	49	69	44	-	114	57	29	27	112	44	54	135	41	97	75	-	-	50
Berth 6	24	26	396	44	200	41	39	81	100	23	29	35	100	57	50	60	145	53
Berth 8	94	-	274	215	257	308	254	173	292	106	-	56	-	-	200	380	300	191
Berth 10	30	26	26	15	29	111	39	100	36	31	36	32	31	37	28	27	45	38
Jetty Rd	-	-	-	-	-	-	-	-	160	62	146	68	148	160	38	127	134	56
Tully Street	-	-	-	-	-	-	-	-	92	28	93	27	38	43	25	100	103	38
Ross Street	-	-	-	-	-	-	-	-	72	31	54	27	34	60	13	147	179	66
Breakwater Wall 1	-	-	-	-	-	-	-	-	-	-	-	81	31	-	-	3	-	-
Breakwater Wall 2	-	-	-	-	-	-	-	-	-	-	-	63	34	-	-	35	-	-
Casino Carpark	-	-	-	-	-	-	-	-	-	41	61	47	19	40	43	56	-	-
Mariners Peninsula	-	-	-	-	27	88	18	3	72	72	21	31	16	37	32	27	-	-
Jezzine Army Barracks	-	-	-	-	40	-	67	6	79	35	29	81	31	83	36	21	-	-

Table 3.4 presents a summary of the number of months for which monitoring data is presented for



each monitoring station along with the range of levels recorded and the number of recorded exceedences of the deposited dust criteria of 120 mg/m<sup>2</sup>/day for the six stations likely to be representative of dustfall levels at the Project Site.

**Table 3.4: SUMMARY OF DATA AVAILABILITY AND COMPLIANCE**

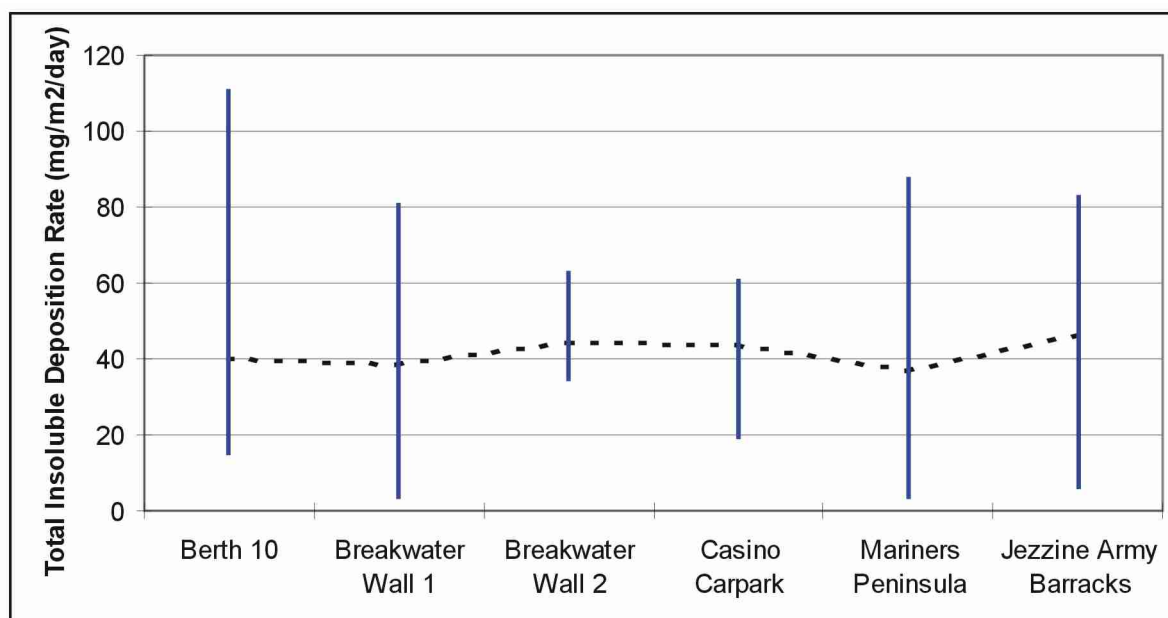
Monitoring Station	Number of Months of Data Presented	Range of Measured Deposition Rates	Number of Exceedences Recorded
<b><i>Representative of Project Site</i></b>			
Berth 10	18	15 - 111	0
Breakwater Wall 1	3	3 - 81	0
Breakwater Wall 2	3	34 - 63	0
Casino Carpark	7	19 - 61	0
Mariners Peninsula	12	3 - 88	0
<b><i>Representative of Typical Townsville Waterfront Background Dust Levels</i></b>			
Jezzine Army Barracks	11	6 - 83	0

Review of the available monitoring data collected at stations likely to be representative of dust levels at the Project Site confirms that measured dust deposition rates are well below the EPA nuisance dust goal of 120 mg/m<sup>2</sup>/day with the exception of Berth 10. For Berth 10, which is within the Port area, two months of monitoring results in excess of 100 mg/m<sup>2</sup>/day were observed. It should be noted, however, that at other monitoring stations likely to be representative of the Project Site during these months measured deposited dust levels were significantly lower. This is consistent with the increased separation distance of the other Project Site monitoring positions to sources of dust emissions at the Port.

Review of the measured levels of deposited dust for the background monitoring position (Jezzine Army Barracks), indicates that for some months, dust levels at this position are higher than those recorded at the monitoring stations near to the Project Site. This indicates that dust is a feature of the environment in Townsville and the Port is not the only source of dust emissions impacting on the Townsville area.

Data collection rates presented in Table 3.4 identify that for three of the monitoring stations (Berth 10, Mariner's Peninsula and Jezzine Army Barracks) greater than 11 months of data is available. For the other stations representative of the Project Site less data was collected (7 months for the Casino Carpark and 3 months of each of the Breakwater Wall monitoring positions). This was due to the vandalism experienced in the areas where these monitoring stations were located. Despite this vandalism, the available data was collected during the drier months in the Townsville area hence is likely to provide a reasonable assessment of potential deposited dust levels at the Project Site.

Figure 5 presents a summary of the range of insoluble deposited dust levels measured at each of the six monitoring stations discussed above. In this figure, the vertical blue bars represent the range of values measured at the location with the dotted line representing the average measured at each station over the available monitoring data from January 2006 to December 2007.



**Figure 5: Range of Insoluble Deposited Dust Levels Measured (November 2006 – October 2008)**

#### 3.4.1.1 Comparison With Other Areas of Queensland

Despite the relatively low levels of deposited dust measured in the Townsville area, nuisance dust remains an important issue for a number of Townsville residents. The local interest in nuisance dust levels relates primarily to the 'black dust' identified by a number of residents in the Yarrowonga area. Given this, in reviewing the deposited dust monitoring data collected at the Project Site and surrounding area, it is useful to compare the levels of nuisance dust to those in other areas of Queensland.

Deposited dust monitoring was reported in annual air monitoring reports for a number of areas throughout Queensland by the Queensland Environmental Protection Agency from 1987 – 1994. Routine monitoring of deposited dust ceased after this time. Table 3.5 presents a summary of available monitoring data for stations throughout residential, industrial and commercial areas of Queensland.

**Table 3.5: SUMMARY OF HISTORICAL DEPOSITED DUST MONITORING DATA**

Monitoring Site	Surrounding Landuse	1987	1988	1989	1990	1991	1992	1993	1994
<b>South-East Queensland</b>									
Mary St, Brisbane	CBD	84	50	33	31	37	39	40	38
Brunswick St, Fortitude Valley	CBD	62	51	57	52	53	56	51	60
Ashridge Rd, Darra	Industrial	103	145	181	95	127	115	115	168
Curtain Ave, Eagle Farm	Industrial	-	-	-	42	35	38	38	47



Monitoring Site	Surrounding Landuse	1987	1988	1989	1990	1991	1992	1993	1994
Lavarack Ave, Eagle Farm	Industrial	90	85	84	60	-	-	-	-
Ipswich Rd, Oxley	Industrial	54	39	44	39	52	51	149	62
Robinson Rd, Geebung	Light Industry	118	118	84	109	142	143	-	-
Robinson Rd, Geebung (2)	Light Industry	-	108	84	104	-	-	-	-
Brisbane St, Ipswich	Commercial	59	41	44	45	50	42	57	53
Logan Rd, Holland Park	Residential	41	36	44	36	52	42	43	43
Samford Rd, Mitchelton	Residential	49	56	51	53	63	57	60	65
<b>Gladstone</b>									
Auckland St, Gladstone	Commercial / Residential	23	41	42	46	-	-	-	-
<b>Townsville</b>									
Pilkington Street, Garbutt	Light Industry	-	-	-	-	58	75	78	114
Moray St, Stuart	Industrial	26	36	47	-	-	-	-	-
Archer St, South Townsville	Industrial / Residential	46	48	44	52	60	40	55	-
Palmerston St, Gulliver	Residential	20	37	22	37	35	31	34	-
Virgil St, Townsville	Residential	39	41	28	49	38	42	44	40
Cambridge St, Vincent	Residential	-	-	-	-	-	-	60	47

Review of the monitoring data presented in Table 3.5 confirms that dust levels in Queensland area are generally well within the 120 mg/m<sup>2</sup>/day guideline value adopted by the Queensland EPA. The exceptions to this are the industrial areas in Brisbane including Darra, Oxley and Geebung.

Figure 6 and Table 3.6 presents a comparison of the historical deposited dust monitoring results for stations located in residential areas identified in Table 3.5 with the average dust levels measured at the project specific monitoring sites. Review of the figure confirms that deposited dust levels measured at all of the project specific monitoring stations are comparable to other residential areas throughout Queensland, including residential areas in Brisbane and Townsville. Similarly, comparison of deposited dust levels with those for residential areas in New Zealand identifies a similar pattern with average deposition rates of 1 g/m<sup>2</sup>/30days (33 mg/m<sup>2</sup>/month)<sup>2</sup>.

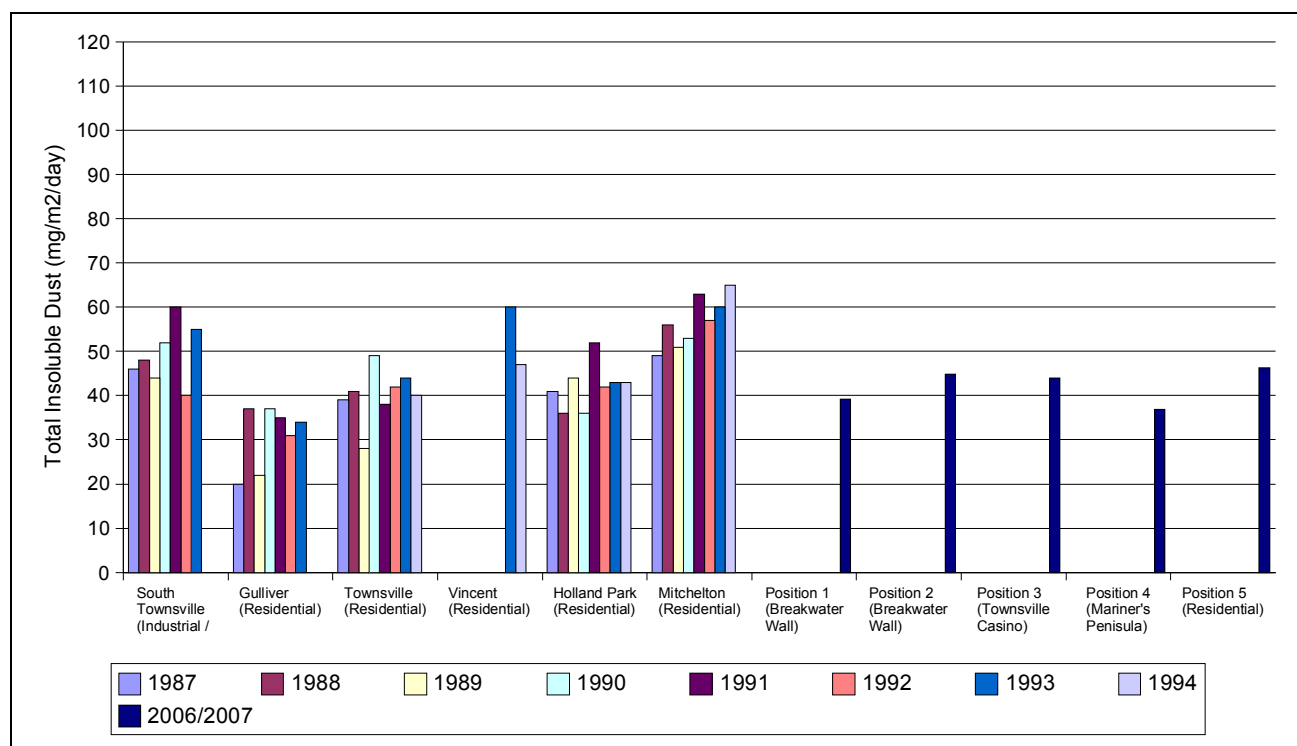
On this basis it is concluded that deposited dust levels at the Project Site are unlikely to vary significantly from other residential areas within Queensland.

<sup>2</sup> Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions (September 2001) published by the NZ Ministry for the Environment



**Table 3.6: AVERAGE DEPOSITED DUST LEVELS AT RESIDENTIAL AREAS IN QUEENSLAND**

Station Type	Monitoring Station / Location	Average Measured Deposited Dust (mg/m <sup>2</sup> /day)
Qld EPA (Average over period 1987 - 1994)	South Townsville (Industrial / Residential)	40 - 60
	Gulliver (Residential)	20 - 37
	Townsville (Residential)	28 - 49
	Vincent (Residential)	47 - 60
	Holland Park (Residential)	36 - 52
	Mitchelton (Residential)	49 - 65
Project Specific (Average of available monitoring data)	Position 1 (Breakwater Wall)	39.2
	Position 2 (Breakwater Wall)	44.8
	Position 3 (Townsville Casino)	44.0
	Position 4 (Mariner's Peninsula)	36.8
	Position 5 (Residential)	46.3



**Figure 6: Comparison of Average Historical Deposited Dust Levels with Project Specific Monitoring Stations**





## 4 CONCLUSIONS AND RECOMMENDATIONS

The Townsville Ocean Terminal (TOT) project site (the Project Site) is located on and adjacent to the existing Townsville foreshore and incorporates the existing Port Western Breakwater and the Northern (Offshore) Breakwater, the existing perimeter of the land around the Townsville Hotel and Casino Complex and the Townsville Entertainment Centre.

In response to the EIS prepared for the TOT Project a number of key stakeholders have raised issues regarding the Air Quality Assessment (AQA) undertaken. The focus of these comments is varied although most respondents have identified that the meteorological conditions and activities considered by the air quality monitoring undertaken for the project is not considered to be adequate. The AQA provided a summary of available monitoring data at the time of submission. Since that time further monitoring data has been collected with a summary of the methodology and results of the monitoring presented in this report.

The results of the monitoring of deposited dust levels indicates that, while dust is a feature of the Townsville area, the levels of dust deposition likely to be experienced at the Project Site are comparable to other areas in Townsville and other parts of Queensland with no exceedences of the criteria observed.



# **APPENDIX A**

## **GLOSSARY OF TERMS**



## APPENDIX A: GLOSSARY OF AIR QUALITY TERMINOLOGY

Term	Definition
Conversion of ppm to mg/m <sup>3</sup>	<p>Where R is the ideal gas constant; T, the temperature in kelvin (273.16 + T°C); and P, the pressure in mm Hg, the conversion is as follows:</p> $\mu\text{g m}^{-3} = (P/RT) \times \text{Molecular weight} \times (\text{concentration in ppm})$ $= \frac{P \times \text{Molecular weight} \times (\text{concentration in ppm})}{62.4 \times (273.2 + T^{\circ}\text{C})}$ <p>For the purposes of the air quality assessment all conversions were made at 25°C.</p>
g/s	grams per second
mg/m <sup>3</sup>	milligrams (10 <sup>-3</sup> ) per cubic metre. Conversions from mg/m <sup>3</sup> to parts per volume concentrations (ie, ppm) are calculated at 25 degrees Celsius as required by the SEPP(AQM).
µg/m <sup>3</sup>	micrograms (10 <sup>-6</sup> ) per cubic metre. Conversions from µ g/m <sup>3</sup> to parts per volume concentrations (ie, ppb) are calculated at 25 degrees Celsius.
ppb	parts per billion.
ppm	parts per million.
VOC	Volatile Organic Compounds. These compounds can be both toxic and odorous.
PM <sub>10</sub> , PM <sub>2.5</sub> , PM <sub>1</sub>	Fine particulate matter with an equivalent aerodynamic diameter of less than 10, 2.5 or 1 micrometres respectively. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
50th percentile	The value exceeded for 50 % of the time.
NO <sub>x</sub>	Oxides of nitrogen – a suite of gaseous contaminants that are emitted from road vehicles and other sources. Some of the compounds can react in the atmosphere and, in the presence of other contaminants, convert to different compounds (eg, NO to NO <sub>2</sub> ).
NO <sub>2</sub>	Nitrogen dioxide – one of the group of NO <sub>x</sub> compounds that can form through chemical interactions in the atmosphere following emission from the source.