Appendix L Air Quality Assessment

PORT of TOWNSVILLE
Nexus North Queensland

Appendix L
Air Quality Assessment

Townsville Marine Precinct Project

Environmental Impact Statement

GHD

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Executive Summary

Port of Townsville Limited (POT) commissioned GHD to assess the potential air quality impacts resulting from the construction and operation of the Townsville Marine Precinct.

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

- *Environmental Protection Act 1994*;
- Environmental Protection (Air) Policy 2008;
- State Development and Public Works Organisation Act 1971 (Qld); and
- National Environment Protection (Ambient Air Quality) Measure (2003) [National Environment Protection Council (Queensland) Act 1994].

The Coordinator-General declared the Townsville Marine Precinct project to require an environmental impact statement (EIS) and set Terms of Reference (ToR) with respect to Air Quality and these are addressed by this report.

The results of the assessment suggest that construction related dust from the Port of Townsville Marine Precinct would not significantly impact on the amenity of sensitive receivers provided appropriate management procedures as outlined in this report are implemented. An Environmental Management System will need to be implemented for the construction phase to control dust in the nearby residential area to the south. This will require Level 1 watering (2 litres/m^2/h) on all exposed surfaces and the access road to be surface treated (asphalt seal) from site entry until at least 50m north OR a reactive dust management (higher) level of dust control under adverse weather conditions.

The expansion of the Port monitoring network for dust deposition will assist in the ongoing management of dust impacts.

Air emission from proposed operational activities within the marine precinct have been assessed against relevant criteria. Results suggest that the operational activities assessed consisting of sandblasting, fuel storage and fishing trawlers will not have a significant impact on any nearby sensitive receivers and air quality objectives will be achieved. New developments on the site would need to go through individual assessment and planning approval on a case-by-case basis.

1. Introduction

1.1 Project Description

The Port of Townsville (the Port) 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, refuelling 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^2 and includes a harbour, port and docking facilities.

The Marine 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 Port of Townsville Limited (POT) 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, which is 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.

Figure 1 Project Location

1.3 Scope of Works

The scope of works for the air quality assessment comprised:

- Describing the environmental values of the area that may be affected by the project in the context of environmental values as defined by the *Environmental Protection Act 1994* and Environmental Protection (Air) Policy 2008 (see Section 3.1);
- Providing sufficient data on local meteorology (see Section 3.3) and ambient levels of pollutants (Section 3.2);
- Objectives for air quality emissions to be stated in respect to relevant standards, relevant emission guidelines, and any relevant legislation (see Section 2.2);
- The predicted average ground level concentrations in nearby areas should be provided (see Section 4). These predictions should be made for both normal and expected maximum emission conditions and the worst-case meteorological conditions should be identified and modelled where necessary (Section 4.4);
- The proposed levels of emissions should be compared with the current National environmental protection measures for ambient air quality, and the Environmental Protection (Air) Policy. The Coordinator-General requirements of assessing levels of emissions were taken as assessing the dispersed impact against the Policy objectives (see Section 4.5); and
- Describing how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed (see Section 5).

This air quality assessment has been conducted subject to the limitations described in Section 7.

2. Legislative Requirements

2.1 Coordinator-General Requirements

On 22 August 2008, the Coordinator-General declared the Townsville Marine Precinct project to require an environmental impact statement (EIS) in accordance with Part 4 of the State Development and Public Works Organisation Act 1971 (Qld). On 3 November 2008, the Townsville Marine Precinct project was determined to be a 'controlled action' by the Commonwealth Minister for the Department of Environment, Heritage and the Arts under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 with respect to potential impacts on matters of national environmental significance. In order to protect matters of national environmental significance, the EIS addresses the Terms of Reference (ToR) prepared by the Department of Infrastructure and Planning on behalf of the Coordinator General. The purpose of the EIS is to provide information on the nature and extent of potential environmental, social and economic impacts (direct, indirect and cumulative) arising from the design, construction and operation of the project. The EIS also provides information on the nature and extent of management measures to ensure potential detrimental impacts are avoided or mitigated wherever possible.

This detailed air quality assessment has been undertaken to ensure the project achieves balanced environmental, social, and economic benefits and addresses the ToR satisfactorily. Land use controls, to better respond to the air quality impacts arising from the site, the surrounds and the development, have been specifically tailored and presented within this document. Where potential adverse impacts have been identified, appropriate mitigation measures have been proposed to manage and control the impacts as defined in the ToR. The proposed levels of emissions have been compared with the current National environmental protection measures for ambient air quality and the Environmental Protection (Air) Policy. These have been appropriately defined and identified within the modelling where necessary to achieve the ToR.

2.2 Queensland Air Quality Requirements

The Environmental Protection (Air) Policy of 2008, referred to as the EPP (Air), sets out ambient air quality goals by which pollutant levels can be assessed for their potential to cause harm to human health and wellbeing in Queensland. For ambient dust the EPP (Air) goals are:

- (Respirable) particulate matter as PM10; 50μg/m^3 as a 24-hour average (no more than five days per year); and
- Particles (as total suspended particulate, TSP); 90μg/m^3 as an annual average.

The EPP (Air) is silent on dust fall as a nuisance pollutant. New South Wales have set a deposited dust criterion[1] that is widely used as an informal guideline in other states. This criterion is 2.0 g/m^2/month as a maximum increase in deposited dust with the maximum total deposited dust level to be below 4.0 g/m^2/month. Despite this criterion being required to be met as an annual average only, it is sometimes compared to the individual monthly monitoring results. However, while sometimes expressed with time rate units of days (120 mg/m^2/day), there is no obligation or even possibility to compare it to daily deposition measurements.

[1] Department of Environment and Conservation (2005), 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW", Department of Environment and Conservation (NSW), Sydney, August 2005.

EPP (Air) goals for other pollutants that may be emitted through operational activities are:

- Benzene: 10 μg/m^3 as a one year average;
- Carbon monoxide: 11 mg/m^3 as a eight hours average (no more than one day each year);
- Nitrogen dioxide: 250 μg/m^3 as a one hour average (no more than one day each year) and 62 μg/m^3 as a one year average for health and well being and 33 μg/m^3 as a one year average for health and biodiversity of ecosystems;
- Particulate matter as PM2.5: 25 μg/m^3 as a 24-hour average;
- Sulphur dioxide: 570 μg/m^3 as a one hour average, 230 μg/m^3 as a one day average, 57μg/m^3 as a one year average for health and well being and 22 μg/m^3 as a one year average for health and biodiversity of ecosystems;
- Toluene: 4.1 mg/m^3 as a 24 hour average and 1.1 mg/m^3 as a 30 minute average for protecting aesthetic environment; and
- Xylenes: 1.2 mg/m^3 as a 24-hour average and 950 μg/m^3 as a one year average.

2.3 National Air Quality

The National Environment Protection Council of Environmental Ministers, now the Environment Protection and Heritage Council (EPHC), set uniform standards for Australian ambient air in June 1998. These are known as the National Environment Protection (Ambient Air Quality) Measure, also known as Air NEPM, which sets non-binding[2] standards and ten-year goals (i.e. 2008). The Air NEPM goal for PM10 is 50μg/m^3 as a 24-hour average (no more than five days per year). Note that these are reflected in the Queensland EPP (Air) discussed in the previous section.

A variation to the Air NEPM was made in May 2003 "which strengthens air quality standards to help protect Australians from the adverse health impacts of small pollutant particles".[3] The variation introduced advisory reporting standards for fine particles of size 2.5 micrometres or less (also known as PM2.5). The NEPM standard for PM2.5 is 25μg/m^3 as a 24-hour average and 8μg/m^3 as an annual average.

[2] The Air NEPM standards apply to regional Air Quality as it effects the general population and does not apply in areas impacted by localised air emissions such as industrial sources, construction activity and heavily trafficked streets and roads.

[3] http://www.ephc.gov.au/nepms/air/air_variation.html

3. Existing Conditions

3.1 Environmental Values

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

- Protecting the health and biodiversity of ecosystems;
- Human health and wellbeing;
- Protecting the aesthetics of the environment, including the appearance of buildings, structures and other property; and
- Protecting agricultural use of the environment.

3.2 Air Quality

The proposed marina development and associated construction works are adjacent to the existing Townsville Port and also the suburb of South Townsville.

In these areas, existing ambient sources of dust are expected to consist of regional urban sources such as motor vehicle emissions, smoke particles from hinterland fuel reduction burns and wildfires, and dust storm events. Being a coastal site, sea-salt as an aerosol will also be a significant contributor to particulate levels. The expanding cities of Townsville and Thuringowa, with associated population growth and industry expansion, also create an air pollution load for various gaseous pollutants on the regional airshed.

3.2.1 Townsville Regional Airshed

The Queensland Environmental Protection Agency (EPA) has a monitoring network of five sites in Townsville. Results from this monitoring, along with additional industry monitoring from the Townsville Port Authority and Sun Metals Corporation, are reported on monthly[4] and annually[5] by the EPA.

The gaseous pollutants of Ozone (O_3), Nitrogen dioxide (NO_2) and Sulphur dioxide (SO_2) are measured by the EPA at Pimlico (inland and to the South-east of the Port) while industrial monitoring of SO_2 is done by Sun Metals at Stuart (well inland and south of the Port). Respirable particulate matter (PM10) is measured at Pimlico (EPA) and the Townsville Port (industry). The EPA have a more extensive network for Dustfall and Total Suspended Particulate matter (TSP) at the Coast Guard, South Townsville, North Ward and Yarrawonga to supplement dustfall measured at Pimlico. These dust measurements, from March 2008, speciate for various metals[6] (TSP) and Lead (TSP and dustfall).

[4] http://www.epa.qld.gov.au/environmental_management/air/air_quality_monitoring/air_quality_reports/monthly_bulletins/

[5] http://www.epa.qld.gov.au/environmental_management/air/air_quality_monitoring/air_quality_reports/

[6] TSP measured one day in six and analysed metals are Copper, Zinc, Nickel, Arsenic, and Cadmium as well as Lead

The following information, from Queensland EPA annual reporting for 2007 against the National Environment Protection (Ambient Air Quality) Measure requirements[7], summarises the air quality environmental values for the Townsville airshed:

- Carbon monoxide (CO) is not required to be monitored because "pollutant levels are reasonably expected to be consistently below the relevant NEPM standard";
- Monitoring at Pimlico "over the period 2004 to 2007 has shown nitrogen dioxide levels to be consistently below 40 percent of the NEPM standards";
- Lead falls into the same category as CO (however monitoring has commenced in Townsville around industrial sources from May 2008);
- Of the five regions reporting against the 24-hour PM10 NEPM standard (South-east Queensland, Toowoomba, Gladstone and Mackay), Townsville was the lowest;
- For all one-hour sulphur dioxide statistics at and above the 90th percentile, both Pimlico and Stuart are lower than for all other regions; and
- Similar to all regions, the one-hour and four-hour NEPM standards for ozone were always met.

3.2.2 Townsville Port

Site-specific ambient air quality data are monitored at the Townsville Port. The Townsville Port monitoring station is located at a shipping berth breakwater (refer Figure 3) within Townsville Harbour. PM10 is measured at this site using TEOM instrumentation[8]. Wind speed and direction are also recorded. The monitoring station operation is supported and maintained by the Queensland EPA to Australian Standards for Air Quality monitoring.

There were no events during the 2005/06, 2006/07 and the 2007/08 periods where PM10 exceeded the old EPP (Air) goal, up to the end of 2008, of 150μg/m^3 as a 24-hour average. The highest recorded PM10 24-hour average during this time was 127.6 μg/m^3. This is displayed graphically in Figure 2. The 1997 Air Policy was repealed on 1 January 2009 and replaced with the 2008 Policy. The new air quality objective for PM10 reflects the NEPM goal of 50μg/m^3 as a 24-hour average not to be exceeded five days each year. There were eight days during the 2005-2006 reporting period where the 24-hour average exceeded 50μg/m^3. Since then, all years would have complied with the new 2008 Policy criteria.

On a monthly basis during 2007/08, July and October experienced more elevated PM10 results when compared to other months and February, June and September had generally lower PM10 concentrations. During 2006/07, October 2006 experienced the most elevated PM10 levels while February saw the minimum concentrations for the year. The annual PM10 average and 70th Percentiles for the past ten years at the Townsville Port TEOM are presented in Table 1. The 70th percentile, measured at about 24 μg/m^3 during the past few years, can be considered the 'background' dust load expected in an area. Particulate loading can be seen to have increased at the end of the last decade (possibly coinciding with extra capacity throughput at the Port) with a reversal to a downward trend in the past few years.

[7] http://www.epa.qld.gov.au/publications/p02572aa.pdf/Queensland_2007_air_monitoring_report.pdf

[8] Tapered-Element Oscillating Microbalance.

The PM10 annual average from October 2007 to September 2008 was 21.1 μg/m³ at the Townsville Port (EPA monthly reporting) which is about 50% higher than coincident monitoring at the inland 'population average' Pimlico monitoring site of 14.8 μg/m³. The oceanic aerosol (fine salt particulates) and industrial nature of the Port surroundings can account for this difference. In both cases, comparing to the NEPM standards suggests the environmental values of the area concerning dust levels are 'healthy' (i.e. amenity is protected).

Figure 2 PM10 24-hour concentration July 2005 – June 2008

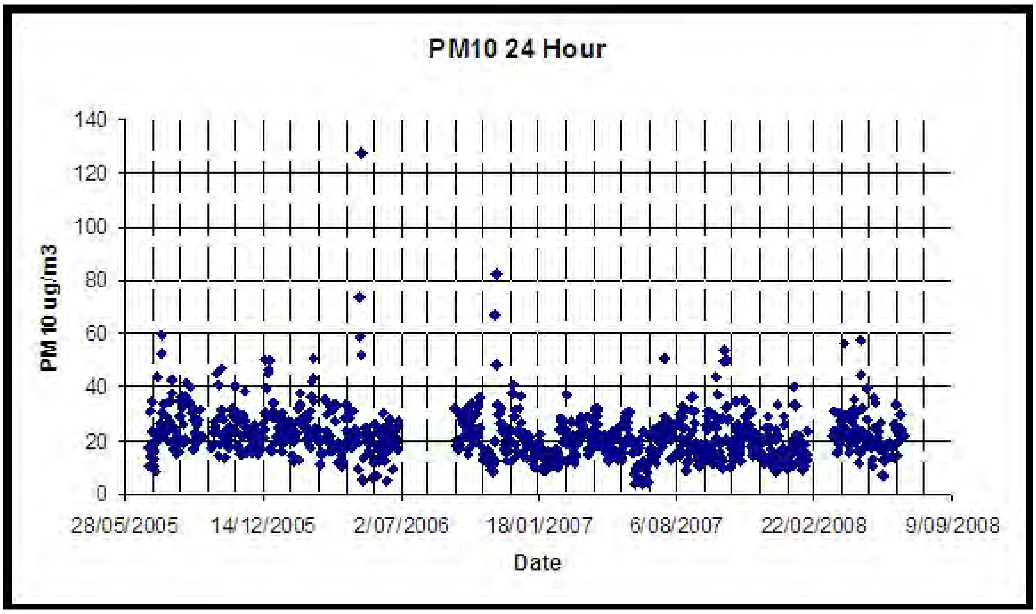


Table 1 Annual Average and 70th Percentile PM10 Concentrations –Townsville Port

Year	Annual Average (μg/m³)	70th Percentile ("background") (μg/m³)
2007-2008	21.1	23.9
2006-2007	19.8	22.7
2005-2006	24.2	26.6
2004-2005	22.7	24.1
2003-2004	24.2	27.4
2002-2003	26.9	30.0
2001-2002	20.8	23.3
2000-2001	22.5	25.3
1999-2000	14.0	17.1
1998-1999	8.8	10.1
1997-1998	15.5	17.6

Townsville Port also has an existing array of dust deposition gauges located throughout the Port (refer Figure 3). These gauges collect dust monthly and are analysed for solids, metals, nitrogen and phosphorous.

A summary of results from the dust deposition gauges is provided in Table 2 below. Monthly dust deposition for the past two years has been plotted for each of the dust deposition gauges and is displayed in Appendix A.

Rail Loop experiences the highest dust deposition rates out of all the sites with an average of 3.4 g/m^2/month for the 2007/08 year. The location with the lowest annual average over the same period is the Port Entrance (1.0 g/m^2/month).

Figure 3 Existing dust monitoring locations at Townsville Port

Table 2 Summary of Dust Deposition Gauge Monitoring Result (Insoluble Solids g/m^2/month)

Year	Avg	S.D	Max	Avg	S.D	Max	Avg	S.D	Max	Avg	S.D	Max
Site	**Port Entrance**			**Rail Loop**			**Ross Street**			**Tully Street**		
2007-2008	1.0	0.6	2.1	3.4	3.0	11.0	2.2	1.6	5.2	1.5	0.9	3.0
2006-2007	1.4	0.8	2.9	2.0	1.6	6.0	1.4	0.4	1.8	1.7	0.9	2.6
2005-2006	1.2	0.8	2.6	1.5	1.0	3.6	-	-	-	-	-	-
2004-2005	2.2	1.7	4.7	1.7	2.3	7.9	-	-	-	-	-	-
2003-2004	-	-	-	2.7	2.5	8.7	-	-	-	-	-	-

Avg=Average; S.D=standard deviation

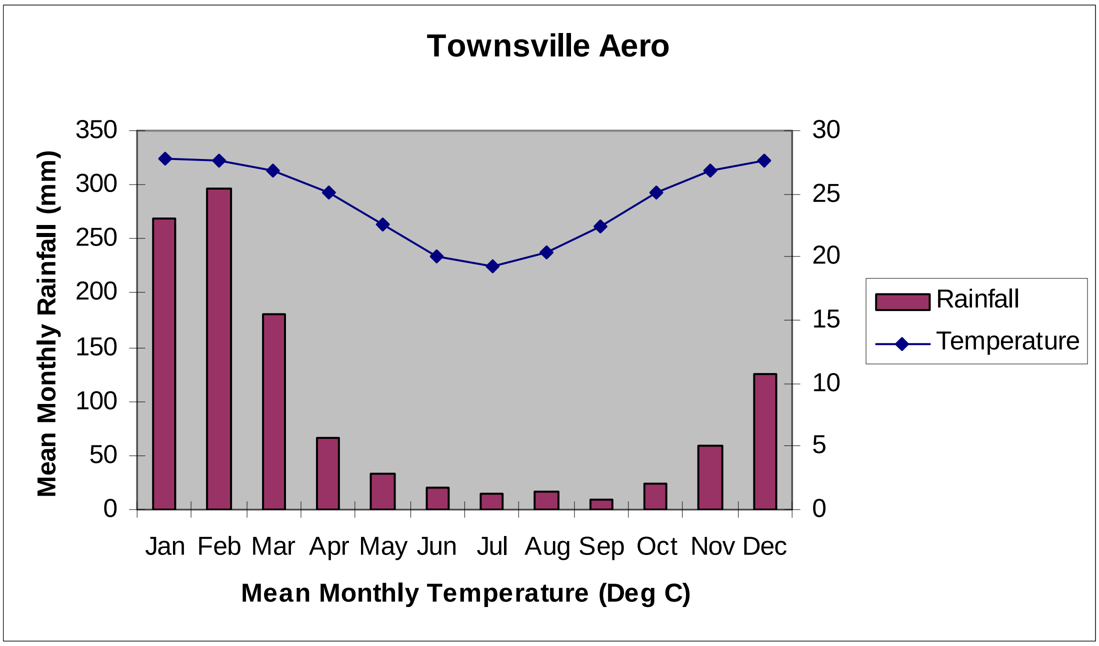
3.3 Meteorology

Site representative meteorology is available from the EPA monitoring site located in the existing port (see Figure 3). For the year 2003/04, hourly meteorological data from the Townsville Port monitoring station (co-located with the Tapered Element Oscillating Microbalance (TEOM)) was used to develop a site-specific Townsville Port meteorological file. These data included raw data on temperature, wind and turbulence; the latter to enable calculation of atmospheric stability. Atmospheric stability categories were derived using the standard deviation of wind direction (sigma-theta, α_A) workbook method, as detailed in the US EPA *Meteorological Monitoring Guidance for Regulatory Modelling Applications* (USEPA, 2000). An atmospheric mixing height was calculated using the methodology of the NSW approved methods with due regard for wind speed and stability (Department of Environment and Conservation, 2005).

3.3.1 Rain

Average annual rain at Townsville is over 1 m; with a recorded mean of 1115.3 mm for the past 68 years at the Townsville Airport BoM AWS. As indicated in Figure 4, April through to November is noticeably drier than other times of the year. On average, close to 66 days per year have recorded more than 1 mm of rain. This averages one in 5.5 days, although the 'dry season' months have fewer days with about three per month compared with 10 to 11 days per month for other months. This has implications for dust management as rainfall suppresses dust generation.

Figure 4 Mean Monthly Rainfall and Temperature for Townsville



Wind

For the wind speed classes indicated in Figure 5, the most common occurrences fall between 1.5 and 3.0 m/s. The highest observed hourly-averaged wind speed was 6.7 m/s and an overall average wind speed of 2.6 m/s. This is lower than would normally be expected on a coast exposed to the south-east trade winds (albeit with Cape Cleveland in that direction) but may be influenced by the surrounding port infrastructure to the east and south, and the Jupiters Townsville Hotel & Casino to the west of the weather station.

Figure 5 Wind speed frequencies at Townsville Port TEOM Weather Station

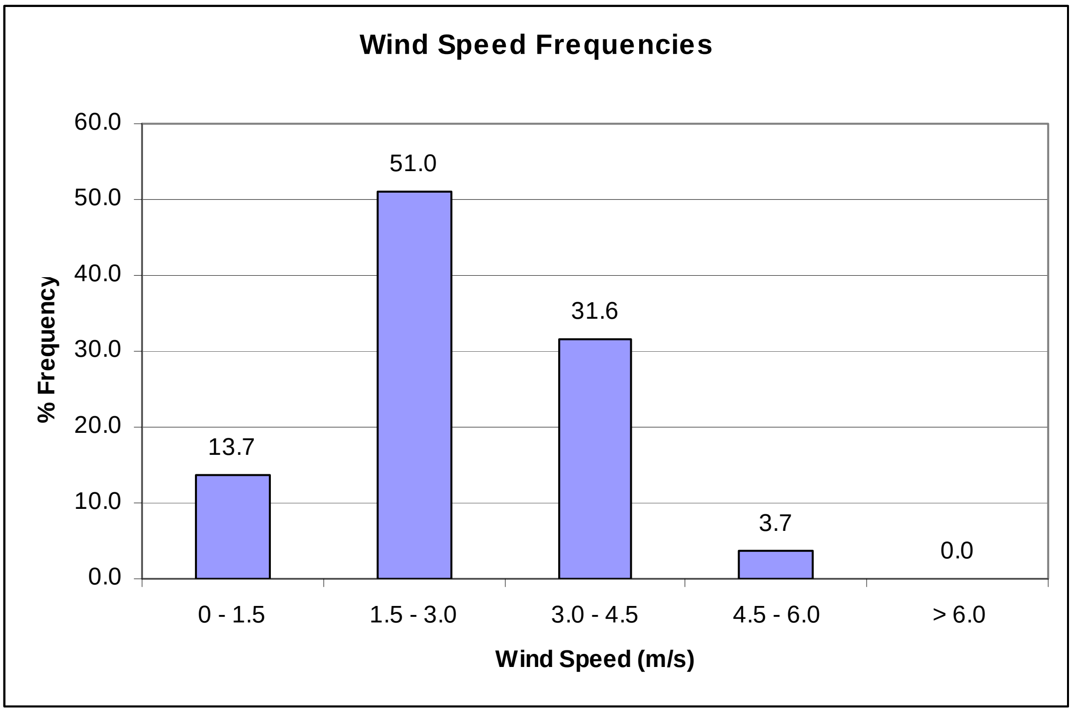
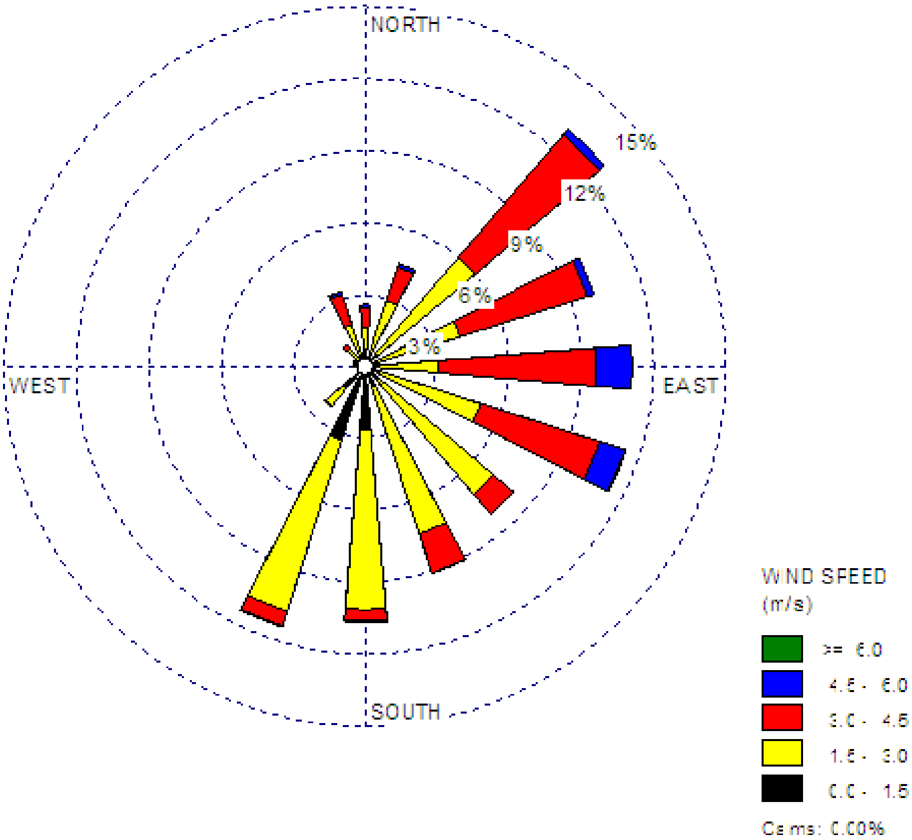


Figure 6 Speed and direction wind rose for Townsville Port TEOM Weather Station

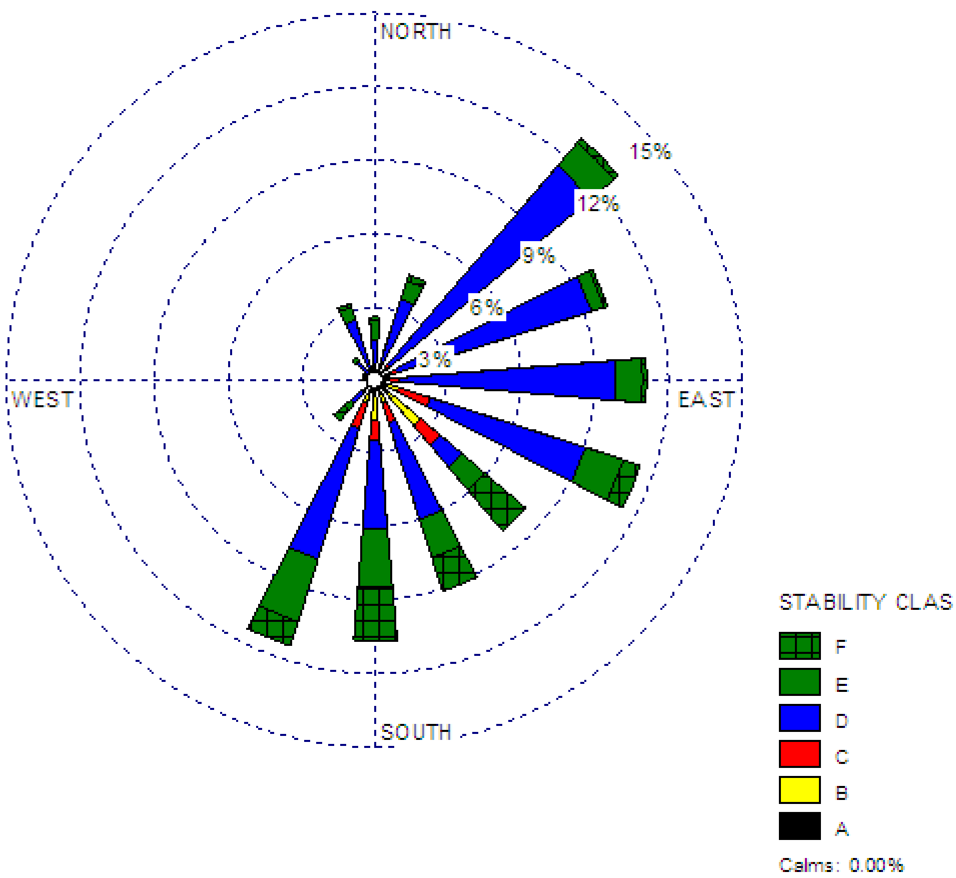


The wind rose plot for the meteorological data of Figure 6 shows the predominant wind directions being from the NE, E, SE, and S. The stronger winds (>3 m/s) are from the NE, E and SE directions, with most light winds (<3.0 m/s) with a southerly component.

Stability categories are indicators of atmospheric turbulence and the dispersive properties of the atmosphere. Stability class at any given time depends on the vertical temperature profile of the atmosphere, thermal turbulence caused by the rising of air heated at ground level and mechanical turbulence that is the wind flow over a certain terrain.

The observed distribution of stability categories is illustrated in Figure 7. This indicates the low proportions of unstable categories (A to C), moderate proportion of stable categories (E and F), with a higher proportion of neutral categories (D). At a costal site such as this with winds mostly off the ocean, stable conditions are likely to dominate as the temperature gradients required to establish convective or stable (temperature inversions) conditions are moderated by the significance of the adjoining water body physics.

Figure 7 Atmospheric stability rose for Townsville Port TEOM Weather Station



The predominant directions for neutral conditions (stability D) are from the north-east, east and the south, comparable with the directions of high wind speed and from off the Coral Sea/Pacific Ocean. These windy weather conditions are the most frequently occurring and disperse dust rapidly but also generate dust from exposed dry surfaces.

The majority of stable categories (stability E and F) are from the south and east directions. These stable conditions are associated with light winds and result in poor dispersion from any mechanically generated, ground-based dust sources.

4. Potential Impacts

During construction and ongoing maintenance of the Townsville Marine Precinct, dust will be generated principally via the following mechanisms:

- **Mechanical disturbance:** dust emissions brought about by construction and maintenance vehicles/equipment; and
- **Wind erosion:** dust emissions from exposed, disturbed soil surfaces under high wind speeds.

On-going maintenance of the marine precinct is expected to generate little and only sporadic dust events. These can be considered normal construction activity not associated with a significant project and exposed open space is no longer considered in this report. The extent to which construction dust emissions may impact on the surrounding sensitive land uses will depend upon a number of site-specific factors. Once construction is completed, exposed surfaces will either be built over or minimised through rehabilitation of the site. Normal traffic associated with precinct activity is expected to be typical of any other port/marina. Key factors have been identified and are discussed in more detail in the following sections.

4.1 Meteorological Effect on Dust Dispersion

An analysis of the wind climate for the Townsville Port gives some indication of the potential for off-site exposure to dust emissions generated during construction and maintenance. The impacts of dust emissions fall under two distinct categories, being health and amenity.

Potential health impacts are attributable to the concentration of respirable particulates in ambient air. Respirable particles of dust have an aerodynamic equivalent diameter of 10 microns or less and are otherwise known as PM10. These fine fractions of dust will have maximum impact under light winds and stable atmospheric conditions, which occur most frequently overnight and very early in the morning, and will therefore, become significant if construction operations extend outside typical operating hours.

The presence of larger suspended dust particles, greater than 35 micron, is likely to affect amenity by way of reducing visibility (whilst in the air column) and soiling of materials via dust deposition. Amenity impacts are most marked in high wind conditions, when larger particles may be suspended and transported a significant distance before being deposited. Mitigation of amenity related dust impacts would in turn act to reduce health impacts due to dust emissions.

The typical distribution of wind speed, given in Figure 5, will show a shift to lighter wind speeds with increasing distance inland. Hence the industrial area to the west of the proposal and residents of South Townsville will experience a higher potential for wind erosion than the more inland residential areas of Townsville. Dust mitigation measures will take account of the local wind speed for sensitive receivers adjacent to the proposal.

4.2 Intensity, Duration and Frequency of Construction Operations

The potential for exposure to dust emissions will also be dependant on the intensity of construction operations (i.e. the amount of dust generated) and the duration and frequency of the operations in any given locality. For this reason it is necessary to define the expected construction process, including: details of project sequencing and timelines; vehicle and plant type: movement patterns and shift timing.

4.2.1 Description of Proposed Construction Operations

The proposal footprint has been identified, as can be seen in Figure 1. Precise timing and staging of the works and construction methodologies are stated below. Timing for delivery is as follows:

- Stage 1 of Marine Precinct in place and operational by 30 June 2011;
- Stage 2 to be operational by 30 June 2015; and
- Stage 3 to nominally be operational by December 2017.

Construction Vehicles and Equipment

Construction and administrative vehicles associated with the transit route are to comprise multiple construction teams with diesel powered vehicles and plant. This plant is to consist of:

- Working vehicles associated with earthworks such as scrapers, front-end loaders, rollers and compactors, concrete delivery trucks and jack hammers;
- Track-mounted articulated arm excavators. These will be fitted with a bucket for excavation and may also be used to remove materials from the delivery semi-trailers;
- Haul trucks/tip trucks to transport/move rock, sand and other fill as required;
- Vehicle mounted crane, to remove materials from the delivery semi-trailers;
- Water trucks; and
- Semi-trailers (haul vehicles) to deliver materials.

Worst-case construction activity is to operate six days per week - between 6.30 am to 6.30 pm Monday to Saturday. Some construction activities such as dredging will be undertaken 24 hours a day, however due to the nature of the works there will be no significant dust produced.

Table 3 below describes the construction equipment that will be required on site for the different stages of work, the duration each piece of equipment will be required for, the quantity required and the work activity to be performed.

Table 3 Construction Equipment on Site – Dredging and Reclamation Works

Phase of Works	Equipment	Number	Activity
End Dumped Revetment / Breakwater Construction			
Trawler Basin revetment 16 weeks	Trucks	24/day	Delivery of revetment core material and armour
	Excavator	1	Handling / Placing rock fill
	Loader	1	Rehandling/ Stockpiling fill
	Offroad Dump Truck	1	Rehandling / Transporting fill
	Dozer	1	Trimming / Level finished surface
Stage 2 revetment	Trucks	140/day	Delivery of revetment core material and armour

Phase of Works	Equipment	Number	Activity
6 weeks Stage 3 revetment 4 weeks	Excavator	3	Handling / Placing rock fill
	Loader	2	Rehandling/ Stockpiling fill
	Offroad Dump Truck	3	Rehandling / Transporting fill
	Dozer	3	Trimming / Level finished surface
Offshore Breakwater Construction			
Offshore Breakwater Construction 14 weeks	Trucks	140/day	Delivery of breakwater core material and armour
	Excavator	1	Handling / Placing rock fill
	Loader	1	Rehandling/ Stockpiling fill
	Dozer	1	Trimming / Level finished surface
	Bobcat	2	Rehandling Fill onboard barges
	Transport Barge	2	Transporting core and armour
	Garb Barge	1	Placing Breakwater armour
	Survey Boat	1	Hydrographic Surveys
	Work Boat	1	General support
Backhoe Dredging			
Trawler Basin 7 weeks Stage 2 Inner Harbour 19 weeks Channel + swing basin re-alignment 14 weeks Under Offshore breakwater foundation 22 weeks Pile Moorings 6 weeks	Backhoe Dredge	1	Dredging
	Split Bottom barge	2	Transporting and dumping dredge spoil
	Tug	1	Supporting dredger and split bottom barges
	Workboat	1	Supporting dredger and tug
	Survey Boat		Hydographic survey
	Support Boat	1	General support / provisioning / fuel / transport
Cutter Suction Dredging			
Dredging of Stage 2 Inner Harbour	Small Cutter Suction Dredge	1	Dredging to reclaim

Phase of Works	Equipment	Number	Activity
7 weeks	Floating spoil pipeline	1	Spoil transport
	Adjustable weir box	1	Tailwater management
	Dozer / loader	1	Spoil pipe handling
	Support Boat	1	General support / provisioning / fuel / transport
Reclamation using imported fill			
Stage 2 28 weeks Stage 3 29 weeks	Trucks	140/day	Delivery of sand fill material
	Excavator	3	Placing and handling fill
	Dozer	3	Trimming, Placing and Compacting fill
	Loader	2	Placing and rehandling fill
	Offroad Dump truck	3	Rehandling and transporting fill
Backfilling dredge trench			
Reinstatement of foundation under offshore breakwater 24 weeks	Trucks	140/day	Delivery of sand / quarry fill material
	Loader	1	Loading barges
	Survey Boat	1	Hydographic survey
	Drag bar / bed leveller	1	Finishing / levelling
	Split bottom Barge or transport barge	2	Transporting and dumping fill
	Spreader barge	1	Placing / dumping fill

4.2.2 Sources of Dust

Construction and maintenance activities for the development that will generate localised emissions to air of crustal dust will be:

- Excavation;
- Wheel generated dust from mobile plant and deliveries;
- Handling and localised stockpiling of topsoil, and spoil;
- Removal and transport from site of spoil;
- Delivery to site of fill material;

- Levelling and rehabilitation of fill and disturbed soil surfaces; and
- Wind erosion of exposed unstable soil surfaces and localised stockpiles.

Vehicle and Other Exhaust Emissions

Vehicle exhaust emissions (gaseous pollutants and particles) during the construction phase have the potential to impact on air quality, however the impact is likely to be negligible given the intensity of operations compared to surrounding local (port operations) and regional (Townsville city) activity.

All construction and administrative vehicles should be maintained in a serviceable condition such that exhaust emissions are reduced to manufacturer specified levels.

4.3 Location of Sensitive Receivers

The identification of sensitive receptor locations relative to the development is required, not only for the evaluation of dust impacts, but also in defining adequate dust mitigation and management strategies in areas adjacent to the proposal. The list of possible receptors in Table 4, derived from the preliminary environmental assessment, is a starting point and can be culled further to produce a short-list.

Table 4 Possible sensitive receptors surrounding the Marine Precinct

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 Expresso		
Cannan Street	Archer Street	Ross Island Hotel		
Hubert Street	Nelson Street			
Bell Street	Macrossan Street			

A staged dust management plan can be developed as a generic guide, whereby the level of dust mitigation required will be dependant upon the location of sensitive receivers relative to the construction point within the development. This is discussed further in Section 5.

4.4 Worst Case Dust Modelling

There is potential for dust generation from on-site construction activities that can have impacts off-site. These are most likely to occur during dry periods; with the highest probability of occurrence during July, August and September, however a run of dry days can occur at any time of the year. It was decided to use computer modelling of dust emissions and dispersion to identify worst-case conditions and to give an indication of the radius of influence from construction activities to potential sensitive receptors. The aim of the modelling was to give contour plots of maximum predicted construction activity impact for worst-case conditions for the development. The EPA Victoria regulatory dispersion model AUSPLUME (V6.0) was used for this purpose (Environment Protection Authority - Victoria, 1999). Where possible, default model settings were used.

Inputs required for the model comprise:

- Meteorology;
- Terrain type/land-use; and
- Dust emission rates.

The Townsville Port meteorological data, discussed in Section 3.3, is suitable for use in the AUSPLUME (V6.0) dispersion model.

Land-use/terrain around the port/marina precinct can be categorised as either an urban/industrial environment of low-rise obstacles equivalent to rolling hills (surface roughness 0.15 m) or water (surface roughness 0.05 m). Dust emission sources to consider include: earthmoving; excavation activities; compaction; transport and tipping of materials, fill, rubble and waste; and stockpiling of materials.

The worst case modelling was taken to be concurrent emissions from the following operations:

- Construction activities occur from 6.30 am to 6.30 pm Monday to Saturday over a period of one year;
- Equipment includes three excavators, three dozers, three off road dump trucks, two loaders and a total of 140 trucks per day delivering sand fill, equating to 12 per hour with a turn around of four trucks every twenty minutes; and
- Exposed surface area (including stockpiles) of 137 200 m^2, which is the stage 3 of construction, as this stage is to be closest to the sensitive receivers.

Adopted Dust Emission Rates

National Pollutant Inventory (NPI) emission factors give an estimate of likely dust generation for each type of construction activity. A default silt content of 10% and a moisture content of 2% were assumed. This is conservative because material so close to the Ocean has potential to be wetter than default (overburden at coal mines). The emission factors are a representation of uncontrolled emission rates with some allowance for control actions and their associated emission reductions (expressed in percentage terms).

The excavator was used in loading the haul trucks while the grader (taken as a CAT 247B Multi-terrain Loader) and a CAT 323C Vibratory Soil Compactor were modelled in continuous tandem operation. The wheel-generated dust of the grader was calculated using the default emission factor based on an operating speed of 10 km/h. The compactor emission rate was calculated assuming operation on wet material with moisture content of 10% and a working speed of 5.0 km/h. Haul trucks with a 20 tonne capacity and gross vehicle mass of 30 tonnes were assumed to complete 12 dumping/loading cycles per hour. The operating speed of the haul trucks generating wheel dust was limited to 15 km/h (on-site speed limit). Wind erosion from stockpiles and exposed areas assumed the NPI default emission factor, independent of wind speed, of 0.4 kg/ha/h with PM10 being half this value. It has been assumed that the greatest exposed area at any one time is 13.72 hectares.

The hourly emission rates modelled are given in Table 5.

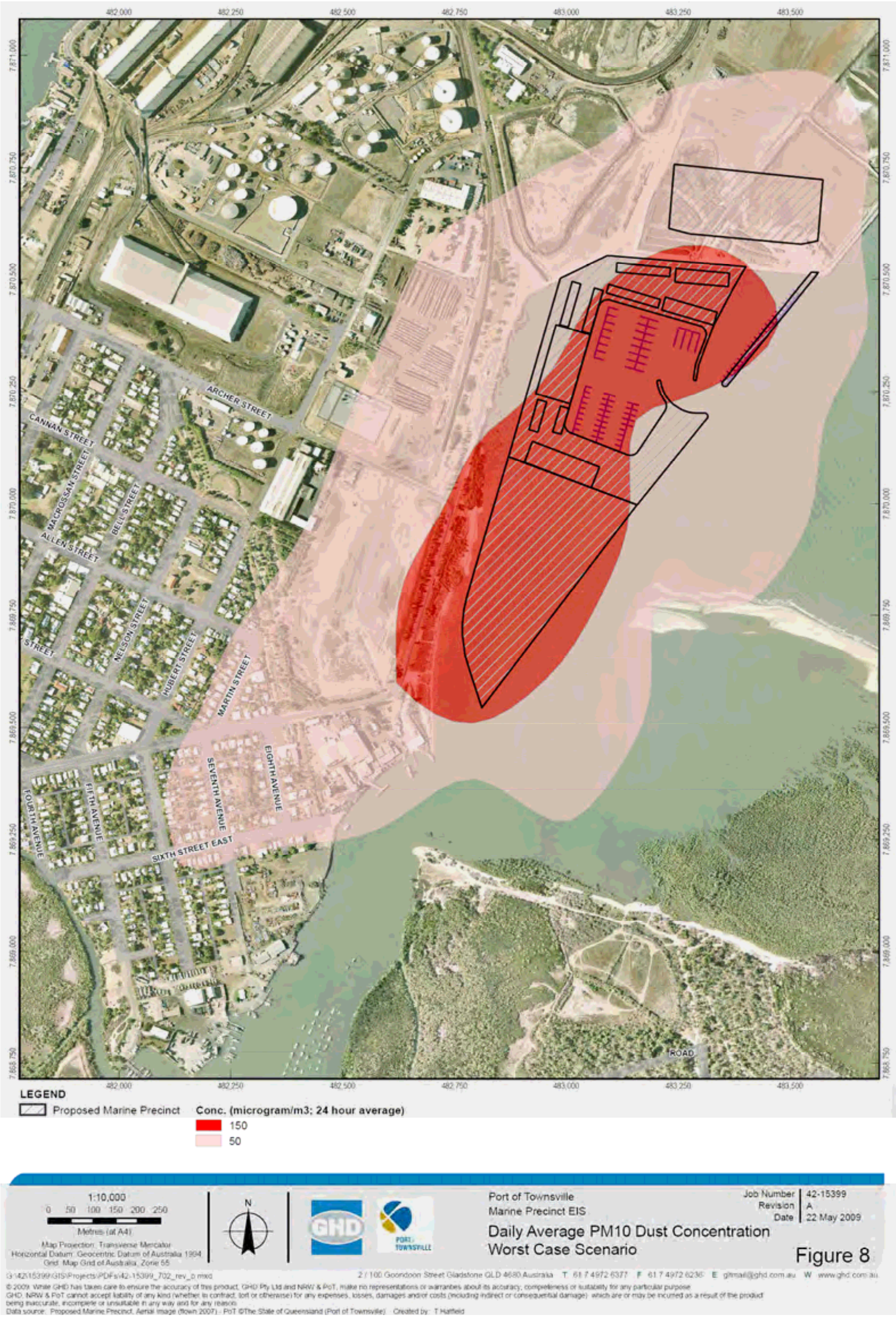
Table 5 Emission rates

Construction activity	Emission rate (kg/h)	
	TSP	PM10
Loading and dumping	16.8	6
Grader	10.8	3.4
Bulldozer	50.2	12.2
Excavator	1.5	0.7
Hauling	16.9	8.0
Exposed stockpile and surfaces	5.5	2.7

4.5 Modelling Results

The results of dispersion modelling are shown in Figure 8 for PM10 dust concentration. For the residential zoning areas with sensitive receptors, dust concentrations are always below 50 $\mu g/m^3$ at distances greater than 800 m from the construction activity. The modelling shows that, for the assumed default and uncontrolled emissions, dust concentrations will likely exceed the criteria at nearby residential receivers and therefore mitigation will be required.

Figure 8 Worst-case daily average PM10 dust concentration from proposed construction activities (uncontrolled emissions)



Mitigation

Worst-case modelling suggests that the hourly dust concentrations may exceed 50 $\mu g/m^3$ at nearby sensitive (to dust) receivers. The following commonly used dust mitigation actions were considered to reduce the estimated dust impact from the construction of the development.

- Level 1 watering on all exposed surfaces (2 litres/m^2/h). This control method achieves a 50% emission reduction (NPI Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals Version 2.0, 2000); and
- Access road to be surfaced (an asphalt seal results in near zero dust emissions) from site entry until at least 50 m north, beyond the coordinate (482810 East, 7869676 North).

Mitigated Results

The results of dispersion modelling are shown in Figure 9 for PM_{10} dust concentration and in Figure 10 for dust deposition. For the suburban area to the south, dust concentrations are always below 50 $\mu g/m^3$ at distances greater than 250 m from the construction activity. The dust deposition, expressed as annual average g/m^2/month, shows a similar pattern with all areas beyond 150 m being below the recognised critical level (2 g/m^2/mth annualised = 24 g/m^2/year) for nuisance dust complaints. The dust deposition limit contours are well within the PM_{10} limit contours, so it can be assumed that if dust emissions are controlled to meet PM criteria then dust deposition criteria will also be achieved.

Figure 9 With-mitigation daily average PM10 dust concentration from proposed construction activities

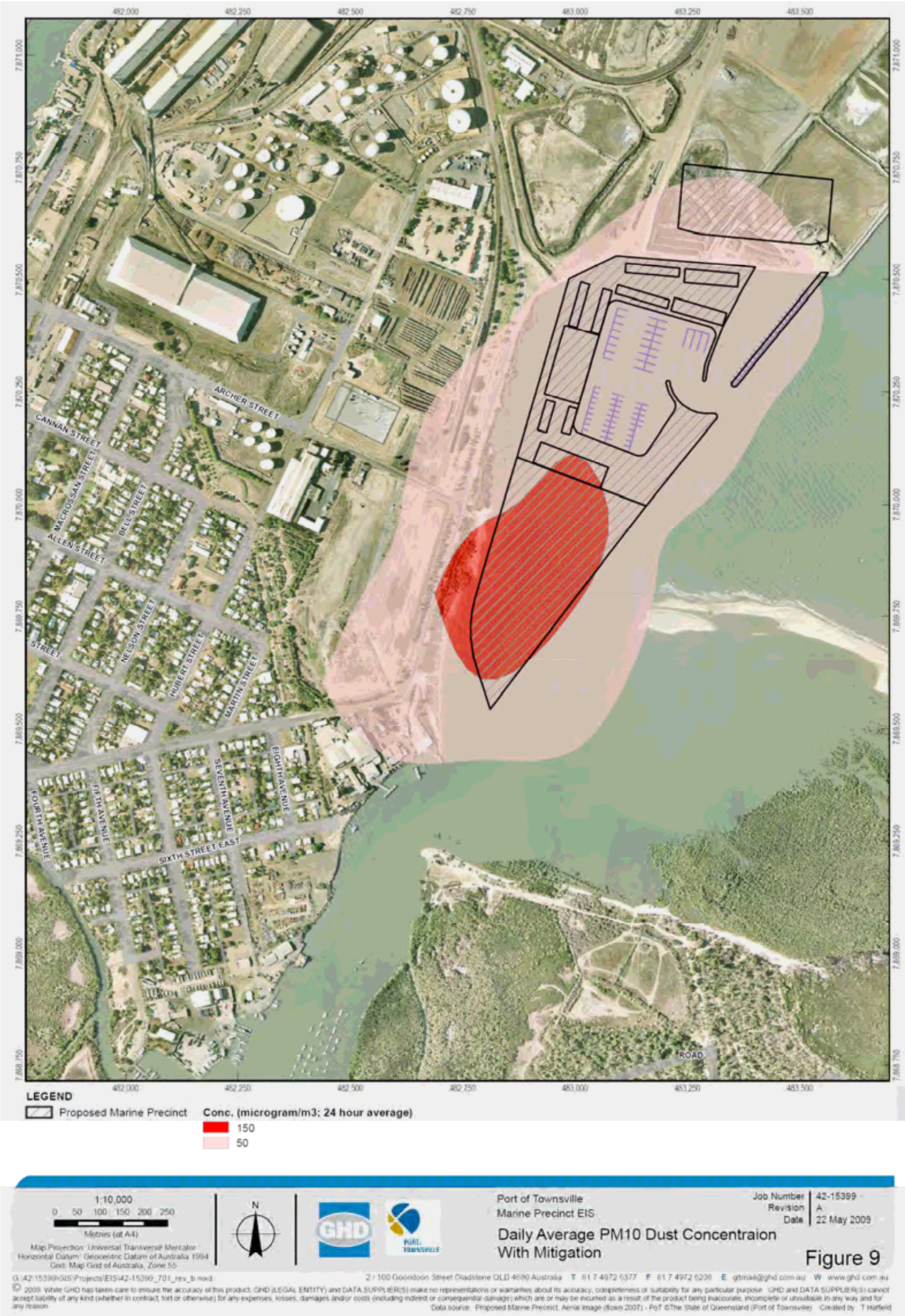
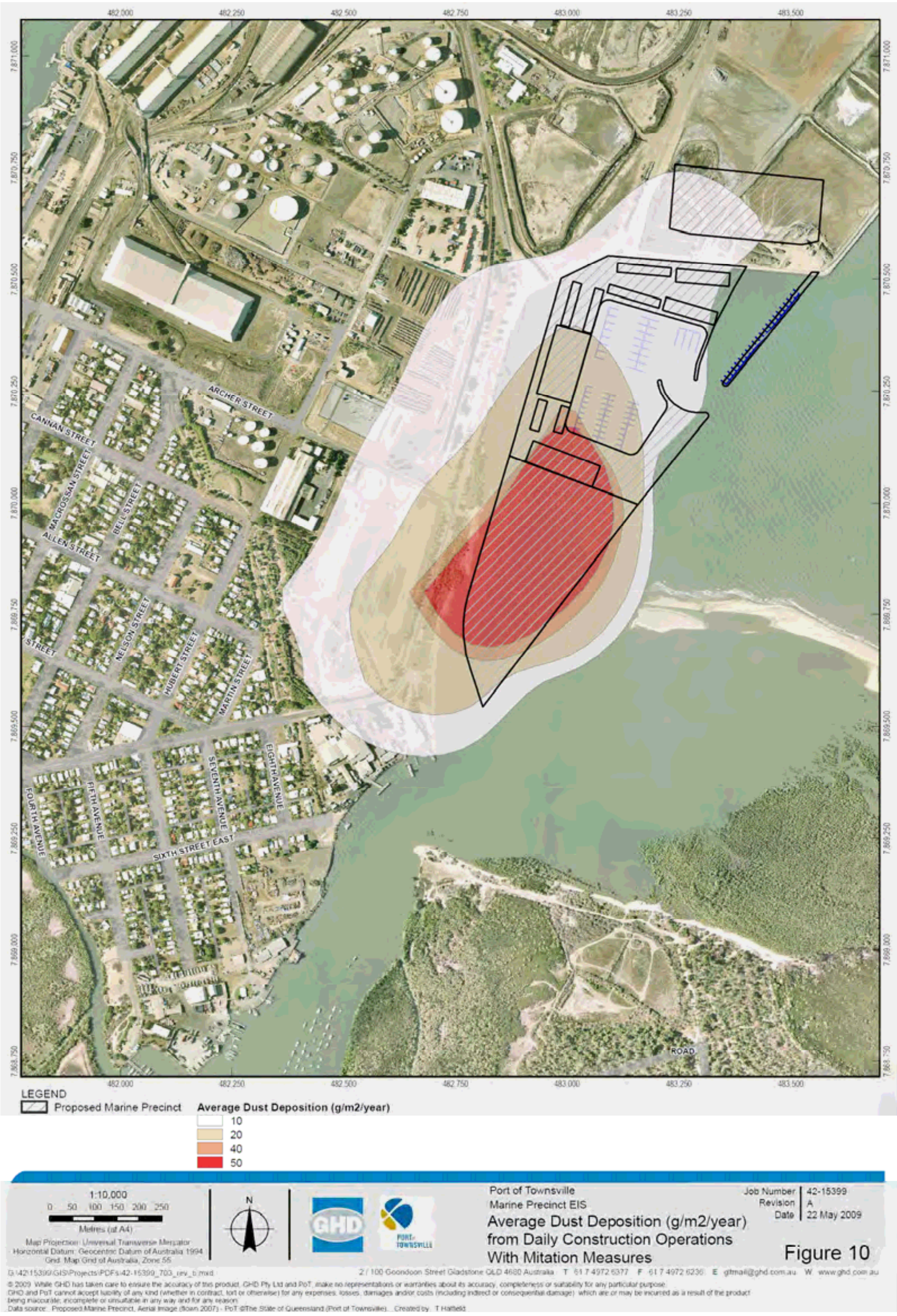


Figure 10 With-mitigation average dust deposition (g/m2/year) from daily operating construction site



Operational Impacts

During operation, there may be a number of users of the marine precinct that have the potential to impact on the local air quality. No specific details are known at this stage, however potential tenants of the marine precinct may include the following:

- Marine industry allotments including maritime infrastructure and vessel fabrication;
- Berth facilities including for 50 trawlers, scientific and tourism vessels, provisioning activities, refuelling 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.

4.5.1 Worst Case Emissions Modelling

There is potential for air emissions from on-site operations that can have impacts on the surrounding environment. It was decided to use computer modelling of air emissions and dispersion to identify worst-case conditions and to give an indication of the radius of influence from operation activities to potential sensitive receptors. The aim of the modelling was to give contour plots of maximum predicted impact from possible operational activity for worst-case conditions for the marina development.

As for construction, inputs required for the model comprise:

- Meteorology;
- Terrain type/land-use; and
- Emission rates.

The Townsville Port meteorological data was once again used with land-use/terrain around the port/marina precinct being unchanged (see Section 4.4).

After consultation with the Port Authority, emission sources to consider include the following:

- Abrasive blasting from boat maintenance and ship building activities;
- Fuel storage; and
- Marine vessels i.e. fishing trawlers moored for maintenance and re-supply.

There may be other potential emission sources on-site but due to lack of detailed information these have not been included in this assessment.

Adopted Abrasive Blasting Emission Rates

National Pollutant Inventory (NPI) emission factors give an estimate of likely PM_{10} generation from sandblasting activities (NPI 1999). Sandblasting will likely be used on-site for paint removal and surface preparation in boat building and maintenance facilities. There are many types of material that can be used, however for the worst-case scenario it has been assumed that steel grit will be used, with works being undertaken in an unenclosed area. It has been assumed that 5000 kg of steel grit will be used per year for sandblasting activities, which is based on 500 hours of blasting using 10 kg of steel grit per hour. This is considered reasonable as the Australian Defence Force Williamstown Base, which is a much larger scale of operation, uses approximately double this.

It is assumed that abrasive blasting operations will be undertaken for up to 500 hours a year and hourly emission rates are provided in Table 6.

Table 6 Emission Rates for Sandblasting

Source	Emission rate kg/hour of abrasive material (PM2.5)	Emission rate kg/hour of abrasive material (PM10)
Sandblasting of mild steel panels – uncontrolled	0.00262	0.02621

Adopted Fishing Trawler Diesel Emission Rates

National Pollutant Inventory (NPI) emission factors give an estimate of likely CO, NO_2, PM_{10} and SO_2 generation from diesel vehicle exhaust emissions (NPI 2008). There is no specific emission estimation manual for diesel boats such as a trawler so it has been assumed that emission will be similar to that of an engine in a medium sized goods vehicle (auxiliary power rather than a marine engine for propulsion) (European Parliament, 1997).

Up to 50 diesel fishing trawlers may use the berths at the marine precinct. These will be coming and going in and out of the port and some will remain at berth for extended periods of time. Whilst at berth trawlers will likely use a smaller, auxiliary engine for power supply. To assess potential air emissions, five trawlers running on auxiliary power (300 kW diesel engine) have been modelled in the marine precinct. NO_2 emissions have been estimated based on 90% of diesel NO_x being NO (Peckham, 2003).

Table 7 Emission Rates for Fishing Trawlers

Source	Emission rate (kg/hour) of			
	CO	NO_2	PM_{10}	SO_2
Diesel Trawler	1.5	0.18	0.06	0.00276

Adopted Fuel Storage Emission Rates

Diesel fuel will be stored on-site for use by the occupants of the marine precinct. NPI emission factors give an estimate of the likely emissions from various fuel types (NPI 2008). Benzene, toluene and xylene emissions from diesel storage have been estimated for a vertical fixed roof tank. The fuel storage emission rate was calculated assuming a 100 000 L diesel storage in a vertical fixed roof tank, refilled every four weeks for a total yearly consumption of approximately 1 300 000 L. Hourly emission rates are provided in Table 8.

Table 8 Emission Rate for Fuel Storage

Source	Emission rate (kg/hour) of		
	Benzene	Toluene	Xylene
100 000 L diesel storage	7.19571×10^{-5}	7.19571×10^{-5}	7.31977×10^{-5}

4.6 Modelling Results

4.6.1 Sandblasting

The results of dispersion modelling for sandblasting are shown in Figure 11 for PM_{10} concentration and Figure 12 for $PM_{2.5}$ concentration. The contours show that both PM_{10} and $PM_{2.5}$ concentrations are well below the applicable criteria of 50 $\mu g/m^3$ and 25 $\mu g/m^3$ respectively. The modelling shows that PM_{10} concentrations are between 1 and 1.5 $\mu g/m^3$ at a distance of 50 m from the source, and levels will be insignificant at any nearby sensitive receivers. $PM_{2.5}$ levels are a factor of ten times lower than PM_{10} and are also considered insignificant. With negligible incremental impact, it is considered that the cumulative impact (incremental plus background) will comply with the assessment criteria.

Figure 11 Daily average PM10 concentration from sandblasting activities (EPP(Air) goal of 50 $\mu g/m^3$)

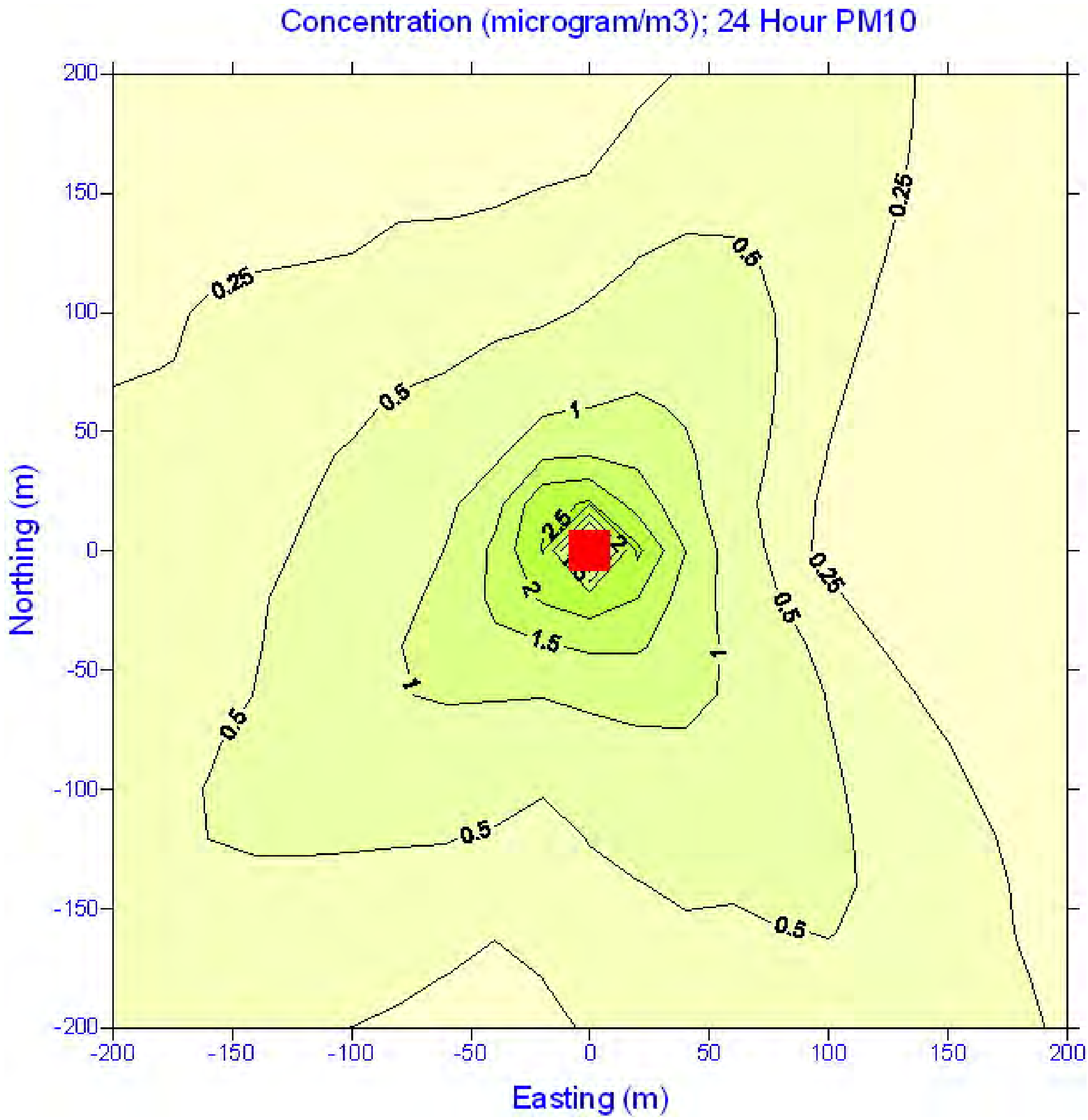
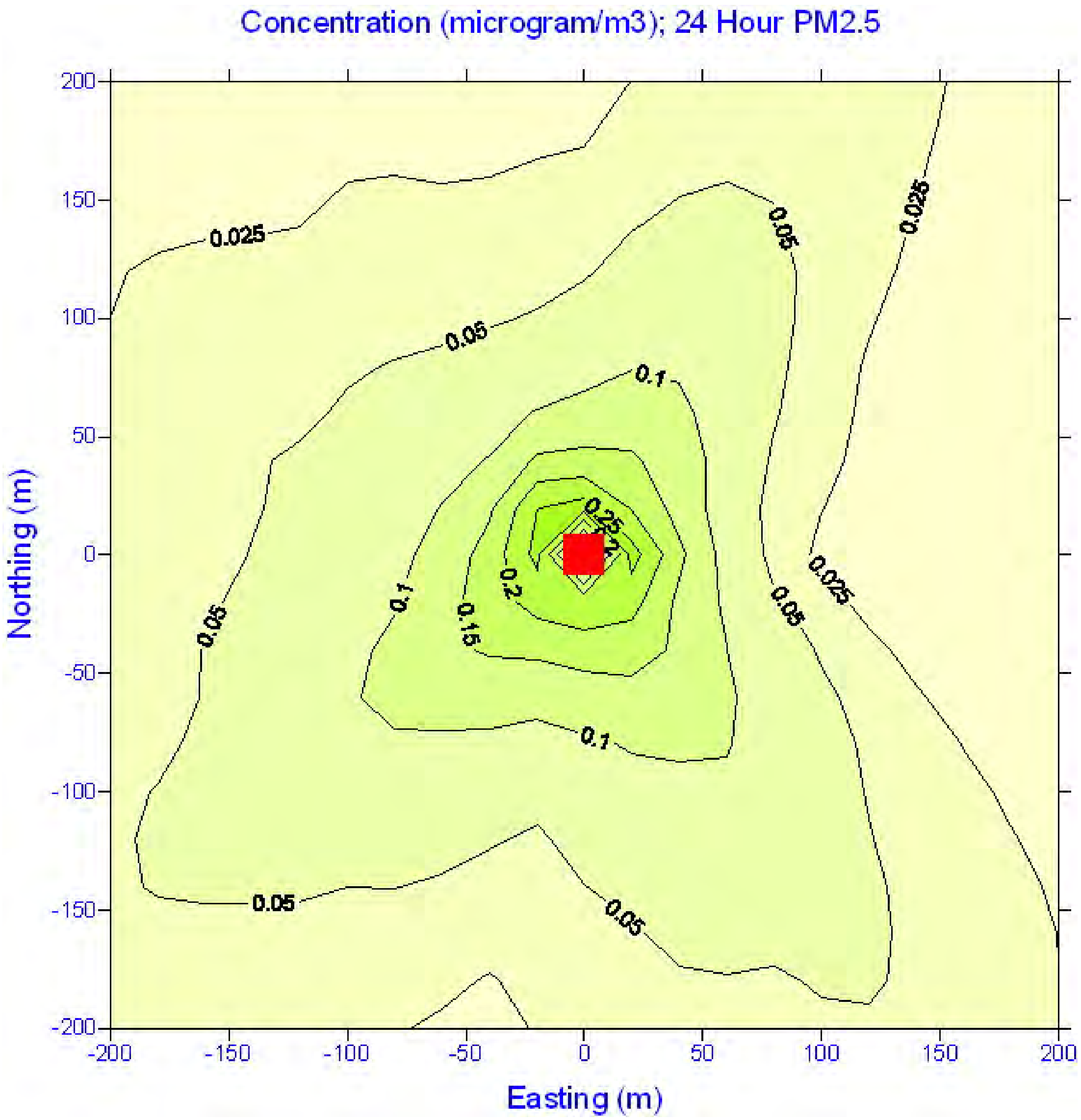


Figure 12 Daily average PM2.5 concentration from sandblasting activities (EPP(Air) goal of 25 $\mu g/m^3$)



4.6.2 Fishing Trawlers

The results of dispersion modelling for fishing trawlers are shown in Figure 13 for CO concentration, Figure 14 for NOx concentration, Figure 15 for PM_{10} concentration, Figure 16 for SO_2 concentration.

The highest CO concentration of 1 mg/m^3 is to the south east of the trawler berths, which is well below the criterion of 8 mg/m^3.

The contours show that predicted peak NO_2 concentrations are below the applicable criterion of 250 μg/m^3 averaged over one hour within 100 m of the five in-line trawlers. Levels at sensitive receivers over 350 m away will be significantly lower and within the EPP (Air) goal. The yearly averaged NO_2 concentration is 10 μg/m^3, which is well below the yearly health and wellbeing objective of 62 μg/m^3 and the health and biodiversity of ecosystem criterion of 33μg/m^3.

Predicted peak PM_{10} concentrations from the five trawlers are below the 50 μg/m^3 criterion. The highest predicted PM_{10} concentration is 30μg/m^3 to the south west of the trawler berths within 100 m.

Predicted peak SO_2 concentrations are a maximum of 2.5 μg/m^3 within 100 m to the southwest of the trawlers. Predicted concentrations are compliant with the criteria of 570 μg/m^3.

The incremental impact of each of these constituents is well within the assessment criterion levels and it is considered that the cumulative impact (incremental plus background) will comply with the respective criterion.

Figure 13 8 hour average CO concentration from fishing trawlers in the marina (EPP(Air) goal of 11 mg/m3)

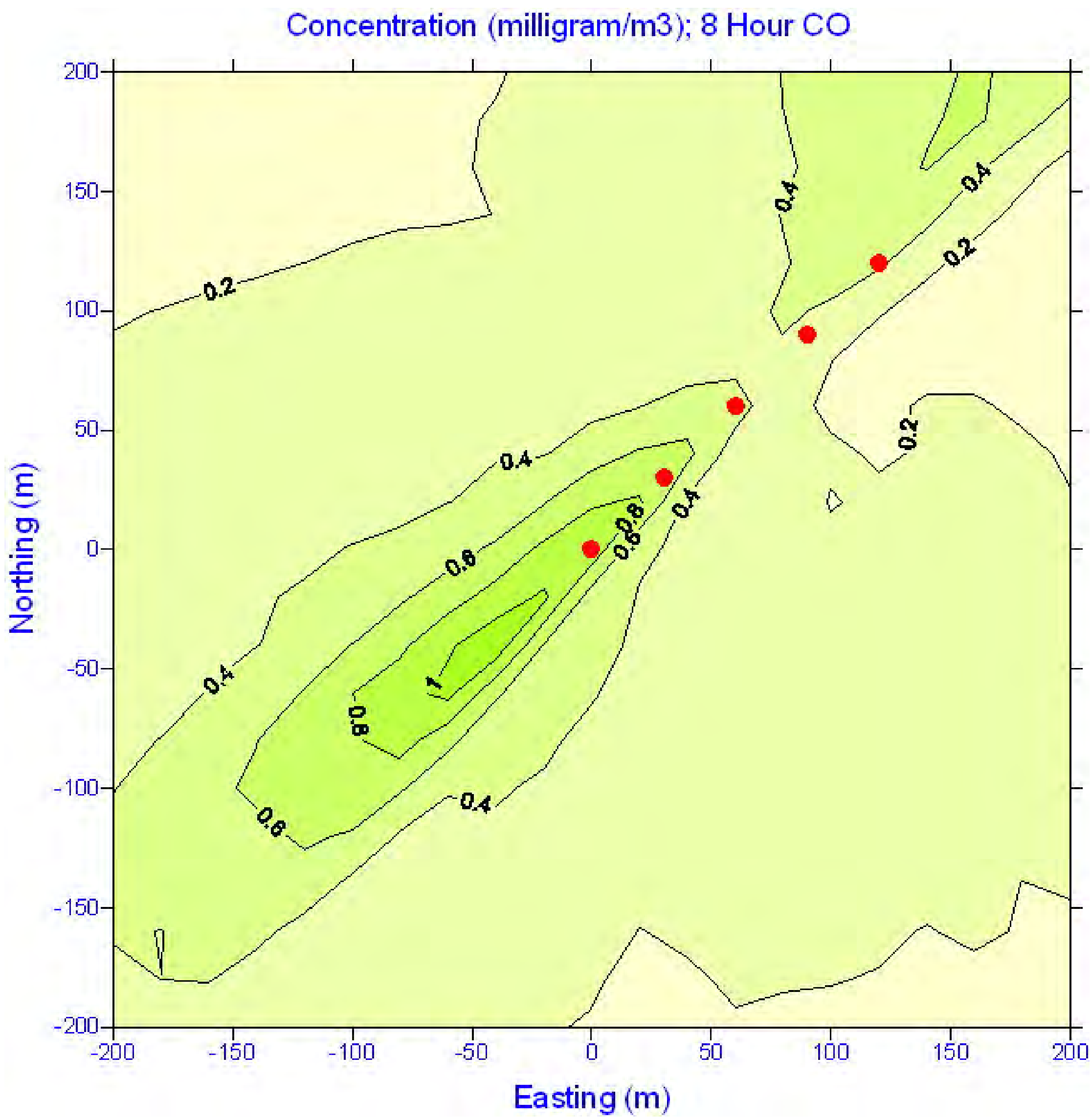


Figure 14 1 hour average NOx concentration from fishing trawlers in the marina (EPP(Air) NO2 goal of 250 µg/m^3; NO_2 is 10% of NOx)

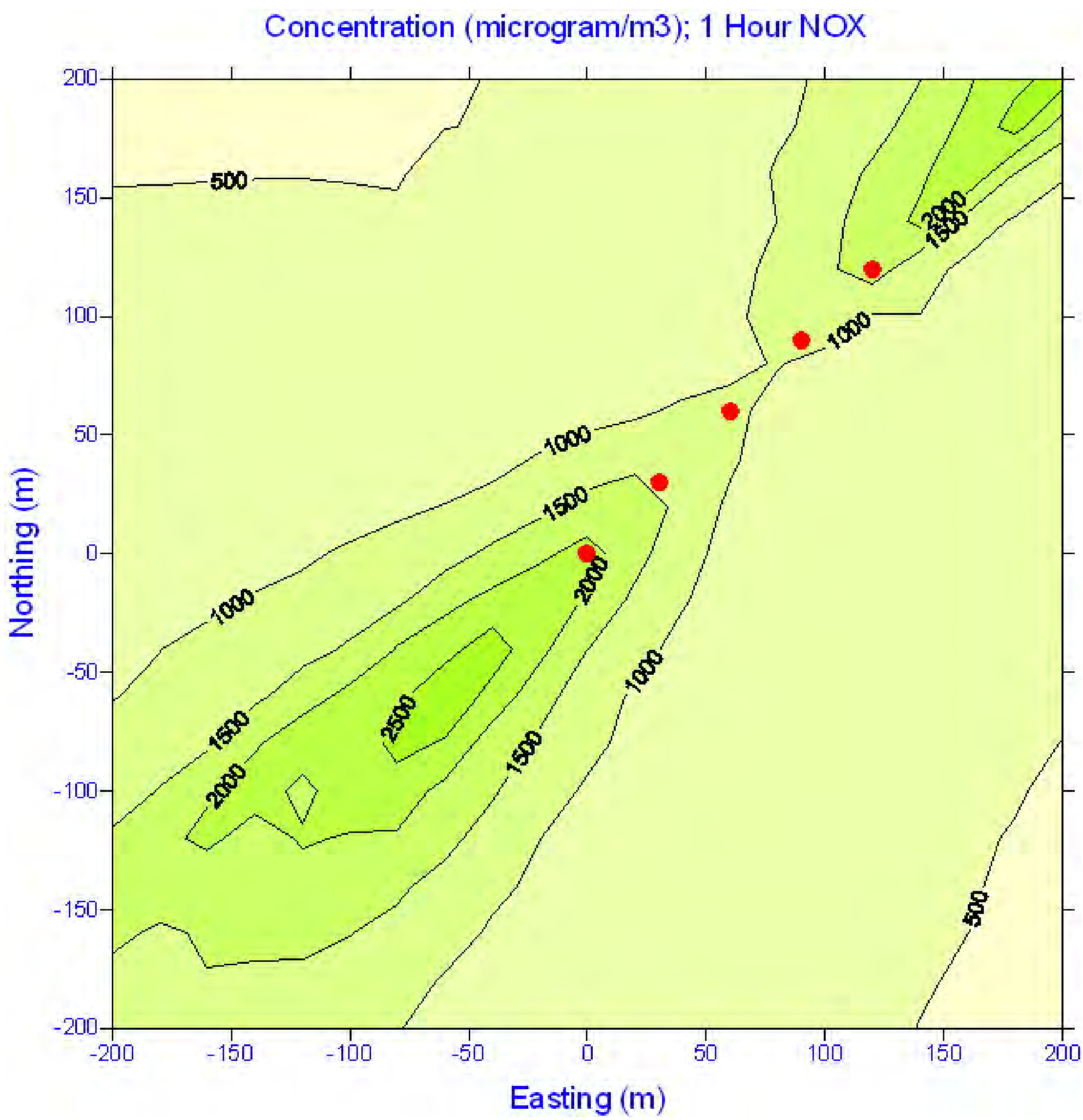


Figure 15 24 hour average PM10 concentration from fishing trawlers in the marina (EPP(Air) goal of 50 $\mu g/m^3$)

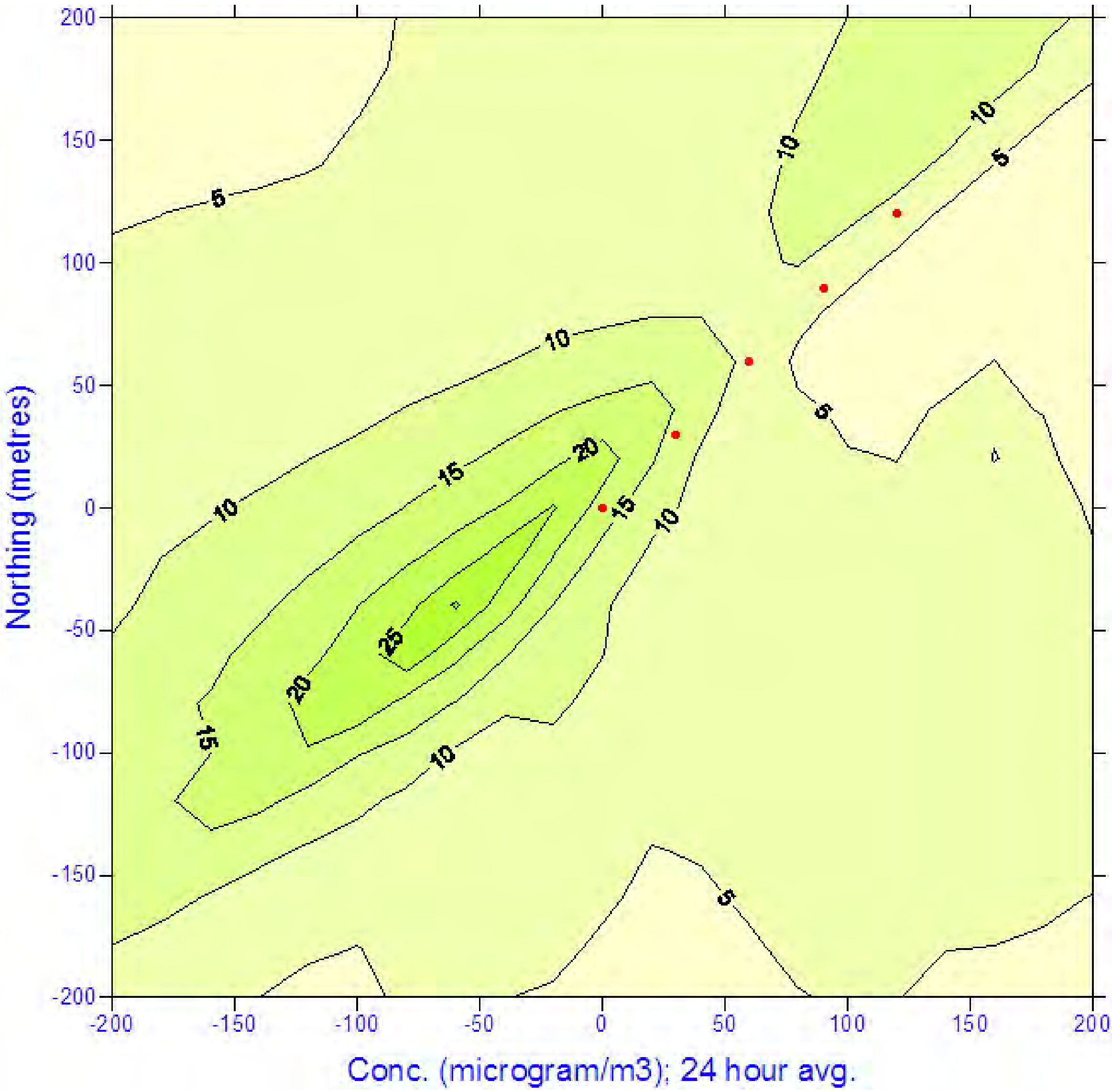
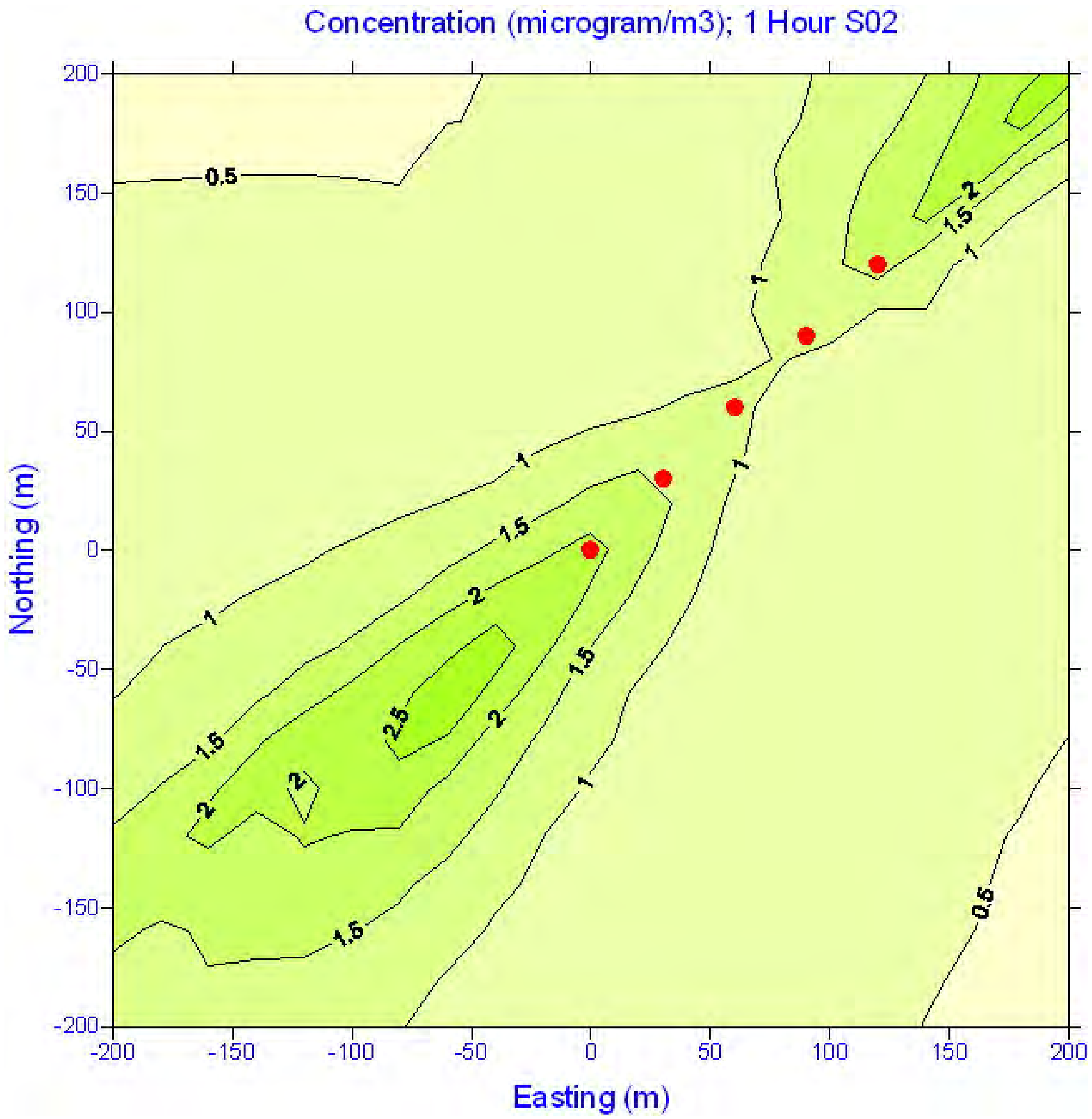


Figure 16 1 hour average SO_2 concentration from fishing trawlers in the marina (EPP(Air) goal of 570 $\mu g/m^3$)



4.6.3 Fuel Storage

The results of dispersion modelling for storage of fuel are shown in Figure 17 for Benzene, Figure 18 for Toluene and Figure 19 for Xylenes.

The model results show that benzene concentrations are well below the criterion (10 $\mu g/m^3$) with a maximum benzene concentration of approximately 0.012 $\mu g/m^3$ adjacent to the fuel tank.

Predicted peak toluene concentrations are also insignificant when compared to the criterion of 4.1 mg/m^3 over a 24 hour averaging period. The highest predicted toluene concentration is 3.3×10^{-5} mg/m^3.

Predicted xylene concentrations are insignificant when compared to the criterion of 1.2 mg/m^3 over a 24-hour averaging period. The highest predicted xylene concentration is 3.4×10^{-5} mg/m^3.

All emissions from fuel storage are expected to be insignificant at all nearby sensitive receivers. Background levels for these constituents are unknown but will most likely be very low as the marina is not adjacent to roads with high volume traffic loads. Hence, the background plus incremental levels will also be well below the assessment criterion.

Figure 17 1 year average Benzene concentration from diesel fuel storage tank (EPP(Air) goal of 10 μg/m^3)

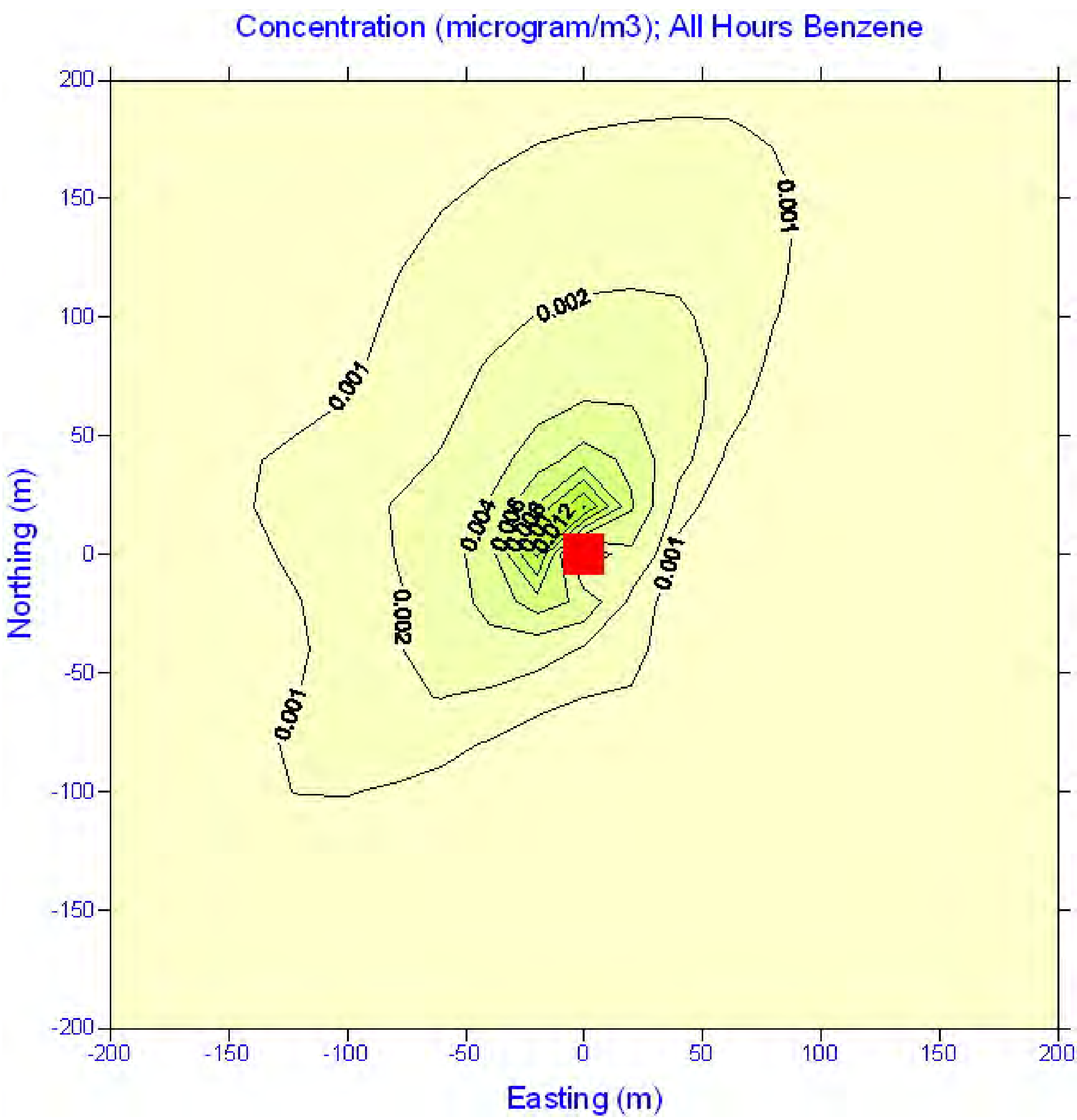


Figure 18 24 hour average Toluene concentration from diesel fuel storage tank (EPP (Air) goal of 4.1 mg/m^3)

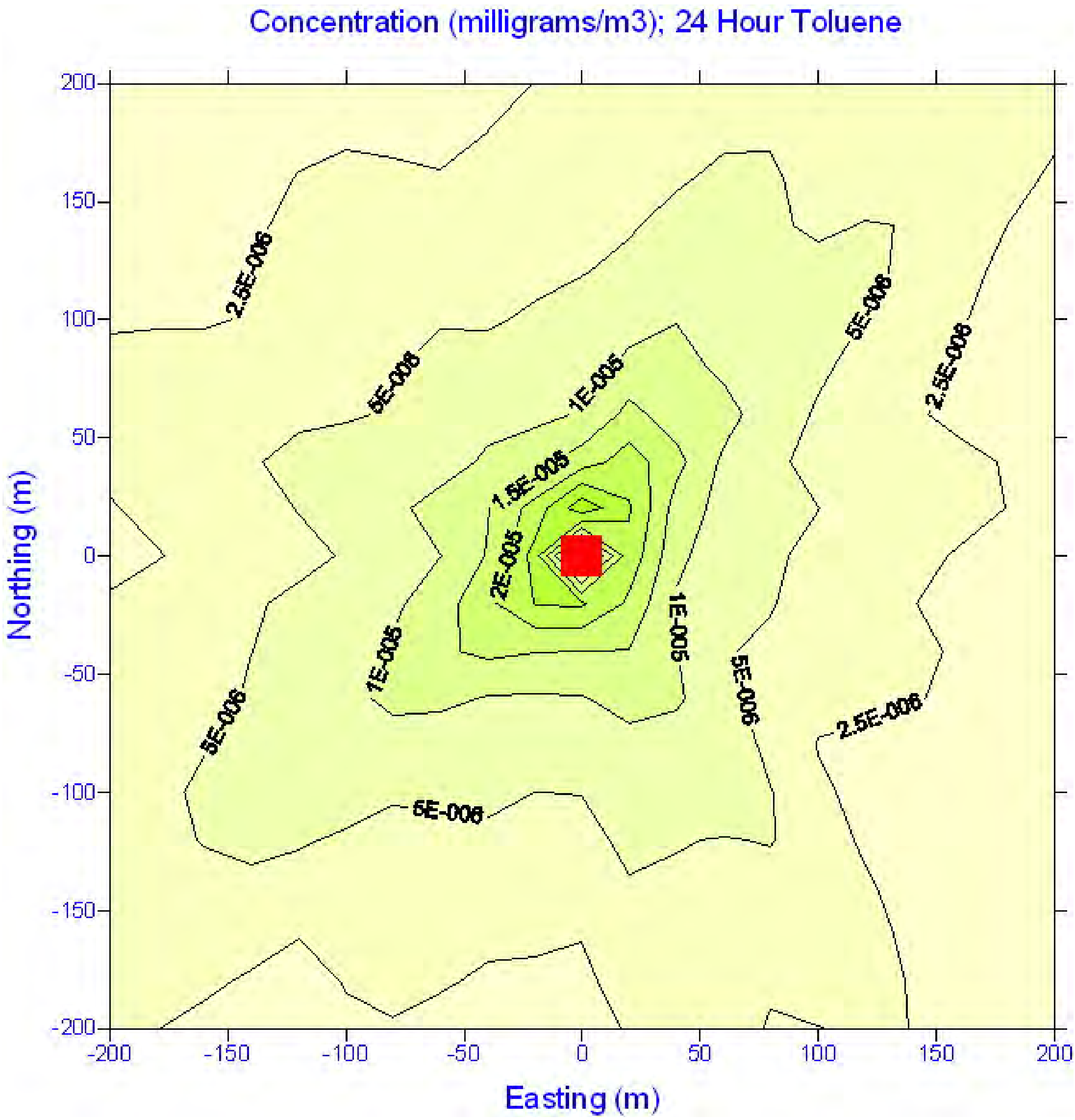
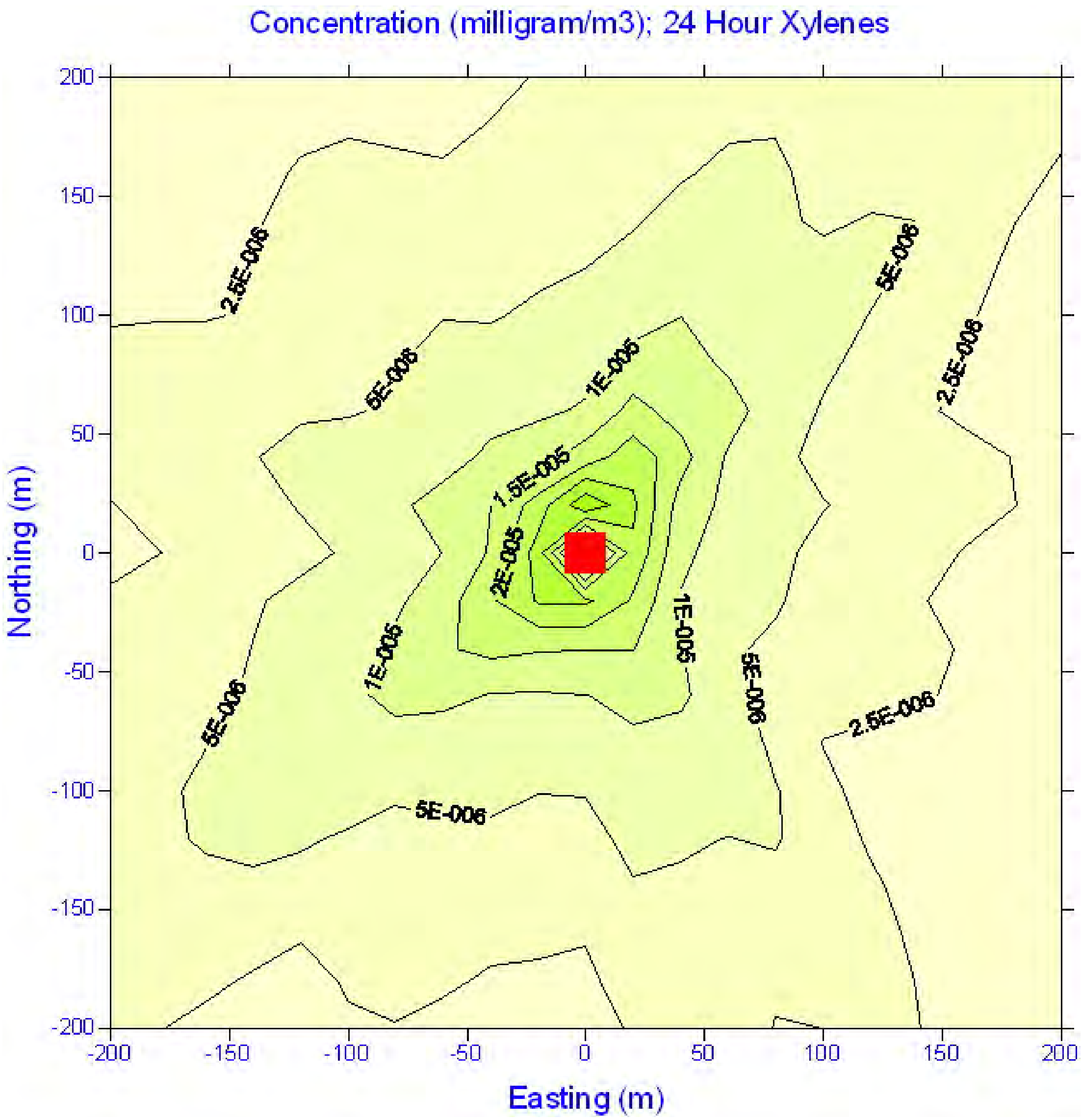


Figure 19 24 hour average Xylenes concentration from diesel fuel storage tank (EPP(Air) goal of 1.2 mg/m^3)



5. Proposed Management and Mitigation Measures

5.1 Dust Management and Monitoring Framework

In developing a framework for a dust management plan, the following elements need to be considered:

- Identification of sources and their significance;
- Objectives and targets for off-site impacts;
- Dust control where both ‘typical’ and ‘high level’ mitigation measures are defined; and
- Dust monitoring.

The identification of dust sources was discussed in Section 4.2. The objective of the dust management plan is to ensure there is no health risk or loss of amenity at sensitive receptors due to emissions of dust to the environment. This objective can be met by complying with any targets set by the Coordinator-General as discussed in Section 2.

A suggested draft construction and maintenance dust management plan, which is intended to form part of an Environment Management Plan (EMP) for the project, is discussed in Section 5.2 for typical dust management and in Section 5.3 for high level dust management.

It is recommended that high-level control measures be adopted during construction of those sections of the redevelopment that fall within close range of sensitive receptor sites as identified in the preliminary environmental assessment report and listed in Table 4, both residential and commercial. Using this approach, a staged dust management plan has been developed whereby the dust mitigation and management measures implemented are influenced by the proximity of sensitive receptors. In essence, the dust management plan will detail actions for typical and high level dust control and will specify at which locations each set of actions should be followed.

5.2 Typical Dust Management and Mitigation Measures

From the identification of potential dust emission sources (Section 4.2.2), appropriate dust management and mitigation measures for a **typical** level of control apply along the transit route where construction activity is occurring and there are no immediate sensitive receptors (housing within 250 m of active work areas that are not stockpiles or exposed surfaces).

Table 9 Typical Dust Management and Mitigation Measures

Management policy	Ensure that ambient air quality is maintained in the vicinity of the Marine Precinct construction zone.
Performance objective	To eliminate causes of local complaint from dust originating from construction activity.
Management strategies	All construction and maintenance equipment/vehicles to be operated and maintained in sound working order to minimise exhaust emissions. Defined haul routes to be used. Vehicular speeds will be limited to 20 km/h on areas of unconsolidated or unsealed soil associated with the immediate site works. Watering of exposed surfaces as required to reduce risk of nuisance dust. Regular sweeping of access roads to ensure material is not transported onto roads around the site. Review of daily weather updates from the Bureau of Meteorology, or a private meteorology service provider, to give warning of likely strong winds to assist with daily management of wind blown dust from unconsolidated soil surfaces and material stockpiles; this includes: ◗ All haulage vehicles are to have their loads covered while transporting material to the work area; ◗ Southern site boundary fence to be 3 m high and cyclone-mesh fence with 90% shade cloth covering; and ◗ Areas of disturbed soil, stockpiles and temporary spoil containment are to be covered by mulch or tarpaulins as best as practicable.
Performance indicators	All local dust complaints responded to within 12 hours. Mitigation measures implemented within 24 hours of receiving a verified dust complaint.
Monitoring and reporting	Visible observations of dust moving off-site; especially during dry and/or windy weather. Daily audit of mitigation equipment and dryness of exposed surfaces by site manager; includes logging complaints and action taken. Dust deposition gauges operated in front of representative residences if construction activity likely to be within 500 m for more than 30 days. Free-call number available for public complaints.

Corrective actions	Prompt mitigation of visible dust emissions, which may involve; ◗ Stabilisation of surface silt content through application of localised water sprays, or the use of appropriate chemical dust suppressants (suitable for stockpiles and spoil dumps); ◗ Control of mechanically induced dust emissions (from clearing, scraping, excavation, loading, dumping filling and levelling activities etc.) by application of water sprays; and ◗ Awareness of operational areas more frequently exposed to higher winds, and the predominant wind directions in these areas at various times of the year. Temporary wind barriers may be employed where necessary.
Responsibility	Site Supervisor for operational control and response. Project Manager for auditing and resolving complaints.

5.3 High Level Dust Management and Mitigation Measures

If a higher level of control is deemed to give added protection to residential areas to the south of the site, particularly if sealing the entry road is impracticable, a high-level of dust control can be achieved by developing a proactive and reactive dust management regime. This measure involves real-time particulate monitoring using a real-time aerosol monitor, with PM10 size selective inlet, which will be located between construction operations and identified sensitive receptor sites (near Boundary Street and Eighth Avenue).

The real-time monitor can be configured to provide a warning (via an audible, or visible signal or as a communication link) of short-term elevations in concentrations of respirable dust so that immediate dust suppression and remediation steps can be initiated. Reactive mitigation measures may include application of water sprays, reducing the intensity of operations, or even altering the type of construction operations until suitable meteorological conditions prevail. The threshold particulate concentration for alarm/warning activation would be based on a criteria level established by the Coordinator-General as an intervention level for respirable dust; typically 150$\mu g/m^3$ as a short term (15-minute) trigger which will result in the daily dust exposure being below the daily EPP (Air) limit.

Table 10 High Level Dust Management and Mitigation Measures

Management policy	Ensure that ambient air quality is maintained in the near vicinity of the Marine Precinct construction site.
Performance objective	To eliminate causes of local complaint, especially in the residential zone to the south, from dust originating from construction activity and ensure particulate real-time route monitoring does not exceed PM10 greater than 50µg/m^3 over a 24-hour average.
Management strategies	All of the identified controls for 'Typical Dust Management and Mitigation'. Real-time and reactive dust monitoring system.
Performance indicators	All local dust complaints responded to within six hours. Mitigation measures implemented within 12 hours of receiving a legitimate dust complaint.
Monitoring and reporting	Real-time dust monitoring conforming to: ◗ Australian Standard AS2922-1987 Ambient Air – Guide for the siting of sampling units; and ◗ AS/NZ 3580.12.1 2001 Methods for sampling and analysis of ambient air Method 12.1: Determination of light scattering - Integrating nephelometer method. All other monitoring and reporting for 'typical' management including: visible observations; daily audits; dust deposition gauges; logging complaints and corrective actions; and public free-call number.
Corrective actions	When real-time monitoring indicates PM10 dust levels above 150µg/m^3 over a rolling one-hour average: ◗ Increased water rates; ◗ Speed restrictions on vehicular traffic reduced to 10 km/h; and ◗ Cessation of mechanically generated dusty activity.
Responsibility	Site Supervisor for operational control and response. Project Manager for auditing and resolving complaints.

6. Conclusion and Recommendations

The results of the assessment suggest that construction-related dust from the Port of Townsville Marine Precinct would not significantly impact on the amenity of sensitive receivers provided appropriate management procedures as outlined in this report are implemented. An Environmental Management System will need to be implemented for the construction phase to control dust in the nearby residential area to the south. This will require Level 1 watering (2 litres/m^2/h) on all exposed surfaces and the access road to be surface treated (asphalt seal) from site entry until at least 50 m north OR a reactive dust management (higher) level of dust control under adverse weather conditions.

The expansion of the Port monitoring network for dust deposition will assist in the ongoing management of dust impacts.

Air emission from proposed operational activities within the marine precinct have been assessed against relevant criteria. Results suggest that the operational activities assessed consisting of sandblasting, fuel storage and moored fishing trawlers will not have a significant impact on any nearby sensitive receivers and air quality objectives will be achieved.

7. Limitations

This report presents the results of an investigation and analysis to determine the construction dust impact and limited operational scenarios from the Port of Townsville Limited proposed Marine Precinct, and were produced specifically for the Port of Townsville Limited and the purposes of this commission. GHD accepts no responsibility for other use of the data. No warranties, expressed or implied, are offered to any third parties and no liability will be accepted for use of this report by any third party.

The advice tendered in this report is based on information obtained from the client, regulatory dispersion modelling and sample weather and pollution data collected at Townsville Port (by both the Port Authority and the Queensland EPA) and surrounding monitoring stations. GHD accepts no responsibility for the integrity of the software coding of the EPA Victoria approved regulatory dispersion model used (AUSPLUME).

The work conducted by GHD under this commission has been to the standard that would normally be expected of professional environmental consulting firm practising in this field in the State of Queensland. However, although strenuous effort has been made to identify and assess all significant construction dust issues and possible operational emissions required by this brief we cannot guarantee that other issues outside of the scope of work undertaken by GHD do not remain.

An understanding of the site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure-specific and some experienced-based. Hence this report should not be altered, amended or abbreviated, issued in part or issued in any way incomplete without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of the report that has been modified other than by GHD.

7.1 Knowledge Gaps

At this stage of the project, assumptions have been made to allow for the completion of the construction dust assessment (and related documentation) and to possible, but yet to be confirmed, operational activity. These include realistic assumptions on construction equipment used. The key assumption is concerned with the construction activity and method and confirmation of sensitive receptor locations.

Datasets that give an indication of the location of sensitive receivers in the surrounding suburban area have been made available. In order to develop a detailed dust management plan for construction operations, the location of sensitive receivers in the immediate vicinity of the precinct, especially to the south of the site, say to 250 metres, may define the level of dust mitigation required.

8. References

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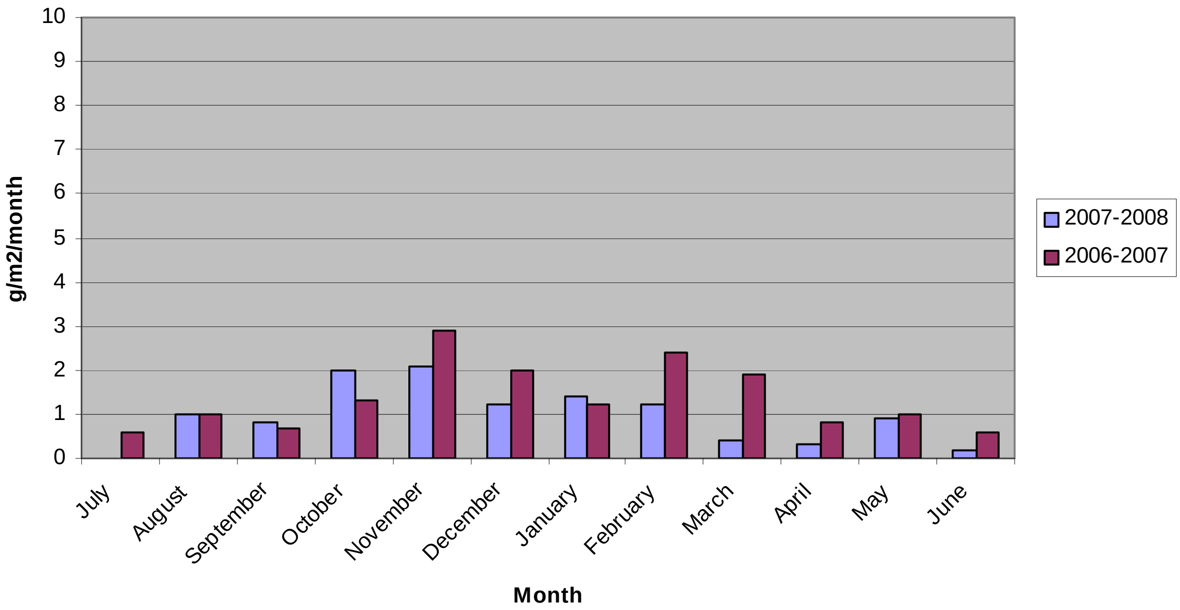
Appendix A

Dust Deposition Gauge Graphs

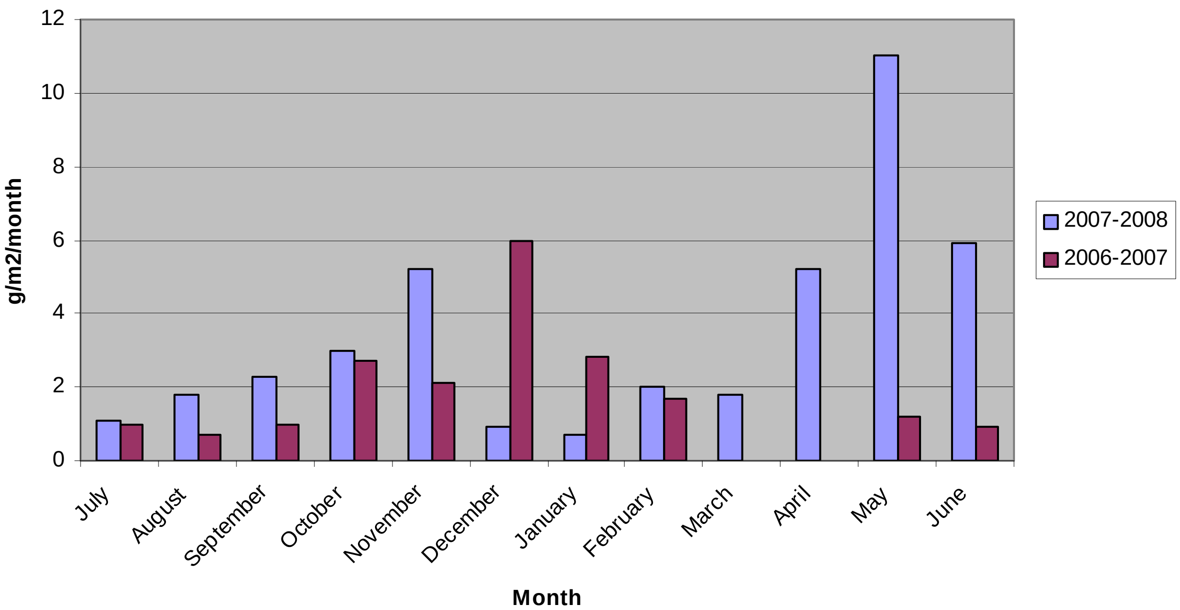
2007 – 2008

2006 – 2007

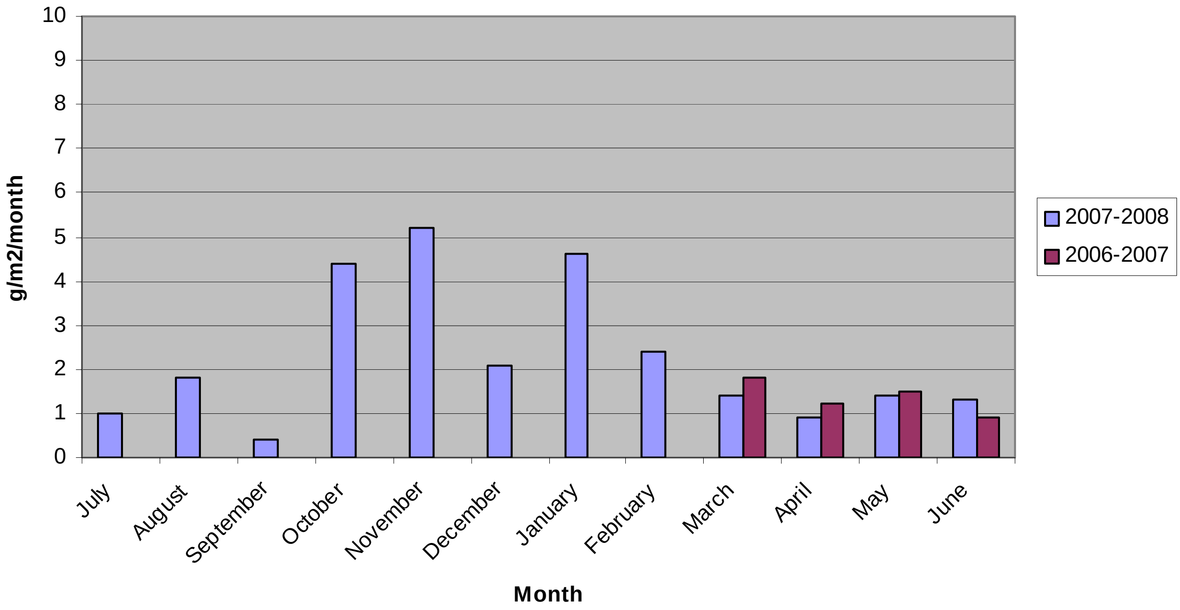
Entrance Dust Deposition



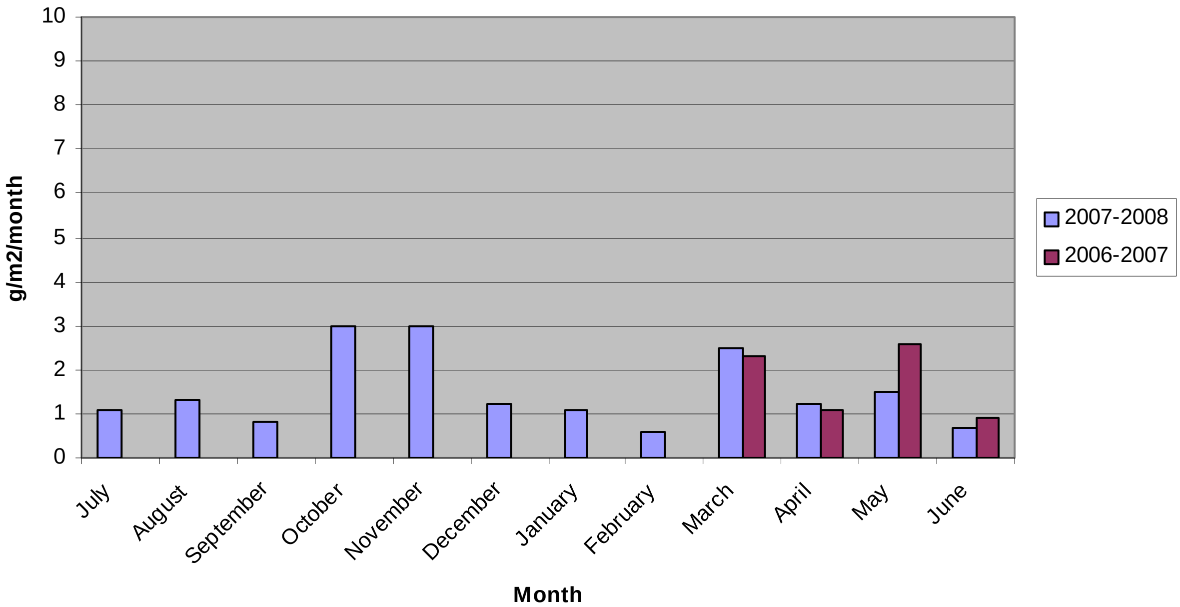
Rail Loop Dust Deposition



Ross Street Dust Deposition



Tully Street Dust Deposition



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