TOWNSVILLE PORT EXPANSION PROJECT

Additional Information to the Environmental Impact Statement

SECTION 11

Air Quality

TOWNSVILLE PORT EXPANSION PROJECT

AECOM BMT WBM

11.0 Air Quality

11.1 Introduction

Air quality impacts and mitigations are discussed in Chapter B.9 (Air Quality) of the Environmental Impact Statement (EIS). The air quality impacts associated with the construction of the Port Expansion Project (PEP) were assessed with predicted concentrations of particulates at identified sensitive receptor locations. It was predicted that the regulatory criterion for PM_{10} will be exceeded at sensitive receptors close to the western boundary of the PEP over the course of the modelling period. The predicted short-term exceedances were predicted to occur at a frequency of between 0 to 13 days per year, with adverse impacts over longer time periods not expected.

Changes in methodology and approach were necessary to address submissions made in response to the EIS. The key matters identified during the consultation period include:

- air quality impacts from operational activities
- assessment of shipping emissions for the Project
- inclusion and refinement of the Conceptual Reactive Monitoring Program.

11.2 Response to Submissions

11.2.1 Air quality impacts from operational activities

14 submissions requested assessment of air quality impacts from the existing operational activities at the Port and/or future operational activities of the PEP. Dust emissions from existing port operations are currently quantified by monitoring data collected by a continuous air quality monitoring station at the Coast Guard site. This station is part of a Department of Environment and Heritage Protection network of air quality monitoring stations throughout Queensland. As identified in Section B.9.3.4.1 of the EIS, this monitoring station is adjacent to the western boundary of the port and collects PM_{10} data. A summary of the background data collected at this site is presented in Table B.9.2 of the EIS.

Long term particulate monitoring data from a historically POTL operated monitoring site (situated near Berth 10) was obtained from 1994 to 2011. Data from this location was analysed in the EIS and presented in Table B.9.3 of the EIS. This data was used to represent the background dust concentrations.

The Department of Environment and Heritage Protection advised in March 2014 that impacts from future operational activities will be dealt with under future approval processes and at this stage further assessment of the Project is not required. Emissions from future operational activities will need to be assessed as part of a development application for the newly created PEP area which will be considered on a case by case basis.

11.2.2 Assessment of shipping emissions for the Project

Two submissions related to the shipping emissions discussed in the EIS. One requested the inclusion of shipping emissions in the revised assessment. An emission inventory for combustion emissions from ships whilst at port has been developed. These emissions were included in three modelling scenarios to quantify impacts of ship emissions at nearby sensitive receptors. Shipping emissions are assessed in Section 11.3.4.1 of the AEIS.

In addition to particulate matter, discussed in Section B.9.3.2 in the EIS, combustion gases from ship emissions have been included (Nitrogen Dioxide, Carbon Monoxide and Sulfur Dioxide). To retain consistency with the EIS, particulate matter smaller than 2.5 micrometres in diameter (PM2.5) was not considered for construction activities, however $PM_{2.5}$ was considered as part of the shipping emissions. Health effects of the modelled particulate and combustion gas have been included in Appendix A4.

The second submission raised a number of concerns relating to the potential for aesthetic impacts from the operation of the port. In particular, the aesthetic issues raised were as follows:

- the increase in the black plumes of smoke from foreign vessels (apparently not bound by Australian emission standards)
- the sickly (and unhealthy) odour of bunker oil
- the foul and pungent odour of cattle manure and urine
- the increase in dense black and dark brown particulate which already falls on residences on The Strand and other suburbs such as Yarrawonga, and vessels in the Breakwater Marina.

The concerns in relation to black smoke relate to the visual emissions from ships burning poor quality fuel, which is an acknowledged historical problem in the shipping industry worldwide. The cause of the black plumes of smoke are predominantly the ship engines when steaming to or from the port under their own power. Ships can and have in the past utilised poorer quality fuels when steaming and as such led to the perception of visual impacts from the shipping. In addition to the visual concerns, the use of poor quality fuel has also contributed to odour releases from the ships as the poorer quality fuels often have higher sulfur contents which have a stronger odour when released.

When the ships are at port (the majority of the time spent in the Townsville area), the ship's main engines are not being used and the only emissions are from ship power generation and boiler emissions. The shipping industry is needing to address the increasing concerns in relation to visual and odorous emissions at port and are responding in the following manner:

- moving toward the use of low sulfur fuel when at port for the auxiliary engines and boilers
- use of low sulfur fuels when approaching visually sensitive or odour sensitive areas.

As an example of where this is occurring, is within Sydney Harbour. New regulations have recently been passed requiring cruise ships to use low sulfur fuel (when within Sydney Harbour) and are due to be enacted on 1 July 2016. In addition, industry within the Sydney harbour is voluntarily implementing similar arrangements with their haulage fleets in expectation that the Cruise ship regulations will be expanded to cover all heavy material.

Although there are no current requirements for ships to comply with the two points listed above for the Port of Townsville, given the trends in the industry and the recent changes in the NSW regulations, it is expected that these changes will be implemented at other major ports within Australia. These changes will lead to the reduction in the appearance of smoke plumes and the elimination of the odour and aesthetic concerns raised in relation to the PEP EIS.

The reduction in black smoke will also have the effect of the reduction in particulate emissions form the ships close to the port and hence will reduce the potential for particulate deposition at residential areas bordering the port.

Odour associated with cattle manure and urine is presumably a comment in relation to the export of live cattle from the port. This is an operational aspect that is beyond the scope of this assessment. However, any operation on the newly expanded Port would need to be undertaken in a manner consistent with best practice, including the management of run-off and solid waste. These aspects would need to be managed to ensure odour emissions comply with the Queensland DEHP odour requirements and would be assessed prior to the commencement of any live cattle export.

11.2.3 Inclusion and refinement of Reactive Monitoring Program

The Department of Environment and Heritage Protection requested further details of the reactive monitoring program, specifically the associated trigger levels. Draft dust monitoring trigger values have been developed as a part of this AEIS and are provided in Section 11.3.4.2 of the AEIS.

11.3 Revised Environmental Impact Assessment

11.3.1 Legislation and policy

Legislation and policy changes that have occurred since the development of the EIS are identified in Section 1.0 of the AEIS. The legislative and policy changes did not impact on the assessment of air quality values presented in the EIS, or the management of these values.

The *Environmental Protection (Air) Policy 2008* (EPP [Air]) sets ambient air quality objectives for priority air pollutants in Queensland. Table 11.1 presents air quality objectives for particulates and combustion gases included in this air dispersion modelling assessment, making reference to the environmental values the criteria were specifically developed to protect. It should be noted the objectives for the particulates and combustion gases listed below are not applicable to air emissions experienced within a workplace that are emitted from that workplace, i.e. the objectives do not apply to the construction site itself.

These criteria are designed to provide a level to meet the health and well-being environmental value. In addition to the criteria above, the Department of Environment and Heritage Protection criteria for deposited dust and the New South Wales Environment Protection Agency criteria for annual average PM_{10} (DEC, 2005) as follows were also used for assessment:

- deposited dust (dustfall) limit of 120 mg/m2.day averaged over 4 weeks
- annual average PM_{10} criterion of 30 $\mu g/m^3$.

Table 11.1 Queensland EPP (Air) ambient air quality objectives

Indicator	Averaging Period	EPP (Air) Criteria	Environmental Value	Units
TSP	1 year	90	Health and well-being	$\mu g/m^3$
PM_{10}	24 hours	50*	Health and well-being	$\mu g/m^3$
$PM_{2.5}$	24 hours	25	Health and well-being	µg/m3
	Annual	8	Health and well-being	$\mu g/m^3$
NO_2	1 hour	250	Health and well-being	$\mu g/m^3$
	Annual	62	Health and well-being	$\mu g/m^3$
CO	8 hours	11,000	Health and well-being	$\mu g/m^3$
SO_2	1 hour	570	Health and well-being	$\mu g/m^3$
	24 hours	230	Health and well-being	$\mu g/m^3$
	Annual	57	Health and well-being	$\mu g/m^3$

* 5 days allowable exceedances per year. On this basis, the sixth highest predicted 24-hour concentration has been compared with the criterion.

11.3.2 Design refinement

The Project design has been refined as described in Section 2.0 of the AEIS. The refined design has not fundamentally changed the air quality impacts identified in the EIS. Sources of dust are largely unchanged from those assessed in the EIS (refer Section B.9.3 of the EIS). The design refinement has allowed the construction activities to be clearly defined, resulting in a more accurate breakdown of when the activities are likely to occur. This has resulted in some activities that were modelled in the EIS as being concurrent, are no longer occurring concurrently and thereby reducing dust emissions during any given construction stage.

In addition, the staging of the overall works is different from the EIS resulting in a changed number of modelling scenarios that have been examined by the air quality assessment. The construction works for the revised PEP are expected to be undertaken in 3 stages (Stages 1 to 3).

11.3.3 Supporting studies

An assessment has been undertaken considering the revised design for the PEP. The assessment of the revised design was undertaken using an air quality impact assessment methodology as outlined in the EIS. The methodology incorporated the following aspects.

- A dispersion modelling assessment using the CALPUFF dispersion model. The CALPUFF settings were consistent with those used in the EIS and is considered the most appropriate model for the coastal environment in which the PEP is situated.
- Regional meteorology which has been processed into a region wide wind field, which incorporates terrain and land use influences. To ensure consistency with previous studies, the meteorology used the same data as the EIS. No guideline or model changes have been released since the EIS that will necessitate a change to the meteorological data used for the modelling.
- Receptor list consistent with the receptors assessed in the EIS. The receptor list was considered to still provide a good list of representative locations at which the impacts from the revised PEP could be assessed and then compliance inferred to the surrounding environment beyond the receptors.
- Site specific on-site construction activities, activity specific mitigation measures and project scheduling were compiled into an inventory, which is considered to be reflective of the expected operations on the refined PEP.
- Background particulate and combustion gas concentrations measured at the port were incorporated with the modelling results.

The incorporation of these aspects of the assessment ensures that the assessment is robust and consistent with expectations in the Terms of Reference. Appendix A4 summarises the aspects of the assessment that have been modified relevant to the background data, air quality objectives and findings of the revised dispersion modelling.

11.3.4 Revised assessment

The following sections focus on the revised assessment of the construction activities and the mitigation measures recommended ensuring the predicted dust levels are achieved when construction commences.

11.3.4.1 Impact assessment

The assessment of the impacts associated with the revised design of the PEP has been considered both in isolation from background concentration (assessed the incremental addition of particulate and combustion gases to the environment from the PEP activities) and cumulatively (expected overall dust concentrations taking into consideration the existing levels of particulate and combustion gases in the environment). The cumulative assessment combines emissions from PEP (construction emissions incorporating mitigation for the construction activities) and shipping (emissions without mitigation) with emissions from existing operating facilities, industries and other background sources in the Townsville area through the monitoring data collected around the Port. Impacts from the proposed PEP construction emissions in isolation and cumulatively are presented in the following section.

PEP Construction Stage Scenarios and Receptors

Dispersion modelling investigations need to include how sources are operating and how they combine to impact on their surroundings. The PEP construction stages and the equipment expected to be used has been defined in detail in Appendix A4.

As part of the revised design of the PEP, three scenarios have been developed to represent the operations during the long period of construction activities (one for each of the revised PEP construction stages). The three modelling scenarios are described as follows.

- Stage 1 Scenario: Dust and shipping emissions for construction Stage 1, with haul roads unsealed. The haul roads are assumed to run from the boundary of the existing sealed section of road to approximately the centre of the Stage 1 reclamation area. The length of the unsealed haul road was modelled as 1 km (2 km round trip per vehicle). Wind erosion emissions were included for approximately 25 ha of the reclamation area.
- Stage 2 Scenario: Dust and shipping emissions for construction Stage 2, with internal haul roads from construction of Stage 1 which have been sealed to a degree whereby negligible dust is emitted. This scenario assumed unsealed haul road distance of 1 km and that the initial entry road onto the PEP had been sealed. Wind erosion emissions were included only for newly reclaimed land in Stage 2 — reclaimed land from Stage 1 was assumed to be sealed (through surface sealing or vegetation).
- Stage 3 Scenario: Dust and shipping emission sources for construction Stage 3 with internal haul roads from construction of Stage 1 and 2 which have been sealed to a degree whereby negligible dust is emitted. Wind erosion emissions were included only for newly reclaimed land in Stage 3 — reclaimed land from Stage 1 and 2 was assumed to be sealed (through surface sealing or vegetation).

Further details of the above scenarios and their relevant emission sources have been provided in Appendix A4.

Details of the receptors assessed for this study are shown in Table 11.1. Receptor locations situated where peak impacts may occur are shown on Figures 11.1, 11.2 and 11.3.

Table 11.2 Sensitive Receptor Locations

Receptor ID	Modelled Receptor Location	Approximate Distance from PEP (km)	Receptor Type
1	The Ville Resort - Casino – Top Floor	1.4	Commercial
2	The Ville Resort - Casino – Floor 6	1.4	Commercial
3	The Ville Resort - Casino – Floor 3	1.4	Commercial
4	Corner Archer and Ross Streets, South Townsville	1.8	Residential
5	55 Macrossan Street, South Townsville	1.9	Residential
6	29 Hubert Street, South Townsville	2.0	Residential
7	Breakwater Quays	1.6	Residential
8	Townsville CBD	2.7	Residential
9	Corner of The Strand and Gregory Street, North Ward	2.6	Residential
10	91 The Strand, North Ward	3.1	Residential
11	Corner of The Strand and Howitt Street, North Ward	3.6	Residential
12	North Ward Sports Grounds	3.2	Public Space

PEP impacts in isolation

The incremental predicted particulate and combustion gas concentrations from the three modelled stages of the PEP have been presented in the following section. No background particulate concentrations have been included in the results presented in Table 11.2, Table 11.3 or Table 11.4.

Construction dust

The results for the dispersion modelling for the three construction scenarios are presented in this section. Predicted 6th highest 24 hour average PM_{10} and annual average PM_{10} concentrations from PEP emissions in isolation at each modelled sensitive receptor are presented in Table 11.3. Predicted concentrations were well below the relevant criteria at all sensitive receptors.

Table 11.3 Predicted PM_{10} concentrations – Revised PEP in isolation

Receptor ID	Predicted PEP Contribution PM_{10} (µg/m³)					
	6th Highest 24 Hour Average			Annual Average		
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
1 – Casino Top Floor	5.0	5.2	4.0	1.8	1.8	1.3
2 – Casino Floor 6	6.8	6.8	4.9	2.3	2.2	1.7
3 – Casino Floor 3	12.8	12.4	8.8	3.7	3.5	2.7
4 – Archer and Ross	14.7	13.5	10.5	3.0	3.1	2.3
5 – Macrossan	17.9	17.7	15.4	3.5	3.8	2.8
6 – Hubert	13.9	15.8	10.0	1.9	2.6	1.8
7 – Breakwater	12.2	13.1	11.0	3.2	3.1	2.6
8 – CBD	6.7	6.3	5.1	1.4	1.5	1.2
9 – Strand and Gregory	11.9	15.5	11.4	2.6	3.4	2.5
10 – Strand	12.1	14.4	11.4	2.8	3.5	2.7
11 – Strand and Howitt	9.9	15.8	12.3	3.0	3.8	2.9
12 – North Ward	7.9	8.8	6.9	1.7	1.9	1.4
Criteria	50			30		

Figure 11.1, Figure 11.2 and Figure 11.3 show the concentration contours for modelled 24 hour PM_{10} in isolation from the background – i.e. dust from the PEP construction activities only, for Scenarios 1, 2, and 3 respectively. The contours shown on each figures denote the 6th highest 24 hour PM_{10} concentrations.

Maximum predicted 24 hour average PM_{10} concentrations at each sensitive receptor have been calculated to satisfy a request by the Department of Environment and Heritage Protection to show the highest predicted PM_{10} levels from the PEP construction activities. Maximum PM_{10} concentrations are presented in Table 11.4.

Table 11.4 Predicted Maximum 24 Hour Average PM_{10} concentrations – Revised PEP in isolation

Receptor ID	Predicted PEP Contribution PM_{10} Maximum 24 Hour Average (µg/m³)		
	Stage 1	Stage 2	Stage 3
1 – Casino Top Floor	7.3	6.3	4.9
2 – Casino Floor 6	10.2	8.1	5.9
3 – Casino Floor 3	18.0	14.0	11.4
4 – Archer and Ross	29.2	28.4	21.6
5 – Macrossan	37.2	33.0	26.0
6 – Hubert	26.9	24.3	16.8
7 – Breakwater	20.2	19.5	12.6
8 – CBD	16.6	15.2	10.6
9 – Strand and Gregory	20.2	28.4	17.4
10 – Strand	15.3	17.4	19.2
11 – Strand and Howitt	14.9	17.4	16.0
12 – North Ward	17.8	13.8	11.2

All predicted PM_{10} concentrations for PEP emissions in isolation were predicted to be below criteria at all sensitive receptors for all scenarios. Following the refinement of the construction stages and the associated activities, the predicted PM_{10} levels listed in Table 11.3 and 11.4 are shown to comply with their short term criterion and as such further analysis of the data was not deemed necessary (as was the case for the EIS air quality predictions).

Predicted annual average TSP concentrations and dust deposition rates at sensitive receptors from PEP emission in isolation are presented in Table 11.5. Predicted TSP and dust deposition impacts were well below criteria at all sensitive receptors.

Table 11.5 Predicted TSP Concentrations and Dust Deposition Rates – PEP in Isolation

Receptor ID	Predicted PEP Contribution Annual Average TSP (µg/m³)			Predicted PEP Contribution Dust Deposition Rate (g/m²/month)		
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
1 – Casino Top Floor	5.7	5.5	4.0	0.00	0.00	0.00
2 – Casino Floor 6	9.1	7.2	5.3	0.00	0.00	0.00
3 – Casino Floor 3	7.2	11.1	8.3	0.00	0.00	0.00
4 – Archer and Ross	8.6	9.6	7.2	0.04	0.02	0.01
5 – Macrossan	4.6	12.2	8.7	0.04	0.03	0.01
6 – Hubert	7.6	8.4	6.2	0.02	0.01	0.00
7 – Breakwater	3.4	9.6	7.8	0.06	0.04	0.02
8 – CBD	6.2	4.7	3.8	0.02	0.01	0.01
9 – Strand and Gregory	6.6	10.0	7.8	0.03	0.03	0.02
10 – Strand	7.0	10.7	8.6	0.03	0.02	0.02
11 – Strand and Howitt	3.8	11.3	8.7	0.02	0.02	0.02
12 – North Ward	3.8	5.9	4.5	0.02	0.01	0.01
Criteria	90			4		

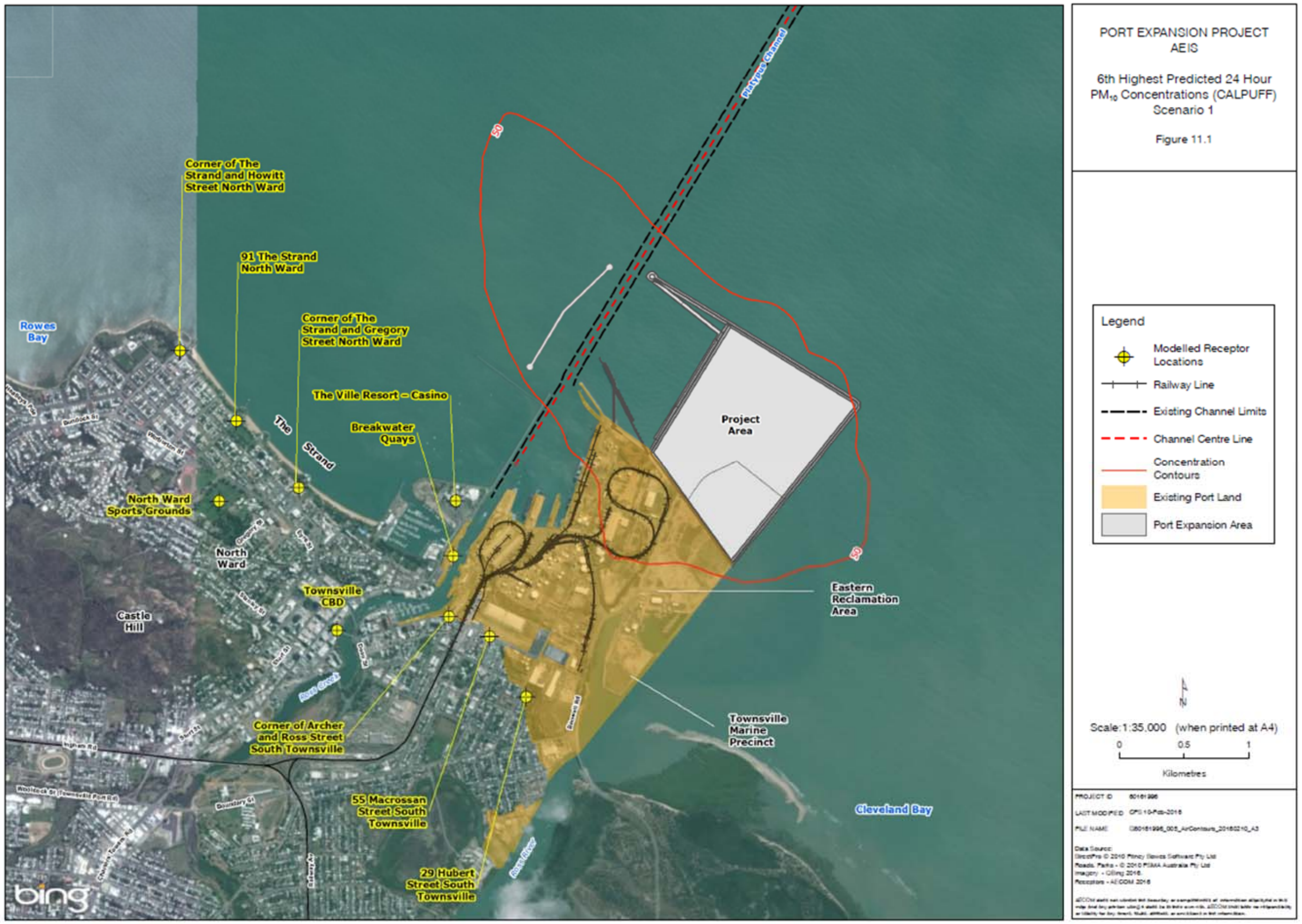

Figure 11.1 6th Highest Predicted 24 Hour PM_{10} Concentrations (CALPUFF) Scenario 1

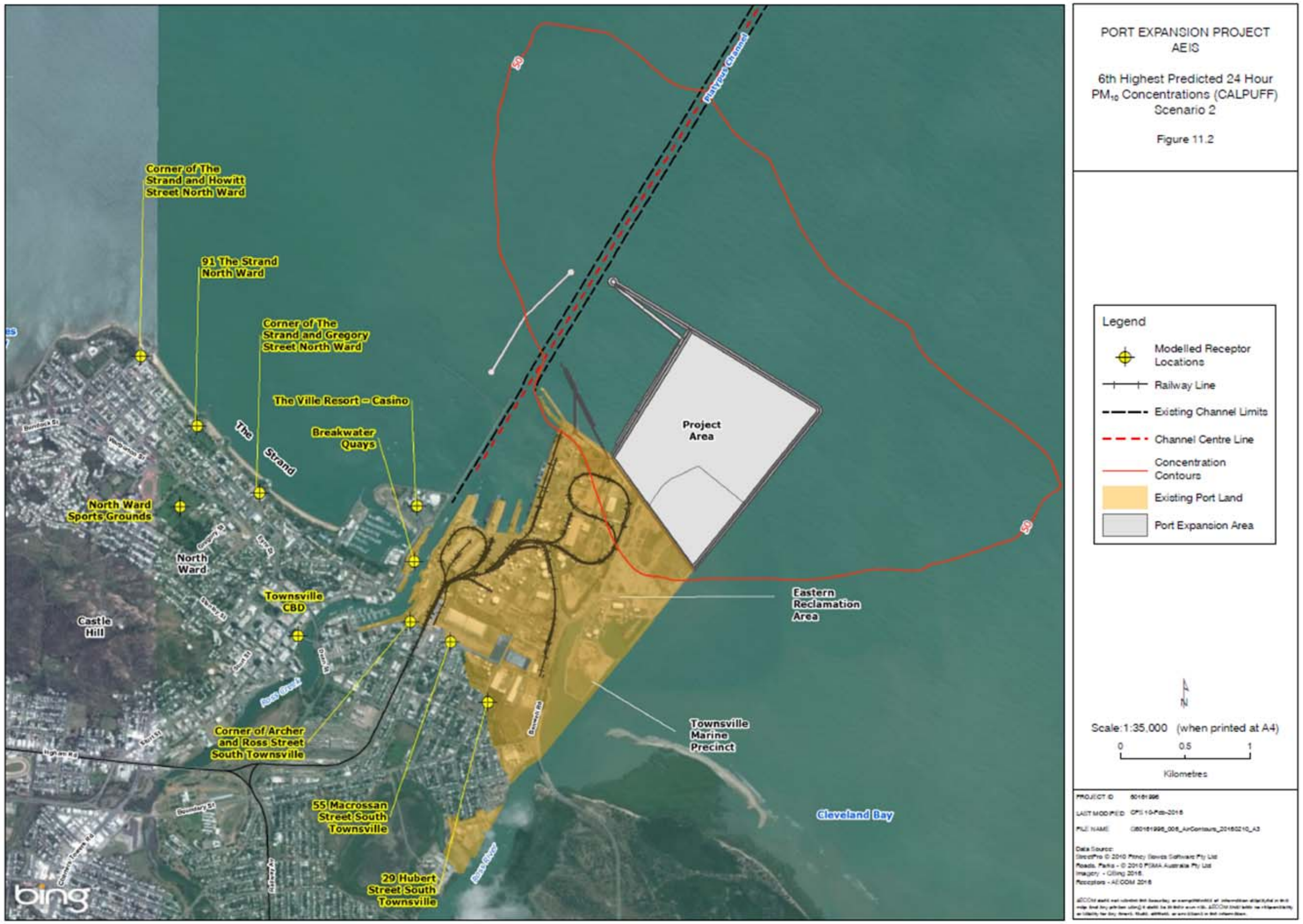

Figure 11.2 6th Highest Predicted 24 Hour PM_{10} Concentrations (CALPUFF) Scenario 2

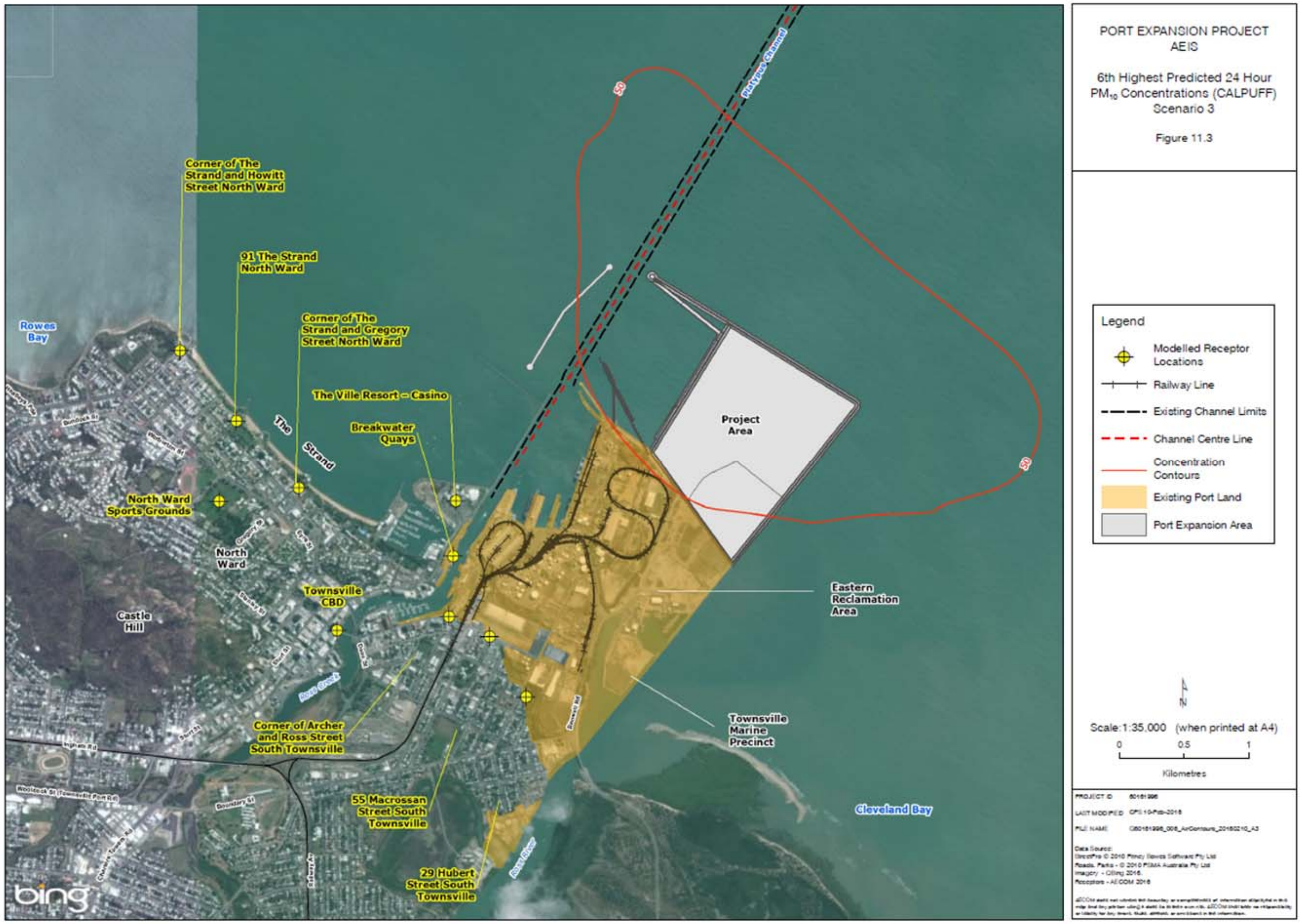

Figure 11.3 6th Highest Predicted 24 Hour PM_{10} Concentrations (CALPUFF) Scenario 3

Particulate and combustion gas emissions from shipping

Dispersion modelling results for shipping emissions for Stage 1, Stage 2 and Stage 3 are presented in Appendix A4. All particulate and combustion gas concentrations were predicted to fall below the respective criteria. The predicted particulate and combustion gas concentrations in Appendix A4 combine emissions from ships berthed at both the existing port and the PEP. Predicted particulate and combustion gas concentrations due to port operations in isolation were well below relevant air quality criteria for all particulate and combustion gases at all sensitive receptors.

Contour plots of predicted 1 hour average NO_2 concentrations for Stage 1, Stage 2 and Stage 3 are also presented in Appendix A4.

Cumulative airshed conditions

This section presents predicted cumulative particulate and combustion gas concentrations at sensitive receptors – i.e. the sum of predicted PEP contribution and the adopted background particulate and combustion gas concentrations discussed in Appendix A4. Background concentrations of particulates and selected combustion gases are based around measurements taken from the Townsville area and are considered to be a reasonable estimation of the existing levels of dust and combustion gases in the Airshed.

Construction dust

Predicted cumulative 24 hour average and annual average PM_{10} concentrations at nearby sensitive receptors are presented in Table 11.6. These values were calculated by adding the adopted 24 hour average background PM_{10} concentration (24.7 μg/m³) to each predicted 24 hour concentrations from the model. Applying a uniform background concentration to each modelled hour is a conservative approach to estimating cumulative impacts.

Table 11.6 Predicted cumulative PM_{10} concentrations at sensitive receptors – Revised PEP

Receptor ID	Predicted Cumulative PM_{10} (μg/m³)					
	6th Highest 24 Hour Average			Annual Average		
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
1 – Casino Top Floor	29.7	29.9	28.7	23.2	23.2	22.7
2 – Casino Floor 6	31.5	31.5	29.6	23.7	23.6	23.1
3 – Casino Floor 3	37.5	37.1	33.5	25.1	24.9	24.1
4 – Archer and Ross	39.4	38.2	35.2	24.4	24.5	23.7
5 – Macrossan	42.6	42.4	40.1	24.9	25.2	24.2
6 – Hubert	38.6	40.5	34.7	23.3	24.0	23.2
7 – Breakwater	36.9	37.8	35.7	24.6	24.5	24.0
8 – CBD	31.4	31.0	29.8	22.8	22.9	22.6
9 – Strand and Gregory	36.6	40.2	36.1	24.0	24.8	23.9
10 – Strand	36.8	39.1	36.1	24.2	24.9	24.1
11 – Strand and Howitt	34.6	40.5	37.0	24.4	25.2	24.3
12 – North Ward	32.6	33.5	31.6	23.1	23.3	22.8
Criteria	50			30		

Long term annual average PM_{10} concentrations were predicted to be below criteria at all sensitive receptors. Short term 24 hour average PM_{10} concentrations were predicted to be below criteria at all sensitive receptors for all modelled scenarios.

Following completion of the reassessment of Air Quality impacts as part of the AEIS, DEHP have advised of a possible reduction in the PM_{10} annual average criteria (following the review and addition of a long term criteria to the Air Quality NEPM). The newly adopted PM_{10} annual average NEPM limit is 25µg/m³. The levels predicted by the AEIS modelling fall below the new NEPM criteria with the exception of two receptors during Stage 2 of construction (exceedance margin of 0.2µg/m³). These minor exceedances shown by the modelling are able to be appropriately managed on ground through the proposed mitigation measures including the site based reactive monitoring program. It should be noted that the Project site based reactive monitoring program will have appropriately set limits to meet relevant legislative standards at the time of each stage.

Predicted cumulative annual average TSP concentrations and dust deposition rates at sensitive receptors are presented in Table 11.7. Cumulative TSP and Dust Deposition values were calculated by adding the adopted annual average background TSP concentration (43.6 μg/m³) and average dust deposition rate (1.4g/m².month) to each relevant predicted concentration from the model. Cumulative impacts were predicted to be well below criteria at all sensitive receptors.

Table 11.7 Predicted cumulative TSP concentrations and dust deposition rates at sensitive receptors – Revised PEP

Receptor ID	Predicted Cumulative Annual Average TSP (µg/m³)			Predicted Cumulative Dust Deposition Rate (g/m²/month)[1]		
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
1 – Casino Top Floor	49.3	49.1	47.6	1.40	1.40	1.40
2 – Casino Floor 6	52.7	50.8	48.9	1.40	1.40	1.40
3 – Casino Floor 3	50.8	54.7	51.9	1.40	1.40	1.40
4 – Archer and Ross	52.2	53.2	50.8	1.44	1.42	1.41
5 – Macrossan	48.2	55.8	52.3	1.44	1.43	1.41
6 – Hubert	51.2	52.0	49.8	1.42	1.41	1.40
7 – Breakwater	47.0	53.2	51.4	1.56	1.44	1.42
8 – CBD	49.8	48.3	47.4	1.42	1.41	1.41
9 – Strand and Gregory	50.2	53.6	51.4	1.43	1.43	1.42
10 – Strand	50.6	54.3	52.2	1.43	1.42	1.42
11 – Strand and Howitt	47.4	54.9	52.3	1.42	1.42	1.42
12 – North Ward	47.4	49.5	48.1	1.42	1.41	1.41
Criteria	90			4		

Shipping emissions

Cumulative impacts of shipping emissions combined with uniform background particulate and combustion gas concentrations are calculated for all scenarios modelled. Predicted cumulative NO_2 concentrations at nearby sensitive receptors are presented in Appendix A4. Short term 1 hour concentrations and long term annual average concentrations are predicted to be below criteria at all sensitive receptors.

11.3.4.2 Mitigation measures

Concentrations at nearby sensitive receptors were predicted to comply with their respective assessment criteria. To achieve this level of compliance, the dispersion modelling assumed a range of active mitigation measures that should be applied as part of any well managed earthworks project. Measures such as road watering, road sealing (where practicable), stockpile management, water sprays, equipment maintenance and windbreaks have been assumed and should be applied to the development to ensure the predicted dust levels are achieved. The mitigation measures recommended in the EIS (Section B.9.5.1) are considered to be sufficient for the revised design. The details of the final distribution and management of these measures will be defined as part of the development of the Construction Environmental Management Plan (Appendix B2) which will be updated prior to construction.

In addition to these active mitigation measures, other passive mitigation options should also be considered, particularly for projects that have a large footprint and recognising the fact that construction projects need to be managed to allow some flexibility in the range of equipment used on site. Passive mitigation refers to measures that indirectly affect the generation of dust, such as reactive monitoring plans that allow the management of the site through the monitoring of the dust that is emitted from the site. The following conceptual reactive monitoring program has been provided as an example of what may be implemented on the PEP development.

Conceptual Reactive Monitoring Program

Where possible, dust-generating activities should be undertaken during the morning when the prevailing winds will typically blow any particulate matter away from receptors. In the afternoon, when the prevailing winds will blow dust from the site towards receptors, additional care should be taken to manage and mitigate emissions through measures outlined above (details such as equipment type, monitoring location and other operational procedures will be further defined in the CEMP).

Where a monitoring system is continuous in nature, trigger levels can be used as an early warning system for the monitoring of ambient air quality impacts on the local environment. The trigger levels are generally set below a relevant assessment criteria to alert staff prior to the concentration reaching the relevant criterion value.

If a trigger level is exceeded, the following reactive management program is to be followed. The program is designed as a three stage approach; Investigate, Action and Stop Work.

- The Investigate stage is designed to identify the issue, the likely reasons and formulate a response should the Action stage be reached.
- The Action stage is designed to implement those measures formulated in the Investigate stage and review their effectiveness.
- Should the Stop Work stage be reached, there is a high likelihood that the criterion may be reached. All works should stop at this stage until the measured levels are below the Action level.

Should the Action trigger level PM_{10} be reached, an investigation should be conducted to determine the source/s of the dust and to evaluate the appropriate measures to be implemented. Measures in addition to those already included, dust control measures may include the following actions:

- increased use of a water cart or water sprays to suppress dust in open areas or roadways
- installation of temporary sheeting to cover localised exposed areas or stockpiles and covering soil stockpiles that will remain on the site for more than 24 hours (where practicable)
- ensuring excavated material is moist at the time of exposure and handling
- consolidation of material stockpiles
- use of chemical dust-suppressants (provided the chemicals do not pose a risk of contamination or an environmental hazard due to proximity to water or an occupational health and safety hazard)
- use of alternative coverings such as hydromulch to stabilise the surface of open disturbed areas
- use of additional dust suppression features on items of dust generating plant and equipment
- covering surfaces where appropriate
- all trucks transporting spoil or fill on the site are to be covered
- ceasing works when works are generating unacceptable dust levels (as defined through the Construction Environmental Management Plan (Appendix B2)).

Table 11.8 provides details of an indicative reactive management program.

Table 11.8 Reactive management program

Trigger Stage	Averaging Period	Trigger Value (µg/m³)	Primary Responsibility	Action Required
Investigate	1-hour	Triggers will be considered on a stage by stage basis depending on the nature of the expected activities.	Identified prior to the commencement of each stage of work.	Undertake review of possible dust sources operating during the average period. Identify possible control measures for these activities, action taken if deemed necessary.
Action	1-hour	Triggers will be considered on a stage by stage basis depending on the nature of the expected activities.	Identified prior to the commencement of each stage of work.	Ensure implementation of the control actions identified in Investigate Stage. Effectiveness of control actions to be reviewed and escalate where appropriate. Identify long-term solutions to dust issues.
Stop Work	1-hour	Triggers will be considered on a stage by stage basis depending on the nature of the expected activities.	Identified prior to the commencement of each stage of work.	Targeted shut down of relevant activities until the measured levels are below the stated Action Stage trigger value.

Trigger Value Calculation

Trigger level calculations are based around actual background monitoring data and as such should be prepared using up-to-date monitoring data immediately prior to the commencement of work. The trigger levels need to be calculated prior to the commencement of the construction works.

The following calculations present a conceptual calculation of trigger levels assuming a background concentration of particulate emissions. Calculations of the trigger level values were based around the objective of remaining below the 24 hour average PM_{10} criterion at the port boundary monitoring location, or other relevant location determined prior to each stage.

The total of all 1 hour average concentrations throughout the day (i.e. the sum of individual 1 hour concentrations) needs to fall below 1200 $\mu g/m^3$ (50 $\mu g/m^3$ x 24 hourly results = 1200 $\mu g/m^3$). The process for calculating the 1 hour trigger levels is discussed below.

The ambient PM_{10} concentration is equal to approximately 25 $\mu g/m^3$ (based on results from the existing monitoring location). Assuming an 11 hour operational day and subsequently, 13 non-operational hours, the maximum daily sum of 1 hour average concentrations was calculated as follows:

- Daily 1 hour average maximum total = 1200 $\mu g/m^3$ – (13 x 25 $\mu g/m^3$) = 875 $\mu g/m^3$

Over the working day, therefore, the 1 hour average concentration should stay below the following value:

- Investigation Trigger Value = 875 μg /m^3 / 11 hours = 80 μg /m^3

In regards to the Action trigger value, the objective is to prevent exceedance of the criterion due to two consecutive elevated 1 hour average results. As calculated above, the allowable daily maximum value of the summed hourly concentrations is 875 μg/m^3. To ensure this value is not exceeded in a two hour period, the Action trigger value is as follows:

- Action Trigger Value = 875 μg /m^3 / 2 hours = 437.5 μg /m^3

The Stop Work criterion represents a concentration whereby the daily assessment criteria will likely be exceeded if this value is exceeded. On this basis, the shutdown value is simply equal to the daily allowed total, resulting in the Stop Work trigger value as follows:

- Stop Work Trigger Value = 875 μg/m^3

11.3.5 Summary

The following Table 11.9 provides a summary of the mitigation measures proposed to reduce impacts of dust and shipping emissions generated by the Project. Mitigation measures will be outlined and implemented through the Construction Environmental Management Plan (refer Appendix B2) and Operational Environmental Management Plans (refer Appendix B3).

It should be noted that the lack of exceedances noted in this report is a direct result of the application of standard mitigation measures rather than an expectation that limited dust will be generated. Should the mitigation measures assumed in the dispersion modelling not be applied, then the level of dust impact would be expected to be much higher and the compliance with criteria cannot be expected.

Table 11.9 Summary of air quality impacts and mitigation measures

Element	Primary Impacting Process	Updated Risk Rating			Mitigation Measures	Mitigated Risk Rating
		Magnitude	Likelihood of impact	Risk Rating		
Shipping emissions leading to degradation of air quality amenity at sensitive receptors.	Construction / Operation	Low	Unlikely	Low	Promote the use of low sulfur fuels when berthing at the port	Low
Increased dust emissions leading to degradation of air quality amenity at sensitive receptors.	Construction	Moderate	Possible	Medium	Implement appropriate dust control measures including: ▪ covering trucks when transporting fill ▪ sealing newly reclaimed land as soon as practicable by vegetation and/ or chemical sealants ▪ use of water sprays on stockpiled or disturbed areas ▪ use of water sprays (water trucks) on trafficked areas to minimised dust generation ▪ implement Reactive Monitoring Program and trigger values.	Low
Increased fuel combustion emissions leading to degradation of air quality amenity at sensitive receptors.	Construction / Operation	Negligible	Almost Certain	Low	Turn engines off while parked on site. Regularly maintain equipment, plant and machinery Implement site speed limits. Reduce haul road lengths. Manage vehicle movement to prevent queuing / idling.	Low

11.4 Conclusion

The air quality impacts associated with the construction of the PEP were reassessed following the refinement of the PEP design and construction staging. The shipping emissions at both the existing port and the PEP were also included in the assessment. Following the redesign of the construction staging, there was a general decrease in the overall dust emissions expected from the Project, leading to a lower predicted dust concentration than those reported in the EIS at sensitive receptors beyond the boundary of the port.

Concentrations of PM_{10} and TSP were predicted to be below the *Environmental Protection (Air) Policy 2008* criteria (established for health and well-being) for all averaging periods, at all modelled sensitive receptors. Dust deposition rates were predicted to be below the criterion for dustfall, also designed for the preservation of the well-being of surrounding areas, at all modelled sensitive receptors. Concentrations of NO_2, SO_2, CO, and $PM_{2.5}$ from shipping emissions were predicted to be below the *Environmental Protection (Air) Policy 2008* criteria (established for health and well-being) for sensitive receptors for both short term and long term averaging periods. The overall risk to health and well-being from shipping emissions was considered to be low.

In order to minimise dust emissions from the PEP construction activities, a range of activity specific and project wide mitigation measures should be implemented. Measures adopted for specific construction activities and the trigger levels defined to ensure the ongoing management of dust from the site should be applied to ensure the compliance with the dust criteria. An Air Quality Management Plan, which outlines mitigation measures and site practices to minimise the generation of dust from the site, particularly during periods where the meteorological conditions are likely to transport the dust off-site, should be prepared and implemented for both the construction and operational periods of the development. All activities on the site should be undertaken with the objective of preventing visible emissions of dust beyond the site boundary. In the event of visible dust emissions occurring at any time, all practicable dust mitigation measures, including cessation of dust-generating works, should be identified and implemented.

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