APPENDIX M

Air quality data

NARROMINE TO NARRABRI ENVIRONMENTAL IMPACT STATEMENT

INLAND RAIL

ARTC

APPENDIX M Air quality data

This appendix provides background data and analysis used to undertake the air quality impact assessment. The results of the assessment are summarised in chapter B10.

Construction impacts

Dust emissions inventory

Dust and particulate matter (PM_{10}, $PM_{2.5}$) was identified as the primary emission to air during the construction of the proposal. Construction tasks with significant potential for the generation of dust include earthworks and the handling and transfer of earth and other material.

Dust emissions from construction activities have been calculated for the following activity classifications:

- construction of rail and road infrastructure
- construction infrastructure – operation of borrow pits
- construction infrastructure - establishment of compounds and temporary workforce accommodation
- construction infrastructure – fixed concrete batching plants at select compounds
- construction infrastructure – mobile concrete batching plants
- construction infrastructure – operation of concrete batching plants at multi-function compounds
- construction infrastructure – vehicle movements on borrow pit access tracks.

Derived emission rates for these construction activities are presented in Table M.1.

Table M.1 Dust emissions inventory

POLLUTANT	EMISSION FACTOR	UNITS	NOTES
Rail and road infrastructure			
PM_{10}	0.11	Tonnes/acre/month	WRAP – Recommended PM_{10} emission factors for construction operations Level 1 (Average conditions).
	9.5E-06	g/m^2/month	
$PM_{2.5}$	0.011	Tonnes/acre/month	$PM_{2.5}$/PM_{10} ratio assumed to be 0.1[1]
	9.5E-07	g/m^2/month	
Construction infrastructure – Operation of borrow pits			
Scenario 1 (maximum throughput) – hourly throughput is based on the maximum borrow pit size (955,000 m³) with an assumed 3 year life, 12-hour work day, and peak activity factor of 2. Equivalent hourly throughput = 363 t/hour. It is assumed that 12 haul trucks will travel a total of 250m on the borrow site per hour. *Scenario 2 (average throughput) - hourly throughput is based on the maximum borrow pit size (481,000 m³) with an assumed 3 year life, 12-hour work day, and peak activity factor of 2. Equivalent hourly throughput = 180 t/hour. It is assumed that approximately 6 haul trucks will travel a total of 250m on the borrow site per hour.*			

POLLUTANT	EMISSION FACTOR	UNITS	NOTES
PM_{10}	4.1	g/s	National Pollutant Inventory (NPI) Emission estimation technique manual for mining version 3.1 (NPI manual) (2012) AP-42 Section 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing. Included is control factor for Level 1 watering (2 L/m2/h) on internal haul roads achieving a 50% reduction in dust generation.
$PM_{2.5}$	0.41	g/s	$PM_{2.5}/PM_{10}$ ratio assumed to be 0.1
Construction infrastructure – Establishment of compounds and temporary workforce accommodation			
PM_{10}	0.11	Tonnes/acre/month	WRAP – Recommended PM_{10} emission factors for construction operations Level 1 (Average conditions).
	9.5E-06	g/m²/month	
$PM_{2.5}$	0.011	Tonnes/acre/month	$PM_{2.5}/PM_{10}$ ratio assumed to be 0.1
	9.5E-07	g/m²/month	
Construction infrastructure – Operation of fixed concrete batching plants at select compounds			
Calculated emission rates are based on a plant throughput of 200 m³/hour, typical concrete source levels and densities, with typical emission controls, and 20m of unpaved roads truck access into site.			
PM_{10}	1.5	g/s	AP42 Compilation of Air Pollutant Emission Factors Section 11.12 - Concrete Batching
$PM_{2.5}$	0.15	g/s	$PM_{2.5}/PM_{10}$ ratio assumed to be 0.1
Construction infrastructure – Operation of mobile concrete batching plants			
Calculated emission rates are based on a plant throughput of 50 m³/hour, typical concrete source levels and densities, with typical emission controls, and 20m of unpaved roads truck access into site.			
PM_{10}	0.38	g/s	AP42 Compilation of Air Pollutant Emission Factors Section 11.12 - Concrete Batching
$PM_{2.5}$	0.38	g/s	$PM_{2.5}/PM_{10}$ ratio assumed to be 0.1
Construction infrastructure – Operation of concrete batching plants at multi-function compounds			
Calculated emission rates are based on a plant throughput of 200 m³/hour, typical concrete source levels and densities, with typical emission controls, and 20m of unpaved roads truck access into site.			
PM_{10}	1.5	g/s	AP42 Compilation of Air Pollutant Emission Factors Section 11.12 - Concrete Batching
$PM_{2.5}$	0.15	g/s	$PM_{2.5}/PM_{10}$ ratio assumed to be 0.1

POLLUTANT	EMISSION FACTOR	UNITS	NOTES
Construction infrastructure – Vehicle movements on borrow pit access tracks			
Heavy traffic movements from borrow pits are estimated at a total of 280 return movements per twelve hour day, for a total of 560 one way movements per day across the four borrow pits. Assuming movements are typically spread evening across all four borrow pits, approximately 12 one-way heavy vehicle movements are expected hourly at each access tack.			
PM_{10}	0.31	g/VKT	National Pollutant Inventory (NPI) Emission estimation technique manual for mining version 3.1 (NPI manual) (2012) - Wheel generated dust from unpaved roads Included is control factor for Level 2 watering (> 2 L/m2/h) achieving a 75% reduction in dust generation.
	0.0001	g/m^2/s	
$PM_{2.5}$	0.031	g/VKT	$PM_{2.5}/PM_{10}$ ratio assumed to be 0.1
	0.00001	g/m^2/s	

Note 1: **$PM_{2.5}/PM_{10}$ ratio assumed to be 0.1** as outlined in Western Regional Air Partnership Fugitive Dust Handbook (WRAP), Countless Environmental, 2006.

Dust dispersion modelling

A screening level assessment was undertaken with consideration of the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005). The 70th percentile background concentrations listed in Table B10 2 of chapter B10 were added to the predicted 24-hour concentrations to assess the total (cumulative) 24-hour impact for both PM_{10} and $PM_{2.5}$. The predicted worst-case 24-hour PM_{10} and $PM_{2.5}$ concentrations for the key activity classifications are shown in Figure M.1 to Figure M.8 as concentration versus distance graphs.

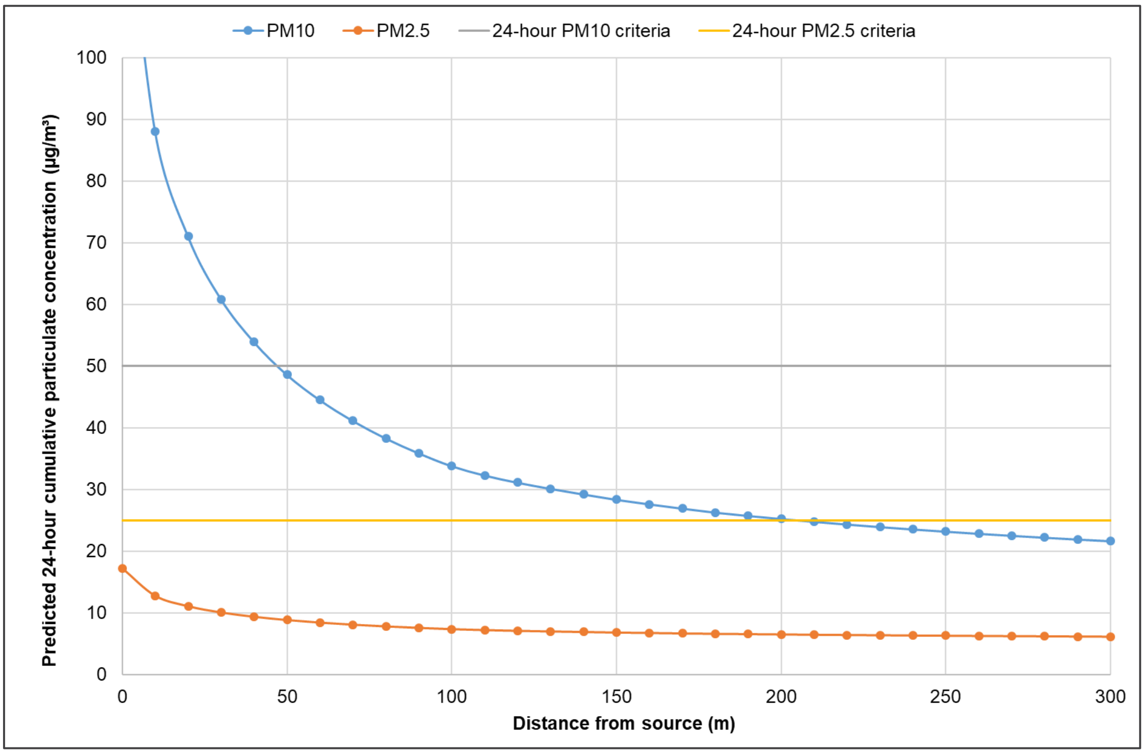

Figure M.1 Dispersion modelling result for rail and road infrastructure construction: Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations

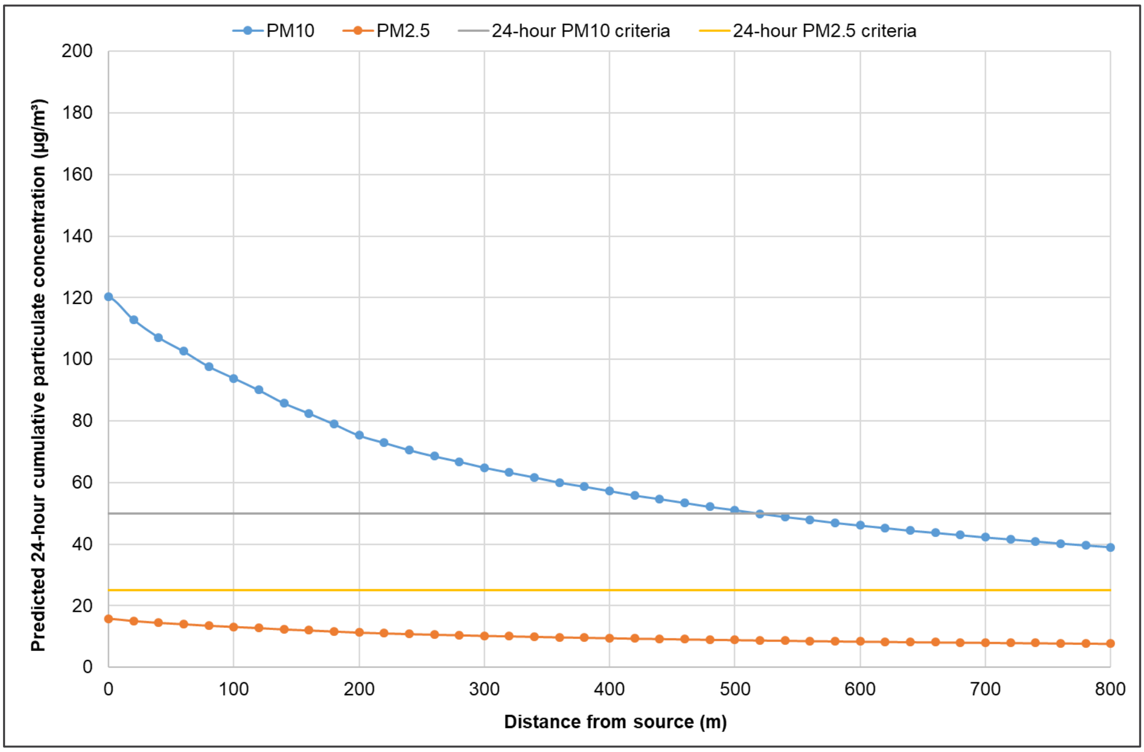

Figure M.2 Dispersion modelling result for operation of borrow pits (scenario 1): Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations

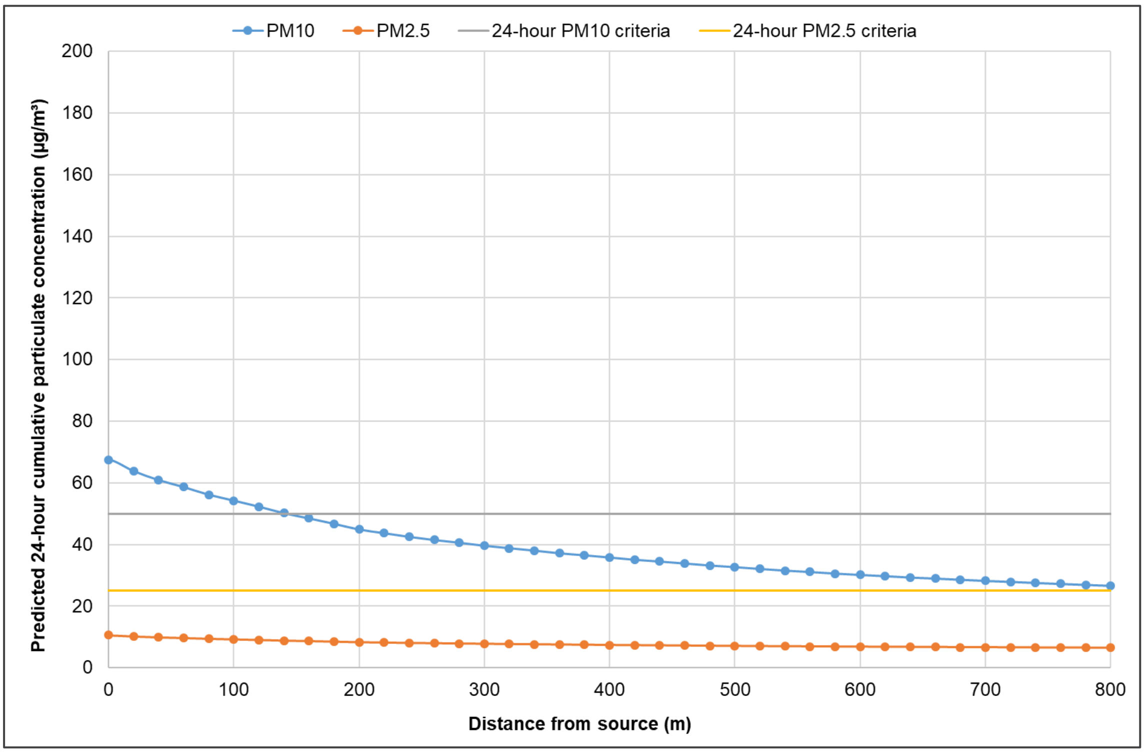

Figure M.3 **Dispersion modelling result for operation of borrow pits (scenario 2): Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations**

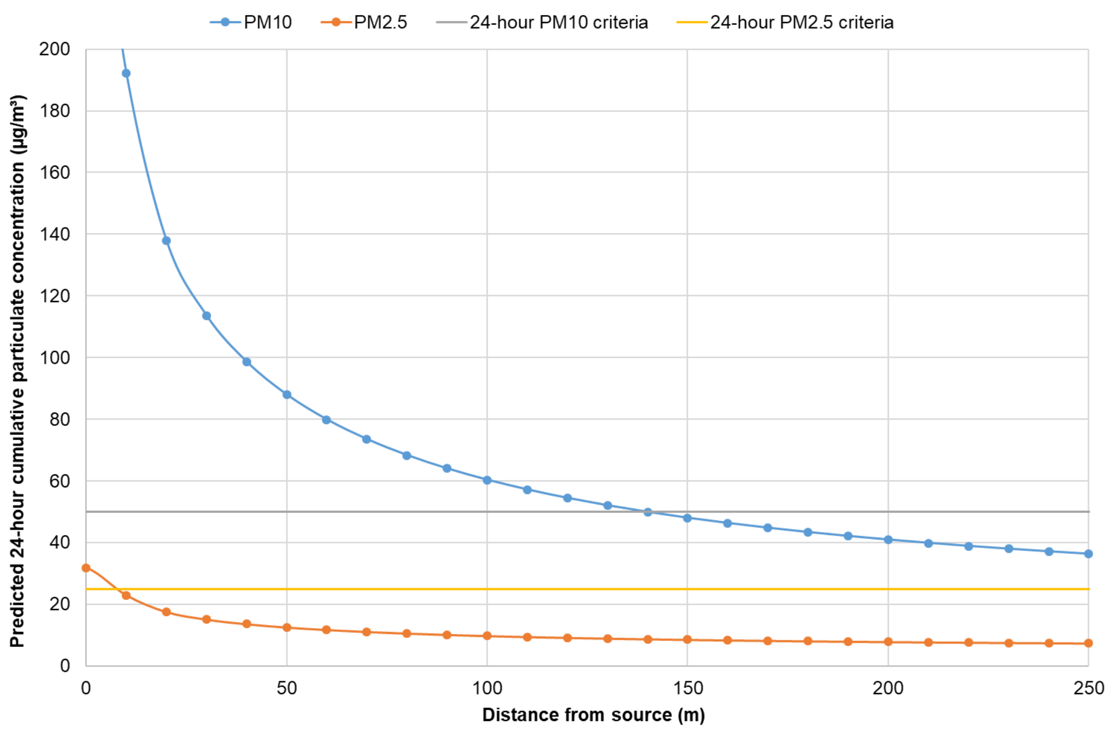

Figure M.4 **Dispersion modelling result for establishment of compounds and temporary workforce accommodation: Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations**

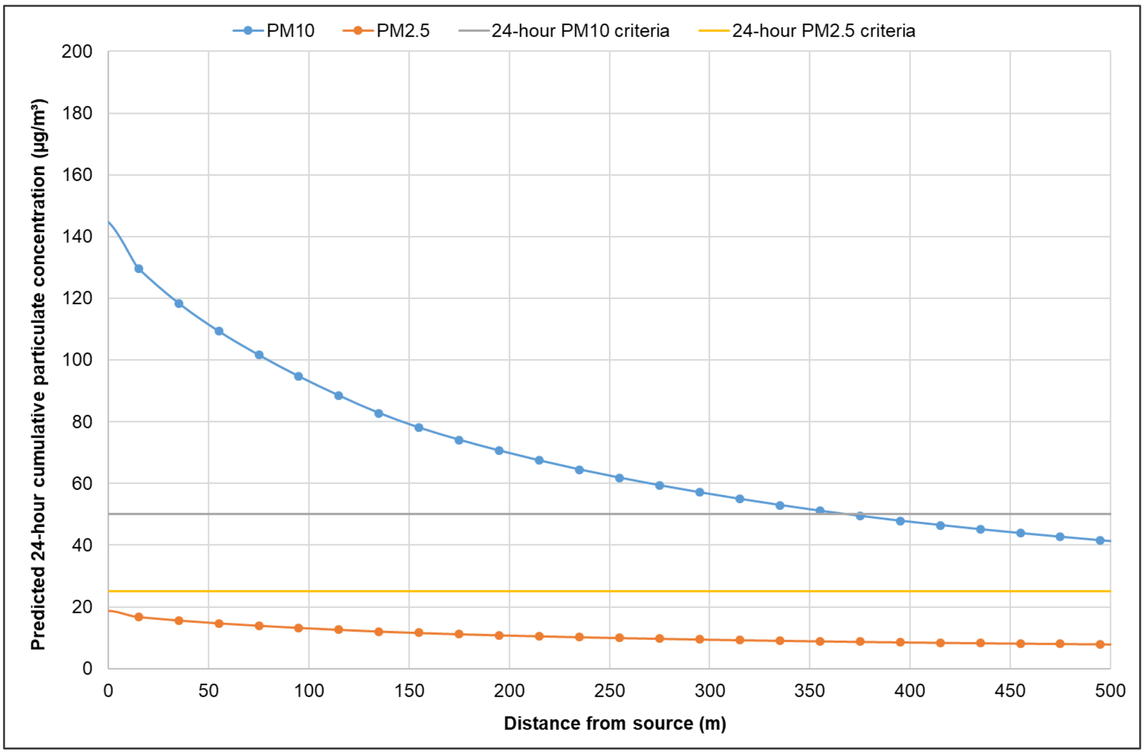

Figure M.5 Dispersion modelling result for concrete batching at multi-function compounds: Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations

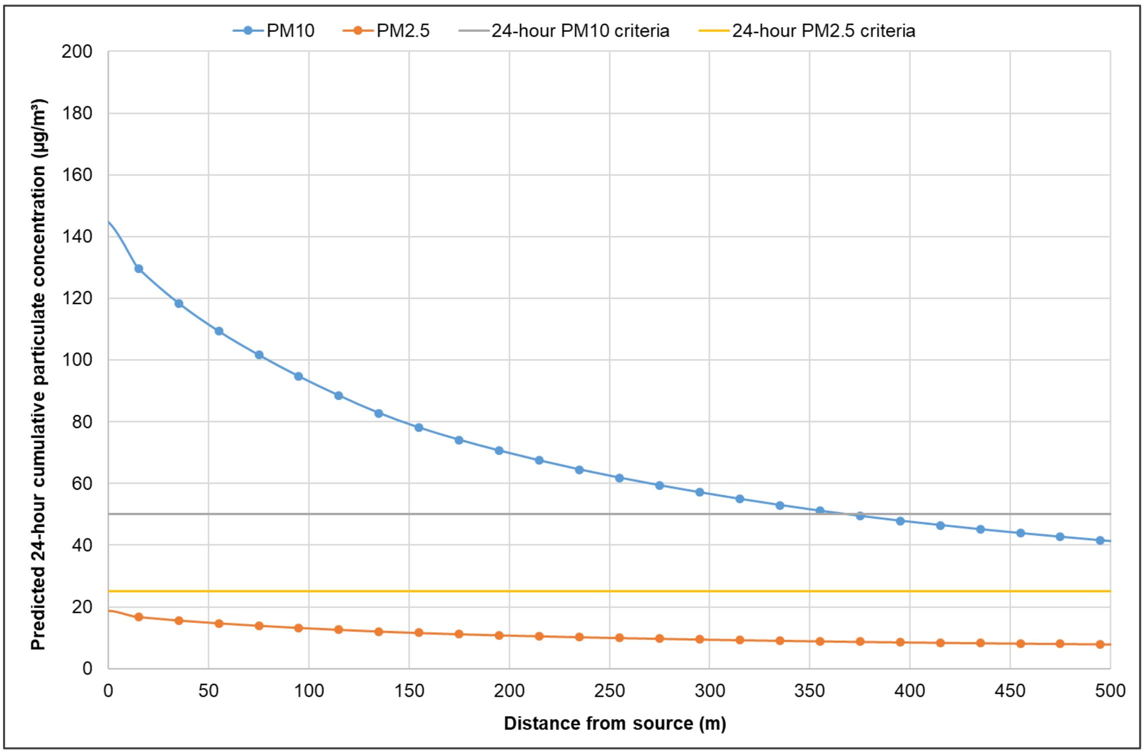

Figure M.6 Dispersion modelling result for fixed concrete batching at select compounds: Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations

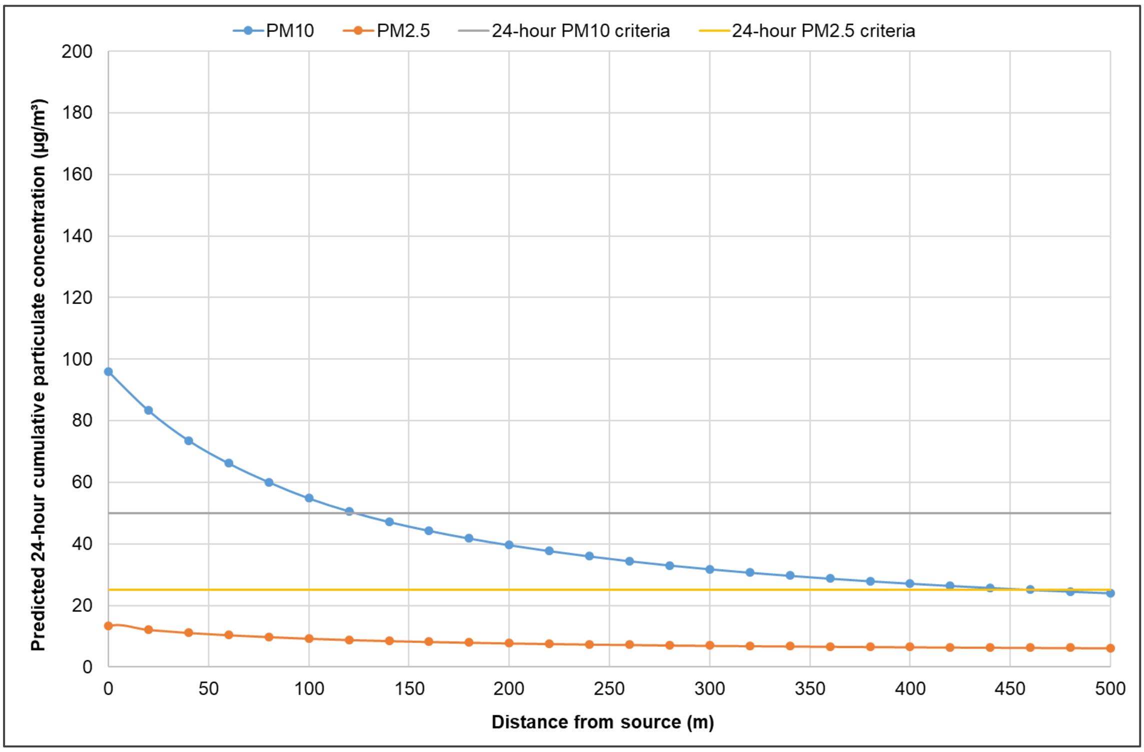

Figure M.7 Dispersion modelling result for mobile concrete batching plants: Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations

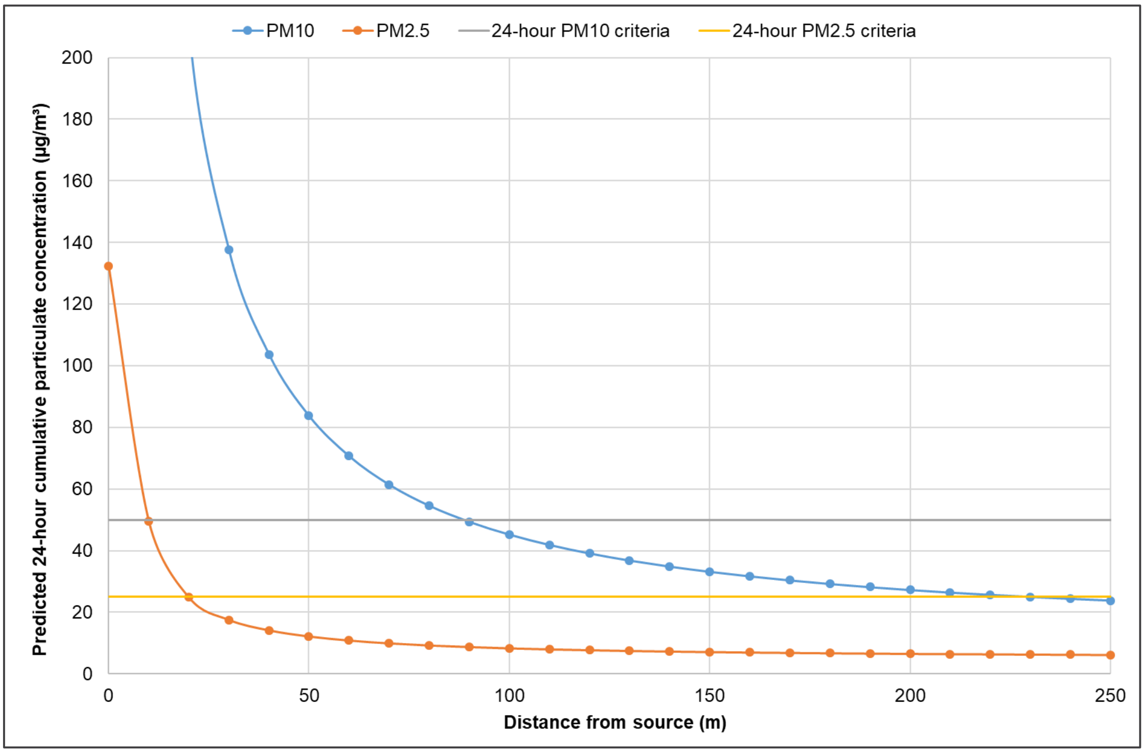

Figure M.8 Dispersion modelling result for borrow pit access tracks: Cumulative PM_{10} and $PM_{2.5}$ ground level concentrations

Operational impacts

Operational emissions inventory

Adopted locomotive emission rates were based on a recent investigation titled *Diesel Locomotive Fuel Efficiency and Emissions Testing: Prepared for NSW EPA* (ABMARC, 2016). The study examined the fuel efficiency and emission performance of two classes of locomotive that are commonly used in NSW freight operations. Data for a 93 class locomotive (9317) was adopted to model crossing loop emission rates.

Emissions at crossing loops are assumed to be equivalent to that of two adjacent locomotives at idle notch. Modelled emission rates for NO_2 are presented in Table M.2.

Table M.2 NO_2 emission rates

POLLUTANT	EMISSION FACTOR	UNITS	NOTES
Rail and road infrastructure			
NO_2	634	g/hr	Diesel Locomotive Fuel Efficiency and Emissions Testing: Prepared for NSW EPA (ABMARC, 2016). Idle notch for two locomotives.
	0.18	g/s	

Operational dispersion modelling

An assessment of potential air quality impacts due to locomotive idling was carried out using AUSPLUME dispersion modelling. The dispersion model configuration is described below:

- Modelled emissions were from a single stack with following parameters:
  - height = 4.5 metres
  - diameter = 0.3 metres
  - temperature = 200 degrees Celsius
  - velocity = 10 m/s.
- Building wake influences were included in the model configuration to account for plume downwash associated with turbulence generated by locomotive structure.

Due to the absence of available NO_2 data at Narrabri it is assumed that concentrations measured at the Gunnedah station are representative of the baseline environment for sensitive receivers across the proposal site. The maximum 1-hour NO_2 background concentration described in Table B10.2 of chapter B10 was added to the predicted 1-hour concentration to assess the total (cumulative) NO_2 impact.

The result of dispersion modelling for train idling at crossing loops is presented in Figure M.9 as a concentration versus distance graph.

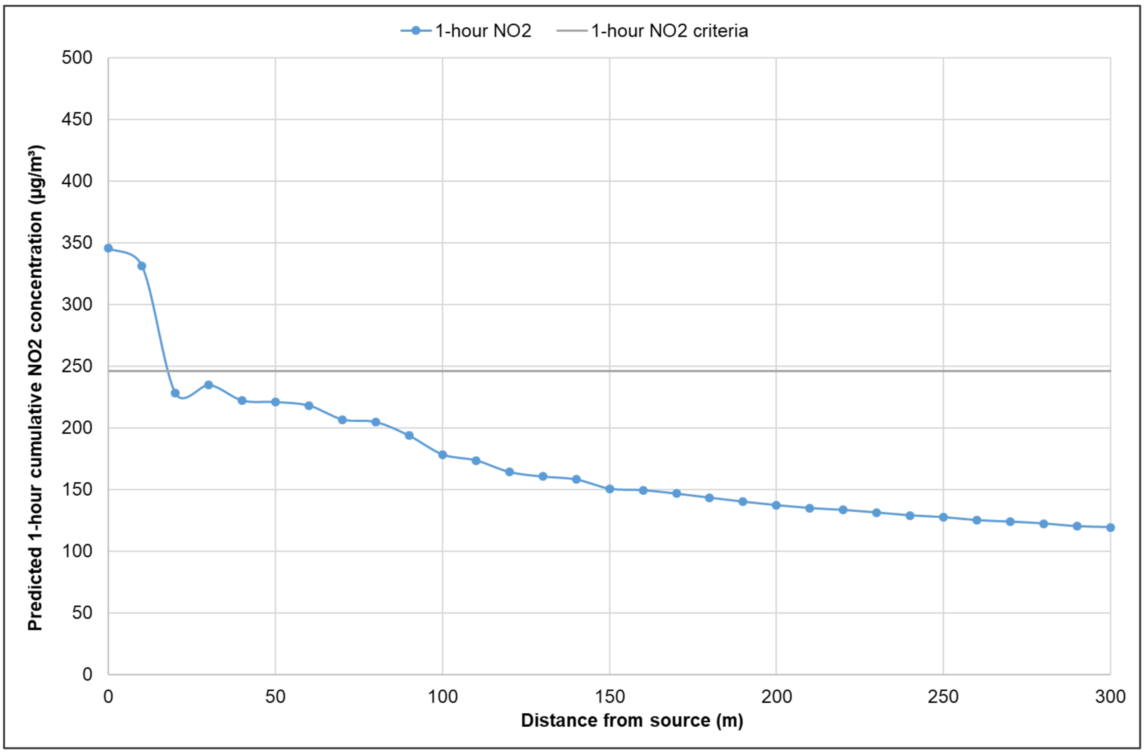

Figure M.9 Dispersion modelling result for locomotives idling at crossing loops: Cumulative NO_2 ground level concentration