6.9 Air Quality

This chapter presents the methodology and results of the construction and operational air quality impact assessment for the proposal. Further detail regarding the methodology and the results for the assessment is provided in Appendix H.

6.9.1 Methodology

Construction Impacts

A semi-quantitative risk assessment of potential dust impacts on surrounding sensitive receptors was carried out for the construction of the proposal. The assessment was based on the methodology described in the UK Institute of Air Quality Management (IAQM) document, *Guidance on the assessment of dust from demolition and construction*.

The IAQM construction dust risk assessment methodology is commonly used both in NSW and other states of Australia to assess potential dust risks associated with proposed road construction projects. The risk of dust soiling and human health impacts due to particulate matter (PM_{10}) on surrounding areas were determined based on the scale of activities and proximity to sensitive receptors. The IAQM method uses a four-step process to assess dust impacts:

- Step 1: Screening based on distance to nearest sensitive receptors
- Step 2: Assessing the risk of dust impacts from construction activities based on:
  - Scale and nature of the works, which determines the potential dust emission magnitude
  - Sensitivity of the area
- Step 3: Determining site-specific mitigation for dust-emitting activities
- Step 4: Reassessing the risk of dust impacts after mitigation has been considered.

Operational Impacts

To assess operational air quality impacts, a Level 1 Screening Assessment was undertaken in accordance with the NSW Approved Methods (EPA 2017) using the Tool for Roadside Air Quality (TRAQ) (Version 1.3) developed by Roads and Maritime.

Traffic forecast data from the traffic modelling for the proposal was used to estimate vehicle emissions to enable the quantification of potential air quality impacts attributed to operation of the proposal. Average Annual Daily Traffic (AADT) volumes forecasted for the design opening year (2026) and 10 years after opening (2036) were used as the basis for the estimate of vehicle emissions for daily average traffic (taking into account the traffic volume, traffic mix, speed, number of lanes and road grade).

Details of the construction and operational impacts from the proposal are provided in Section 6.9.3.

6.9.2 Existing environment

Climate and weather

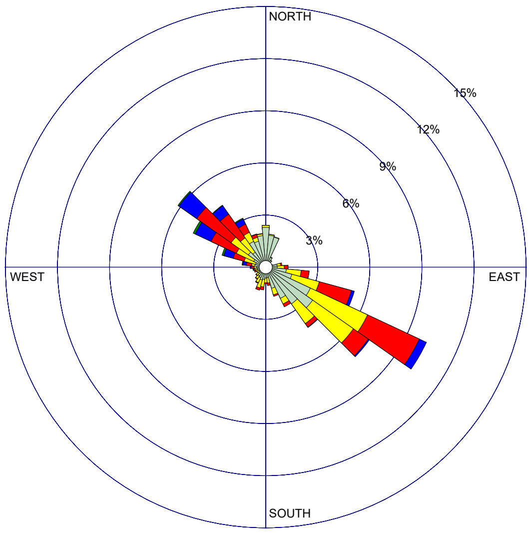
The climate and weather at Singleton are affected by several factors such as terrain and land use. Wind speed and direction are largely affected by topography on a small scale, while factors such as regional scale winds affect wind speed and direction on a larger scale. Wind speed and direction are important variables in assessing potential air quality impacts, as they dictate the direction and distance air pollutants travel.

DPIE operate three ambient air quality monitoring stations in proximity to the proposal area that collect wind speed and wind directional data. DPIE monitoring stations include the:

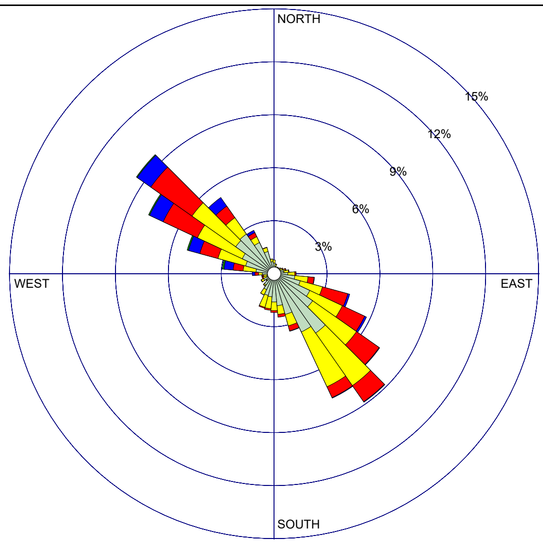
- Singleton north-west station located approximately 900 metres north-east of the northern end of the proposal area
- Singleton station is approximately 1.9 kilometres east of the centre of the proposal area
- Singleton south station approximately 1.5 kilometres east of the southern end of the proposal area.

Annual average wind roses for 2018 at the Singleton north-west, Singleton and Singleton south DPIE monitoring stations are presented individually in Figure 6-27 and in context with their location in Figure 6-28. Annual average wind patterns shown in Figure 6-28 are relatively similar between the three locations, with predominant wind directions from both the north-west and south-east (which follows the axis of the Hunter Valley). Annual average wind speeds are relatively low at all three stations ranging from 2.1 metres per second at Singleton and 2.9 metres per second at Singleton south.

Given the relatively low wind speeds observed at the monitoring stations, there would be the potential for periods during the year when low wind speeds and calm conditions may result in higher pollution levels (as these conditions commonly correspond to poor dispersion conditions). The screening assessment in Section 6.9.3 adopts a conservative approach through the use of unfavourable weather conditions typically not conducive to rapid dispersion of air pollutants. Weather conditions are based on a wind speed of one metre per second, temperature of 15 degrees Celsius and pascal stability class F (typical of stable night time conditions).



Singleton Meteorological Station



Singleton north-west Meteorological Station

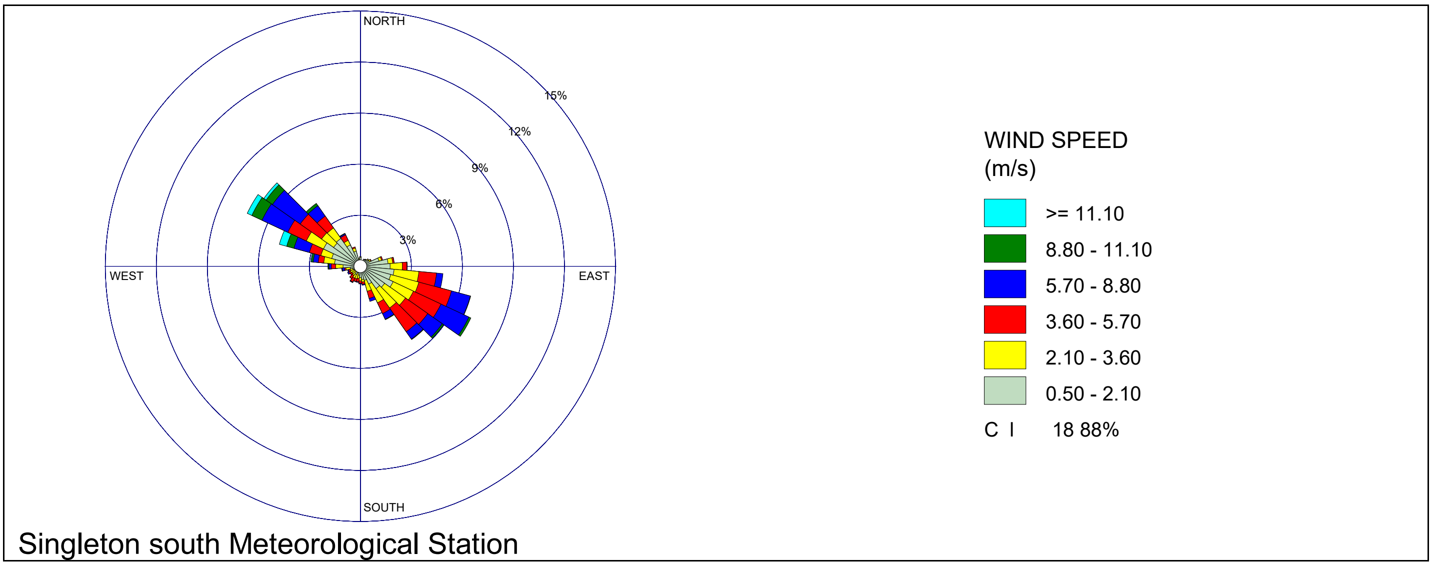


Figure 6-27: Annual 2018 Wind Roses for DPIE Ambient Air Quality Monitoring Stations in the Singleton area (DPIE 2019)

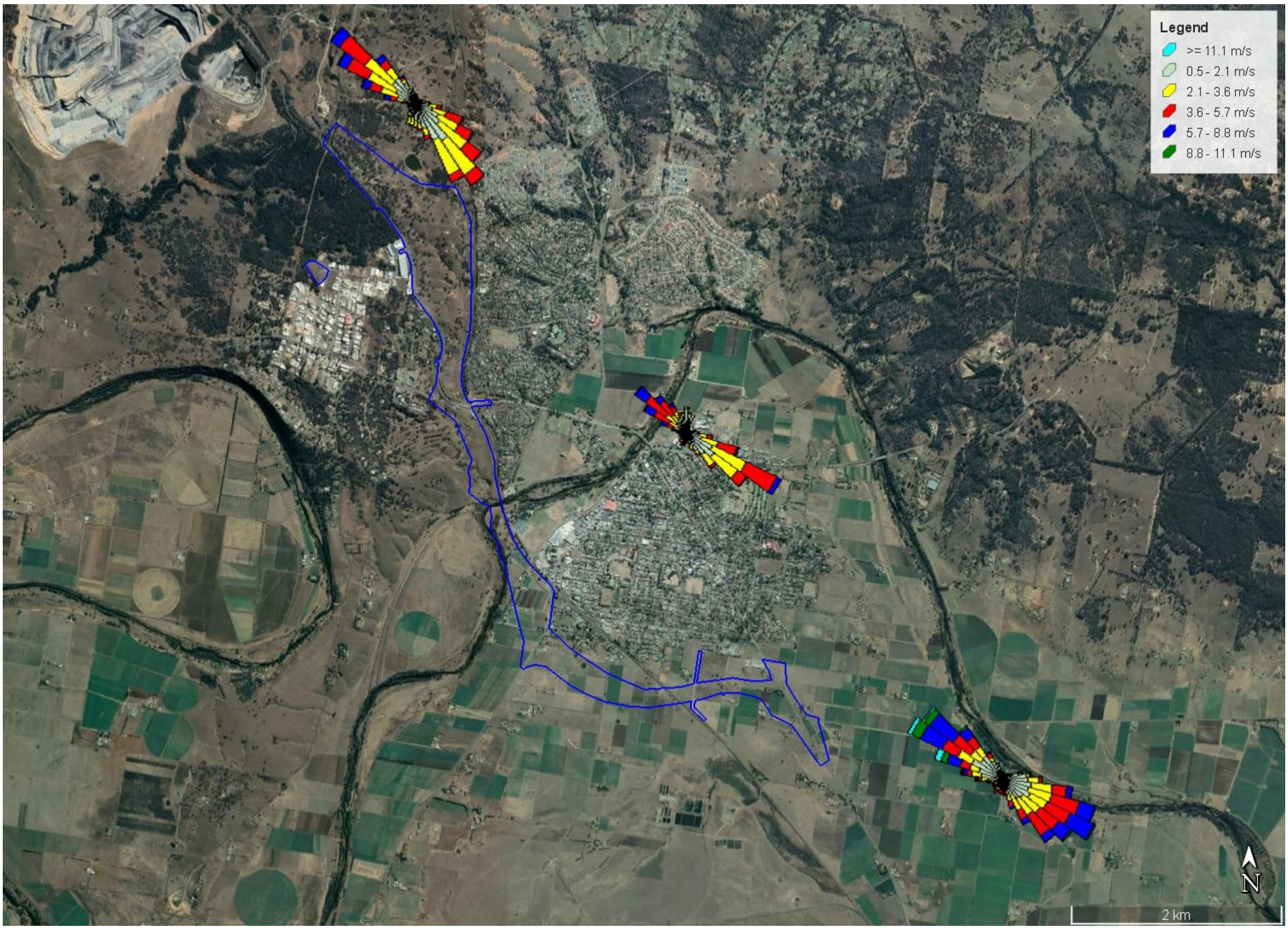


Figure 6-28: Annual 2018 Wind Roses for DPIE Ambient Air Quality Monitoring Stations in the Singleton area (DPIE 2019)

Ambient air quality

Ambient air refers to atmospheric air in its natural state. For ambient air quality within and around the proposal area, pollutants of concern include carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter equal to or less than 10 microns in diameter (PM_{10}).

As shown in Figure 6-28 DPIE operates three ambient air quality monitoring stations which all monitor for PM_{10}. Nitrogen dioxide (NO_2) is also monitored at the Singleton monitoring station. Monitoring data for 2018 at each monitoring station is reported in Table 6-43 against the appropriate ambient air quality criteria as stated under the EPAs *NSW Approved Methods for Modelling and Assessment of Air Pollutants* (EPA 2017) for the appropriate averaging periods. Table 6-43 also reports the 90th percentile concentration for NO_2 and PM_{10} as TRAQ utilises 90th percentile background data to calculate potential cumulative impacts from vehicle emissions and is discussed in Section 6.9.3. In the absence of local CO data at Singleton, default CO background concentrations from the Roads and Maritime TRAQ database have been used in this assessment.

Table 6-43 shows that both the 1-hour maximum and annual average NO_2 concentrations recorded at the Singleton station for 2018 were under the relevant EPA criteria. The PM_{10} 24 hour maximum concentrations were well above the EPA criterion at all stations in the Singleton area. These concentrations are attributed to dust storms occurring in November 2018, however the 90th percentile concentrations used in TRAQ are below the maximum 24 hour EPA criterion at all stations. Annual average PM_{10} concentrations for the area were above the criterion at Singleton north-west. This is likely to be attributed to mining activities occurring to the north-west of the monitoring station. Annual average PM_{10} concentrations recorded at Singleton and Singleton south monitoring stations were just below the criterion.

Table 6-43: 2018 Ambient Air Quality Data at EPA Monitoring Stations at Singleton, NSW (EPA 2019)

Pollutant	Averaging Period	Concentration (µg/m^3)$_1$			EPA Criteria (µg/m^3)
		Singleton	Singleton north-west	Singleton south	
NO_2	1 hour (Maximum)	71.8	No data	No data	246.0
	1 hour (90th Percentile)	34.9	No data	No data	Not applicable
	Annual Average	15.9	No data	No data	68.0
PM_{10}	24 hour (Maximum)	192.8	195.5	183.3	50.0
	24 hour (90th Percentile)	37.5	46.3	37.0	Not applicable
	Annual Average	24.0	26.8	23.0	25.0

$_1$ µg/m^3 refers to micrograms per cubic metre

The assessment of particulates from the TRAQ model is limited to the assessment of PM_{10} emissions. This excludes an analysis of particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$) which forms the finer proportion of atmospheric PM_{10} and given their size are able to travel further and generally persist for longer in the atmosphere.

The Upper Hunter Valley Fine Particle Characterisation Study (Hibberd et al. 2013) carried out in 2012 identified the main contributing sources of $PM_{2.5}$ at Singleton and identified both vehicles and industry contributed about 17 per cent (plus or minus two per cent) of annual $PM_{2.5}$ emissions. Soil dust and fugitive coal dust also contributed about 12 per cent (plus or minus two per cent) of annual $PM_{2.5}$ emissions at Singleton. Other major sources of $PM_{2.5}$ included secondary ammonium sulphate and pollutant aged sea-salt.

The DPIE Singleton station monitors ambient $PM_{2.5}$ concentrations. The maximum 24 hour $PM_{2.5}$ concentration for 2018 was 19.2 µg/m^3 which is below the 24 hour EPA criterion of 25 µg/m^3. The annual average concentration for 2018 however was found to be just above the EPA annual criterion of 8 µg/m^3 recorded at 8.1 µg/m^3.

Sensitive receptors and land use

The land use surrounding the proposal is mainly rural and residential. Areas of higher density residential include Singleton Heights, Darlington and Singleton, with the majority of sensitive receptors lying to the east of the proposal and divided by the Main North railway line. The residential area contains a mix of sensitive land uses including houses, schools, retirement homes and sporting fields. There is also an industrial development located to the west of the proposal at McDougalls Hill, as well as low density residential areas and a caravan park.

The TRAQ model calculates pollutant concentrations directly downwind of vehicle emissions from the road at pre-specified distances. Typically, the nearest sensitive or commercial receptor is located at least 10 metres or more from the kerb of the road. For this assessment the modelled concentrations directly downwind of the proposal have been modelled at discrete receptor locations at the kerb as well as 10 metres, 20 meters, 30 metres and 50 metres from the kerb.

6.9.3 Potential impacts

Construction Impacts

Step 1: Screening Assessment

The IAQM method recommends assessment of dust impacts for construction activities where sensitive receptors are located closer than:

- 350 metres from the boundary of the proposal
- 50 metres from the routes used by construction vehicles on public roads, up to 500 metres from the site entrance.

There are a number of sensitive receptors located within 350 metres of the proposal area and therefore further assessment of dust impacts was carried out for the proposal.

Step 2: Risk Assessment of Unmitigated Impacts

Step 2A: Dust Emission Magnitude

Under the IAQM methodology, dust emission magnitudes are estimated according to the scale of works being carried out and other considerations such as meteorology, types of material being used, or general construction methodology. The IAQM guidance provides examples to aid classification and is presented in Appendix H. The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large.

Potential dust emission magnitudes for the proposal were estimated based on the indicative construction work methodology described in Section 3.3 and presented in Appendix H. Potential dust generating activities and associated magnitude are included in Table 6-44.

Table 6-44: Dust Emissions Magnitude

Activity	Potential Dust Generating Activities	Magnitude
Demolition	• A number of buildings on acquired properties would require removal within the proposal area. Progressive demolition of building structures would occur using modified excavators. Details regarding building removal and demolition works are detailed in Section 3.3.1.	Large
Earthworks	• Large scale earthworks would be required as part of the proposal with the majority of earthworks associated with filling for the new road and embankments. The estimated quantities of materials associated with earthworks are provided in Table 3-6 • Other earthworks would be associated with utility adjustment or relocation, including electricity, water and sewerage, gas and telecommunications and landscaping works • Stockpiling would occur at the Waterworks Lane, Gowrie Gates and Northern connection construction sites • A number of heavy earth moving vehicles would be required during earthworks. An indicative list of plant and equipment is provided in Section 3.3.3.	Large
Construction	• Large construction footprint area as shown in Figure 3-2 to Figure 3-6. Construction activities are described in detail in Section 3.1 but include construction of about eight kilometres of new highway; bridges, connections to existing road infrastructure, utility adjustments or relocation, drainage infrastructure and urban design and landscaping works • A number of ancillary facilities would also be constructed including construction compounds and laydown/stockpiling areas as described in Section 3.4 • A number of dust generating materials would be required for construction including aggregates, sand, concrete and fly ash • A range of plant and equipment would be used during construction. An indicative list of plant and equipment is provided in Section 3.3.3	Large
Construction traffic	• Construction of the proposal would generate a large number of light and heavy vehicles movements. Estimated heavy vehicle movements are shown in Table 3-7 • Construction vehicle activities include the movement of construction workers, delivery of construction materials; spoil movement and waste removal and delivery of construction equipment and machinery • Temporary access roads would be built to facilitate the movements of construction vehicles and construction materials to key construction work areas for bridges and bypass connection points within the proposal footprint. Construction vehicle and light vehicle access routes are shown in Figure 3-2 to Figure 3-6.	Large

Step 2B: Sensitivity of the Surrounding Area

The IAQM methodology defines the sensitivity of the area to dust impacts, as low, medium or high sensitivity. This sensitivity takes into account a number of factors including the specific sensitivities of receptors in the area, the proximity and number of receptors, local background concentrations of PM_{10} and site-specific factors including if there are natural shelters to reduce the risk of wind-blown dust.

Surrounding vegetation primarily includes roadside vegetation and pasture within 100 metres from the bulk of dust-emitting activities likely to take place. However, the northern portion of the proposal area is adjacent to an ecologically endangered community (EEC) as described in Section 6.1.2.

High levels of dust deposition on vegetation have the potential to reduce photosynthesis in plants due to shading of the upper leaves. This ecological impact is typically observed upwards of seven grams of dust per metre square of leaf surface. An extremely high amount of dust deposition from construction works would be required before ecological effects from the proposal were observed, particularly given the cumulative EPA dust deposition criteria in NSW is four grams per metre square per month. As such dust deposition from construction impacts on surrounding ecological communities is likely to be negligible. The classifications are determined according to matrix tables provided in the IAQM guidance document. Individual matrix tables for dust soiling and human health impacts are provided. Factors used to determine the sensitivity of the surrounding area are described as follows:

- Receptor sensitivity (for individual receptors):
  - High sensitivity are locations where members of the public are likely to be exposed to elevated concentrations of PM_{10} for eight hours or more in a day. For example private residences, hospitals, schools, or aged care homes
  - Medium sensitivity include places of work where exposure is likely to be eight hours or more in a day
  - Low sensitivity are locations where exposure is transient, one or two hours maximum. For example parks, footpaths, shopping streets, and playing fields.
- Ambient annual mean PM_{10} concentrations (only applicable to the human health impact matrix)
- Number of receptors in the area (categorised as one to 10, 10 to 100 or greater than 100)
- Proximity of receptors to dust sources based on radii of 20 metres, 50 metres 100 metres and 350 metres from the source.

Sensitivity of the area surrounding the proposal was estimated according to the IAQM guidance. The overall sensitivity of the potential receivers to both dust and human health impacts is classified as high, based on the following factors in Table 6-45.

Table 6-45: Sensitivity of the Area with Accordance with the IAQM

Potential Impact	Sensitivity of the Area	Justification
Dust Soiling	High	• Greater than 100 high-sensitivity receptors (residential) within 50 metres of construction activities.
Human Health (PM_{10})	High	• Greater than 100 high-sensitivity receptors (residential) within 50 metres of construction activities • Annual average PM_{10} concentration in the Singleton area between 23 $\mu g/m^3$ and 26.8 $\mu g/m^3$ which is either just below or above the EPA criterion of 25 $\mu g/m^3$.

Step 2C: Unmitigated Risks of Impacts

The dust emission magnitudes for each activity were combined with the sensitivity of the area to determine the risk of construction dust air quality impacts, with no mitigation applied. The risk of impacts for each activity was assessed according to the IAQM risk matrix methodology.

The outcome of the semi-quantitative air quality risk assessment indicates that the unmitigated air quality impacts from the construction phase of the proposal described in Table 6-44 pose a high risk for both dust soiling and human health impacts within 50 metres to the proposal. The majority of residential receptors are situated over 50 metres from the proposal and would have a medium to low risk given their offset distance from the proposal.

Step 3: Mitigation Strategies

A range of mitigation strategies aimed at reducing the likelihood of air quality impacts to offsite sensitive receptors were identified (refer to Section 6.9.4). These mitigation strategies should be considered for all work elements of the proposal.

Step 4: Reassessment

The final step of the IAQM methodology is to determine whether there are significant residual impacts, post mitigation, arising from the proposal. The guidance states:

*"*For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'."

It is anticipated that with the implementation of the recommended mitigation strategies provided in Section 6.9.4, the residual effect (impacts) of the proposal would be 'not significant' at all locations for both dust soiling and human health impacts.

Operational Impacts

Traffic Forecast Data

Traffic movements on the proposed Singleton bypass have the potential to result in motor vehicle emissions from fuel combustion, fluid evaporation, brake and tyre wear, and re-suspended road dust. Emissions from motor vehicles would comprise mainly hydrocarbons, CO, NO_x and PM_{10}.

Traffic activity including the number of vehicles, the vehicle type mix and vehicle speeds can directly influence the near roadside air pollutant concentrations. Vehicle emissions would vary based on the vehicle type mix or ratio of light to heavy vehicles, fuel type mix (for example, petrol and diesel), and the distribution of vehicles by age of manufacture. Traffic forecast data as detailed in the traffic and transport chapter of this REF have been used to estimate vehicle emissions and to quantify air quality impacts attributed to operation of the proposal.

AADT volumes including vehicle type mix, were forecast for the design opening year (2026) and 10 years after opening (2036). The traffic data was then used to estimate vehicle emissions for daily average traffic taking into account the traffic volume, vehicle mix, speed, number of lanes and road grade. Peak hourly traffic speed has been based on average estimated afternoon peak traffic volumes. The proposed road grades would vary throughout the proposal between negative six per cent and five per cent. For each section of road modelled the highest grade has been adopted as a conservative measure. The traffic data used for this assessment is provided in Appendix I.

Potential reductions in traffic numbers along local roads within the Singleton area as a result of the proposal have not been quantified as part of this assessment. Operation of the proposal would reduce traffic numbers; including heavy vehicles through Singleton, improving both traffic flow and travel times.

The reduction in both vehicle numbers and congestion would potentially result in a reduction in vehicle emissions and associated ground level concentrations.

Dispersion Calculation

For the purpose of this assessment a Level 1 Screening Assessment has been carried out in accordance with the Approved Methods using the Tool for Roadside Air Quality (TRAQ) (Version 1.3) developed by Roads and Maritime. Air emissions from key sections along the proposal that would experience changes in traffic have been generated using the total traffic volume with percentages of vehicles in each age bracket and type category. Road grade and speed information was also included in the calculations.

Vehicle emission factors from the World Road Association, referred to as PIARC (formerly the Permanent International Association of Road Congress) are used by TRAQ to estimate emissions from relevant roads in the vicinity of Singleton bypass. In 2004, PIARC (2004) published a document with comprehensive vehicle emissions factors for different road gradients, vehicle speeds and for vehicles conforming to different European emission standards. The emission data in TRAQ have been modified to take into account the age, vehicle mix and emission control technology of the Australian vehicle fleet using DPIE data.

To assess air quality impacts it is necessary to have information on existing pollutant levels in the area in which the proposal would be likely to contribute to these levels. TRAQ provides 90th percentile background data for CO (one hour and eight hour), NO_2 (one hour) and PM_{10} (24 hour) in the Lower Hunter as well as annual averages. In the absence of local data at Singleton for CO (one and eight hour) 90th percentile, background concentrations for the Lower Hunter have been adopted for CO for this assessment. Local air quality data for NO_2 and PM_{10} has been identified and discussed in Section 6.9.2. This data has been added to the TRAQ background air quality database and incorporated into the dispersion model.

Carbon Monoxide

Predicted 2026 and 2036 incremental and cumulative maximum one hour and eight hour CO concentrations are presented in Appendix H and show that predicted CO concentrations comply with EPA criteria both incrementally and cumulatively for 2026 and 2036.

Nitrogen Dioxide

Predicted 2026 and 2036 incremental and cumulative maximum one hour and annual average NO_2 concentrations are presented in Appendix H and show that predicted NO_2 concentrations comply with EPA criteria both incrementally and cumulatively for 2026 and 2036.

Particulate Matter

Predicted 2026 and 2036 incremental and cumulative maximum 24-hour and annual average PM_{10} concentrations are presented in Appendix H and indicates the potential for maximum 24 hour average exceedances along the main alignment of the proposal. Predicted cumulative exceedances are limited to the area within 20 metres of the proposed kerb. It should be noted however that predicted exceedances are largely due to existing high background concentrations:

- Background data from the Singleton north-west station has been used for the calculation of all cumulative concentrations. Singleton north-west station has higher particulate concentrations than the other two stations due to the proximity of nearby mining activities and as such the use of this station provide a worst case indication (and potentially over-conservative) of background particulate concentration
- Predicted emission concentrations take into account both the emissions that come out of a car on a cold morning whilst it is warming up and worst case meteorological conditions typical of winter nights. The steepest (positive) road grade recorded within each section of the alignment was also assumed for

each model run. These assumptions are also considered worst case and result in a conservative estimation of the pollutant concentrations.

The predicted cumulative exceedances of the annual average criterion are largely attributed to the high background concentrations observed at the Singleton north-west station that recorded higher particulate concentrations than the other two stations due to the proximity of nearby mining activities (refer to Appendix H for further information).

Further analysis of the worst case incremental PM_{10} impacts attributed to the proposal identify that:

- Worst case predicted 24 hour PM10 concentrations occur at the kerb before the exit ramp to Singleton at the southern connection which contributes 30 per cent (2026) to 32 per cent (2036) of the EPA criterion. The contribution of the proposal to the exceedance decreases with distance contributing 12 per cent (2026) to 13 per cent (2036) of the criteria at a distance of 10 metres from the kerb and five per cent (2026) to six per cent (2036) by 50 metres. It also should be noted that only minor changes to the existing alignment of the New England Highway at the southern connection are proposed an as such no significant incremental increases to PM10 concentrations at sensitive receptors are anticipated
- All other modelled sections of the proposal alignment worst case predicted 24 hour PM10 concentrations attributed 10 per cent (2026) to 11 per cent (2036) or less of the criterion at a distance of 10 metres from the kerb and under five per cent (2016 and 2036) by 50 metres. The highest incremental concentrations were generally found to occur along the main alignment of the proposal. Predicted incremental impacts at Magpie Street, Gowrie Gates, Putty Road and the southern connection were below three per cent of the criterion 10 metres from the kerb for 2026 and 2036
- Worst case predicted annual average PM10 concentrations occur at the kerb before the exit ramp to Singleton; contributing 24 per cent (2026) to 26 per cent (2036) of the EPA criterion. The contribution of the proposal decreases with distance to 10 per cent (2026 and 2036) of the criteria at a distance of 10 metres from the kerb and four per cent (2026 and 2036) by 50 metres
- All other modelled sections of the alignment worst case predicted annual average PM10 concentrations attributed less than 10 per cent (2026 and 2036) of the criterion at a distance of 10 metres from the kerb and under five per cent (2016 and 2036) by 50 metres. The highest incremental concentrations were generally found to occur along the main alignment. Predicted incremental impacts at Magpie Street, Gowrie Gate, Putty Road and Singleton entry and exit ramps and southbound traffic to the New England Highway were below three per cent of the criterion 10 metres from the kerb for 2026 and 2036.

Worst case incremental PM10 impacts are provided in full in Appendix H.

Based on the analysis above it is evident that the worst case predicted incremental contributions from the proposal are smaller than the existing background concentrations within the area. Both 24 hour PM10 and annual average contributions for most sections of the alignment were found to make up approximately 10 per cent or less of the criteria; with the incremental contributions further decreasing with distance from the kerb.

As discussed in Section 6.9.2 the TRAQ is limited to the assessment of PM10 emissions. PM10 emissions from vehicles however are predominantly made up of the finer PM2.5 particle fraction (about 95 percent). To enable an estimate of potential PM2.5 impacts, predicted PM10 have been scaled to provide an indicative estimate of PM2.5 contributions from the proposal (refer to Appendix H).

Based on the assumption that 95 per cent of PM10 emissions are PM2.5 the worst case predicted incremental 24 hour PM2.5 concentration of 14.3 µg/m3 for 2026, and 15.5 µg/m3 for 2036 occurred at the kerb before the exit ramp to Singleton at the southern connection. The proposal contribution decreases with distance with 5.8 µg/m3 (2026) and 6.1 µg/m3 (2036) at 10 metres from the kerb and 2.6 µg/m3 (2026) and 2.7 µg/m3 (2036) 50 metres from the kerb.

When accounting for the maximum recorded 24 hour concentration at Singleton for 2018 of 19.2 µg/m3 the worst case predicted incremental 24 hour PM2.5 concentration at 10 metres from the kerb was equal to the 24 hour EPA criterion (25 µg/m3) for 2026 and just above the criterion for 2036. Predicted 24 hour average cumulative concentrations of PM2.5 were compliant with the EPA criteria at a distance of 20 metres or greater from the kerb before the exit ramp at the southern connection. As discussed above however only minor changes to the existing alignment on this section of road are proposed as such no significant incremental increases to PM10 concentrations at sensitive receptors are anticipated. All other sections of the alignment were compliant the 24 hour EPA criterion (25 µg/m3) at 10 metres from the kerb and beyond.

The existing annual average PM2.5 concentration recorded at Singleton for 2018 was 8.1 µg/m3; just above the 8.0 µg/m3 EPA criterion. Therefore the incremental contribution from the project has been reviewed in isolation. The worst case predicted annual average PM2.5 concentration of 5.8 µg/m3 for the year 2026 and 6.2 µg/m3 for the year 2036 occurred at the kerb before the exit ramp to Singleton. The contribution of the proposal decreased with distance with 2.3 µg/m3 (2026) and 2.5 µg/m3 (2036) at 10 metres from the kerb and 1.0 µg/m3 (2026 and 2036) 50 metres from the kerb. Annual PM2.5 incremental contributions were found to be higher along the main alignment with predicted incremental impacts at entry and exit ramps generally less than 1.0 µg/m3 10 metres from the kerb for 2026 and 2036.

6.9.4 Safeguards and Management Measures

Given the background particulate concentration in the region surrounding the proposal, careful consideration of the design and implementation of the mitigation measures is needed. The measures in Table 6-46 are recommended to minimise the potential for generation of dust during construction.

Table 6-46: Summary of air quality mitigation measures

Impact	Environmental safeguards	Responsibility	Timing
Air quality	An Air Quality Management Plan will be prepared and implemented as part of the CEMP. The Plan will identify: • Potential sources of air pollution (such as dust, vehicles transporting waste, plant and equipment) during construction • Air quality management objectives consistent with any relevant published EPA and/or DPIE guidelines • Mitigation and suppression measures to be implemented, such as spraying or covering exposed surfaces, provision of vehicle clean down areas, covering of loads, street cleaning, use of dust screens, maintenance of plant in accordance with manufacturer's instructions • Methods to manage works during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces • When the air quality, suppression and management measures need to be applied, who is responsible, and how effectives will be assessed. • Community notification and complaint handling procedures	Construction contractor	During Construction
Air quality	As part of the AQMP, a monitoring program would be developed for monitoring construction dust		

Impact	Environmental safeguards	Responsibility	Timing
	from the proposal. The monitoring plan would be implemented prior to construction and during the construction period to assess effective implementation of air quality safeguards, identify any unexpected or inadvertent impacts, and identify recommended revisions or improvements.		