AIR QUALITY ASSESSMENT

RAPID TRANSIT RAIL FACILITY

JBA Planning

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TODOROSKI AIR SCIENCES

Air Quality Assessment
Rapid Transit Rail Facility

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1 INTRODUCTION

Todoroski Air Sciences has been engaged by JBA Planning on behalf of Transport for NSW (hereafter referred to as the Proponent) to undertaken an air quality impact assessment for the proposed Rapid Transit Rail Facility (hereafter referred to as the Project).

This report comprises:

- A background to the project and description of the local setting;
- A review of the characteristics of the receiving environment surrounding the Project site;
- A qualitative assessment of potential air quality impacts arising from construction activities;
- A discussion of the potential air quality impacts arising from activities associated with the Project; and
- A review of the potential air quality impacts on the Project due to existing sources.

2 PROJECT BACKGROUND

Transport for NSW (TfNSW) proposes to develop a Rapid Transit Rail Facility on land between Tallawong Road, Schofields Road and First Ponds Creek in the localities of Rouse Hill and Schofields. The Rapid Transit Rail Facility would comprise a purpose built train stabling and maintenance facility to support Sydney's new rapid transit rail network.

Sydney's Rail Future: Modernising Sydney's Trains, released in June 2012, sets the long term strategy to increase the capacity of Sydney's rail network through investment in new services and upgrading of existing infrastructure. New generation, single deck rapid transit trains are a key element of the strategy.

The operational and land requirements for the rapid transit network are being progressed in accordance with the NSW Long Term Master Plan, released in December 2012. *Sydney's Rail Future* forms an integral component of the Long Term Transport Master Plan. It is important to ensure that the delivery of rapid transit infrastructure can occur as outlined in *Sydney's Rail Future*.

The Rapid Transit Rail Facility is to cater for future expansion of the rapid transit system, including a future harbour crossing and link to the southern suburbs. The facility would be constructed in two phases and would provide stabling for 45 trains and maintenance facilities for 76 trains. The initial design capacity would be 20 trains (stabling and maintenance).

An indicative layout for the facility is shown in **Figure 2-1**.

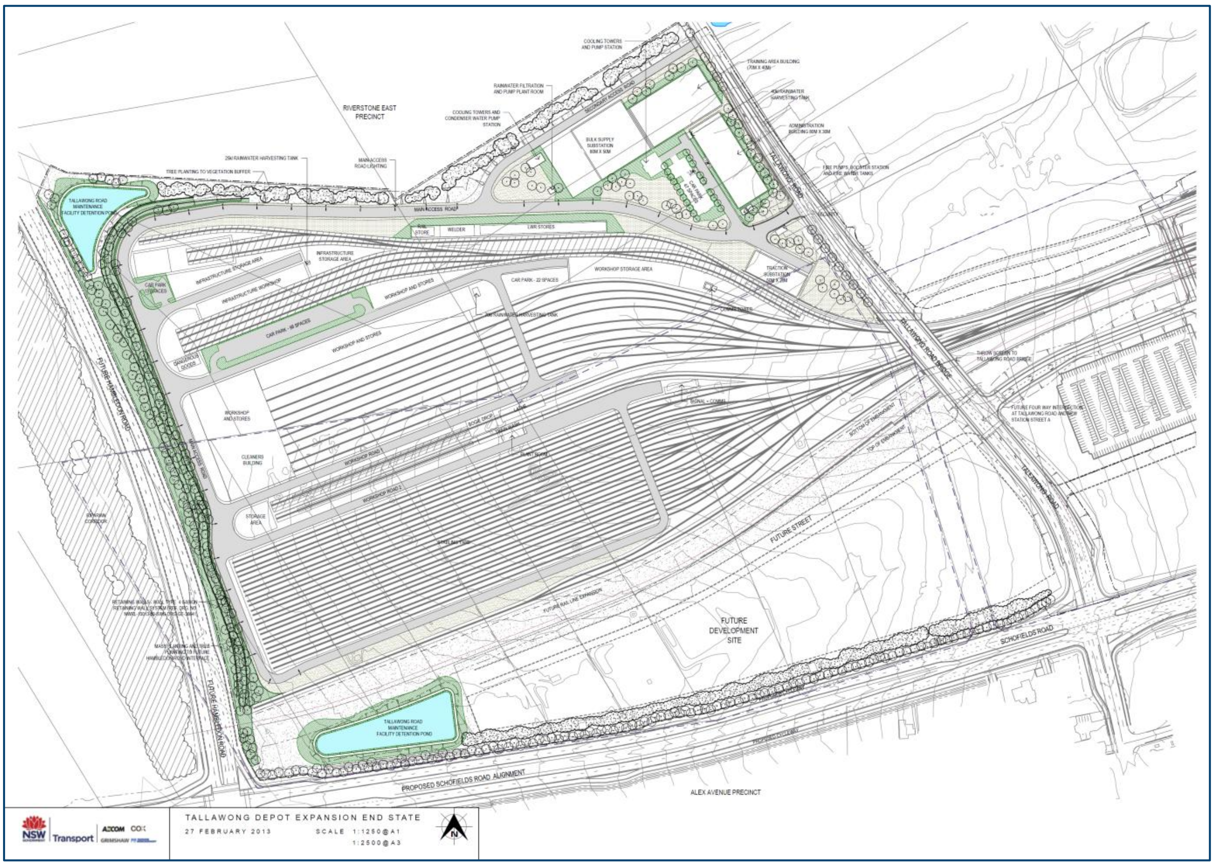

Figure 2-1: Indicative site layout (end state)

3 STUDY REQUIREMENTS

This air quality assessment has been prepared in general accordance to satisfy the Director-Generals Environmental Assessment Requirements (presented in **Table 3-1**) and other agency comments (presented in **Table 3-2** and **Table 3-3**).

Table 3-1: Director-General's Environmental Assessment Requirements

Specific matter	General Requirements	Section
Air Quality - including but not limited to	Modelling and assessment of air pollutants, including an assessment of atmospheric pollutants of concern for local air quality including fugitive and point sources	7 & 8
	Potential odour from exhaust emissions	7 & 8
	Taking into account the *Approved Methods for the Modelling and Assessment of Air pollutants in NSW* ([**NSW**] **DEC, 2005**)	7 & 8

Table 3-2: Environmental Protection Authority - Recommended Environmental Assessment Requirements

Air Issues - Air quality	Section
1. Assess the risk associated with potential discharges of fugitive and point source emissions for all stages of the proposal. Assessment of risk relates to environmental harm, risk to human health and amenity.	7 & 8
2. Justify the level of assessment undertaken on the basis of risk factors, including but not limited to: a. Proposal location; b. Characteristics of the receiving environment; and c. Type and quantity of pollutants emitted.	4, 7 & 8
3. Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to: a. Meteorology and climate; b. Topography; c. Surrounding land-use; receptors; and d. Ambient air quality.	4 & 6
4. Include a detailed description of the proposal. All processes that could result in air emissions must be identified and described. Sufficient detail to accurately communicate the characteristics and quality of all emissions must be provided.	7 & 8
5. Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.	7 & 8
6. Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment.	8
7. Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment. Air dispersion modelling must be conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (**NSW DEC, 2005**).	7 & 8
8. Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the Protection of the Environment Operations (POEO) Act (1997) and the POEO (Clean Air) Regulation (2010).	7 & 8
9. Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010 and its implementation plan Action for Air	8
10. Detail emission control techniques/practices that will be employed by the proposal.	7 & 8

Table 3-3: Blacktown City Council - Director General's Requirements

Key Issues	Section
Impact on air quality	7 & 8

4 LOCAL SETTING

The study area is located mid-way along Schofields Road, and is bounded by Schofields Road to the south, Tallawong Road to the east, First Ponds Creek to the west and property boundaries to the north (see **Figure 4-1**).

Land to the north, east and west of the subject site is predominately characterised by a mix of rural residential and agricultural uses, the rezoning of the Area 20 precinct to the east and the Riverstone precinct to the west for urban uses.

The local topography surrounding the site is characterised as relatively flat with slight undulations in the terrain. The local topography does not appear to contain any significant terrain features which would influence wind dispersion patterns, beyond the normal pattern of winds in the north-western Sydney Basin.

Figure 4-1: Project location

5 AIR QUALITY ASSESSMENT CRITERIA

5.1 Preamble

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the potential atmospheric pollutants which may occur as a result of the Project and the applicable air quality criteria.

5.2 Particulate matter

Particulate matter refers to particles of varying size and composition. The air quality goals relevant to this assessment refer to three classes of particulate matter based on the size of the particles. The first class is referred to as Total Suspended Particulate matter (TSP) which measures the total mass of all particles suspended in air. The upper size range for TSP is nominally taken to be 30 micrometres (µm) as in practice, particles larger than 30 to 50µm settle out of the atmosphere too quickly to be regarded as air pollutants.

The TSP is defined further into two sub-classes. They are PM_{10} particles, particulate matter with aerodynamic diameters of 10µm or less, and $PM_{2.5}$, particulate matter with aerodynamic diameters of 2.5µm or less.

Earthmoving activities generate particles in all the above size categories. The great majority of the particles generated are due to the abrasion or crushing of rock and general disturbance of dusty material. These particulate emissions will be generally larger than 2.5µm as these fine sub-2.5µm particles are usually generated through combustion processes or as secondary particles formed from chemical reactions rather than through mechanical processes that dominate emissions on mine sites.

Combustion particulates can be more harmful to human health as the particles have the ability to penetrate deep into the human respiratory system as they are small and can be comprised of acidic and carcinogenic substances.

5.2.1 NSW Environment Protection Authority impact assessment criteria

Table 5-1 summarises the air quality goals that are relevant to this study as outlined in the New South Wales Environment Protection Authority (NSW EPA) document "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (**NSW DEC, 2005**). The air quality goals for total impact relate to the total dust burden in the air and not just the dust from the proposed modification. Consideration of background dust levels needs to be made when using these goals to assess potential impacts.

Table 5-1: NSW EPA air quality impact assessment criteria

Pollutant	Averaging Period	Impact	Criterion
TSP	Annual	Total	90µg/m³
PM_{10}	Annual	Total	30µg/m³
	24-hour	Total	50µg/m³
Deposited dust	Annual	Incremental	2g/m²/month
		Total	4g/m²/month

Source: NSW DEC, 2005

The criterion for 24-hour average PM_{10} originates from the National Environment Protection Measure (NEPM) goals (**NEPC, 1988**). These goals apply to the population as a whole, and are not recommended to be applied to "hot spots" such as locations near industry, busy roads or mining. However, in the absence of alternative measures, NSW EPA does apply the criteria to assess the potential for impacts to arise at such locations.

The NEPM permits five days annually above the 24-hour average PM_{10} criterion to allow for bush fires and similar events. Similarly, it is normally the case that on days where ambient dust levels are affected by such events they are excluded from assessment as per the NSW EPA criterion.

5.2.2 $PM_{2.5}$ concentrations

The NSW EPA currently does not have impact assessment criteria for $PM_{2.5}$ concentrations; however the National Environment Protection Council (NEPC) has released a variation to the NEPM (**NEPC, 2003**) to include advisory reporting standards for $PM_{2.5}$ (see **Table 5-2**).

The advisory reporting standards for $PM_{2.5}$ are a maximum 24-hour average of 25µg/m^3 and an annual average of 8µg/m^3, and as with the NEPM goals, apply to the average, or general exposure of a population, rather than to "hot spot" locations.

Table 5-2: Advisory standard for $PM_{2.5}$ concentrations

Pollutant	Averaging Period	Criterion
$PM_{2.5}$	24-hour	25µg/m^3
	Annual	8µg/m^3

5.3 Other air pollutants

Emissions of other air pollutants will also potentially arise from activities occurring at the Project with the source of these emissions generated from sources such as petrol and diesel powered equipment. Emissions from diesel powered equipment generally include carbon monoxide (CO), nitrogen dioxide (NO_2) and other pollutants, such as sulphur dioxide (SO_2).

CO is colourless, odourless and tasteless and is generated from the incomplete combustion of fuels when carbon molecules are only partially oxidised. It can reduce the capacity of blood to transport oxygen in humans resulting in symptoms of headache, nausea and fatigue.

NO_2 is reddish-brown in colour (at high concentrations) with a characteristic odour and can irritate the lungs and lower resistance to respiratory infections such as influenza. NO_2 belongs to a family of reactive gases called nitrogen oxides (NO_x). These gases form when fuel is burned at high temperatures, mainly from motor vehicles, power generators and industrial boilers (**USEPA 2011**). NO_x may also be generated by blasting activities. It is important to note that when formed, NO_2 is generally a small fraction of the total NO_x generated.

Sulphur dioxide (SO_2) is a colourless, toxic gas with a pungent and irritating smell. It commonly arises in industrial emissions due to the sulphur content of the fuel. SO_2 can have impacts upon human health and the habitability of the environment for flora and fauna. SO_2 emissions are a precursor to acid rain, which can be an issue in the northern hemisphere; however it is not known to have any widespread impact in NSW, and is generally only associated with large industrial activities. Due to its potential to impact on human health, sulphur is actively removed from fuel to prevent the release and formation of SO_2. The sulphur content of Australian diesel is controlled to a low level by national fuel standards and as such the emissions of SO_2 generated from diesel powered equipment are generally considered to be too low to generate any significant off-site impact.

5.4 Odour

5.4.1 Introduction

Odour in a regulatory context needs to be considered in two similar, but different ways depending on the situation.

NSW legislation prohibits emissions that cause offensive odour to occur at any off-site receptor. Offensive odour is evaluated in the field by authorised officers, who are obliged to consider the odour in the context of its receiving environment, frequency, duration, character and other such factors and to determine whether the odour would interfere with the comfort and repose of the normal person unreasonably. In this context, the concept of offensive odour is applied to operational facilities and relates to actual emissions in the air.

However, in the approval and planning process for proposed new operations (or modifications to existing projects), the odour in question does not yet exist and it is necessary to consider hypothetical odour. In this context, modelling is required and thus odour concentrations are used and are defined in odour units. The number of odour units represents the number of times that the odour would need to be diluted to reach a level that is just detectable to the human nose. Thus by definition, odour less than one odour unit (1 OU), would not be detectable to most people.

The range of a person's ability to detect odour varies greatly in the population, as does their sensitivity to the type of odour. Thus there can be a wide range of variability in the way odour response is interpreted. As a result the assessment of odour impacts and the application of specific air quality goals related to odour is a challenging aspect of air science.

It needs to be noted that odour refers to complex mixtures of odours, and not the odour arising from a single chemical. Odour from a single, known chemical rarely occurs (when it does, it is best to consider that specific chemical in terms of its concentration in the air). In most situations odour will be comprised of a cocktail of many substances that is referred to as a complex mixture of odour, or more simply odour.

For developments with potential for odour it may be necessary to predict the likely odour impact that may arise. This is done by using air dispersion modelling which can calculate the level of dilution of odours emitted from the source at the point that it reaches surrounding receptors. This approach allows the air dispersion model to produce results in terms of odour units.

The NSW criteria for acceptable levels of odour range from 2 to 7 OU, with the more stringent 2 OU criteria applicable to densely populated urban areas and the 7 OU criteria applicable to sparsely populated rural areas, as outlined below.

5.4.2 Complex Mixtures of Odorous Air Pollutants

Table 5-3 presents the assessment criteria as outlined in the NSW EPA document "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (**NSW DEC, 2005**). This criterion has been refined to take into account the population densities of specific areas and is based on a 99th percentile of dispersion model predictions calculated as 1-second averages (nose-response time).

Table 5-3: Impact assessment criteria for complex mixtures of odorous air pollutants (nose-response-time average, 99th percentile)

Population of affected community	Impact assessment criteria for complex mixtures of odorous air pollutants (OU)
Urban (≥~2000) and/or schools and hospitals	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (≤~2)	7.0

Source: NSW DEC, 2005

The NSW odour goals are based on the risk of odour impact within the general population of a given area. In sparsely populated areas the criteria assume there is a lower risk that some individuals within the community would find the odour unacceptable, hence higher criteria apply.

In this case, there is known odour in the area that has potential to affect the proposed site. Given the nature of the Project, odour criteria ranging from 5 to 7 OU would be applicable, given that most workers would only be present during limited working hours on any day or week.

6 EXISTING ENVIRONMENT

This section describes the existing environment including the climate and ambient air quality in the area surrounding the Project.

6.1 Local climate

Long-term climatic data from the Bureau of Meteorology (BoM) weather stations at Prospect Reservoir (Site No. 067019) and Richmond RAAF (Site No. 067105) were used to characterise the local climate in proximity of the Project. The Prospect Reservoir station is located approximately 14km south of the Project and the Richmond RAAF is located approximately 15km northeast of the Project.

Table 6-1 and **Figure 6-1** present a summary of data from Prospect Reservoir collected over an approximate 47-year period. **Table 6-2** and **Figure 6-2** present a summary of data from Richmond RAAF collected over an approximate 19-year period.

The data indicate that January is the hottest month with mean maximum temperatures of 28.4°C and 30.0°C respectively at the Prospect Reservoir and Richmond RAAF stations. July is the coldest month with mean minimum temperatures of 6.1°C and 3.6°C.

Humidity levels exhibit variability and seasonal flux across the year. Mean 9am humidity levels range from 80% in May to 65% in September and October at Prospect Reservoir and 83% in June and 58% in October at Richmond RAAF. Mean 3pm humidity levels vary from 57% in May to 45% in August and September at Prospect Reservoir and 53% in May and June to 39% in August and September at Richmond RAAF.

Rainfall peaks during the summer months and declines during winter at both stations. The data indicates that February is the wettest month with an average rainfall of 97.2mm over 10.7 days at Prospect Reservoir and 125.8mm over 11.9 days at Richmond RAAF. September is the driest month at Prospect Reservoir with an average rainfall of 46.9mm over 8.4 days and August is the driest month at Richmond RAAF with an average rainfall of 30.7mm over 6.3 days.

Wind speeds during the warmer months tend to have a greater spread between the 9am and 3pm conditions compared to the colder months at Prospect Reservoir, however the difference between 9 am and 3 pm wind speed is relatively constant at Richmond RAAF across the year. The mean 9am wind speeds range from 7km/h in February to 10km/h in October at Prospect Reservoir and 5.7km/h in May to 10.3km/h in October at Richmond RAAF. The 3pm wind speeds range from 10.3km/h in May to 15.4km/h in October at Prospect Reservoir and 12.6km/h in May to 19.4km/h in September at Richmond RAAF.

Table 6-1: Monthly climate statistics summary - Prospect Reservoir

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Mean max. temperature (ºC)	28.4	28.0	26.3	23.6	20.2	17.3	16.8	18.7	21.3	23.7	25.4	27.4
Mean min. temperature (ºC)	17.7	17.8	16.1	13.0	9.9	7.4	6.1	6.8	9.4	12.1	14.3	16.3
Rainfall												
Rainfall (mm)	94.4	97.2	96.2	74.7	71.6	75.2	57.0	49.8	46.9	59.1	72.7	75.2
Mean No. of rain days (≥1mm)	10.7	10.7	10.9	9.4	9.0	9.5	7.8	7.9	8.4	9.4	9.6	9.9
9am conditions												
Mean temperature (ºC)	21.3	21.0	19.6	16.9	13.5	10.7	9.6	11.1	14.5	17.4	18.4	20.6
Mean relative humidity (%)	75	79	79	77	80	79	76	70	65	65	70	70
Mean wind speed (km/h)	7.5	7.0	7.3	8.0	7.7	8.0	8.1	9.2	9.7	10.0	8.5	8.2
3pm conditions												
Mean temperature (ºC)	26.8	26.3	24.8	22.4	19.2	16.5	15.9	17.4	19.6	22.1	23.4	25.9
Mean relative humidity (%)	52	54	55	52	57	55	50	45	45	46	50	49
Mean wind speed (km/h)	12.7	12.4	12.0	11.5	10.3	12.3	12.4	14.3	15.3	15.4	14.4	14.5

Source: Bureau of Meteorology, 2013

Table 6-2: Monthly climate statistics summary - Richmond RAAF

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Mean max. temperature (ºC)	30.0	29.1	26.8	23.9	20.6	17.9	17.4	19.7	22.7	25.0	26.7	28.5
Mean min. temperature (ºC)	17.6	17.7	15.6	11.4	7.6	4.9	3.6	4.4	8.0	11.0	14.1	16.0
Rainfall												
Rainfall (mm)	78.5	125.8	74.2	48.9	52.4	48.0	31.2	30.7	49.7	52.8	83.5	61.6
Mean No. of rain days (≥1mm)	11.2	11.9	11.0	9.5	10.4	9.8	8.2	6.3	7.4	9.1	12.4	10.9
9am conditions												
Mean temperature (ºC)	22.1	21.3	19.1	17.0	13.1	10.0	8.9	11.4	15.4	18.3	19.2	20.9
Mean relative humidity (%)	72	78	80	76	82	83	80	69	63	58	68	68
Mean wind speed (km/h)	9.1	8.1	6.6	6.9	5.7	6.3	5.9	8.1	9.9	10.3	9.9	8.9
3pm conditions												
Mean temperature (ºC)	28.5	27.4	25.8	23.0	19.7	17.0	16.5	18.7	21.5	23.5	25.2	27.5
Mean relative humidity (%)	47	52	52	49	53	53	48	39	39	40	46	44
Mean wind speed (km/h)	16.6	15.6	14.7	14.4	12.6	13.5	14.3	17.7	19.4	19.1	19.0	17.7

Source: Bureau of Meteorology, 2013

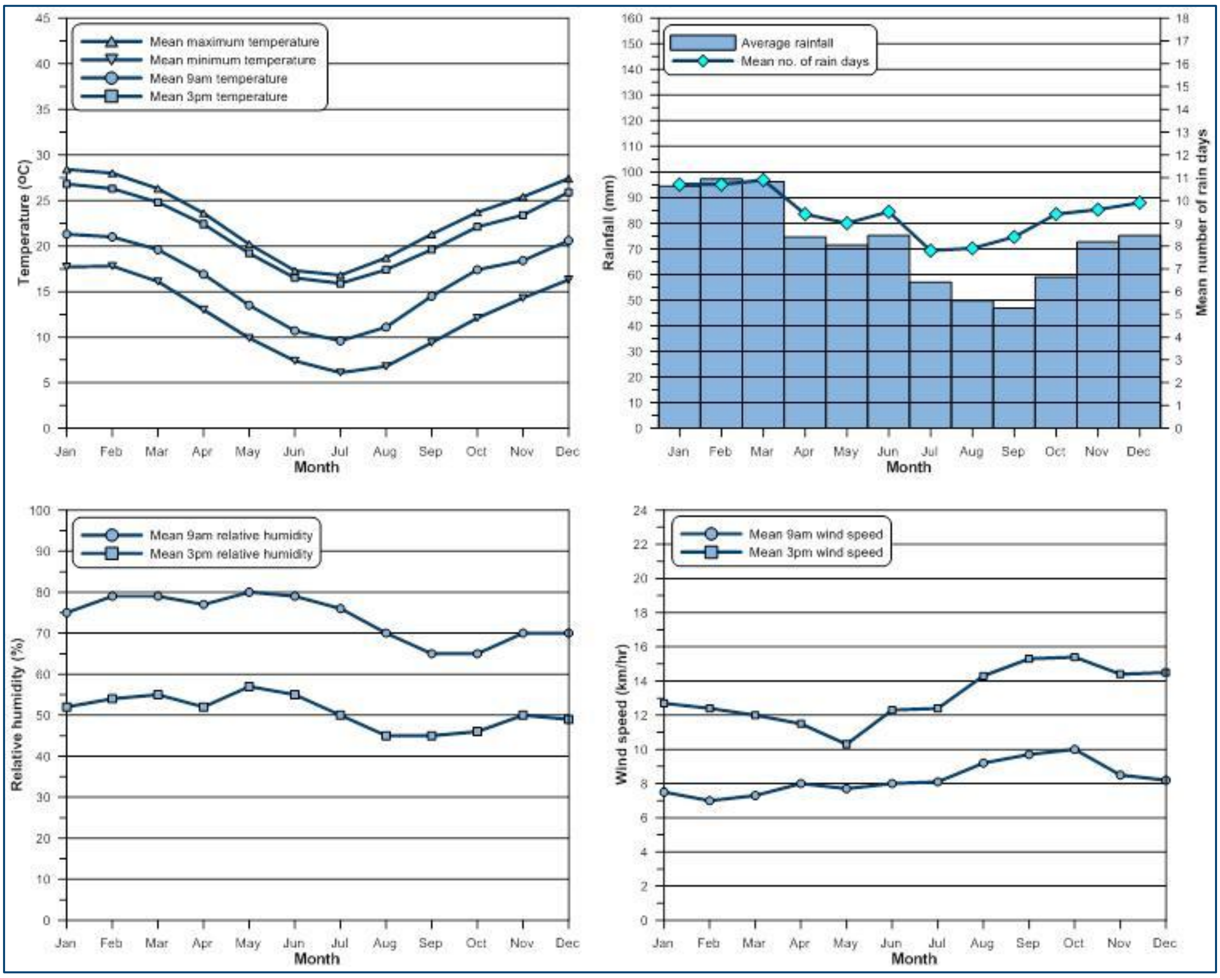

Figure 6-1: Monthly climate statistics summary - Prospect Reservoir

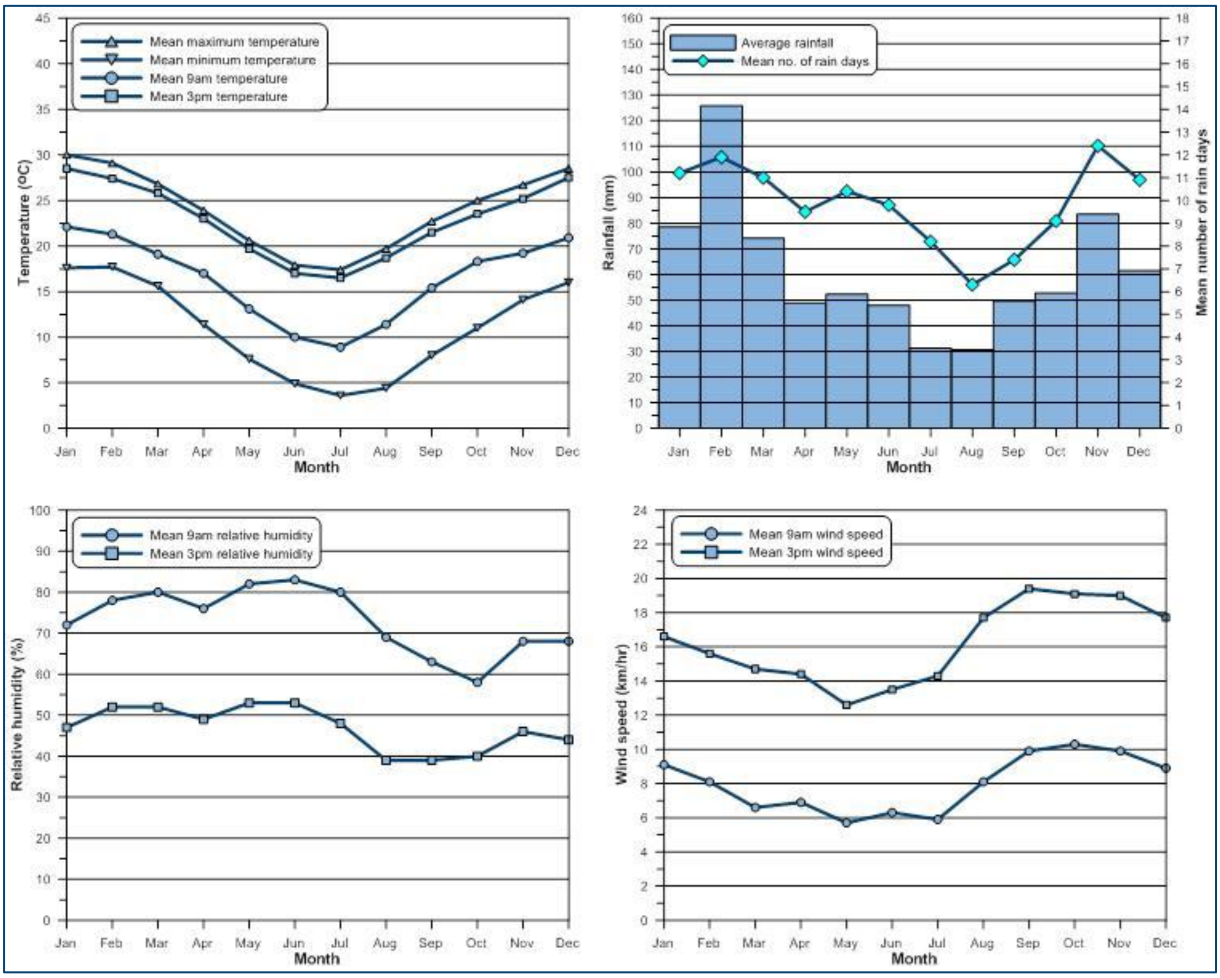

Figure 6-2: Monthly climate statistics summary - Richmond RAAF

6.2 Local air quality

The main sources of air pollution in the wider area of the Project may include agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities. This section reviews the ambient monitoring data collected from a number of NSW EPA monitoring stations in the general area of the Project.

The air quality monitoring data collected from January to December 2012 from the Richmond and St Marys, Vineyard and Prospect monitoring stations have been reviewed.

6.2.1 PM_{10} and $PM_{2.5}$ Monitoring

A summary of the PM_{10} monitoring data recorded during January 2012 to December 2012 is presented in **Table 6-3** and **Figure 6-3**. The data indicate that annual average PM_{10} levels recorded at these monitoring sites are below the criterion of 30µg/m^3.

Figure 6-3 indicates that the maximum recorded 24-hour average PM_{10} concentrations exceeded the 50µg/m^3 criterion at the Richmond monitor on three occasions in August 2012. An investigation into the cause of these exceedences suggests a potential bushfire or back burning event in the area as reflected in the $PM_{2.5}$ monitoring data (see **Figure 6-4**).

It can be seen from **Figure 6-3** that concentrations are nominally highest in the spring and summer months. This is attributed to the warmer weather leading to drier ground and elevating the amount of windblown dust, the occurrence of bushfires and also increased pollen levels which would have contributed to the recorded levels.

Table 6-3: Summary of PM_{10} levels (µg/m³)

Month	Average				Maximum			
	Richmond	St Marys	Vineyard	Prospect	Richmond	St Marys	Vineyard	Prospect
Jan	15.1	15.8	15.3	15.9	31.7	32	29.1	25.6
Feb	11.6	11.7	11.9	13.6	26.4	25.7	26	25.8
Mar	11.3	12.9	12.0	14.2	15.8	20.7	17	20.5
Apr	12.2	13.4	13.7	15.4	28.4	31.1	28.6	29.4
May	13.3	14.3	14.6	18.4	22.3	30.5	29.5	34.2
June	9.9	9.2	10.8	14.3	19.8	14.8	22.5	24.8
July	10.1	10.2	10.6	13.5	14.4	15.8	16.7	20.3
Aug	21.3	14.6	14.2	17.4	99.2	33.3	34.3	33.4
Sep	17.2	16.0	15.6	19.1	31.6	30.5	29.5	34.4
Oct	18.3	17.0	17.3	20.8	33.9	32.8	32.9	38.7
Nov	21.6	18.9	19.0	22.1	38.9	34.3	34.2	37.1
Dec	19.9	19.5	18.4	22.3	29.1	28.1	27	35.5
Annual	**15.2**	**14.5**	**14.5**	**17.2**	-	-	-	-

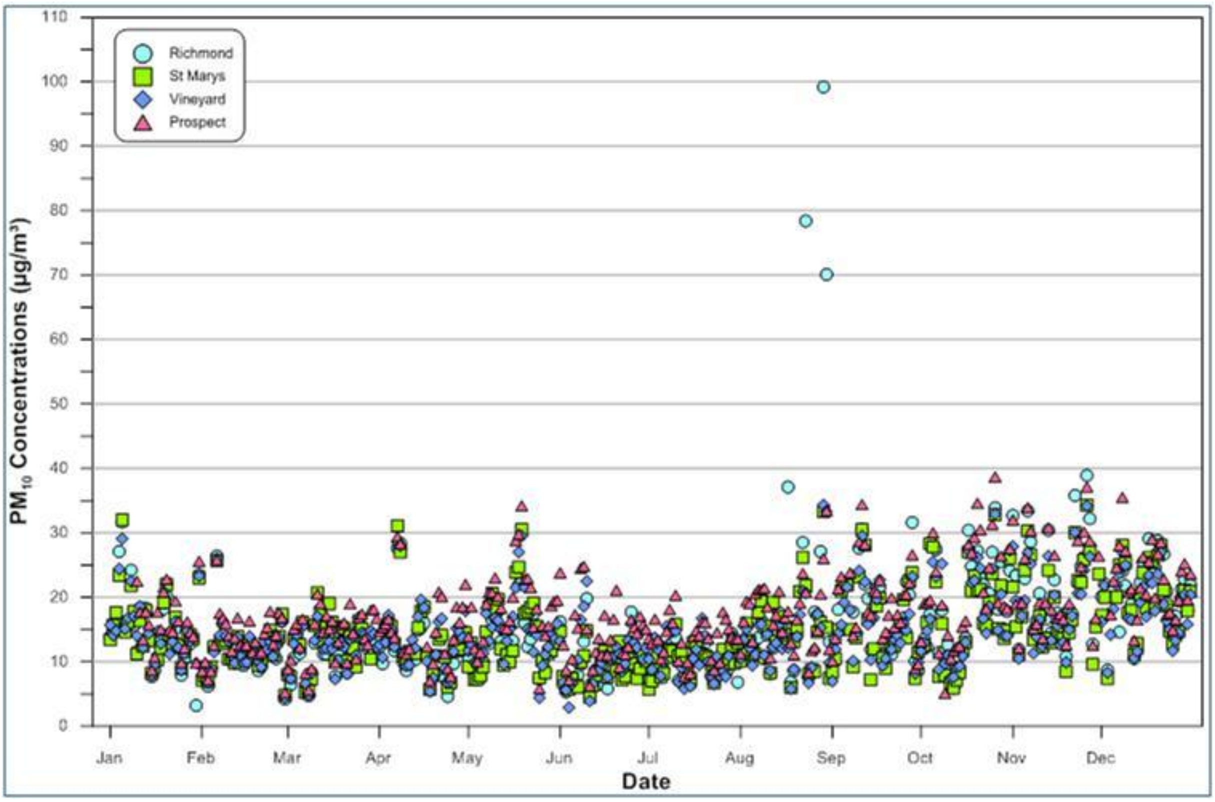

Figure 6-3: 24-hour average PM10 concentrations at NSW EPA monitors - 2012

A summary of the $PM_{2.5}$ monitoring data recorded during January 2012 to December 2012 from the Richmond monitor is presented in **Table 6-4** and **Figure 6-4**. The data indicate that annual average $PM_{2.5}$ levels recorded at this monitoring site are below the advisory reporting standard of 8µg/m³ and the maximum 24-hour average levels were below 25µg/m³ for all months except August.

The elevated levels recorded in August coincide with the elevated PM_{10} levels during the same period and suggest they are likely due to combustion sources, such as a bush fire or back burning event.

Table 6-4: Summary of PM2.5 levels Richmond monitor (µg/m³)

Month	Average	Maximum
	Richmond	
Jan	3.4	8.3
Feb	3.1	8.7
Mar	2.9	4.9
Apr	3.7	9.4
May	5.4	13.5
June	3.8	14.3
July	3.6	9.0
Aug	10.2	116.7
Sep	7.9	16.4
Oct	6.3	11.9
Nov	7.9	18.1
Dec	6.6	10.6
Annual	5.4	-

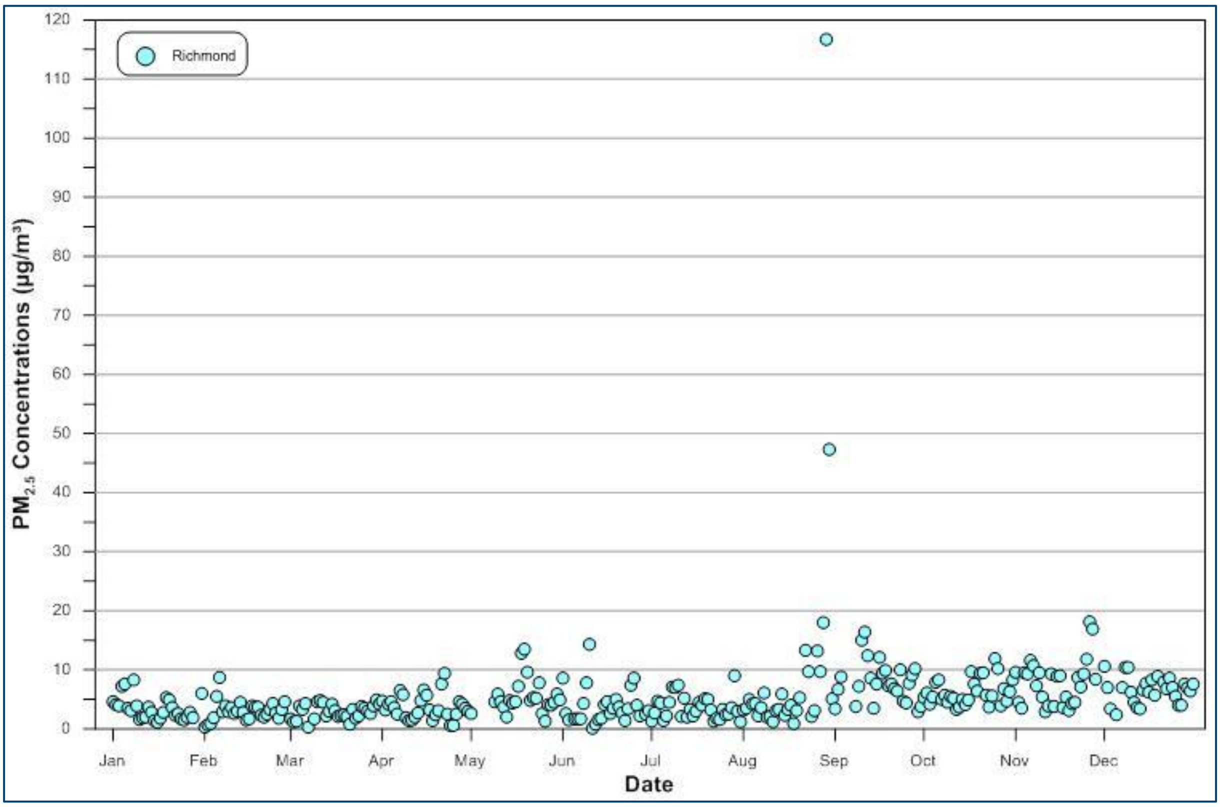

Figure 6-4: 24-hour average PM2.5 concentrations at NSW EPA Richmond monitor - 2012

7 CONSTRUCTION EMISSIONS

The Project involves the site establishment and the construction of new infrastructure which would include activities with the potential to generate dust emissions.

The landform of the Project site is currently undulating and the proposed design would require a more consistent level across the site to enable trains to operate. To establish the site, a temporary disturbance of the new ground level would require a cut and fill of spoil material.

Other activities associated with the construction of the Project involve the establishment of a number of buildings and related infrastructure.

Potential dust emissions may be generated during earthworks including loading/emplacement, transport and shaping operations. Windblown dust may be generated from exposed areas and stockpiles during periods of high wind speed. Exhaust emissions from the operation of construction vehicles and plant would also generate particulate emissions.

Emissions of the pollutants and odours generated from the exhaust emissions of diesel powered machinery and plant equipment are generally considered to be too small, too infrequent or too widely distributed to generate any significant off-site pollutant concentrations. However these emissions are generally included in the particulate emissions estimation equations for the activity.

The estimated dust emissions for earthworks associated with construction activities are presented in **Table 7-1** and the corresponding emission factors from the US EPA AP42 Emissions Factors document (**USEPA, 1985 and updates**) and the State Pollution Control Commission document (**SPCC, 1983**) that were applied to estimate the potential dust emissions are outlined below the table.

Table 7-1: Estimated annual TSP emission rate - Construction activities

Activity	TSP emissions (kg/year)
Loading spoil to haul truck	89
Hauling to Emplacement (on-site)	3,811
Hauling fill material onto the site	2,406
Emplacing on-site	167
Dozers on various activities	12,473
Wind erosion from exposed areas and stockpiles	15,319
Total TSP emissions (kg/yr)	**34,265**

Loading/Unloading material

$$EF_{TSP} = k \times 0.0016 \times \left(\left(\frac{U}{2.2}\right)^{1.3} \Big/ \left(\frac{M}{2}\right)^{1.4}\right) kg/tonne$$

Where k = 0.74, U = wind speed (m/s) and M = moisture content (%)

Hauling material

$$EF_{TSP} = \left(\frac{0.4536}{1.6093} \times \left(\frac{s}{12}\right)^{0.7} \times 4.9 \times \left(M \times \left(\frac{1.1023}{3}\right)^{0.45}\right)\right) kg/VKT$$

Where S = silt content (%), M = moisture content (%)

Dozer activity

$$EF_{TSP} = \frac{2.6(s)^{1.2}}{M^{1.3}}$$

Where S = silt content (%), M = moisture content (%)

Wind erosion

$$EF_{TSP} = 0.4\, kg/ha\,/hour$$

The impact due to these activities is difficult to accurately quantify due to the short, sporadic periods of dust generating activity that may occur over the construction time frame. The sources are considered temporary in nature and would be confined to the construction period.

The total amount of dust generated from the proposed construction earthworks activities would be comparable to a modest quarry operation. The calculations assume that reasonable construction dust controls are implemented and that the site is managed via a construction dust management plan. Given that the activities would occur for a limited period, it is unlikely that there would be any significant or prolonged effect at any off-site impacts.

7.1 Construction mitigation measures

To ensure dust generation during construction activities is controlled and the potential for off-site impacts are reduced, appropriate operational and physical mitigation measures will be utilised.

Table 7-2 summarises the potential mitigation strategies which may be employed during the construction activity.

Table 7-2: Construction dust mitigation measures

Source	Mitigation Measure
General	Activities to be assessed during adverse weather conditions and modified as required (e.g. cease activity where reasonable levels of dust cannot be maintained using the available means)
	Engines of on-site vehicles and plant switched off when not in use
	Vehicles and plant fitted with pollution reduction devices
	Maintain and service vehicles according to manufacturer's specifications
	Haul roads and plant to be sited away from sensitive receivers where possible
Exposed areas and Stockpiles	Minimise area of exposed surfaces
	Water suppression on exposed areas and stockpiles
	Minimise amount of stockpiled material
	Locate stockpiles away from sensitive receivers
	Apply barriers, covering or temporary rehabilitation
	Progressive staging of construction activities
	Rehabilitation of completed sections as soon as practicable
	Keep ancillary vehicles off exposed areas
Material handling	Reduce drop heights from loading and handling equipment
Hauling activities	Watering of haul roads (fixed or mobile)
	Sealing of long term / heavy use roads
	Sealed haul roads to be cleaned regularly
	Restrict vehicle traffic to designated routes, that can be managed by regular watering
	Impose speed limits
	Wheel wash or grids near exit points to minimise mud/ dirt track out
	Street cleaning to remove dirt tracked onto sealed roads
	Covering vehicle loads when transporting material off- site

Source	Mitigation Measure
Cutting, grinding or sawing equipment	Dust suppression (e.g. water sprays for concrete cutting)

8 OPERATIONAL EMISSIONS

Activities associated with the operation of the facility include the maintenance of trains and operation of workshops and associated infrastructure for train maintenance. There is potential for these activities to generate air emissions that need to be considered.

The maintenance of the rolling stock would occur within the maintenance workshop where activities such as washing, underfloor wheel lather and a facility for removing bogies from under train carriages would take place. Generally these activities have low potential for any significant off-site emissions to arise. The activities occur within a building, where potential emissions can be contained or their discharge managed effectively.

Washing, degreasing and painting of small parts of trains is likely to occur within workshops. This has a modest potential for emissions to be generated. The activity however has significant potential for workplace emissions exposure and will therefore need to be managed to a level adequate to protect workers that would be carrying out the activity or working alongside the activity. These activities would therefore be conducted within specifically designed areas where any potentially excess fume can be contained, or captured, or treated and discharged via vents and pollution control equipment. There is only a low likelihood that the emissions from these activities would lead to any significant off-site impacts. However, it is noted that in the event that significant emissions arise, it would be relatively straightforward to identify the issue, and to modify the process or equipment to alleviate the matter.

The infrastructure workshop would include facilities for servicing track infrastructure equipment, a locomotive storage shed and facilities for track welding and repair. There would also be storage of a variety of rail borne maintenance equipment, such as a rail grinder, track test vehicles, track cleaning machinery, re-railing and overhead wiring machinery.

Welding of track on-site may also occur. Track welding facilities would include an enclosed welding space. This ensures that air containing welding fume and any metallic emissions can be contained, and treated as necessary before release. As for the small components, washing degreasing and painting, it is a relatively straightforward matter to capture potential welding and metal work fume in dedicated work areas to protect workers health, and hence the mitigation needed to do this would also ensure that levels at more distant receptors remain low and not significant.

A dangerous goods store would be used to store paint, solvents and other such materials. Fugitive emissions can arise from such stores, however modern storage is specifically designed to ensure there is adequate ventilation with no build up of any fumes that may be released upon opening. Therefore the levels from the store, by design would be low and are not expected to be of any significance off-site.

Graffiti removal from trains may involve the use of solvents. Generally, low emissions solvents can be used to minimise these emissions, but this will not always be the case for effective treatment. Graffiti removal may occur on various trains, both internally and externally and it may not be feasible to conduct this activity in a dedicated area. However, because of this the potential point of emissions would vary from day to day and thus graffiti removal activities are unlikely to be detectable off-site at any location on a routine basis or for prolonged periods.

Generally the risk of any detectable effects from this activity might occur for graffiti removal from large external areas of trains that are stabled near the edges of the Project site and near receptors. There are however very few isolated receptors in such locations around the facility and generally the majority of receptors are located well away from the trains and workshops, making the risk of any such impact small.

8.1 Operational activity mitigation measures

Operational activities would be managed by ensuring that at the outset the design of the workshops and the various activities includes adequate controls. This would apply to all potential areas on the site with the ability to emit significant quantities of air pollutants.

The detailed design of the Project site would include consideration of means to protect workers and off-site receptors adequately from excessive air quality impacts. Overall, provided that the measures that would normally be installed on any equivalent modern facility are applied, the risk of any impact is anticipated to be low. In part this is because the basic site layout is also designed to mitigate noise and maximise distance from receptors and emissions sources on the site.

The detailed design would be verified before finalisation by a suitably experienced air quality expert to ensure that it is adequate in this regard. This verification would consider the cumulative effect of all likely air pollution sources, and any necessary mitigation of pre-existing environmental effects (odour) on workers.

Table 8-1 summarises the potential mitigation strategies which may be employed during the operations.

Table 8-1: Operational mitigation measures

Source	Mitigation Measure
General	All areas on the site to be maintained in a condition to minimise erosion (water and wind erosion). This may include vegetation, gravel surfacing, or paving of heavily trafficked areas.
	Engines of on-site vehicles and plant switched off when not in use
	Vehicles and plant fitted with pollution reduction devices
	Maintain and service vehicles according to manufacturer's specifications
	Dust build up on sealed roads to be regularly removed. The source of the dust, where possible, to be eliminated (e.g. water erosion from garden bed or unauthorised track).
Dedicated maintenance areas	Dedicated painting, degreasing, cutting, grinding, welding and similar such areas to be fitted with effective fume extraction systems to protect workers adequately, and if necessary filtration to ensure that no excessive impacts occur at nearby receptors.
Outdoor activities/ external graffiti removal	Where possible activities where large quantities of solvents or air pollutants may be released near the site boundary and upwind of a receptor should be avoided or postponed to a more suitable period of weather. Where possible, low VOC solvents should be used, in the minimal quantity necessary to be effective.

Any necessary pollution control measures applied at the site would be designed to meet the requirements of the Protection of the Environment Operations Act (1997) **(POEO Act, 1997)** and Protection of the Environment Operations (Clean Air) Regulation **(POEO Reg, 2010)**. An example of the applicable standards of concentration for scheduled premises emitting solid particulates is shown in **Table 8-2**.

Table 8-2: Standards of concentration for scheduled premises: general activities and plant

General standards of concentration			
Air impurity	**Activity or plant**	**Standard of concentration**	
Solid particles (Total)	Any activity or plant (except as listed below)	Group 6	50 mg/m^3
	Any plant used for heating metals	Group 6	50 mg/m^3
	Any crushing, grinding, separating or materials handling activity	Group 6	20 mg/m^3

Source: (POEO (Clean Air) Regulation 2010)

8.2 Potential cumulative impacts

Cumulative air quality impacts arising due to activities at the facility are unlikely to occur when considering the current local land use in the vicinity of the Project. The Project site is located in an area away from other industrial activities which may generate similar air emissions would result in cumulative air quality impacts.

It is noted that future land uses may change and increase the potential for cumulative air quality impacts to occur and is anticipated that these would be investigated as required for any future industrial uses near the Project.

Nevertheless, when considering the scale of air emissions emanating from the Project and the mitigation measures utilised at the site, the potential air emissions would be minimal and hence unlikely to result in cumulative impacts regardless of the future land uses surrounding the Project.

8.3 Other legislative considerations

The *Action for Air* (**NSW Department of Environment, Climate Change and Water [DECCW], 2009**) is the NSW Government's 25-year air quality management plan for Sydney, Wollongong and the Lower Hunter which has been in place since 1998. Since this time air quality in these regions has improved with focus on reductions in the most significant pollutants.

The long-term ongoing emission reductions are achieved through the aims for *Action for Air* which are to:

- Reduce emissions to comply with the State Plan's cleaner air targets, that is, meeting the national air quality standards for six pollutants as identified in the Air NEPM, and

- Reduce the population's exposure to air pollution, and associated health costs.

This Project would complement the NSW State Plan and aims of the *Action for Air* through a number of direct and indirect means. The operation of the Project and related infrastructure aim to reduce dependence on private motor vehicle transport and hence would reduce traffic emissions by providing the accessible public transport in the northwest region of Sydney. The increased uptake of public transport, and the corresponding decreased dependence on private motor vehicles would have a positive impact on the regional air quality for Sydney.

9 CONCLUSIONS

The assessment has examined the potential emissions that may arise from the construction and operation of the Project site.

The assessment finds that construction activities would not be influenced by any out of the ordinary factors, and that no significant effect on receptors would be expected beyond some minor amenity normally associated with a limited period of construction activity.

Operational activities can also be managed to maintain potential impacts to acceptable levels. The primary means to manage operational impacts is through adequate design of the dedicated workshop areas to include the normal levels of air pollution capture, treatment or dispersion. The inherent layout of the proposed site is generally amenable to low impacts at receptors from the proposed activities, which inherently would only generate minimal quantities of pollutants in the first place.

Overall, air quality effects that may arise from this project were not found to be a significant issue. The trains would are electric and would not generate any significant air emission on the site. The activities needed to maintain these trains also have generally low levels of air emissions, and can usually be conducted in modern, well designed workshops which can effectively control and mitigate any emissions that may arise. Any necessary controls for such activities would be implemented in accordance with the relevant regulatory requirements.

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