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# Single-storey Warehouse Development, Wetherill Park

# Air Quality Impact Assessment

| | |
|---|---|
| Addressee(s): | Centuria Capital Limited |
| Site Address: | 88 Newton Road, Wetherill Park NSW |
| Report Reference: | 24.1052.FR1V4 |
| Date: | 4 June 2024 |
| Status: | Final |

**air quality | environment | sustainability**

## Quality Control

| Report | Reference | Status | Prepared by | Checked by | Authorised by |
|---|---|---|---|---|---|
| Single-storey Warehouse Development, Wetherill Park - Air Quality Impact Assessment | 24.1052.FR1V4 | Final | Northstar | DA,MD | MD |

## Report Status

| Northstar References | | Report Status | Report Reference | Version |
|---|---|---|---|---|
| Year | Job Number | (Draft: Final) | (R*x*) | (V*x*) |
| 24 | 1052 | Final | R1 | V4 |
| Based upon the above, the specific reference for this version of the report is: | | | | 24.1052.FR1V4 |

## Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below. A draft report is a working document, is issued without prejudice and is subject to change.

**Martin Doyle** **4 June 2024**

## Non-Technical Summary

Northstar Air Quality Pty Ltd was engaged by Centuria Capital Limited to perform an air quality impact assessment for the construction and operation of a single-storey industrial warehouse development to be located at 88 Newton Road, Wetherill Park NSW.

Identified risks of impact associated with construction activities were assessed using published *Guidance on the Assessment of Dust from Demolition and Construction*, which showed there to be a high risk of dust soiling impacts and medium risk of health impacts associated with demolition activities should no mitigation measures be applied. All other construction phase activities are associated with medium risks of dust soiling impacts and low risks of health impacts. A range of standard mitigation measures have been proposed to ensure that short-term impacts associated with construction activities are minimised.

The prediction of potential impacts associated with operational activities has been performed in general accordance with the requirements of the NSW Environment Protection Authority *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* document, using an approved and appropriate dispersion modelling technique.

Dispersion modelling indicates that all air quality criteria are predicted to be achieved at identified sensitive receptor locations, with the exception of one minor exceedance of the maximum 24-hour average $PM_{2.5}$ criterion. Good site management practices such as the minimisation of vehicle idling whilst on site, would be sufficient to ensure that this minor exceedance is not observed during operation of the development.

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# 1. INTRODUCTION

Centuria Capital Limited (the Applicant) has engaged Northstar Air Quality Pty Ltd (Northstar) to perform an air quality impact assessment (AQIA) for the construction and operation of a warehouse development (the Proposal) to be located at 88 Newton Road, Wetherill Park, NSW (the Proposal site).

This AQIA has been carried out to support a Development Application (DA) to Fairfield City Council in order to assess the risks to air quality associated with construction and operation of the Proposal.

## 1.1. Purpose of the Report

The purpose of this report is to identify and examine whether impacts associated with the construction and operation of the Proposal may adversely affect local air quality.

To allow assessment of the level of risk associated with the Proposal in relation to air quality, the AQIA has been performed in accordance with and with due reference to:

- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW EPA, 2022);
- Protection of the Environment Operations Act 1997;
- Protection of the Environment Operations (Clean Air) Regulation 2022; and
- Technical Framework and Notes – Assessment and Management of Odour from Stationary Sources in NSW (NSW DEC, 2006).

# 2. THE PROPOSAL

The following provides a description of the context, location and scale of the Proposal, and a description of the processes and development activities on site. It also identifies the potential for emissions to air associated with the Proposal.

## 2.1. Environmental Setting

The Proposal site is located at 88 Newton Road, Wetherill Park in the Local Government Area (LGA) of Fairfield. A map showing the location of the Proposal site is provided in Figure 1.

The closest residential property is located approximately 520 metres (m) from the Proposal site boundary to the south on Borneo Court. The immediate area surrounding the Proposal site is commercial/industrial in nature (refer Section 4.1).

## 2.2. Overview and Purpose

In its existing state, the Proposal site contains two large buildings and is used by Weir Minerals Group as their Sydney Distribution Centre. ITW Proline (hardware manufacturer) also occupy part of the Proposal site. The existing built form comprises a large warehouse as well as single storey office building to the east. The warehouse is located towards the centre of the site and incorporates a high bay area and lower bay area.

Consent is sought for the construction and operation of a single-storey warehouse and distribution centre, including ancillary office space at the Proposal site. The intended use of the warehouses located at the Proposal site is not yet determined.

The overall scope of the Proposal is briefly outlined below:

- Demolition of existing buildings and structures;
- Construction and operational use of a single-storey warehouse and distribution centre with ancillary office space and amenities, on-site parking, landscaping, and access;
- Associated works including bulk earthworks, site preparation works and site clearance; and
- Augmentation and construction of servicing utilities.

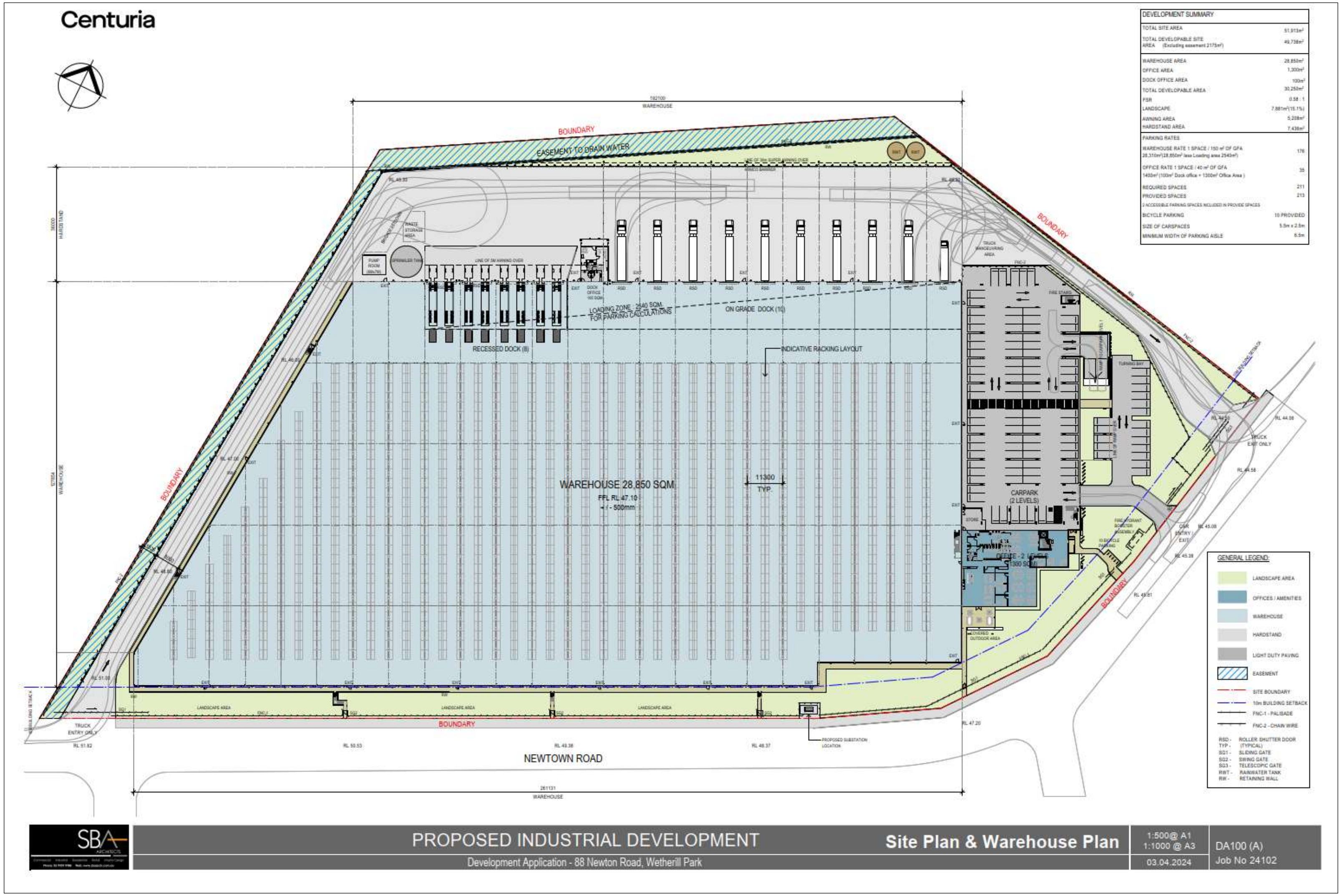
The total site area is approximately 5.19 hectares (ha) contains a developable site area of 49 738 $m^2$. The gross floor area (GFA) of the Proposal site covers 30 250 $m^2$, comprising 28 850 $m^2$ of warehouse GFA and 1 400 $m^2$ of ancillary office GFA. A total of 213 car parking spaces are to be contained within the development proposals.

The Proposal site layout is provided in Figure 2.

Figure 1 Proposal site location


Source: Northstar

**Figure 2 Proposal site layout**




**Source:** SBA Architects

## 2.3. Identification of Potential Emissions to Atmosphere

Given the nature of the Proposal described above, emissions to air would likely be generated as described below.

### 2.3.1. Construction Phase

Construction of the Proposal would involve demolition of the existing structures, earthworks, construction of a warehouse development, ancillary offices, car parking areas and associated infrastructure.

An indicative list of plant and equipment that may be used during the construction of the Proposal includes:

- Excavators;
- Front end loaders;
- Graders;
- Light vehicles;
- Heavy vehicles;
- Drills;
- Pneumatic and or power tools;
- Cranes;
- Commercial vans; and
- Cherry pickers.

A summary of the assessment of the potential air quality risks resulting from construction activities is presented in Section 6, while the full risk assessment is provided in Appendix B.

### 2.3.2. Operational Phase

During the operation of the Proposal, the following activities are anticipated to result in potential emissions to air:

- Movement of vehicles around the internal roadways of the Proposal site on paved road surfaces;
- Diesel and petrol combustion emissions from the consumption of fuel in trucks importing and exporting materials, and cars accessing the car park. The potential emissions would include particulate matter (as $PM_{10}$ and $PM_{2.5}$) and oxides of nitrogen ($NO_X$), including nitrogen dioxide ($NO_2$). There would additionally be some less significant emissions of carbon monoxide (CO), sulphur dioxide ($SO_2$) and air toxics (including benzene and 1,3-butadiene) but for the purposes of this assessment, it is comfortably assumed that the principal gaseous pollutant would be $NO_X$.

Experience in performing assessments of the impact of combustion-related emissions from the use of vehicles indicates that the principal indicator pollutants are particulate matter ($PM_{10}$ and $PM_{2.5}$) and $NO_2$ associated with relevant short-term criteria. $NO_X/NO_2$ concentrations have been used within this assessment as an indicator pollutant for all other combustion-related gaseous emissions resulting from traffic.

Experience gained across a number of similar developments and review of other air quality reports for comparable developments, indicates that in relation to road traffic emissions, impacts associated with particulate matter and $NO_2$ are the 'limiting factor' to compliance with air quality criteria.

For clarity, $SO_2$ and CO would not be routinely assessed as part of an air quality study of this nature and scale as the risks are very low.

The hardstand nature of the Proposal site, and the nature of the activities being performed (i.e. warehousing and distribution, with no 'dusty' activities) would result in the internal vehicular access routes having a low silt loading, and correspondingly the potential for wheel generated particulate matter at the Proposal site is anticipated to be minimal and has not been subject to quantitative assessment. It is noted however that particulate emissions from brake and tyre wear, in addition to that generated through fuel combustion, have been assessed in this AQIA, associated with both truck and passenger vehicle movements.

A summary of the emission sources and potential emissions to air during the construction and operation of the Proposal, which has been subject to assessment is presented in Table 1.

**Table 1 Identified potential sources of air emissions**

| Source | Particulate emissions | | | Gaseous emissions |
|---|---|---|---|---|
| | TSP | $PM_{10}$ | $PM_{2.5}$ | $NO_x$ |
| **Construction phase** | | | | |
| Construction activities | ✓ | ✓ | ✓ | - |
| **Operational phase** | | | | |
| Exhaust emissions and brake and tyre wear – trucks and passenger vehicles | ✓ | ✓ | ✓ | ✓ |

Given the nature of the development at this Proposal site, it is not anticipated that odour would be emitted in any significant quantity during construction or operation. Any potential contamination identified through detailed site investigation would be managed to ensure that no odour would impact upon surrounding receptor locations during construction. During operation, no odorous activities are anticipated, and correspondingly, odour has not been considered further as part of this AQIA.

# 3. LEGISLATION, REGULATION AND GUIDANCE

The following outlines the legislation and air quality criteria which are applicable to the activities being performed at the Proposal site.

## 3.1. Ambient Air Quality Standards

State air quality guidelines adopted by NSW Environment Protection Authority (NSW EPA) are published in the '*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (the Approved Methods (NSW EPA, 2022)), which has been consulted during the preparation of this AQIA.

The Approved Methods lists the statutory methods that are to be used to model and assess air pollutant emissions from stationary sources in NSW. Section 7.1 and Section 7.2 of the Approved Methods clearly outlines the impact assessment criteria for those key pollutants of interest and both individual and principal toxic air pollutants. Principal toxic air pollutants are defined in the Approved Methods (NSW EPA, 2022) on the basis that they are carcinogenic, mutagenic, highly persistent, or highly toxic in the environment.

The criteria listed in the Approved Methods (NSW EPA, 2022) are derived from a range of sources (including National Health and Medical Research Council [NHMRC], National Environment Protection Council [NEPC], and World Health Organisation [WHO]).

The criteria specified in the Approved Methods (NSW EPA, 2022) are the defining ambient air quality criteria for NSW. The standards adopted to protect members of the community from health impacts in NSW for relevant individual air pollutants are presented in Table 2.

**Table 2 NSW EPA impact assessment criteria**

| Air Pollutant | Averaging period | Units | Criterion | Notes |
|---|---|---|---|---|
| Nitrogen dioxide ($NO_2$) | 1 hour | µg·m$^{-3}$ [(a)] | 164 | Numerically equivalent to the AAQ NEPM[(b)] standards and goals. |
| | Annual | µg·m$^{-3}$ [(a)] | 31 | |
| Particulates (as $PM_{10}$) | 24 hours | µg·m$^{-3}$ [(a)] | 50 | |
| | 1 year | µg·m$^{-3}$ [(a)] | 25 | |
| Particulates (as $PM_{2.5}$) | 24 hours | µg·m$^{-3}$ [(a)] | 25 | |
| | 1 year | µg·m$^{-3}$ [(a)] | 8 | |
| Particulates (as TSP) | 1 year | µg·m$^{-3}$ [(a)] | 90 | Assessed as insoluble solids as defined by AS 3580.10.1 |
| Particulates (as dust deposition) | 1 year[(c)] | g·m$^{-2}$·month$^{-1}$ | 2 | |
| | 1 year[(d)] | g·m$^{-2}$·month$^{-1}$ | 4 | |

**Notes:** (a) micrograms per cubic metre of air
(b) National Environment Protection (Ambient Air Quality) Measures
(c) Maximum increase in deposited dust level
(d) Maximum total deposited dust level

Dust deposition is not anticipated to be an issue of concern during the operational phase of the Proposal, given the nature of the emission sources identified. It is generally more of an issue of concern during the construction phase of developments of this nature, and the construction phase risk assessment (Section 6) considers measures to minimise those impacts. The relevant criteria have not been adopted for the quantitative operational phase assessment but are presented for information.

## 3.2. NSW Government Air Quality Planning

NSW EPA has formed a comprehensive strategy with the objective of driving improvements in air quality across the State. This comprises several drivers, including:

- **Legislation:** formed principally through the implementation of the *Protection of the Environment Operations Act* 1997, and the *Protection of the Environment Operations (Clean Air) Regulations* 2022. The overall objective of the legislative instruments is to achieve the requirements of the National Environment Protection (Ambient Air Quality) Measure;
- **Clean Air for NSW**: The 10-year plan for the improvement in air quality;
- **Inter-agency Taskforce on Air Quality in NSW:** a vehicle to co-ordinate cross-government incentives and action on air quality;
- **Managing Particles and Improving Air Quality in NSW**; and
- **Diesel and Marine Emission Management Strategy.**

In regard to the relevance of the NSW Government's drive to maintain and improve air quality across the State and this AQIA, it is imperative that this Proposal would lead to the development of the NSW economy (in terms of activity and employment) and concomitantly not cause a detriment in air quality in achieving its objectives.

# 4. EXISTING CONDITIONS

## 4.1. Surrounding Land Sensitivity

The Proposal site and immediate surrounds is currently zoned as E4 (General Industrial) under the Fairfield City Council Local Environmental Plan (LEP) 2013, whilst a residential area is located 520 m to the south of the Proposal site is zoned R2 (Low Density Residential).

## 4.2. Sensitive Receptor Locations

Air quality assessments include a desktop mapping exercise to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed.

The Approved Methods (NSW EPA, 2022) denotes a sensitive receptor location to be:

> *'A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area'.*

Sensitive locations may also encompass ecological habitats whereby changes in air quality conditions may cause harm and stress to native flora species and vegetation from gaseous pollutants such as oxides of nitrogen ($NO_X$) produced from combustion sources and ammonia ($NH_3$) which can be predominant from agricultural activities.

The focus of the AQIA has been on discrete receptor locations, which are specified in consideration of the Approved Methods (NSW EPA, 2022) and are broadly representative of those areas or sites that may experience the greatest or most likely levels of exposure on account of the Proposal.

In addition to the identified 'discrete' receptor locations, the entire modelling area is gridded with 'uniform' receptor locations that are used to plot out the predicted impacts, and as such the accidental non-inclusion of a location sensitive to changes in air quality does not render the AQIA invalid, or otherwise incapable of assessing those potential risks.

To ensure that the selection of discrete receptors for the AQIA are reflective of the locations in which the population of the area surrounding the Proposal site reside, population density data has been examined. Population density data based on the 2021 census have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre ($km^2$) grid, covering mainland Australia (ABS, 2022).

Using a Geographical Information System (GIS), the locations of sensitive receptor locations have been confirmed with reference to their population densities.

For clarity, the ABS use the following categories to analyse population density (persons·km$^{-2}$):

- No population – Zero (0).
- Very low – Up to 500.
- Low – Between 500 and 2 000.
- Medium – Between 2 000 and 5 000.
- High – Between 5 000 and 8 000.
- Very high – More than 8 000.

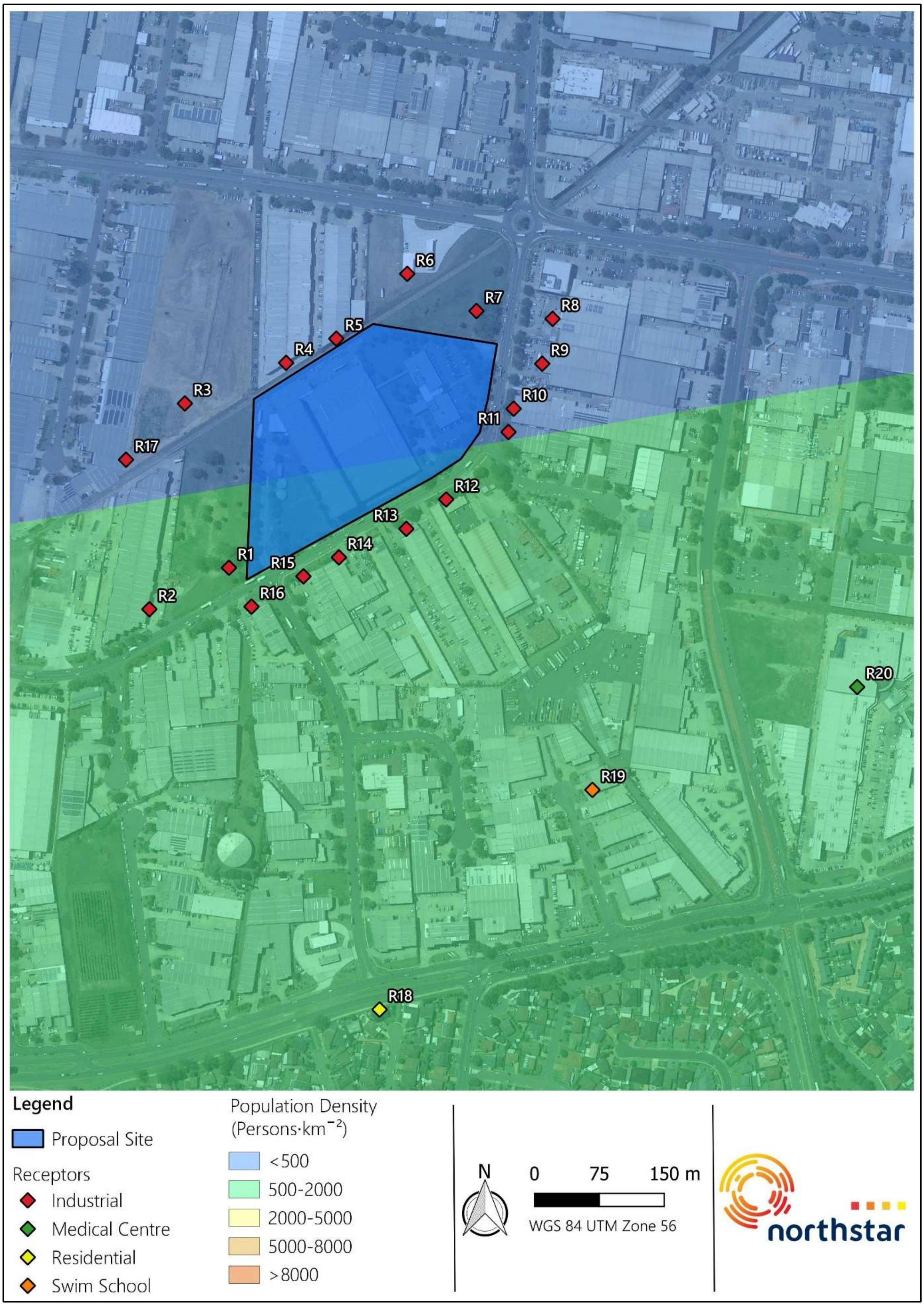
Using ABS data in a GIS, the population density of the area surrounding the Proposal site and locality is in an area of low and very low population density (between 0 and 2 000 persons·km$^{-2}$). The population density of the area surrounding the Proposal site are presented in Figure 3.

In accordance with the requirements of the NSW EPA, several receptors have been identified and the receptors adopted for use within this AQIA are presented in Table 3 and illustrated in Figure 3.

**Table 3 Receptor locations used in the AQIA**

| ID | Location | Land use | Coordinates (UTM) | |
|---|---|---|---|---|
| | | | mE | mS |
| R1 | Newton Road, Wetherill Park | Industrial | 304 740 | 6 252 685 |
| R2 | Newton Road, Wetherill Park | Industrial | 304 648 | 6 252 637 |
| R3 | Victoria Street, Wetherill Park | Industrial | 304 689 | 6 252 875 |
| R4 | Victoria Street, Wetherill Park | Industrial | 304 806 | 6 252 922 |
| R5 | Victoria Street, Wetherill Park | Industrial | 304 864 | 6 252 950 |
| R6 | Victoria Street, Wetherill Park | Industrial | 304 946 | 6 253 025 |
| R7 | Newton Road, Wetherill Park | Industrial | 305 026 | 6 252 982 |
| R8 | Newton Road, Wetherill Park | Industrial | 305 114 | 6 252 973 |
| R9 | Newton Road, Wetherill Park | Industrial | 305 102 | 6 252 921 |
| R10 | Newton Road, Wetherill Park | Industrial | 305 069 | 6 252 869 |
| R11 | Newton Road, Wetherill Park | Industrial | 305 063 | 6 252 842 |
| R12 | Newton Road, Wetherill Park | Industrial | 304 991 | 6 252 764 |
| R13 | Newton Road, Wetherill Park | Industrial | 304 945 | 6 252 730 |
| R14 | Newton Road, Wetherill Park | Industrial | 304 867 | 6 252 697 |
| R15 | Newton Road, Wetherill Park | Industrial | 304 826 | 6 252 675 |
| R16 | Newton Road, Wetherill Park | Industrial | 304 766 | 6 252 640 |
| R17 | Ormsby Place, Wetherill Park | Industrial | 304 621 | 6 252 810 |
| R18 | Borneo Court, Bossley Park | Residential | 304 914 | 6 252 174 |
| R19 | Nello Place, Wetherill Park | Swim School | 305 160 | 6 252 428 |
| R20 | Elizabeth Street, Wetherill Park | Medical Centre | 305 466 | 6 252 547 |

Figure 3 Population densities and sensitive receptors surrounding the Proposal site




**Source:** Northstar

## 4.3. Meteorology

The meteorology experienced within an area can govern the generation (in the case of wind-dependent emission sources), dispersion, transport, and eventual fate of pollutants in the atmosphere. The meteorological conditions surrounding the Proposal site have been characterised using data collected by the Australian Government Bureau of Meteorology (BoM) at surrounding automatic weather stations (AWS).

Three meteorological stations operated by BoM were identified within an approximate 15-kilometre (km) radius of the Proposal site. A summary of the relevant AWS is provided in Table 4 below (listed by proximity).

**Table 4 Meteorological monitoring sites within 15 km of the Proposal site**

| Site name | Station # | Source | Approximate location | | Approximate distance (km) |
|---|---|---|---|---|---|
| | | | mE | mS | |
| Horsley Park Equestrian Centre AWS | 067119 | BoM | 301 708 | 6 252 298 | 3.1 |
| Bankstown Airport AWS | 066137 | BoM | 313 855 | 6 245 099 | 11.7 |
| Holsworthy Control Range | 067117 | BoM | 308 353 | 6 238 177 | 14.9 |

Data at Horsley Park Equestrian Centre AWS for the period between 2018 and 2022 have been analysed for use in this study. The wind roses presented in Appendix C indicate that from 2018 to 2022, winds at Horsley Park Equestrian Centre AWS show generally similar wind distribution patterns across the years assessed, with predominant south-westerly wind directions.

The majority of wind speeds experienced at the Horsley Park Equestrian Centre AWS between 2018 and 2022 are generally in the range 1.5 metres per second ($m \cdot s^{-1}$) to 5.5 $m \cdot s^{-1}$ with the highest wind speeds (greater than 8 $m \cdot s^{-1}$) occurring from mostly north-westerly directions. Winds of this speed are rare and occur during 0.2 % of the observed hours during the years while calm winds (less than 0.5 $m \cdot s^{-1}$) occur during 8 % of hours on average across the years between 2018 and 2022.

An analysis of the correlation coefficients between each year for wind speed, wind direction and particulate matter data distribution was performed to select a representative year for the meteorological modelling (refer Appendix C). Following this analysis, the year 2020 was selected as the representative year for further assessment.

To provide a characterisation of the meteorology which would be expected at the Proposal site, a meteorological modelling exercise has also been performed. A summary of the inputs and outputs of the meteorological modelling assessment, including validation of those outputs is presented in Appendix C.

## 4.4. Background Air Quality

The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional, and global). The relative contributions of sources at each of these scales to the air quality at a location, will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion, and fate of those pollutants.

When assessing the impact of any particular source of emissions on the potential air quality at a location, the impact of all other sources of an individual pollutant, should also be assessed. These 'background' (sometimes called 'baseline') air quality conditions will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data.

Two AQMS have been identified within a 10 km radius of the Proposal site, operated by NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW). These locations (listed by proximity) are briefly summarised in Table 5.

**Table 5 NSW DCCEEW AQMS within 10 km of the Proposal site**

| AQMS location | Distance to Proposal site (km) | 2020 data | Measurements | | | |
|---|---|---|---|---|---|---|
| | | | $PM_{10}$ | $PM_{2.5}$ | TSP | $NO_2$ |
| Prospect | 5.9 | ✓ | ✓ | ✓ | × | ✓ |
| Liverpool | 9.5 | ✓ | ✓ | ✓ | × | ✓ |

The closest representative AQMS with data available for the year 2020 (the selected representative year consistent with the meteorological modelling) is noted to be located at Prospect. Correspondingly, PM and $NO_2$ data from Prospect for the year 2020 have been adopted for use in this AQIA.

Appendix D provides a detailed assessment of the background air quality monitoring data used in this AQIA.

It is noted that none of the AQMS identified in Table 5 measure concentrations of TSP. This pollutant is of relevance to the expected emissions from the Proposal. Other sources of data have been adopted to allow representation of the TSP environment in the area surrounding the Proposal site, and a full discussion is provided in Appendix D.

It is noted that a number of AQMS in NSW metropolitan and regional population centres recorded particulate matter concentrations above the national standard on a number of days towards the start of 2020. This was mainly driven by intense drought conditions and a high frequency of bushfires occurring across NSW in early 2020 (NSW DPIE, 2021).

A summary of the air quality monitoring data and assumptions used to produce this AQIA are presented in Table 6. It is noted that although impacts of ozone ($O_3$) have not been considered in this assessment, $O_3$ data have been adopted to assist in calculating the conversion of $NO_x$ to $NO_2$ for the dispersion modelling assessment (refer Section 5.2.3).

**Table 6 Summary of background air quality used in the AQIA**

| Pollutant | Averaging Period | Units | Measured Value | Notes |
|---|---|---|---|---|
| Particles (as TSP) (derived from $PM_{10}$) | Annual | $\mu g \cdot m^{-3}$ | 41.4 | Estimated on a TSP:$PM_{10}$ ratio of 2.0551: 1 |
| Particles (as $PM_{10}$) | 24-hour | $\mu g \cdot m^{-3}$ | Daily varying | The 24-hour maximum $PM_{10}$ concentration in 2020 was 245.8 $\mu g \cdot m^{-3}$ |
| | Annual | $\mu g \cdot m^{-3}$ | 20.2 | |
| Particles (as $PM_{2.5}$) | 24-hour | $\mu g \cdot m^{-3}$ | Daily varying | The 24-hour maximum $PM_{2.5}$ concentration in 2020 was 70.8 $\mu g \cdot m^{-3}$ |
| | Annual | $\mu g \cdot m^{-3}$ | 8.6 | |
| Nitrogen dioxide ($NO_2$) | 1-hour | $\mu g \cdot m^{-3}$ | 88.2 | Hourly maximum 1-hr average in 2020 |
| | Annual | $\mu g \cdot m^{-3}$ | 15.1 | Annual average in 2020 |
| Photochemical oxidants (as ozone) | 1-hour | $\mu g \cdot m^{-3}$ | 218.3 | Hourly maximum 1-hr average in 2020 |
| | Annual | $\mu g \cdot m^{-3}$ | 40.7 | Annual average in 2020 |

**Note**: Reference should be made to Appendix D

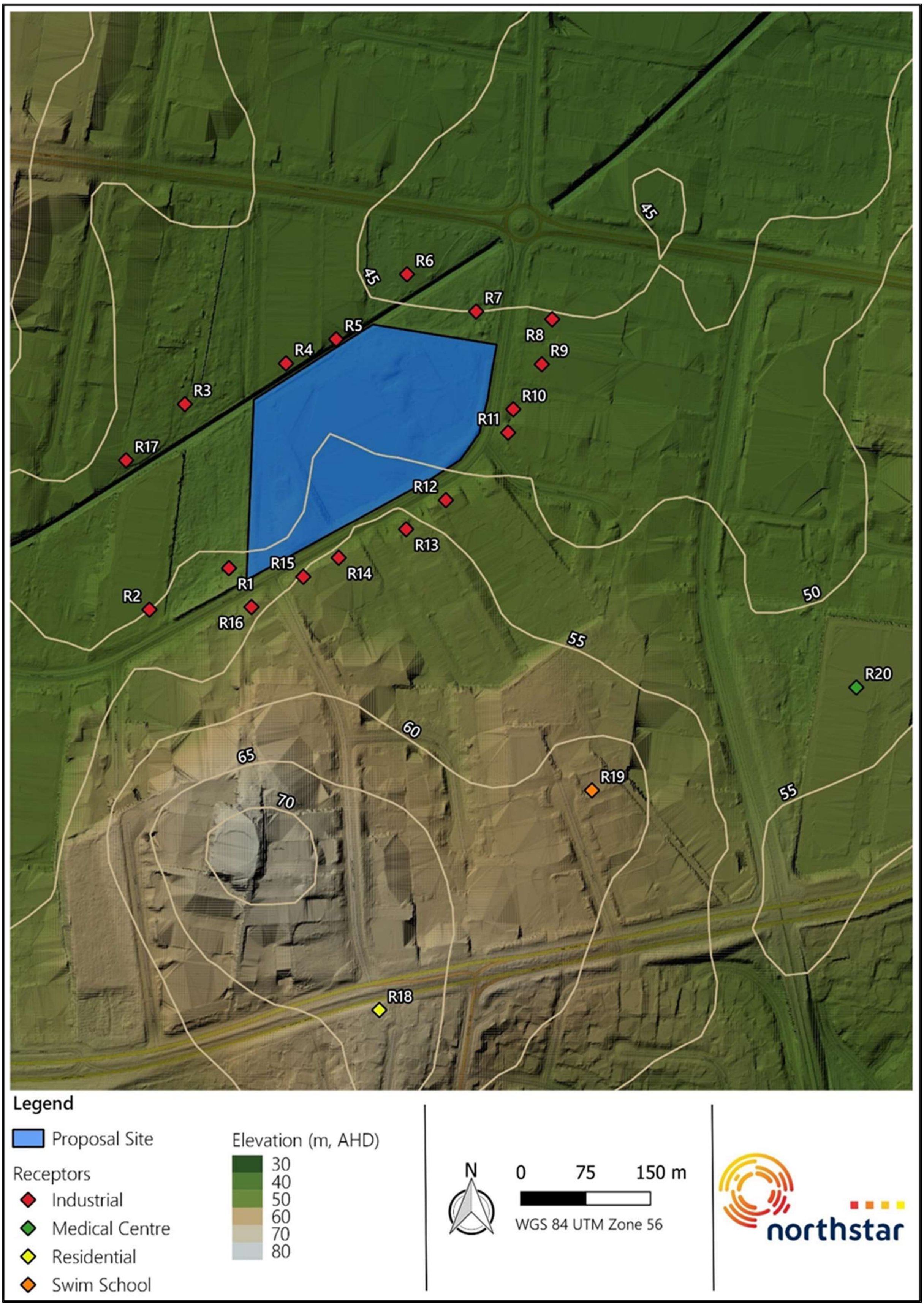
## 4.5. Topography

The Proposal site is located within an area which has a relatively flat surface terrain with little height variation. The elevation of the Proposal site ranges between approximately 45 m to 55 m Australian Height Datum (AHD).

The topography between the Proposal site and the nearest identified sensitive receptor locations is relatively consistent with elevation variances of less than 15 m within the immediate locality. In dispersion modelling terms, the topography is relatively uncomplicated, and does not need to be explicitly accounted for in the dispersion modelling exercise.

An illustration of the local topography encompassing the Proposal site and surrounding area is presented in Figure 4.

Figure 4 Local topography




**Source:** Northstar

## 4.6. Potential for Cumulative Impacts

Given the industrial nature of the area surrounding the Proposal site, there is the potential for emissions generated as part of the Proposal and other surrounding facilities to impact cumulatively on nearby sensitive receptors.

### 4.6.1. Existing Development

A desktop survey identified three existing warehousing and distribution facilities proximate to the Proposal site as follows:

- One Warehousing and Distribution located at 490 Victoria St, Wetherill Park approximately 0.5 km to the northwest of the Proposal site;
- DGL Warehousing and Distribution located at 9 Coates Pl, Wetherill Park approximately 0.75 km to the northwest of the Proposal site; and
- Phoenix Distribution located at 158 Cowpasture Rd, Wetherill Park approximately 1.2 km to the west-northwest of the Proposal site.

It is noted that no publicly available documentation could be found regarding potential air quality impacts on the local environment associated with the abovementioned facilities. Correspondingly, it is considered that the inclusion of background air quality data as described in Section 4.4 would appropriately account for any potential cumulative impacts associated with surrounding land uses.

### 4.6.2. Approved Development

The following outlines recently approved developments in the area surrounding the Proposal site:

- SSD-7664-MOD-3 - Horsley Drive Business Park Stage 2, approximately 1.3 km to the west of the Proposal:
  - Horsley Drive Business Park Stage 2 concept development application, comprising:
  - a Concept Proposal for up to 88 700 $m^2$ of GFA for general industrial, light industrial, warehouse and distribution and ancillary office land uses, building envelopes and levels for Lots 1 – 4, road layout and sites access and landscape designs; and
  - Stage 1 project approval works including subdivision of the site, construction of a public access road off, demolition, bulk earthworks, site infrastructure and landscaping.

An air quality assessment performed to support the concept design concluded that air quality impacts at the nearest sensitive receptors would be 'negligible', and 'neutral' during operations. Given the distance from the Proposal site, cumulative impacts with this approved development are not anticipated to occur.

- SSD-7401-MOD-3 - 24 Davis Road, Wetherill Park, approximately 1.4 km to the northeast of the Proposal site:
  - MOD-1 considered the increase in throughput from 160 000 $t{\cdot}yr^{-1}$ to 350 000 $t{\cdot}yr^{-1}$ of waste at a resource recovery facility. Wastes include general solid waste (non-putrescible), hydro-excavation, drill muds and fluids, and general solid waste (putrescible) including food organics (FO), garden organics (GO) and mixed FOGO. MOD-1 was approved on 21 April 2021.
  - MOD-2 was associated with an amendment to stormwater treatment and was approved on 30 November 2021.
  - MOD-3 was associated with a modification to the configuration of weighbridges, carparking and stormwater management system and was approved on 1 April 2022.

The NSW DPE (now NSW DPHI) assessment report associated with MOD-1 concluded that:

> *"the dust emissions associated with the modification can be mitigated through the proposed conditions of consent and the reactive air quality management measures proposed by the Applicant. The Department has included the NSW EPA's requested conditions in the recommended instrument, including the requirement for an AQMP and the ability for roller doors to be retroactively fitted on the semi-enclosed shed. These conditions will ensure measures are in place should future audits identify dust as an issue."*

Based on those conclusions and considering the significant separation distance to the Proposal site, cumulative impacts are not likely to be significant. Cumulative air quality impacts associated with MOD-2 and MOD-3 are anticipated to be negligible.

### 4.6.3. Likely Future Development

The following outlines proposed developments in the area surrounding the Proposal site:

- SSD-8184 - Fairfield Sustainable Resource Centre Expansion (Widemere Road And Hassall Street, Wetherill Park), approximately 2.2 km northeast of the Proposal site:
  - Expansion of an existing resource recovery facility to process up to 550 000 $t{\cdot}yr^{-1}$ of construction and demolition waste, extend the operating hours and physical works on the site to improve efficiencies.

The SSD is currently in the 'Response to Submissions' phase, although NSW EPA have provided recommended conditions related to dust management and consider that the potential for odour impacts is low. The recommended conditions should ensure that impacts are appropriately managed at the nearest receptors, and given the significant separation distance to the Proposal, cumulative impacts are anticipated to be minimal.

- SSD-15221509 – Woolworths WDC Wetherill Park (250 Victoria Street, Wetherill Park), approximately 2.3 km to the east of the Proposal site:
    - Construction and operation of a warehouse and distribution facility in Wetherill Park for handling chilled and fresh products.

The SSD is also currently in the 'Response to Submissions' phase although an AQIA has been performed. Impacts during construction were considered to represent a low risk, should appropriate mitigation measures be applied, and impacts during operation were predicted to be low, and below relevant air quality criteria. Again, given the significant separation distance, cumulative impacts are anticipated to be minimal.

- PP-2021-3824 – Key Hole Lands (Land holdings on The Horsley Drive, Redmayne Road, Chandos Road, and Horsley Park), approximately 2.5 km to the west of the Proposal site:
    - Planning proposal to amend the current planning provisions of the Fairfield LEP 2013 to rezone the site from RU2 Rural Landscape to IN1 General Industrial to permit industrial and warehouse land uses on the site (the concept masterplan prepared with the planning proposal includes 14 warehouses that have a total of 313 340 $m^2$ GFA).

No publicly available air quality assessment could be found for this development, although given the separation distance, no significant cumulative impacts on air quality surrounding the Proposal site would be anticipated either during the construction or operational phase.

It is noted that the concurrent SSDA submission (SSD-61383966) for the multi-level warehouse to be constructed and operated at the Proposal site has not been included in the cumulative assessment as only one of the two developments would be constructed and operated on approval.

# 5. APPROACH TO ASSESSMENT

## 5.1. Construction Phase

Construction phase activities have the potential to generate short-term emissions of particulates. Generally, these are associated with uncontrolled (or 'fugitive') emissions and are typically experienced by neighbours as amenity impacts, such as dust deposition and visible dust plumes, rather than associated with health-related impacts. Localised engine-exhaust emissions from construction machinery and vehicles may also be experienced, but given the scale of the proposed works, fugitive dust emissions would have the greatest potential to give rise to downwind air quality impacts.

Modelling of dust from construction Proposals is generally not considered appropriate, as there is a lack of reliable emission factors from construction activities upon which to make predictive assessments, and the rates would vary significantly, depending upon local conditions. In lieu of a modelling assessment, the construction-phase impacts associated with the Proposal have been assessed using a risk-based assessment procedure. The advantage of this approach is that it determines the activities that pose the greatest risk, which allows the Construction Environmental Management Plan (CEMP) to focus controls to manage that risk appropriately and reduce the impact through proactive management.

For this risk assessment, Northstar has adapted the methodology presented in *Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management (IAQM) (IAQM, 2024). Reference should be made to Appendix B for the methodology.

Briefly, the adapted method uses a six-step process for assessing dust impact risks from construction activities, and to identify key activities for control as outlined in Appendix B.

## 5.2. Operational Phase

### 5.2.1. Emission Estimation

The estimation of emissions from a process is typically performed using direct measurement or through the application of factors which appropriately represent the processes under assessment. For road-traffic emissions, the assessment considered the applicability of emission factors presented in the National Pollutant Inventory (NPI) *Emission estimation technique manual for aggregated emissions from motor vehicles* (NPI, 2000). The emission factors were discounted due to the age of the emission factors, and the rapid improvements in engine performance over the last two decades. For example, a data set published in the year 2000 would utilise emission standards for passenger cars performing to Australian Design Rule (ADR) 37/01 (at best) which specifies (by way of example) a $NO_X$ emission of 1.93 $g{\cdot}km^{-1}$ for petrol fuelled cars. For comparison, ADR7904 (type approval 2016) specify $NO_X$ emission standard of 0.06 $g \cdot km^{-1}$ for petrol fuelled cars respectively, which represents 3 % of the ADR37/01 standard[1].

To better represent more modern emission performance, reference has been made to the fleet-average NSW EPA GMR Emission Inventory On-Road emission assessment, adapted for this study by assumptions relating to site-specific fleet composition, road gradient and traffic conditions. The model is a development of ADR emission performance standards, fleet distribution published by the Motor Vehicle Census for Australia, and numerous sources of published road-traffic emission databases, including COPERT4.

It is noted that for the purposes of this study, the fleet composition at the Proposal site has been disaggregated by light vehicles (cars) and heavy vehicles (rigid). Appropriate emission factors for the differing vehicles at the Proposal site have been adopted from NSW EPA GMR Emission Inventory On-Road emission assessment and COPERT4. Impacts from diesel- and petrol-powered vehicles have also been considered following a review of the Motor Vehicle Census of Australia to estimate the distribution of diesel and petrol vehicles from the traffic generation resulting from the Proposal.

Emissions of non-exhaust PM, including brake wear, tyre wear and road wear are included as factors in the assessment of $PM_{10}$ and $PM_{2.5}$ emissions.

The emission factors are provided as weighted by the road type, which helps provide definition of base vehicle speed and general traffic flow characteristics. For the purposes of this assessment, the roads at the Proposal site have been assessed as being typified as an "local/residential" road (to represent conditions within the Proposal site):

> *Secondary roads with prime purpose of access to property.* Characterised *by low congestion and low levels of heavy vehicles. Generally, one lane each way, undivided with speed limits of 50 $km \cdot h^{-1}$ maximum. Regular intersections, mostly unsignalised, low intersection delays.*

Traffic data for the Proposal has been provided by Ason Group (Ason Group, 2024). Traffic generation rates for the Proposal have been estimated for AM and PM peak hours as presented in Table 7. It is noted that the estimated AM and PM peak traffic data are equal to each other.

The technical modelling set out in this report has been based on a trip generation rate of 0.22 trips per 100 $m^2$ during the weekday AM and PM peak. The metric of 0.22 trips is the calculated average of 3 nominated sites with comparable size to the proposed development, and subsequently has been used as a point of reference for the traffic impact assessment (Ason Group, 2024).

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[1] https://www.infrastructure.gov.au/vehicles/environment/emission/files/Emission_Standards_for_Petrol_Cars.pdf

As documented in the transport assessment, the actual anticipated trip generation rate associated with the proposed development is 0.22 trips per 100m$^2$. This is lower than the trip generation rate used to inform the modelling and assessment contained in this report. Accordingly, this assessment is considered conservative as the findings and conclusions are based on a higher trip generation rate (and thus greater number of vehicle movements to and from the site) than anticipated in reality.

The daily total traffic generation has been estimated using a methodology previously used by Northstar for a similar warehousing and distribution development, located in Kemps Creek (Northstar, 2021). The methodology indicates that an average of 2.64 vehicle trips per 100 m$^2$ of GFA per day would be likely to be generated by developments of this nature. Using this methodology, the estimated daily vehicle movements associated with the Proposal is 762 vehicle movements, given the size of the warehouse as outlined in Section 2.2. Note that the peak hour traffic data has been adopted for the assessment against short-term (1-hour) air quality criteria, with the daily total used to assess against longer term (24-hour and annual) criteria.

Previous assessments indicate that approximately 23 % of vehicles are likely to be commercial vehicles and correspondingly, this rate has been adopted to determine the split between light and heavy vehicles for this Proposal.

A summary of the estimated traffic generation for the Proposal is presented in Table 7.

**Table 7 Estimated traffic generation**

| Vehicle type | AM peak (trips·hr$^{-1}$) | PM peak (trips·hr$^{-1}$) | Daily total (trips·day$^{-1}$) |
|---|---|---|---|
| Light duty | 51 | 51 | 586 |
| Heavy duty | 15 | 15 | 175 |
| **Total** | **66** | **66** | **762** |

In relation to emissions associated with idling trucks at the Proposal site, trucks are assumed to be idling at all docking locations at all times, which is considered to be highly conservative. Given the layout of the Proposal site, the likelihood of trucks idling at all docks at all times is considered impracticable. Emission factors associated with idling trucks have been sourced from (USEPA, 2008).

A summary of data used in the calculation of vehicle flows and emissions is presented in Table 8.

Table 8 Data used in the calculation of vehicle flows and emissions

| Parameter | Source | Comments |
|---|---|---|
| Traffic flows for the Proposal | (Ason Group, 2024) and assumed (see Table 7) | Traffic data split by car (light) and rigid (heavy) vehicles |
| Peak hour traffic flows | | Peak AM adopted as conservative |
| Vehicle types | | Traffic data split by cars (light) and rigid (heavy) vehicles |
| Fuel types | ABS Motor Vehicle Census, 2020 | Diesel and petrol fuel split for car, light commercial, light rigid, heavy rigid, articulated vehicles (most recent data available, not available by State or Territory) |
| Emissions | NSW EPA GMR Emissions Inventory 2008 | $NO_X$, $PM_{10}$ exhaust emissions, $PM_{2.5}$ from exhaust emission calculated to be 71.4% of $PM_{10}$<br>$PM_{10}$, $PM_{2.5}$ brake and tyre wear emissions calculated for local/residential roads |

### 5.2.2. Atmospheric Dispersion Modelling

A dispersion modelling assessment has been performed using the GRAz Lagrangian model (GRAL). GRAL is developed at the Graz University of Technology, Austria, and supported by the Federal State Government of Styria, Austria.

The GRAL modelling system is increasingly used in Australia and New Zealand, with the 2019 Clean Air Society of Australia and New Zealand (CASANZ) conference featuring a GRAL stream for the first time due to its increased use in AQIA in Australia. The air quality assessments for the WestConnex M4 East (Pacific Environment, 2015) and New M5 (Pacific Environment, 2015b) used the GRAL model to predict operational impacts on ambient air quality and it is the preferred model of Traffic for NSW (TfNSW) for assessment of recent road infrastructure projects.

The GRAL model was selected for the dispersion modelling for this assessment for the following reasons:

- It is suitable for regulatory applications and can utilise a full year of meteorological data;
- It is a particle model and has the ability to predict concentrations under low-wind-speed conditions (i.e. less than 1 $m{\cdot}s^{-1}$) which is better performance under these conditions than most Gaussian models (e.g. CALINE, Cal3QHCR, Cal3/4);
- It is specifically designed for the simultaneous modelling of road transport networks, including line sources (surface roads), point sources (tunnel ventilation outlets) and other sources; and
- It can characterise pollution dispersion in complex local terrain, accounting for the effects of obstacles (e.g. buildings, walls, and vegetation) on flow and turbulence patterns by using a microscale prognostic flow field model.

## 5.2.3. $NO_X$ to $NO_2$ Conversion

The conversion of $NO_X$ to $NO_2$ has been assumed to be in accordance with Method 2 of the NSW EPA Approved Methods (Section 8.1.2 of (NSW EPA, 2022)), commonly known as the 'Ozone Limiting Method' (OLM). This method assumes that all the available ozone ($O_3$) in the atmosphere will react with nitrous oxide (NO) in the plume until either all the $O_3$ or the NO is depleted, thus estimating instantaneous and complete formation of $NO_2$ in the near-field. This approach assumes that the atmospheric reaction is instantaneous, although in reality the reaction takes place over a number of hours and typically at distance from the point of emission.

A level 2 assessment has been performed which uses the contemporaneous hourly model predictions of $NO_X$ and measured hourly $NO_2$ and $O_3$ concentrations at the Prospect AQMS in 2020 (see Section 4.4).

The assumed $NO_X$ to $NO_2$ reaction algorithm is represented as:

$$[NO_2]_{total} = \left\{0.1 \times [NO_x]_{pred}\right\} + MIN\left\{(0.9 \times [NO_x]_{pred}\ or\ \left(\frac{46}{48}\right) \times [O_3]_{bkgrd}\right\} + [NO_2]_{bkgrd}$$

where:

$[NO_2]_{total}$ = the predicted concentration of $NO_2$ in $\mu g{\cdot}m^{-3}$

$[NO_x]_{pred}$ = the dispersion model prediction of the ground level concentration of $NO_X$ in $\mu g{\cdot}m^{-3}$

$[O_3]_{bkgrd}$ = the background ambient $O_3$ concentration in $\mu g{\cdot}m^{-3}$

$\left(\frac{46}{48}\right)$ = the ratio of molar mass of $NO_2$ and $O_3$

$[NO_2]_{bkgrd}$ = the background ambient $NO_2$ concentration in $\mu g{\cdot}m^{-3}$

# 6. CONSTRUCTION AIR QUALITY RISK ASSESSMENT

The methodology adapted by Northstar from IAQM *Guidance on the assessment of dust from demolition and construction* (IAQM, 2024) has been used to assess construction phase risk. The methodology and the full risk assessment are provided in Appendix B.

Briefly, the adapted method uses a six-step process for assessing dust impact risks from construction activities as a function (product) of receptor sensitivity and potential impact magnitude and identifies key activities for control (refer Section 5.1).

## 6.1. Risk (Pre-Mitigation)

Given the sensitivity of the identified receptors is classified as medium for dust soiling, and low for health impacts, and the dust emission magnitudes for the various construction phase activities as presented in Appendix B, the resulting risk of air quality impacts (without mitigation) is as presented in Table 9.

**Table 9 Risk of air quality impacts from construction activities**

| Sensitivity of Area | Dust emission magnitude | | | | | Preliminary risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Demolition | Earthworks | Construction | Track-out | Const. Traffic | Demolition | Earthworks | Construction | Track-out | Const. Traffic |
| **Dust soiling** | | | | | | | | | | |
| Med. | Large | Large | Large | Large | Large | High | Med. | Med. | Med. | Med. |
| **Human health** | | | | | | | | | | |
| Low | Large | Large | Large | Large | Large | Med. | Low | Low | Low | Low |

**Note:** Med. = Medium

The risks summarised in Table 9 show that for demolition activities, there is a high risk of adverse dust soiling impacts and a medium risk of human health impacts. All other construction phase activities are associated with medium risks of dust soiling impacts and low risks of health impacts if no mitigation measures were to be applied to control emissions associated with construction-phase activities.

The risk assessment therefore provides recommendations for construction phase mitigation, commensurate with those identified risks as provided in Appendix B.

## 6.2. Risk (Post Mitigation)

For almost all construction activity, the adapted methodology notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

Given the size of the Proposal site, the distance to sensitive receptors and the activities to be performed, residual impacts associated with fugitive dust emissions from the Proposal would be anticipated to be 'negligible', should the implementation of the mitigation measures outlined in Appendix B be performed appropriately.

# 7. OPERATIONAL AIR QUALITY IMPACT ASSESSMENT

This section presents the results of the dispersion modelling assessment and uses the following terminology:

- **Incremental impact –** relates to the concentrations predicted due to the operation of the Proposal in isolation; and,
- **Cumulative impact** – relates to the incremental concentrations predicted due to the operation of the Proposal PLUS background air quality concentrations discussed in Section 4.4.

The results are presented in this manner to allow examination of the likely impact of the Proposal in isolation and the contribution to air quality impacts in a broader sense.

In the presentation of results, the tables included shaded cells which represent the following:

| | | |
|---|---|---|
| **Model prediction** | **Pollutant concentration / deposition rate less than the relevant criterion** | **Pollutant concentration / deposition rate equal to, or greater than the relevant criterion** |

## 7.1. Particulate Matter

### 7.1.1. Annual Average TSP, $PM_{10}$ and $PM_{2.5}$ Concentrations

The predicted annual average particulate matter concentrations (as TSP, $PM_{10}$ and $PM_{2.5}$) resulting from the operations at the Proposal site are presented in Table 10.

The performance of the Proposal does not result in any exceedances of the annual average particulate matter impact assessment criteria for TSP and $PM_{10}$ (refer Table 2). The annual average $PM_{2.5}$ criterion is already in exceedance of the criterion, without the operation of the Proposal. The Proposal is predicted to represent a minimal contribution to the annual average $PM_{2.5}$ impacts.

Table 10 Predicted annual average TSP, $PM_{10}$ and $PM_{2.5}$ concentrations

| Receptor | Annual average concentration (µg·m$^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TSP | | | $PM_{10}$ | | | $PM_{2.5}$ | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 90 | | | 25 | | | 8 | | |
| Max. % of criterion | 2.2 | 46.0 | 48.2 | 3.8 | 80.8 | 84.6 | 8.9 | 107.5 | 116.4 |
| R1 | 0.6 | 41.4 | 42.0 | 0.3 | 20.2 | 20.5 | 0.2 | 8.6 | 8.8 |
| R2 | 0.1 | 41.4 | 41.5 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |
| R3 | 0.3 | 41.4 | 41.7 | 0.2 | 20.2 | 20.4 | 0.1 | 8.6 | 8.7 |
| R4 | 1.8 | 41.4 | 43.2 | 0.9 | 20.2 | 21.1 | 0.7 | 8.6 | 9.3 |
| R5 | 2.0 | 41.4 | 43.4 | 1.0 | 20.2 | 21.2 | 0.7 | 8.6 | 9.3 |
| R6 | 0.6 | 41.4 | 42.0 | 0.3 | 20.2 | 20.5 | 0.2 | 8.6 | 8.8 |
| R7 | 1.5 | 41.4 | 42.9 | 0.8 | 20.2 | 21.0 | 0.5 | 8.6 | 9.1 |
| R8 | 0.5 | 41.4 | 41.9 | 0.3 | 20.2 | 20.5 | 0.2 | 8.6 | 8.8 |
| R9 | 0.6 | 41.4 | 42.0 | 0.3 | 20.2 | 20.5 | 0.2 | 8.6 | 8.8 |
| R10 | 0.5 | 41.4 | 41.9 | 0.3 | 20.2 | 20.5 | 0.2 | 8.6 | 8.8 |
| R11 | 0.4 | 41.4 | 41.8 | 0.2 | 20.2 | 20.4 | 0.1 | 8.6 | 8.7 |
| R12 | 0.1 | 41.4 | 41.5 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |
| R13 | 0.1 | 41.4 | 41.5 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |
| R14 | 0.2 | 41.4 | 41.6 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |
| R15 | 0.4 | 41.4 | 41.8 | 0.2 | 20.2 | 20.4 | 0.1 | 8.6 | 8.7 |
| R16 | 0.4 | 41.4 | 41.8 | 0.2 | 20.2 | 20.4 | 0.1 | 8.6 | 8.7 |
| R17 | 0.1 | 41.4 | 41.5 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |
| R18 | < 0.1 | 41.4 | 41.5 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |
| R19 | < 0.1 | 41.4 | 41.5 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |
| R20 | < 0.1 | 41.4 | 41.5 | < 0.1 | 20.2 | 20.3 | < 0.1 | 8.6 | 8.7 |

**Note:** Incr = Incremental impact, Bkg = Background, Cumul = Cumulative Impact

## 7.1.2. Maximum 24-hour $PM_{10}$ and $PM_{2.5}$ Concentrations

Table 11 presents the maximum 24-hour average $PM_{10}$ and $PM_{2.5}$ concentrations predicted to occur at the nearest sensitive receptors as a result of the operation of the Proposal. No background concentrations are included within this table.

The predicted incremental concentrations of $PM_{10}$ and $PM_{2.5}$, are demonstrated to be minor, with the highest incremental 24-hour $PM_{10}$ and $PM_{2.5}$ impacts predicted at receptor R4.

Table 11 Predicted maximum incremental 24-hour $PM_{10}$ and $PM_{2.5}$ concentrations

| Receptor | Maximum 24-hour average concentration ($\mu g \cdot m^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| Criterion | 50 | 25 |
| Max. % of criterion | 5.1 | 8.5 |
| R1 | 1.5 | 1.1 |
| R2 | 0.4 | 0.3 |
| R3 | 1.1 | 0.8 |
| R4 | 2.6 | 2.1 |
| R5 | 2.6 | 2.1 |
| R6 | 1.3 | 1.2 |
| R7 | 2.3 | 1.7 |
| R8 | 1.1 | 0.9 |
| R9 | 1.1 | 0.8 |
| R10 | 1.0 | 0.6 |
| R11 | 0.7 | 0.5 |
| R12 | 0.2 | 0.1 |
| R13 | 0.1 | 0.1 |
| R14 | 0.2 | 0.2 |
| R15 | 0.6 | 0.4 |
| R16 | 0.9 | 0.7 |
| R17 | 0.4 | 0.3 |
| R18 | 0.1 | < 0.1 |
| R19 | 0.2 | 0.1 |
| R20 | < 0.1 | < 0.1 |

A contemporaneous analysis of the 24-hour $PM_{10}$ and $PM_{2.5}$ data has been performed where each predicted incremental concentration is added to the corresponding measured background concentration, in accordance with Section 11.2.3(b) of the Approved Methods (NSW EPA, 2022).

Table 12 and Table 13 present the predicted maximum 24-hour average $PM_{10}$ and $PM_{2.5}$ concentrations resulting from the operation of the Proposal, with the corresponding background included for each day.

Results are presented for the receptor at which the highest incremental $PM_{10}$ and $PM_{2.5}$ impacts have been predicted, and for the receptors at which the highest cumulative impacts (increment plus background) have been predicted. These may be different receptors than those at which the highest incremental impacts are predicted.

The left side of Table 12 and Table 13 indicates the predicted concentration on days with the highest cumulative impact (principally driven by the highest background concentrations), and the right side of the respective tables shows the total predicted concentration on days with the highest predicted incremental concentrations with the contemporaneous background values to derive the respective cumulative predictions.

For $PM_{10}$, the maximum cumulative impact (the left-hand side of Table 12), and the maximum incremental impact (the right-hand side of Table 12) are predicted at receptor R10 and receptor R4 respectively.

For $PM_{2.5}$, the maximum cumulative impact (the left-hand side of Table 13), and the maximum incremental impact (the right-hand side of Table 13) are predicted at receptor R5 and receptor R4 respectively.

It is noted that Table 12 and Table 13 includes columns headed by 'rank', referring to the ranking of cumulative impacts i.e. rank 1 being the highest cumulative impact. This has been included to highlight days when the background concentrations are not the driver of exceedances.

Specifically, Table 12 indicates that there were ten days on which the 24-hour $PM_{10}$ criterion was exceeded in 2020 although importantly, the operation of the Proposal is not predicted to result in any additional exceedances of the criterion.

For clarity the background daily $PM_{10}$ concentration on 27 January 2020 is 48.7 $\mu g \cdot m^{-3}$ whilst the Proposal increment of less than 0.1 $\mu g \cdot m^{-3}$ equates to a predicted cumulative impact of 48.8 $\mu g \cdot m^{-3}$, representing 97.6 % of the respective air quality criterion.

Table 12 similarly presents the predicted 24-hour average $PM_{2.5}$ concentrations at the Proposal site, whereby it is noted that there were 13 days which the 24-hour $PM_{2.5}$ criterion was exceeded. It is noted that a number of exceedances are indicated in the 'background' air quality data, and as discussed in Section 4.4, these were due to regional air quality episodes. However, the modelled cumulative 24-hour $PM_{2.5}$ concentrations are not predicted to result in any additional exceedances of the relevant criterion at the Proposal site.

Table 13 indicates that a minor exceedance of the maximum 24-hour average $PM_{2.5}$ criterion is predicted at the adjacent receptor R5. Discussion regarding the minor exceedance and measures to reduce the risk of adverse air quality impacts is provided in Section 8.2.

Contour plots of the incremental contribution of the proposed operations at the Proposal site to the 24-hour average $PM_{10}$ and $PM_{2.5}$ concentrations are presented in Figure 5 and Figure 6.

Table 12 Summary of contemporaneous impact and background – 24-hour $PM_{10}$ concentrations

| Rank | Date | 24-hour average $PM_{10}$ concentration ($\mu g \cdot m^{-3}$) Receptor R10 | | | Rank | Date | 24-hour average $PM_{10}$ concentration ($\mu g \cdot m^{-3}$) Receptor R4 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Incr. | Bkg. | Cumul. | | | Incr. | Bkg. | Cumul. |
| 1 | 23/01/2020 | 0.5 | 245.8 | 246.3 | 1 | 10/02/2020 | 2.6 | 10.6 | 13.2 |
| 2 | 24/01/2020 | < 0.1 | 105.6 | 105.7 | 2 | 13/02/2020 | 2.5 | 15.4 | 17.9 |
| 3 | 8/01/2020 | < 0.1 | 97.8 | 97.9 | 3 | 12/02/2020 | 2.5 | 11.4 | 13.9 |
| 4 | 5/01/2020 | < 0.1 | 81.1 | 81.2 | 4 | 7/02/2020 | 2.5 | 7.9 | 10.4 |
| 5 | 12/01/2020 | < 0.1 | 69.7 | 69.8 | 5 | 8/02/2020 | 2.5 | 11.1 | 13.6 |
| 6 | 4/01/2020 | 0.3 | 68.4 | 68.7 | 6 | 4/02/2020 | 2.4 | 37.6 | 40.0 |
| 7 | 25/01/2020 | < 0.1 | 61.5 | 61.6 | 7 | 19/12/2020 | 2.4 | 19.7 | 22.1 |
| 8 | 11/01/2020 | < 0.1 | 58.0 | 58.1 | 8 | 6/02/2020 | 2.4 | 11.4 | 13.8 |
| 9 | 1/01/2020 | < 0.1 | 57.4 | 57.5 | 9 | 6/01/2020 | 2.2 | 38.0 | 40.2 |
| 10 | 2/01/2020 | < 0.1 | 54.0 | 54.1 | 10 | 31/12/2020 | 2.2 | 16.0 | 18.2 |
| 11 | 27/01/2020 | < 0.1 | 48.7 | 48.8 | 11 | 22/02/2020 | 2.2 | 15.9 | 18.1 |
| These data represent the highest Cumulative Impact 24-hour $PM_{10}$ predictions (outlined in red) as a result of the operation of the Proposal. | | | | | These data represent the highest Incremental Impact 24-hour $PM_{10}$ predictions (outlined in blue) as a result of the operation of the Proposal. | | | | |

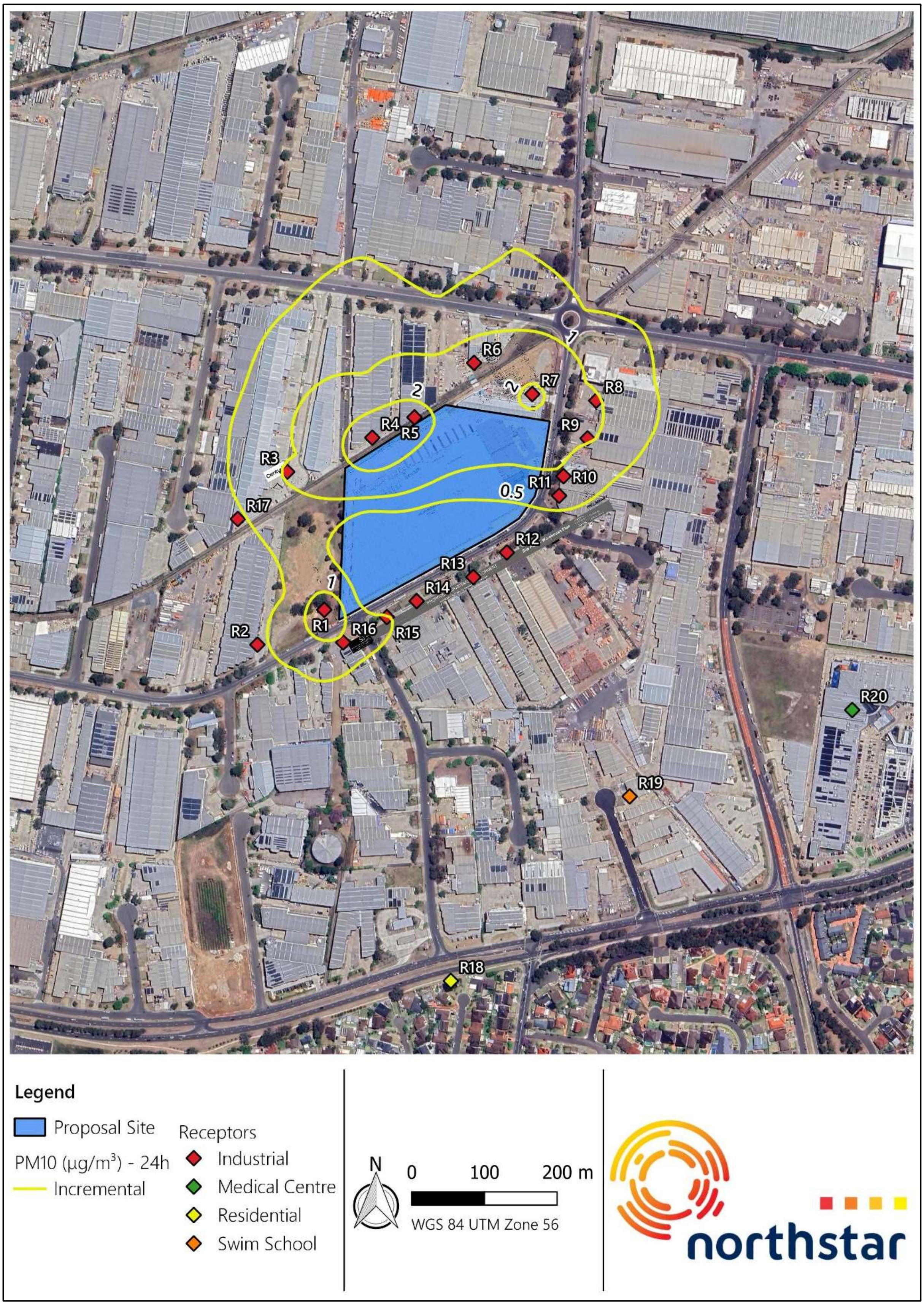
**Note**: Incr. = Incremental impact, Bkg. = Background, Cumul. = Cumulative Impact

Table 13 Summary of contemporaneous impact and background – 24-hour $PM_{2.5}$ concentrations

| Rank | Date | 24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) Receptor R5 | | | Rank | Date | 24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) Receptor R4 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Incr. | Bkg. | Cumul. | | | Incr. | Bkg. | Cumul. |
| 1 | 8/01/2020 | 1.5 | 70.8 | 72.3 | 1 | 8/02/2020 | 2.1 | 2.6 | 4.7 |
| 2 | 12/01/2020 | 1.6 | 47.2 | 48.8 | 2 | 7/02/2020 | 2.1 | 2.7 | 4.8 |
| 3 | 5/01/2020 | 1.8 | 41.7 | 43.5 | 3 | 13/02/2020 | 2.0 | 4.1 | 6.1 |
| 4 | 24/01/2020 | 1.3 | 37.5 | 38.8 | 4 | 4/02/2020 | 2.0 | 19.7 | 21.7 |
| 5 | 29/08/2020 | 0.3 | 37.1 | 37.4 | 5 | 12/02/2020 | 1.9 | 4.1 | 6.0 |
| 6 | 11/01/2020 | 2.0 | 33.4 | 35.4 | 6 | 10/02/2020 | 1.9 | 3.7 | 5.6 |
| 7 | 17/01/2020 | 1.5 | 31.3 | 32.8 | 7 | 19/12/2020 | 1.8 | 6.0 | 7.8 |
| 8 | 2/01/2020 | 1.5 | 30.4 | 31.9 | 8 | 6/02/2020 | 1.8 | 3.3 | 5.1 |
| 9 | 7/06/2020 | 0.8 | 29.3 | 30.1 | 9 | 15/12/2020 | 1.8 | 5.5 | 7.3 |
| 10 | 4/01/2020 | 0.5 | 26.8 | 27.3 | 10 | 6/01/2020 | 1.7 | 13.6 | 15.3 |
| 11 | 1/01/2020 | 1.1 | 25.8 | 26.9 | 11 | 29/01/2020 | 1.7 | 19.4 | 21.1 |
| 12 | 6/06/2020 | 0.4 | 26.2 | 26.6 | 12 | 9/02/2020 | 1.7 | 2.4 | 4.1 |
| 13 | 27/01/2020 | 1.2 | 24.9 | 26.1 | 13 | 12/12/2020 | 1.7 | 3.6 | 5.3 |
| 14 | 23/01/2020 | < 0.1 | 25.4 | 25.5 | 14 | 24/11/2020 | 1.7 | 6.2 | 7.9 |
| 15 | 13/01/2020 | 0.8 | 23.5 | 24.3 | 15 | 11/01/2020 | 1.7 | 33.4 | 35.1 |
| 16 | 30/08/2020 | 0.2 | 23.3 | 23.5 | 16 | 11/12/2020 | 1.7 | 5.2 | 6.9 |
| 17 | 3/01/2020 | 1.0 | 22.3 | 23.3 | 17 | 31/12/2020 | 1.7 | 4.3 | 6.0 |
| These data represent the highest Cumulative Impact 24-hour $PM_{2.5}$ predictions (outlined in red) as a result of the operation of the Proposal. | | | | | These data represent the highest Incremental Impact 24-hour $PM_{2.5}$ predictions (outlined in blue) as a result of the operation of the Proposal. | | | | |

**Note**: Incr = Incremental impact, Bkg = Background, Cumul = Cumulative Impact

Figure 5 Predicted incremental 24-hour $PM_{10}$ concentrations




**Source:** Northstar

Figure 6 Predicted incremental 24-hour $PM_{2.5}$ concentrations


**Source:** Northstar

## 7.2. Nitrogen Dioxide

Predicted incremental and cumulative annual average and maximum 1-hour $NO_2$ concentrations resulting from the operation of the Proposal are presented in Table 14.

Emissions of $NO_X$ have been calculated, with subsequent ground-level concentrations predicted using dispersion modelling techniques. Given that $NO_X$ is a mixture of $NO_2$ and nitric oxide (NO), conversion of $NO_X$ predictions to $NO_2$ concentrations may be performed. Within this assessment, the OLM method has been adopted as outlined in Section 5.2.3.

**Table 14 Predicted 1-hour and annual $NO_2$ concentrations**

| Receptor | Nitrogen dioxide ($NO_2$) concentration ($\mu g \cdot m^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour average | | | Annual average | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 164 | | | 31 | | |
| Max. % of criterion | 2.1 | 53.8 | 55.9 | 30.1 | 48.7 | 78.8 |
| R1 | 0.7 | 88.2 | 88.9 | 0.7 | 15.1 | 15.8 |
| R2 | 0.2 | 88.2 | 88.4 | 0.3 | 15.1 | 15.4 |
| R3 | 0.3 | 88.2 | 88.5 | 1.3 | 15.1 | 16.4 |
| R4 | 0.8 | 88.2 | 89.0 | 8.3 | 15.1 | 23.4 |
| R5 | 1.0 | 88.2 | 89.2 | 9.3 | 15.1 | 24.4 |
| R6 | 0.3 | 88.2 | 88.5 | 3.0 | 15.1 | 18.1 |
| R7 | 1.1 | 88.2 | 89.3 | 6.7 | 15.1 | 21.8 |
| R8 | 0.4 | 88.2 | 88.6 | 2.4 | 15.1 | 17.5 |
| R9 | 1.2 | 88.2 | 89.4 | 1.7 | 15.1 | 16.8 |
| R10 | 2.8 | 88.2 | 91.0 | 1.1 | 15.1 | 16.2 |
| R11 | 2.7 | 88.2 | 90.9 | 0.8 | 15.1 | 15.9 |
| R12 | 2.2 | 88.2 | 90.4 | 0.6 | 15.1 | 15.7 |
| R13 | 1.5 | 88.2 | 89.7 | 0.6 | 15.1 | 15.7 |
| R14 | 1.0 | 88.2 | 89.2 | 0.6 | 15.1 | 15.7 |
| R15 | 1.0 | 88.2 | 89.2 | 0.5 | 15.1 | 15.6 |
| R16 | 0.7 | 88.2 | 88.9 | 0.4 | 15.1 | 15.5 |
| R17 | < 0.1 | 88.2 | 88.3 | 0.6 | 15.1 | 15.7 |
| R18 | 0.1 | 88.2 | 88.3 | 0.1 | 15.1 | 15.2 |
| R19 | 3.5 | 88.2 | 91.7 | 0.3 | 15.1 | 15.4 |
| R20 | 0.3 | 88.2 | 88.5 | 0.2 | 15.1 | 15.3 |

**Note:** Incr = Incremental impact, Bkg = Background, Cumul = Cumulative Impact

The results indicate that predicted incremental concentrations of combustion-related pollutants (characterised by $NO_2$), are below the respective 1-hour and annual $NO_2$ criteria at all surrounding receptor locations (refer Table 2).

Receptor R19 is predicted to experience a maximum 1-hour $NO_2$ concentration of 91.7 $\mu g \cdot m^{-3}$ or approximately 55.9 % of the respective criterion of 164 $\mu g \cdot m^{-3}$ as a result of the Proposal. Regarding annual average $NO_2$ impacts, receptor R5 is predicted to experience a maximum concentration of 24.4 $\mu g \cdot m^{-3}$ equating to 78.8 % of the respective criterion of 31 $\mu g \cdot m^{-3}$.

As such, the results indicate that predicted cumulative concentrations of $NO_2$ at all receptor locations and would comply with both the annual and maximum 1-hour average criteria (refer Table 2).

The performance of the Proposal does not result in any exceedances of the criteria for combustion related pollutants.

A contour plot of the predicted maximum 1-hour incremental $NO_2$ impact is presented in Figure 7. Note that this contour plot presents the maximum predicted incremental $NO_2$ impacts, whilst the values in Table 14 show the incremental impacts on the days with the greatest cumulative impacts.

## Figure 7 Predicted incremental 1-hour $NO_2$ concentrations


**Source:** Northstar

# 8. MITIGATION AND MANAGEMENT

## 8.1. Construction Phase Mitigation

The potential impacts associated with construction phase activities has been performed using a risk-based assessment procedure. This approach is preferred, principally because emissions from construction activities are hard to estimate as they occur over short-term periods, and the rate of actual emissions is highly dependent upon the prevailing meteorology and conditions coincidental to the performance of the specific operations. Also, these can be influenced significantly by the manner in which those activities are performed and managed.

To offer a methodology to identify potential construction phase risks and where controls are required, the IAQM risk-based assessment procedure (IAQM, 2024) has been adopted. This methodology has been adapted for use in Australia by Northstar and used previously in NSW and Australia.

The published procedure assesses risk associated with various construction-phase activities, including demolition, earthworks, construction, and track-out. The identified risks are summarised in Section 6, and the mitigation measures identified to manage those risks are presented in Appendix B.

It is noted that the identified mitigation measures are disaggregated into general measures such as site management and communications and measures associated specifically with demolition, earthworks, construction and track-out.

Additionally, the identified mitigation measures are anticipated to be implemented in the Construction Environmental Management Plan (CEMP).

## 8.2. Operational Phase Mitigation

The operational phase impact assessment indicates that with the exception of one minor additional exceedance of the 24-hour $PM_{2.5}$ criterion, the level of activity being performed at the Proposal site would result in the achievement of all other air quality criteria.

As outlined in Section 7.1.2, a minor additional exceedance of the 24-hour $PM_{2.5}$ criterion was predicted with addition of the background $PM_{2.5}$ concentration on 27 January 2020. However, the adopted background $PM_{2.5}$ concentration on that particular day was already 99.6 % of the relevant criterion, and the minor predicted increment (1.2 $\mu g \cdot m^{-3}$ [4.8 % of the criterion]) results in a minor exceedance of that criterion.

The exceedance has been examined and is primarily driven by the movement and idling of trucks at the Proposal site. It is noted that these impacts are associated with the assumption that 18 trucks would occupy and idle within the associated loading bays at the Proposal site on every hour of the day, which is a highly conservative approach, and not representative of the 'likely' impacts as outlined in Section 5.2.1.

Impacts would be reduced through the adoption of a no-idling policy for heavy vehicles during loading / unloading, where possible, which would reduce emissions of fine particulate and consequently, impacts at the adjacent receptor.  Furthermore, the location at which the minor exceedance is predicted is currently operated as a tile store, where it is unlikely that a significant number of people would be at that location for a period of 24-hours and correspondingly, the risk of impact is subsequently reduced.

## 8.3. Monitoring

Given the discussion presented above, taking into consideration the incremental contribution of the Proposal to air quality impacts in the surrounding area, no air quality monitoring is required or proposed, for either the construction phase or the operational phase.

# 9. CONCLUSION

Northstar was engaged by Centuria Capital Limited to perform an AQIA for the construction of an industrial warehouse development to be located at 88 Newton Road, Wetherill Park NSW.

Construction phase activities will involve demolition, earthworks, construction works and associated vehicle traffic. The associated risks of impacts have been assessed using the published *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2024), and adapted by Northstar for use in Australia. This methodology has been used in a similar context in numerous other similar AQIA studies.

That assessment showed there to be a high risk of dust soiling impacts and a medium risk of health impacts associated with demolition activities should no mitigation measures be applied. All other construction phase activities are associated with medium risks of dust soiling and low risks of health impacts. Correspondingly, a range of standard mitigation measures, relating to communications, site management, monitoring and maintenance of the site, appropriate operation of machinery and track out vehicles for dust control, are proposed to ensure that short-term impacts associated with construction activities are minimised.

The prediction of potential impacts associated with operational activities has been performed in general accordance with the requirements of the Approved Methods (NSW EPA, 2022), using an approved and appropriate dispersion modelling technique. The estimation of emissions has been performed using referenced emission factors.

The potential impacts at all the identified receptor locations have been presented in this study which documents those predictions as:

- **Incremental impact** – relates to the concentrations predicted as a result of the operation of the Proposal in isolation.
- **Cumulative impact** – relates to the concentrations predicted as a result of the operation of the Proposal PLUS the background air quality concentrations.

All air quality criteria are predicted to be achieved, with the exception of one minor exceedance of the maximum 24-hour average $PM_{2.5}$ criterion. Good site management practices such as the minimisation of vehicle idling whilst on site, would be sufficient to ensure that this minor exceedance is not observed during Proposal operation.

# 10. REFERENCES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# APPENDIX A

## Commonly used Abbreviations and Units

## Units used in the Report

Units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units.

### Commonly used SI units

The following units are commonly used in Northstar reports.

| Symbol | Name | Quantity |
|---|---|---|
| **SI base units** | | |
| K | Kelvin | thermodynamic temperature |
| kg | kilogram | mass |
| m | metre | length |
| mol | mole | amount of substance |
| s | seconds | time |
| **Non-SI units mentioned in the SI or accepted for use** | | |
| ° | degree | plane angle |
| d | day | time |
| h | hour | time |
| ha | hectare | area |
| J | joule | energy |
| L | litre | volume |
| min | minute | time |
| N | newton | force or weight |
| t | tonne | mass |
| V | volt | electrical potential |
| W | watt | power |

### Multiples of SI and non-SI units

The following prefixes are added to unit names to produce multiples and sub-multiples of units:

| Prefix | Symbol | Factor |
|---|---|---|
| T | tera- | $10^{12}$ |
| G | giga- | $10^{9}$ |
| M | mega- | $10^{6}$ |
| k | kilo- | $10^{3}$ |
| h | hector- | $10^{2}$ |
| da | deca- | $10^{1}$ |

| Prefix | Symbol | Factor |
|---|---|---|
| p | pico- | $10^{-12}$ |
| n | nano- | $10^{-9}$ |
| μ | micro- | $10^{-6}$ |
| m | milli- | $10^{-3}$ |
| c | centi- | $10^{-2}$ |
| d | deci- | $10^{-1}$ |

In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol.

For example:

- 50 micrograms per cubic metre would be presented as 50 $\mu g \cdot m^{-3}$ and not 50 $\mu g/m^3$; and,
- 0.2 kilograms per hectare per hour would be presented as 0.2 $kg \cdot ha^{-1} \cdot hr^{-1}$ and not 0.2 kg/ha/hr.

### Commonly used SI-derived and non-SI units

| Symbol | Name | Quantity |
|---|---|---|
| $g \cdot m^{-2} \cdot s^{-1}$ | gram per square metre per second | rate of mass deposition per unit area |
| $g \cdot s^{-1}$ | gram per second | rate of mass emission |
| $kg \cdot ha^{-1} \cdot hr^{-1}$ | kilogram per hectare per hour | rate of mass deposition per unit area |
| $kg \cdot m^{-3}$ | kilogram per cubic metre | density |
| $L \cdot s^{-1}$ | litres per second | volumetric rate |
| $m^2$ | square metre | area |
| $m^3$ | cubic metre | volume |
| $m \cdot s^{-1}$ | metre per second | speed and velocity |
| $mg \cdot m^{-3}$ | milligram per cubic metre | mass concentration per unit volume |
| $mg \cdot Nm^{-3}$ | milligram per normalised cubic metre (of air) | mass concentration per unit volume |
| $\mu g \cdot m^{-3}$ | microgram per cubic metre | mass concentration per unit volume |
| $mg \cdot m^{-3}$ | milligram per cubic metre | mass concentration per unit volume |
| Pa | pascal | pressure |
| ppb | parts per billion ($1x10^{-9}$) | volumetric concentration |
| pphm | parts per hundred million ($1 \times 10^{-5}$) | volumetric concentration |
| ppm | parts per million ($1x10^{-6}$) | volumetric concentration |

### Commonly used abbreviations

| Abbreviation | Term |
|---|---|
| ABS | Australian Bureau of Statistics |
| ACT | Australian Commonwealth Territory |
| AGL | above ground level |
| AHD | Australian height datum |
| APC | air pollution control |
| AQI | air quality index |
| AQIA | air quality impact assessment |
| AQMS | air quality monitoring station |
| AQRA | air quality risk assessment |
| ARPANSA | Australian Radiation Protection and Nuclear Safety Agency |
| AS/NZS | Australian Standard / New Zealand Standard |
| AWS | automatic weather station |
| BCA | Building Code of Australia |
| BGL | below ground level |
| BOM | Bureau of Meteorology |

| Abbreviation | Term |
|---|---|
| CEMP | construction environment management plan |
| $CH_4$ | methane |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DEM | digital elevation model |
| EETM | emission estimation technique manual |
| EPA VIC | Environmental Protection Authority Victoria |
| EPBC | Environment Protection and Biodiversity Conservation Act |
| FIBC | flexible intermediate bulk container |
| GIS | geographical information system |
| IAQM | UK Institute of Air Quality Management |
| IBC | intermediate bulk container |
| ID | internal diameter |
| LLV | low level waste |
| LoM | life of mine |
| MSDS | Material Safety Data Sheet |
| NCAA | National Clean Air Agreement |
| NEPM | National Environment Protection Measure |
| $NH_3$ | ammonia |
| NO | nitric oxide |
| $NO_X$ | oxides of nitrogen |
| $NO_2$ | nitrogen dioxide |
| NORM | naturally occurring radioactive material |
| NSW | New South Wales |
| NSW DCCEEW | NSW Department of Climate Change, Energy, the Environment and Water |
| NSW DPHI | NSW Department of Planning, Housing, and Infrastructure |
| NSW DPE | New South Wales Department of Planning and Environment |
| NSW EPA | New South Wales Environment Protection Authority |
| NT | Northern Territory |
| OEMP | operational environmental management plan |
| $O_3$ | ozone |
| OU | odour unit |
| $OU \cdot m^3 \cdot s^{-1}$ | odour units times metres cubed per second |
| $OU \cdot s^{-1}$ | odour units per second |
| Pb | lead |
| PM | particulate matter |
| $PM_{10}$ | particulate matter with an aerodynamic diameter of 10 µm or less |
| $PM_{2.5}$ | particulate matter with an aerodynamic diameter of 2.5 µm or less |
| ROM | run of mine |
| SA | South Australia |

| Abbreviation | Term |
| --- | --- |
| SEPP | State Environmental Protection Policy |
| $SO_X$ | oxides of sulphur |
| $SO_2$ | sulphur dioxide |
| SRTM3 | Shuttle Radar Topography Mission |
| SVOC | semi-volatile organic compound |
| TAPM | The Air Pollution Model |
| TAS | Tasmania |
| TEU | twenty-foot equivalent unit |
| TSP | total suspended particulates |
| TVOC | total volatile organic compounds |
| TWA | time weighted average |
| US EPA | United States Environmental Protection Agency |
| UTM | Universal Transverse Mercator |
| VIC | Victoria |
| VLLW | very low level waste |
| VOC | volatile organic compound |

# APPENDIX B

## Construction Phase Air Quality Risk Assessment

Provided below is a summary of the risk assessment methodology used in this assessment. It is based upon IAQM (2024) *Guidance on the assessment of dust from demolition and construction* (version 2.2) and adapted by Northstar.

### Adaptions to the Published Methodology Made by Northstar

The adaptions made by Northstar from the IAQM published methodology are:

- **$PM_{10}$ criterion:** an amended criterion representing the annual average $PM_{10}$ criterion relevant to Australia rather than the UK;
- **Nomenclature:** a change in nomenclature from 'receptor sensitivity' to 'land use value' to avoid misinterpretation of values attributed to "receptor sensitivity" and "sensitivity of the area" which may be assessed as having different values;
- **Construction traffic:** the separation of construction vehicle movements as a discrete risk assessment profile from those associated with the 'on-site' activities of demolition, earthworks, and construction. The IAQM methodology considers four risk profiles of: 'demolition', 'earthworks', 'construction' and 'trackout'. The adaption by Northstar introduces a fifth risk assessment profile of 'construction traffic' to the existing four risk profiles; and,
- **Tables:** minor adjustments in the visualisation of some tables.

### Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance (IAQM, 2024) suggests screening out any assessment of impacts from construction activities where sensitive receptors are located:

- Beyond a distance of 250 m from the Proposal site boundary; and,
- At a distance greater than 50 m from the route(s) used by construction vehicles on public roads, beginning from the Proposal site entrance and extending past 250 m from the Proposal site entrance.

This step is noted as having deliberately been chosen to be conservative and would require assessments for most developments.

Table B1 overleaf presents the identified discrete sensitive receptors, with the corresponding estimated screening distances as compared to the screening criteria. It is noted that given the Proposal site includes multiple lots and warehouse structures, the distances between receptor locations and boundary / site entrance locations have been measured from the closest lot boundary or site entrance.

**Table B1 Construction phase impact screening criteria distances**

| Receptor | Location | Land use | Screening distance (m) | | |
|---|---|---|---|---|---|
| | | | Proposal site boundary (250 m) | Proposal site entrance (250 m) | Proposal site construction route(s) (50 m) |
| R1 | Newton Road, Wetherill Park | Industrial | 21 | 44 | 45 |
| R2 | Newton Road, Wetherill Park | Industrial | 117 | 144 | 144 |
| R3 | Victoria Street, Wetherill Park | Industrial | 79 | 213 | 214 |
| R4 | Victoria Street, Wetherill Park | Industrial | 16 | 239 | 240 |
| R5 | Victoria Street, Wetherill Park | Industrial | 8 | 277 | 278 |
| R6 | Victoria Street, Wetherill Park | Industrial | 64 | 377 | 378 |
| R7 | Newton Road, Wetherill Park | Industrial | 34 | 384 | 384 |
| R8 | Newton Road, Wetherill Park | Industrial | 70 | 438 | 439 |
| R9 | Newton Road, Wetherill Park | Industrial | 55 | 396 | 396 |
| R10 | Newton Road, Wetherill Park | Industrial | 32 | 340 | 339 |
| R11 | Newton Road, Wetherill Park | Industrial | 32 | 321 | 320 |
| R12 | Newton Road, Wetherill Park | Industrial | 30 | 222 | 221 |
| R13 | Newton Road, Wetherill Park | Industrial | 37 | 167 | 165 |
| R14 | Newton Road, Wetherill Park | Industrial | 29 | 84 | 80 |
| R15 | Newton Road, Wetherill Park | Industrial | 28 | 43 | 34 |
| R16 | Newton Road, Wetherill Park | Industrial | 32 | 48 | 35 |
| R17 | Ormsby Place, Wetherill Park | Industrial | 145 | 206 | 207 |
| R18 | Borneo Court, Bossley Park | Residential | 520 | 527 | 42 |
| R19 | Nello Place, Wetherill Park | Swim School | 406 | 455 | 172 |
| R20 | Elizabeth Street, Wetherill Park | Medical Centre | 526 | 696 | 396 |

With reference to Table B1, sensitive receptors are noted to be within the screening distance thresholds and therefore require further risk assessment as summarised in Table B2.

**Table B2 Application of Step 1 screening**

| Construction impact | Screening criteria | Step 1 screening | Comments |
|---|---|---|---|
| Demolition | 250 m from boundary<br>250 m from site entrance | Not screened | Receptors identified within the screening distance |
| Earthworks | 250 m from boundary<br>250 m from site entrance | Not screened | Receptors identified within the screening distance |
| Construction | 250 m from boundary<br>250 m from site entrance | Not screened | Receptors identified within the screening distance |
| Trackout | 100 m from site entrance | Not screened | Receptors identified within the screening distance |
| Construction Traffic | 50 m from roadside | Not screened | Receptors identified within the screening distance |

## Step 2 – Risk from Construction Activities

Step 2 of the assessment provides 'dust emissions magnitudes' for each of the dust generating activities; demolition, earthworks, construction, track-out (the movement of site material onto public roads by vehicles) and construction traffic.

The magnitudes are: Small, Medium, or Large, with suggested definitions for each category as follows:

**Table B3 Dust emission magnitude activities**

| Activity | Large | Medium | Small |
|---|---|---|---|
| **Demolition** | | | |
| total building volume* | > 75 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | < 12 000 $m^3$ |
| demolition height | > 12 m AGL | 6 m and 12 m AGL | < 6 m AGL |
| onsite crushing | yes | no | no |
| onsite screening | yes | no | no |
| demolition of materials with high dust potential | yes | yes | no |
| demolition timing | any time of the year | any time of the year | wet months only |
| **Earthworks** | | | |
| total site area | > 110 000 $m^2$ | 18 000 $m^2$ to 110 000 $m^2$ | < 18 000 $m^2$ |
| soil types | potentially dusty soil type (e.g. clay which would be prone to suspension when dry due to small particle size | moderately dusty soil type (e.g. silt) | soil type with large grain size (e.g. sand) |
| heavy earth moving vehicles | > 10 heavy earth moving vehicles active at any time | 5 to 10 heavy earth moving vehicles active at any one time | < 5 heavy earth moving vehicles active at any one time |
| formation of bunds | > 6 m AGL | 3 m to 6 m AGL | < 3 m AGL |
| material moved | > 100 000 t | 20 000 t to 100 000 t | < 20 000 t |
| earthworks timing | any time of the year | any time of the year | wet months only |
| **Construction** | | | |
| total building volume | 75 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | < 12 000 $m^3$ |
| piling | yes | yes | no |
| concrete batching | yes | yes | no |
| sandblasting | yes | no | no |
| materials | concrete | concrete | metal cladding or timber |
| **Trackout (within 100 m of construction site entrance)** | | | |
| outward heavy vehicles movements per day | > 50 | 20 to 50 | < 20 |
| surface materials | high potential | moderate potential | low potential |
| unpaved road length | > 100 m | 50 m to 100 m | < 50 m |

| Activity | Large | Medium | Small |
|---|---|---|---|
| **Construction Traffic (from construction site entrance to construction vehicle origin)** | | | |
| Demolition traffic - total building volume | > 75 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | < 12 000 $m^3$ |
| Earthworks traffic total site area | > 110 000 $m^2$ | 18 000 $m^2$ to 110 000 $m^2$ | < 18 000$m^2$ |
| Earthworks traffic soil types | potentially dusty soil type (e.g. clay which would be prone to suspension when dry due to small particle size | moderately dusty soil type (e.g. silt) | soil type with large grain size (e.g. sand) |
| Earthworks traffic material moved | > 100 000 t | 20 000 t to 100 000 t | < 20 000 t |
| Construction traffic total building volume | 75 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | < 12 000 $m^3$ |
| Total traffic heavy vehicles movements per day when compared to existing heavy vehicle traffic | > 50 % of heavy vehicle movement contribution by Proposal | 10 % to 50 % of heavy vehicle movement contribution by Proposal | < 10 % of heavy vehicle movement contribution by Proposal |

The footprint of the Proposal site (the area affected) is estimated at 51 913 $m^2$ (5.19 hectares [ha]) in area.

The Proposal would involve the demolition of the existing structures, construction of the warehouse development as outlined in Section 2.2 and illustrated in Figure 2. A desktop review of the existing structures at the Proposal site indicate that structures may exceed 75 000 $m^3$.

Based on review of layouts provided in Figure 2, the proposed warehouse building is assumed to be greater than 75 000 $m^3$ (threshold for large dust emission magnitude [refer Table B3]). Given the volume of construction to be performed, it is expected that up to 100 vehicle movements would be required to service the Proposal site each day.

Based upon the above assumptions and the assessment criteria presented in Table B3, the dust emission magnitudes are as presented in Table B4.

**Table B4 Construction phase impact categorisation of dust emission magnitude**

| Activity | Dust emission magnitude |
|---|---|
| Demolition | Large |
| Earthworks and enabling works | Large |
| Construction | Large |
| Track-out | Large |
| Construction traffic routes | Large |

### Step 3 – Sensitivity of the Area

Step 3 of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area considers:

- The specific sensitivities that identified land use values have to dust deposition and human health impacts;
- The proximity and number of those receptors locations;
- In the case of $PM_{10}$, the local background concentration; and
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

### Land Use Value

Individual receptor locations may be attributed different land use values based on the land use of the land, and may be classified as having high, medium, or low values relative to dust deposition and human health impacts (ecological receptors are not addressed using this approach).

Essentially, land use value is a metric of the level of amenity expectations for that land use.

The IAQM method (IAQM, 2024) provides guidance on the land use value with regard to dust soiling and health effects and is shown in the table below. It is noted that user expectations of amenity levels (dust soiling) are dependent on existing deposition levels.

**Table B5 IAQM guidance for categorising land use value**

| Land use value | Low | Medium | High |
|---|---|---|---|
| Health effects | Locations where human exposure is transient. | Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for $PM_{10}$ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). | Locations where the public are exposed over a time period relevant to the air quality objective for $PM_{10}$ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). |
| Examples | Public footpaths, playing fields, parks, and shopping street. | Office and shop workers but would generally not include workers occupationally exposed to $PM_{10}$. | Residential properties, hospitals, schools, and residential care homes. |

| Land use value | Low | Medium | High |
|---|---|---|---|
| Dust soiling | The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics, or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. | Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. | Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land. |
| Examples | Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads. | Parks and places of work. | Dwellings, museums, and other culturally important collections, medium- and long-term car parks and car showrooms |

### Dust Soiling Impacts

To assess dust soiling impacts, the sensitivity of the local area is determined by considering the receptors and their quantity, as detailed in Table B6.

**Table B6 IAQM guidance for categorising the sensitivity of an area to dust soiling impacts**

| Land use values | Number of receptors[a] | Distance from the source (m)[b] | | | |
|---|---|---|---|---|---|
| | | < 20 | < 50 | < 100 | < 250 |
| High | > 100 | High | High | Medium | Low |
| | 10 – 100 | High | Medium | Low | Low |
| | 1 – 10 | Medium | Low | Low | Low |
| Medium | > 1 | Medium | Low | Low | Low |
| Low | > 1 | Low | Low | Low | Low |

**Note:** (a) Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered.

(b) With regard to potential 'construction traffic' impacts, the distance criteria of < 20 m and < 50 m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50 m may be screened out of the assessment (as per Step 1) and the corresponding sensitivity is negligible'.

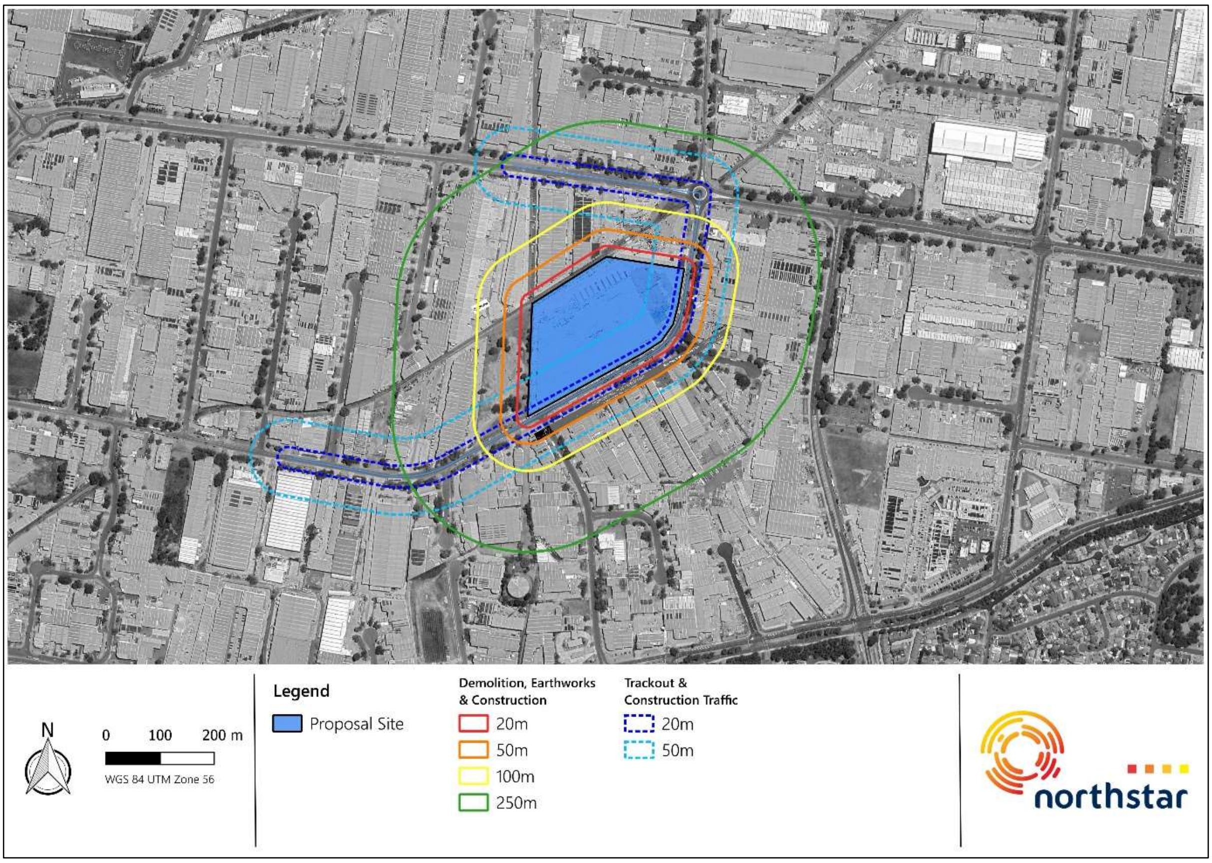
Due to construction activities, receptors within 250 m of the site are rated 'medium' for dust soiling sensitivity. The immediate area surrounding the Proposal site is commercial/industrial in nature (refer to Section 2.1 and Section 4.1).

Figure B1 illustrates the extent of works considered for this AQIA, delineating the outer envelope boundary of the anticipated construction works, the IAQM distance bands and the positions of receptors.

The IAQM guidance does not necessitate precise counting of human receptors. Instead, it advises using professional judgment to estimate the approximate number of buildings within each distance band and that only the highest level of area sensitivity from Table B6 needs to be considered.

It is estimated that up to 10 receptors are within 100 m and up to 100 receptors within a distance of 250 m from the Proposal site boundary. Considering both the sensitivity of receptors and their numbers within specified distances from the footprint, the sensitivity to dust soiling impacts is assessed as 'medium'.

**Figure B1 Scope of construction activities, buffer distances and surrounding environment**




**Source:** Northstar

### Human Health Impacts

The assessed land use value (as described above) is then used to assess the sensitivity of the area surrounding the active construction area, considering the proximity and number of those receptors, and the local background $PM_{10}$ concentration (in the case of potential health impacts) and other site-specific factors.

Additional factors to consider when determining the sensitivity of the area include:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant, the season during which the works would take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which go beyond the classifications given in (IAQM, 2024).

The IAQM guidance for assessing the sensitivity of an area of human health impacts is shown in Table B7.

The background annual average $PM_{10}$ concentration measured at Prospect AQMS in 2020 was 20.2 $\mu g{\cdot}m^{-3}$ (refer Table D2). Together with the calculated land use value, this classifies the area sensitivity as 'low' for dust health impacts.

**Table B7 IAQM guidance for categorising the sensitivity of an area of human health impacts**

| Land Use Value | Annual Mean $PM_{10}$ Concentration ($\mu g{\cdot}m^{-3}$) | Number of receptors[a] | Distance from the source (m)[b] | | | |
|---|---|---|---|---|---|---|
| | | | < 20 | < 50 | < 100 | < 250 |
| High | > 30 | > 100 | High | High | High | Medium |
| | | 10 – 100 | High | High | Medium | Low |
| | | 1 – 10 | High | Medium | Low | Low |
| | 26 – 30 | > 100 | High | High | Medium | Low |
| | | 10 – 100 | High | Medium | Low | Low |
| | | 1 – 10 | High | Medium | Low | Low |
| | 22 – 26 | > 100 | High | Medium | Low | Low |
| | | 10 – 100 | High | Medium | Low | Low |
| | | 1 – 10 | Medium | Low | Low | Low |
| | ≤ 22 | > 100 | Medium | Low | Low | Low |
| | | 10 – 100 | Low | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low |
| Medium | > 30 | > 10 | High | Medium | Low | Low |
| | | 1 – 10 | Medium | Low | Low | Low |
| | 26 – 30 | > 10 | Medium | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low |
| | 22 – 26 | > 10 | Low | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low |
| | ≤ 22 | > 10 | Low | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low |
| Low | - | ≤ 1 | Low | Low | Low | Low |

**Note:** (a) Estimate the total within the stated distance (e.g. the total within 250 m and not the number between 100 m and 250 m), noting that only the highest level of area sensitivity from the table needs to be considered. In the case of high sensitivity areas with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

(b) With regard to potential 'construction traffic' impacts, the distance criteria of < 20 m and < 50 m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50 m may be screened out of the assessment (as per Step 1) and the corresponding sensitivity is 'negligible'.

### Step 4 - Risk Assessment (Pre-Mitigation)

The matrices are shown in Table B8 for each activity determine the risk category with no mitigation applied.

**Table B8 Risk of dust impacts from construction related activities**

| Sensitivity of area | Pre-mitigated dust emission magnitude | | |
|---|---|---|---|
| | Small | Medium | Large |
| **Demolition** | | | |
| Low | Negligible | Low risk | Medium risk |
| Medium | Low risk | Medium risk | High risk |
| High | Medium risk | Medium risk | High risk |
| **Earthworks, Construction and Trackout** | | | |
| Low | Negligible | Low risk | Low risk |
| Medium | Low risk | Medium risk | Medium risk |
| High | Low risk | Medium risk | High risk |
| **Construction traffic (from construction site entrance to origin)** | | | |
| Low | Negligible | Low risk | Low risk |
| Medium | Negligible | Low risk | Medium risk |
| High | Low Risk | Medium risk | High risk |

Given the sensitivity of the identified receptors is classified as medium for dust soiling and low for human health impacts, and the dust emission magnitudes for the various construction phase activities as shown in Table B4, the resulting risk of air quality impacts (without mitigation) is as presented in Table B9.

**Table B9 Risk of air quality impacts from construction activities**

| Sensitivity of Area | Dust emission magnitude | | | | | Preliminary risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Demolition | Earthworks | Construction | Track-out | Const. Traffic | Demolition | Earthworks | Construction | Track-out | Const. Traffic |
| **Dust soiling** | | | | | | | | | | |
| Med. | Large | Large | Large | Large | Large | High | Med. | Med. | Med. | Med. |
| **Human health** | | | | | | | | | | |
| Low | Large | Large | Large | Large | Large | Med. | Low | Low | Low | Low |

**Note:** Med. = Medium

The risks summarised in Table B9 show that for demolition activities, there is a high risk of adverse dust soiling impacts and a medium risk of human health impacts. All other construction phase activities are associated with medium risks of dust soiling impacts and low risks of health impacts if no mitigation measures were to be applied to control emissions associated with construction-phase activities.

The risk assessment therefore provides recommendations for construction phase mitigation, commensurate with those identified risks.

**Step 5 – Identify Mitigation**

Once the risk categories are determined for each of the relevant activities, site-specific management measures can be identified based on whether the site is a low, medium, or high-risk site.

The identified mitigation measures are presented as follows:

N = not required (although they may be implemented voluntarily)

D = desirable (to be considered as part of the CEMP, but may be discounted if justification is provided);

H = highly recommended (to be implemented as part of the CEMP and should only be discounted if site-specific conditions render the requirement invalid or otherwise undesirable).

Table B10 represents a selection of recommended mitigation measures recommended by the IAQM methodology (IAQM, 2024) for construction activities commensurate with the risks identified in Table B9.

Table B10 Site-specific mitigation measures

| Identified Mitigation | | Unmitigated Risk |
|---|---|---|
| **1** | **Communications** | **High** |
| 1.1 | Develop and implement a stakeholder communications plan that includes community engagement before work commences on site. | H |
| 1.2 | Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager. | H |
| 1.3 | Display the head or regional office contact information. | H |
| 1.4 | Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the relevant regulatory bodies. | H |
| 1.5 | Notify residents living within 600 m – 1 000 m of the construction site regarding demolition schedules and recommend harm minimisation measures, such as closing windows and staying indoors, to reduce exposure to dust soiling and air pollution. Include key information in the four most spoken languages in Wetherill Park and Bossley Park: Arabic, Assyrian Neo-Aramic and Chaldean Neo-Aramic and Vietnamese | H |
| **2** | **Site Management** | **High** |
| 2.1 | Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. | H |
| 2.2 | Make the complaints log available to the relevant authority when asked. | H |
| 2.3 | Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book. | H |
| 2.4 | Hold regular liaison meetings with other high-risk construction sites within 250 m of the site boundary, to ensure plans are coordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes. | H |
| **3** | **Monitoring** | **High** |
| 3.1 | Conduct daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the relevant authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars, and window sills within 100 m of the site boundary. | H |
| 3.2 | Carry out regular site inspections to monitor compliance with the dust management plan / CEMP, record inspection results, and maintain an inspection log, to be available to the relevant authority when asked. | H |
| 3.3 | Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. | H |
| **4** | **Preparing and Maintaining the Site** | **High** |
| 4.1 | Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. | H |

| | Identified Mitigation | Unmitigated Risk |
|---|---|---|
| 4.2 | Erect solid screens or barriers around dusty activities or the site boundary that they are at least as high as any stockpiles on site. | H |
| 4.3 | Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period. | H |
| 4.4 | Avoid site runoff of water or mud. | H |
| 4.5 | Keep site fencing, barriers and scaffolding clean using wet methods. | H |
| 4.6 | Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below | H |
| 4.7 | Cover, seed or fence stockpiles to prevent wind erosion | H |
| **5** | **Operating Vehicle / Machinery and Sustainable Travel** | **High** |
| 5.1 | Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable | H |
| 5.2 | Ensure all vehicles switch off engines when stationary - no idling vehicles | H |
| 5.3 | Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable | H |
| 5.4 | Impose and signpost a maximum-speed-limit of 25 $km \cdot h^{-1}$ on surfaced and 15 $km \cdot h^{-1}$ on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the relevant authority, where appropriate | H |
| 5.5 | Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials. | H |
| 5.6 | Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) | H |
| **6** | **Operations** | **High** |
| 6.1 | Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems | H |
| 6.2 | Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate | H |
| 6.3 | Use enclosed chutes and conveyors and covered skips | H |
| 6.4 | Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate | H |
| 6.5 | Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods. | H |
| **7** | **Waste Management** | **High** |
| 7.1 | Avoid bonfires and burning of waste materials. | H |
| **8** | **Measures Specific to Demolition** | **High** |
| 8.1 | Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust). | H |

| | Identified Mitigation | Unmitigated Risk |
|---|---|---|
| 8.2 | Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring dust particles to the ground. | H |
| 8.3 | Avoid explosive blasting, using appropriate manual or mechanical alternatives. | H |
| 8.4 | Bag and remove any biological debris or damp down such material before demolition. | H |
| **9** | **Measures Specific to Earthworks** | **Medium** |
| 9.1 | Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. | D |
| 9.2 | Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. | D |
| 9.3 | Only remove the cover in small areas during work and not all at once | D |
| **10** | **Measures Specific to Construction** | **Medium** |
| 10.1 | Avoid scabbling (roughening of concrete surfaces) if possible | D |
| 10.2 | Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place | H |
| 10.3 | Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery. | D |
| 10.4 | For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust | D |
| **11** | **Measures Specific to Track-Out** | **Medium** |
| 11.1 | Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site. | H |
| 11.2 | Avoid dry sweeping of large areas. | H |
| 11.3 | Cover vehicles entering and leaving the site to prevent material escape during transport. | H |
| 11.4 | Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. | H |
| 11.5 | Record all inspections of haul routes and any subsequent action in a site log book. | H |
| 11.6 | Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned. | H |
| 11.7 | Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). | H |
| 11.8 | Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permit. | H |
| 11.9 | Access gates to be located at least 10 m from receptors where possible. | H |

**Step 6 – Risk Assessment (post-mitigation)**

Following Step 5, the residual impact is then determined.

The objective of the mitigation is to manage the construction phase risks to an acceptable level, and therefore it is assumed that application of the identified mitigation would result in a low or negligible residual risk (post mitigation).

Given the size of the Proposal site, the distance to sensitive receptors and the activities to be performed, residual impacts associated with fugitive dust emissions from the Proposal would be anticipated to be 'negligible', should the implementation of the mitigation measures outlined above be performed appropriately.

# APPENDIX C

## Meteorology

## Meteorological Stations

As discussed in Section 4.3, a meteorological modelling exercise has been performed to characterise the meteorology of the Proposal site in the absence of site-specific measurements. The meteorological monitoring has been based on measurements acquired from surrounding automatic weather stations (AWS) operated by the Australian Government Bureau of Meteorology (BoM).

A summary of the relevant monitoring sites is provided in Table C1.

**Table C1 Meteorological monitoring stations within 15 km of the Proposal site**

| Site name | Station # | Source | Approximate location | | Approximate distance (km) |
|---|---|---|---|---|---|
| | | | mE | mS | |
| Horsley Park Equestrian Centre AWS | 067119 | BoM | 301 708 | 6 252 298 | 3.1 |
| Bankstown Airport AWS | 066137 | BoM | 313 855 | 6 245 099 | 11.7 |
| Holsworthy Control Range | 067117 | BoM | 308 353 | 6 238 177 | 14.9 |

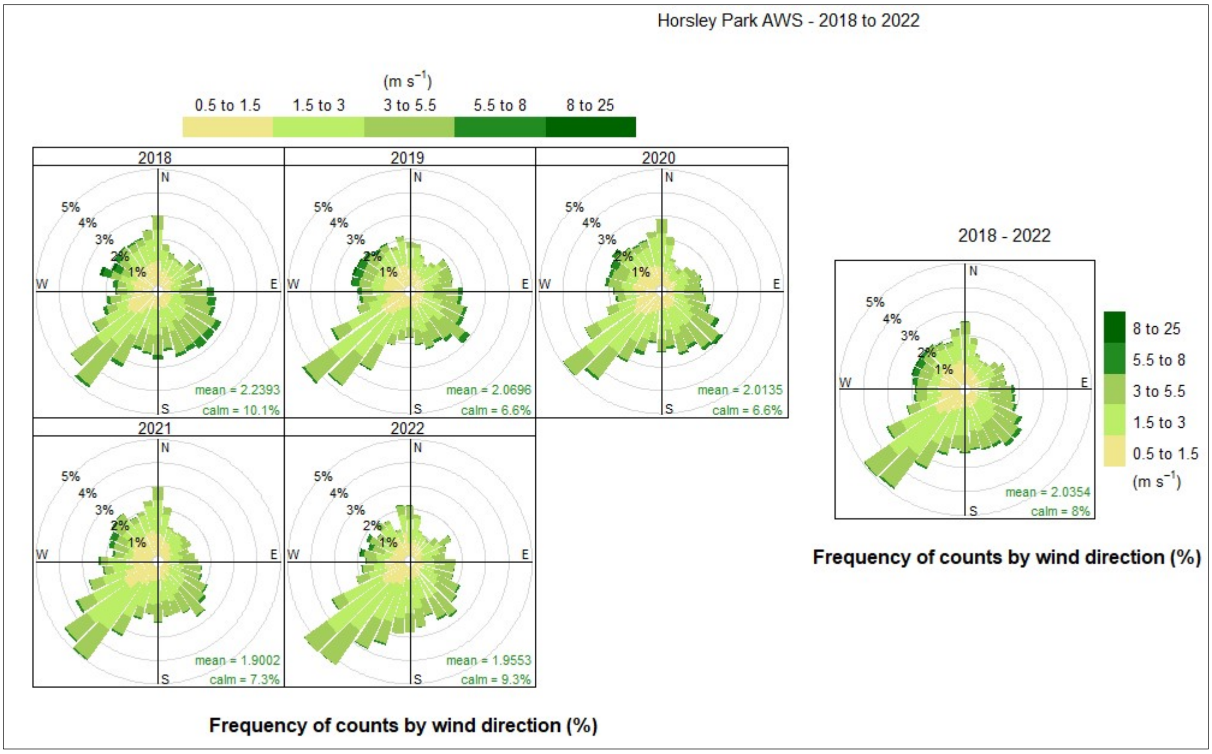
As discussed in Section 4.3, meteorological conditions at Horsley Park AWS have been examined to determine a 'typical' or representative dataset for use in dispersion modelling. Annual wind roses for 2018 to 2022 are presented in Figure C1. The annual wind speed frequency distribution for the five-year period is presented in Figure C2.

The correlation coefficient between each year and the five-year period for the distribution of wind speed, wind direction, $PM_{10}$ and $PM_{2.5}$ are summarised in Table C2. The correlation coefficients were ranked and aggregated to select the representative year for the meteorological modelling. The rankings are also presented in Table C2.

The wind roses indicate that from 2018 to 2022, winds at Horsley Park Equestrian Centre AWS show generally similar wind distribution patterns across the years assessed, with predominant south-westerly wind directions.

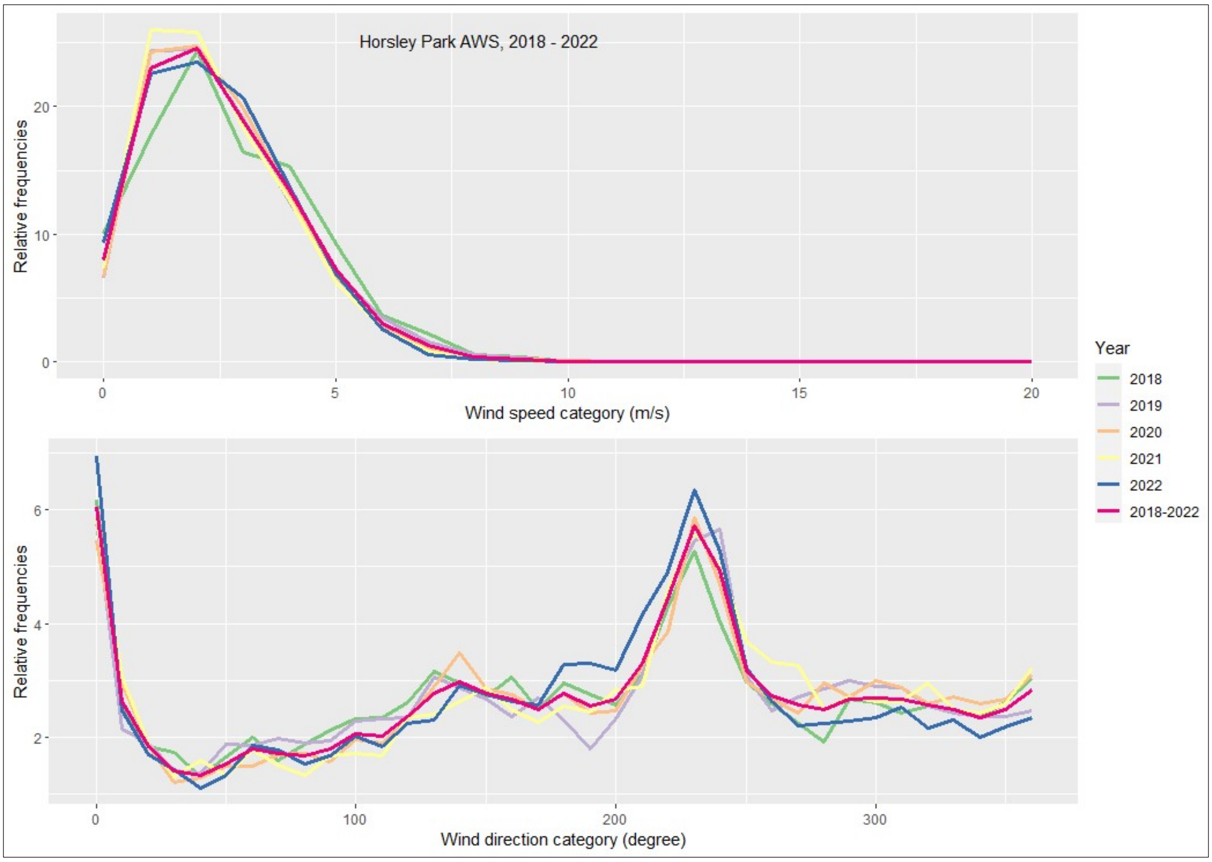
The majority of wind speeds experienced at the Horsley Park Equestrian Centre AWS between 2018 and 2022 are generally in the range 1.5 metres per second ($m{\cdot}s^{-1}$) to 5.5 $m{\cdot}s^{-1}$ with the highest wind speeds (greater than 8 $m{\cdot}s^{-1}$) occurring from mostly north-westerly directions. Winds of this speed are rare and occur during 0.2 % of the observed hours during the years while calm winds (less than 0.5 $m{\cdot}s^{-1}$) occur during 8 % of hours on average across the years between 2018 and 2022.

Figure C1 Annual wind roses – Horsley Park AWS (2018 to 2022)




**Source:** Northstar

Figure C2 Annual wind direction and speed distributions – Horsley Park AWS (2018 to 2022)




**Source:** Northstar

Table C2 Correlation coefficient analysis – Horsley Park AWS and Prospect AQMS (2018 to 2022)

| Parameter | Wind speed | | Wind direction | | $PM_{10}$ | | $PM_{2.5}$ | | Aggregated rank |
|---|---|---|---|---|---|---|---|---|---|
| | Corr. | Rank | Corr. | Rank | Corr. | Rank | Corr. | Rank | |
| 2018 | 0.9834 | 5 | 0.9674 | 4 | 0.9342 | 4 | 0.9703 | 3 | 5 |
| 2019 | 0.9980 | 2 | 0.9617 | 5 | 0.9660 | 3 | 0.9290 | 5 | 4 |
| 2020 | 0.9985 | 1 | 0.9738 | 1 | 0.9986 | 1 | 0.9795 | 2 | 1 |
| 2021 | 0.9965 | 4 | 0.9675 | 3 | 0.9966 | 2 | 0.9840 | 1 | 2 |
| 2022 | 0.9973 | 3 | 0.9727 | 2 | 0.9112 | 5 | 0.9420 | 4 | 3 |
| 2018-2022 | 1 | - | 1 | - | 1 | - | 1 | - | - |

**Note:** Corr. = correlation

Wind speed observations for each year correlated well against the wind speed over the five-year period, with each year having a correlation coefficient greater than 0.98. The year 2020 is the highest ranked for correlation against the wind speed over the five-year period.

Wind direction observations for each year are reasonably well correlated against the wind direction over the five-year period, with each year having a correlation coefficient greater than of 0.96. The year 2020 is the highest ranked for correlation against the wind direction over the five-year period.

Particulate matter concentrations for each year are also well correlated against particulate matter concentrations over the five-year period. Each year resulted in having a correlation coefficient greater than 0.91. The year 2020 is the highest rank for $PM_{10}$ while 2021 was the highest ranked year for $PM_{2.5}$.

The correlation coefficient analysis indicates that 2020 is the most representative year for meteorological modelling.

### Meteorological Processing

The BoM data adequately covers the issues of data quality assurance; however, it is limited by its location compared to the Proposal site. To address these uncertainties, a multi-phased assessment of the meteorology data has been performed.

In absence of any measured onsite meteorological data, site representative meteorological data for this Proposal was generated using The Air Pollution Model (TAPM, v 4.0.5) meteorological model in a format suitable for using in the GRAL dispersion model (refer Section 5.2.2).

Meteorological modelling using TAPM has been performed to predict the meteorological parameters required for GRAL. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

It is noted that an initial TAPM modelling run provided wind roses which did not validate well against observations at Horsley Park AWS. Given the poor validation, that initial TAPM modelling run has not been used in this AQIA.

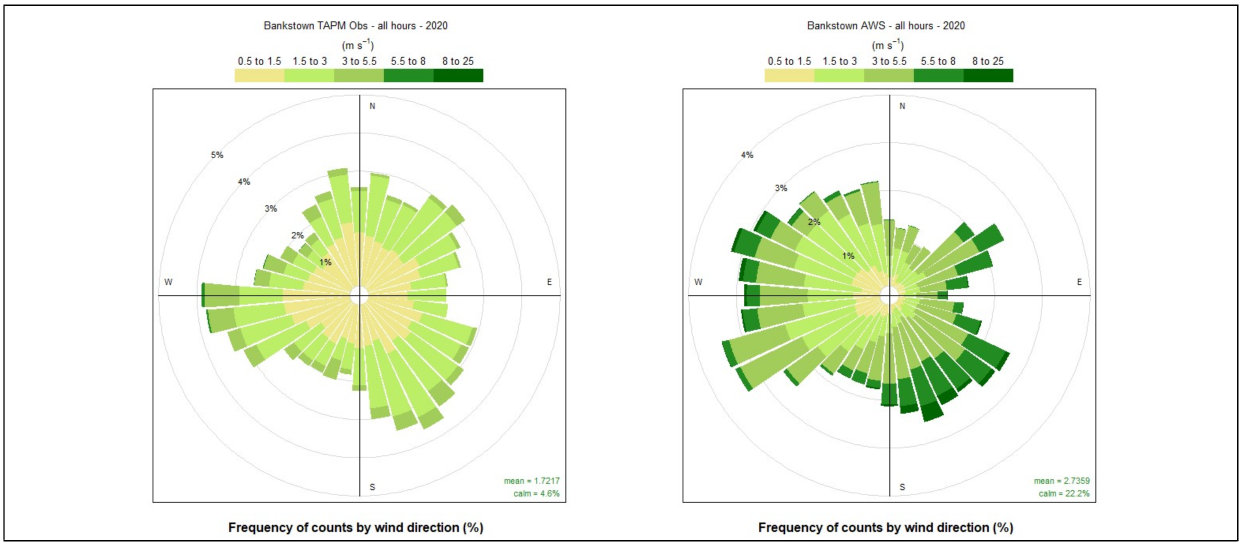
Subsequently, a second TAPM run was performed which used observations at Horsley Park AWS to 'nudge' model predictions towards those observations, and this has been used in this AQIA. To validate model outputs, a comparison of the TAPM generated meteorological data, and that observed at the Bankstown Airport AWS has been performed and is presented in Figure C3. Given the proximity to the Proposal site no validation at another AWS has been performed and the second TAPM run is considered sufficient to represent meteorological parameters at the Proposal site for use in GRAL.

The parameters used in TAPM modelling are presented in Table C3.

**Table C3 TAPM meteorological parameters**

| TAPM v 4.0.5 | |
|---|---|
| Modelling period | 1 January 2020 to 31 December 2020 |
| Centre of analysis | 306 371 mE, 6 258 053 mS (UTM Coordinates) |
| Number of grid points | 35 × 35 × 25 |
| Number of grids (spacing) | 4 (30 km, 10 km, 3 km, 1 km) |
| Terrain | AUSLIG 9 second DEM |
| Data assimilation | Horsley Park AWS |

**Figure C3 Modelled and observed meteorological data – Bankstown Airport AWS (2020)**



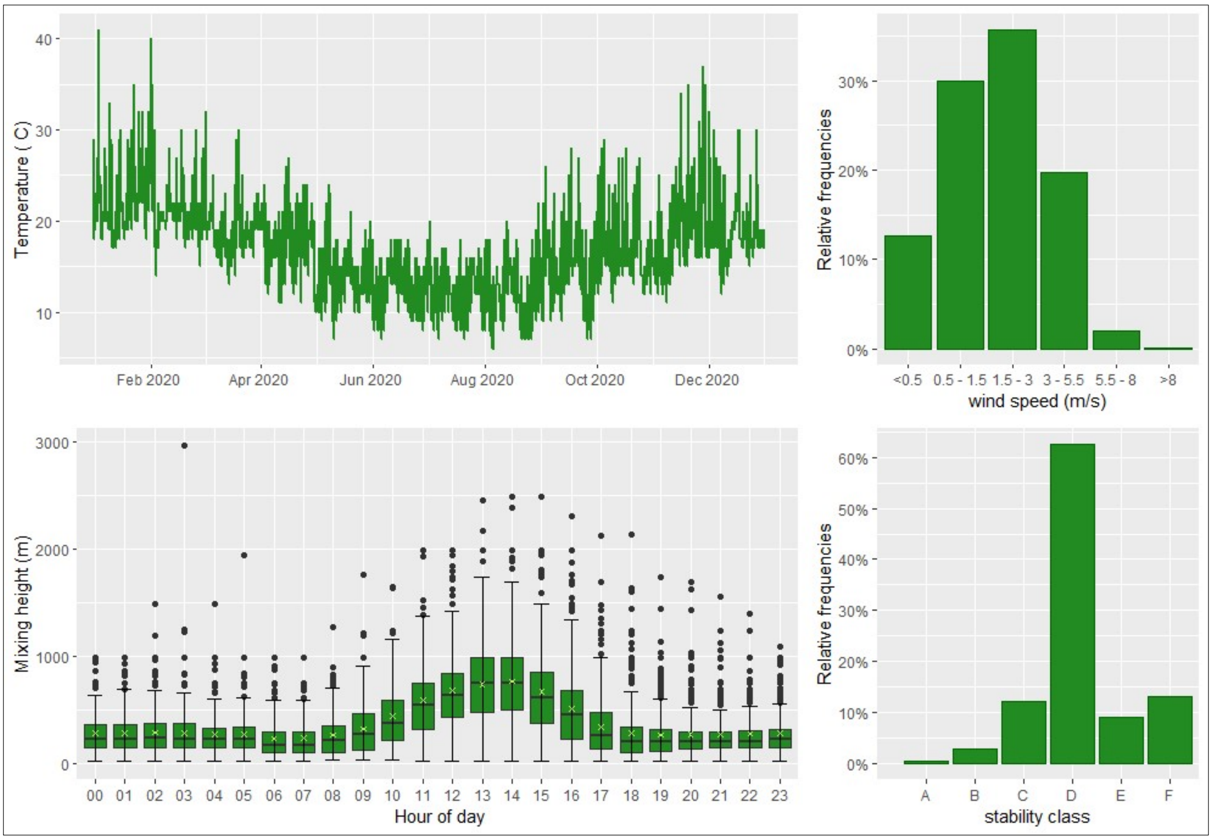

**Source:** Northstar

As generally required by the NSW EPA the following provides a summary of the modelled meteorological dataset. Given the nature of the pollutant emission sources at the Proposal site, detailed discussion of the humidity, evaporation, cloud cover, katabatic air drainage and air recirculation potential of the Proposal site has not been provided. Details of the predictions of wind speed and direction, mixing height and temperature at the Proposal site are provided below.

Diurnal variations in maximum and average mixing heights predicted by TAPM at the Proposal site during 2020 period are illustrated in Figure C4.

As expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and growth of the convective mixing layer.

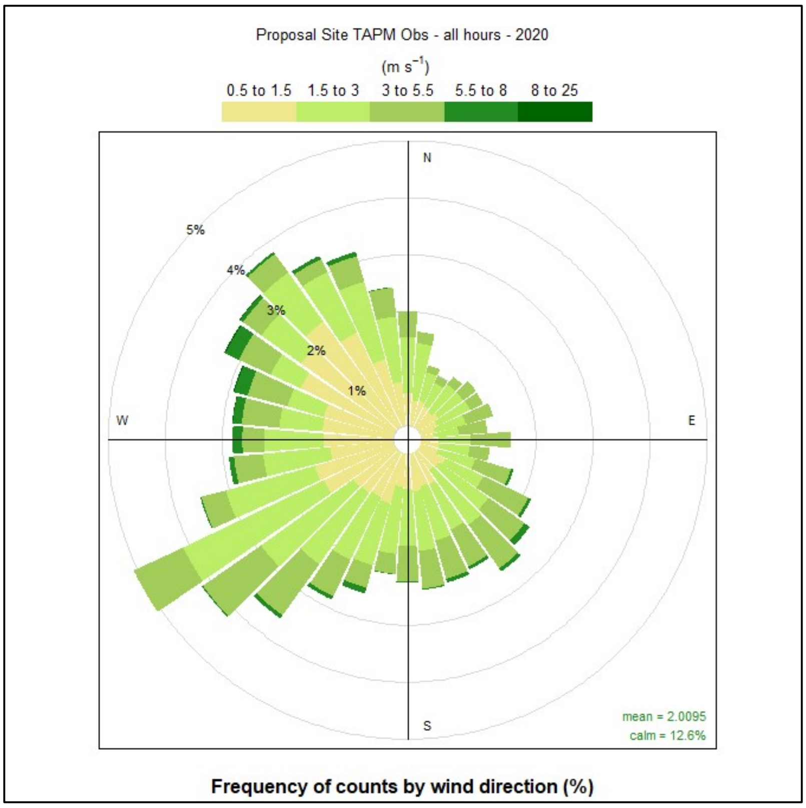
**Figure C4 Predicted mixing height, wind speed and stability class frequency at the Proposal site (2020)**




**Source:** Northstar

The modelled wind speed and direction at the Proposal site during 2020 are presented in Figure C5.

**Figure C5 Predicted wind direction and speed - Proposal site (2020)**




**Source:** Northstar

# APPENDIX D

## Background Air Quality

Air quality is not monitored at the Proposal site and therefore air quality monitoring data measured at a representative location has been adopted for the purposes of this assessment. Determination of data to be used as a location representative of the Proposal site and during a representative year can be complicated by factors which include:

- the sources of air pollutant emissions around the Proposal site and representative AQMS; and
- the variability of particulate matter concentrations (often impacted by natural climate variability).

Air quality monitoring is performed by NSW DCCEEW at two air quality monitoring stations (AQMS) proximate to the Proposal site. Details of the monitoring performed at these AQMS is presented in Table D1.

**Table D1 NSW DCCEEW AQMS within 10 km of the Proposal site**

| AQMS location | Distance to Proposal site (km) | 2020 data | Measurements | | | |
|---|---|---|---|---|---|---|
| | | | $PM_{10}$ | $PM_{2.5}$ | TSP | $NO_2$ |
| Prospect | 5.9 | ✓ | ✓ | ✓ | × | ✓ |
| Liverpool | 9.5 | ✓ | ✓ | ✓ | × | ✓ |

Given the availability of data and its proximity to the Proposal site, data from Prospect AQMS is considered to be a representative air quality dataset and has correspondingly been adopted for use in this assessment. Particulate matter data for the period 2018 to 2022 has been analysed. The annual frequency distribution for the five-year period is presented in Figure D1.

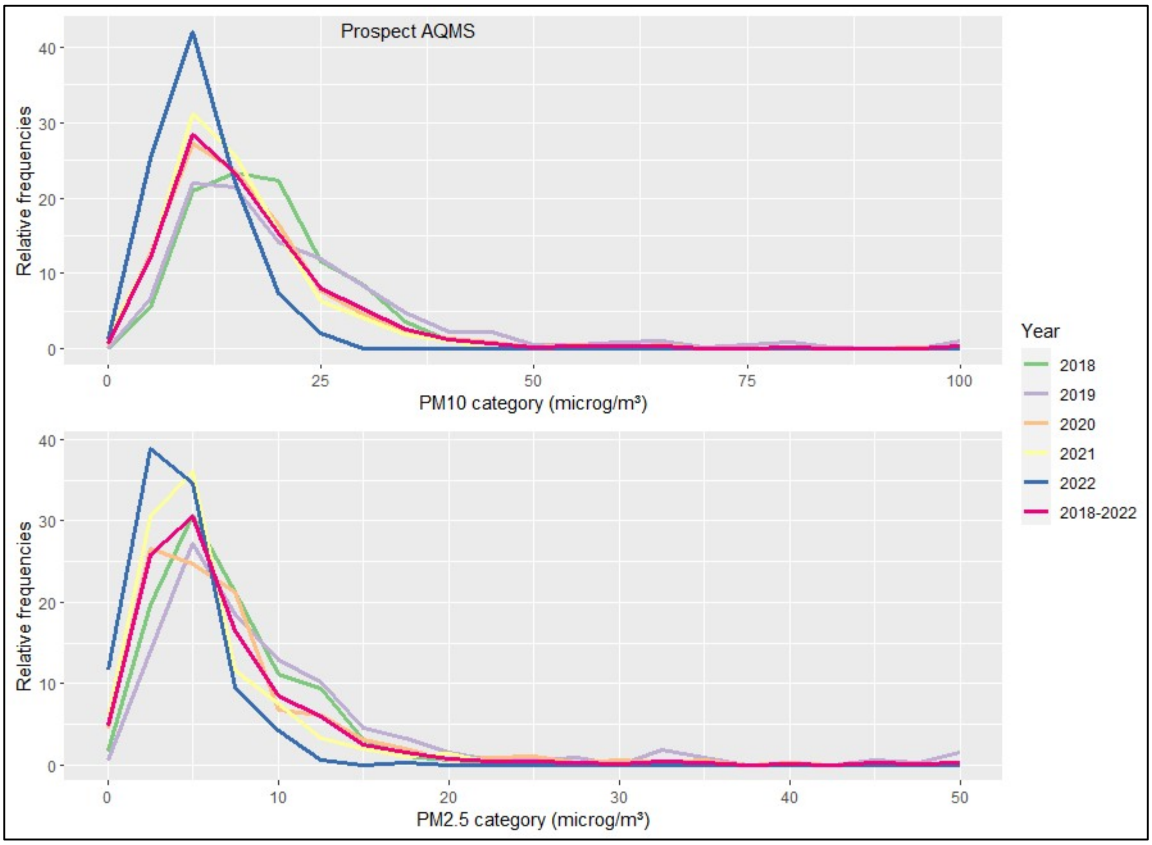
The results of the correlation coefficient analysis provided in Appendix C indicates that meteorological and PM data measured in 2020 is an appropriate dataset for use within this study.

Concentrations of TSP are not measured at any AQMS surrounding the Proposal site. An analysis of co-located measurements of TSP and $PM_{10}$ in the Lower Hunter (1999 to 2011), Illawarra (2002 to 2004), and Sydney Metropolitan (1999 to 2004) regions is presented in Figure D2.

The analysis concludes that, on the basis of the measurements collected in all regions between 1999 to 2011, the derivation of a broad TSP:$PM_{10}$ ratio of 2.0551 : 1 (i.e. $PM_{10}$ represents ~49% of TSP) from the Sydney Metropolitan location is appropriate. In the absence of any more specific information, this ratio has been adopted within this AQIA, resulting in a background annual average TSP concentration of 41.1 $\mu g \cdot m^{-3}$ being adopted.

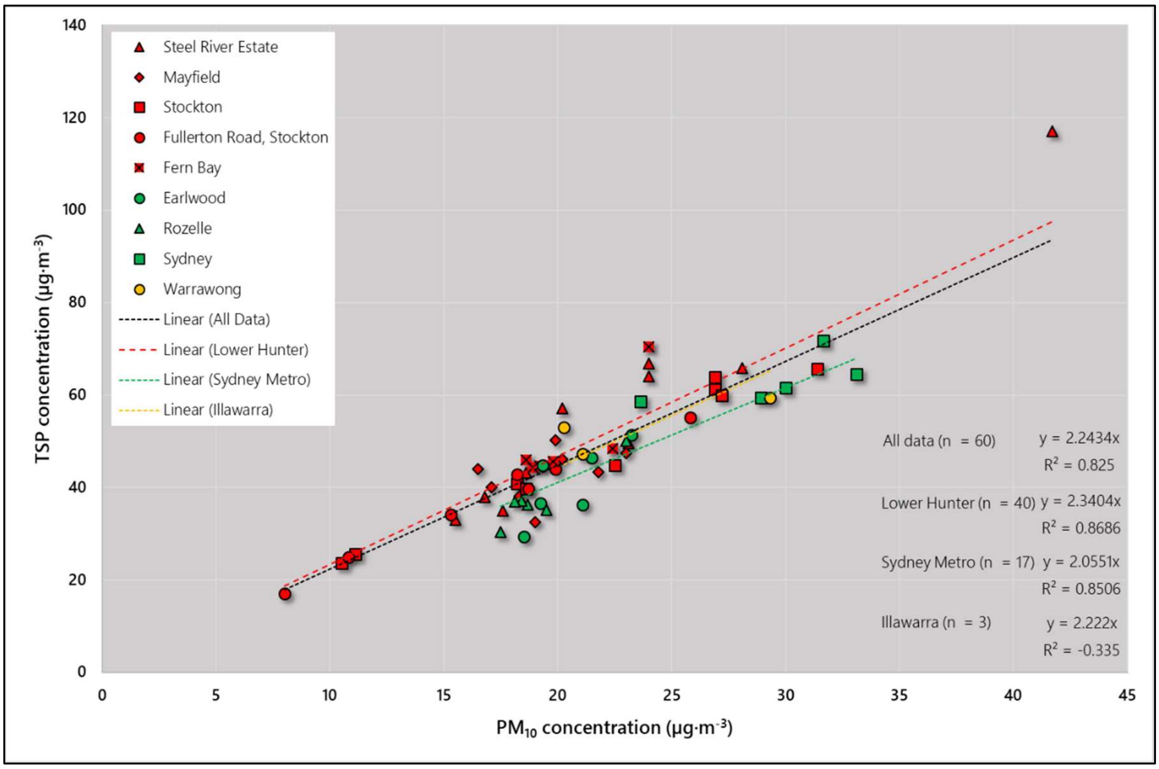
Summary statistics for the selected data are presented in Table D2.

**Figure D1 Annual distribution at Prospect AQMS for $PM_{10}$ and $PM_{2.5}$ (2018 to 2022)**




**Source:** Northstar

**Figure D2 Co-located TSP and $PM_{10}$ measurements - Lower Hunter, Sydney Metro, and Illawarra**




**Source:** Northstar

Graphs presenting the daily varying $PM_{10}$, $PM_{2.5}$ and $NO_2$ data recorded at Prospect AQMS in 2020 are presented in Figure D3, Figure D4 and Figure D5 respectively.

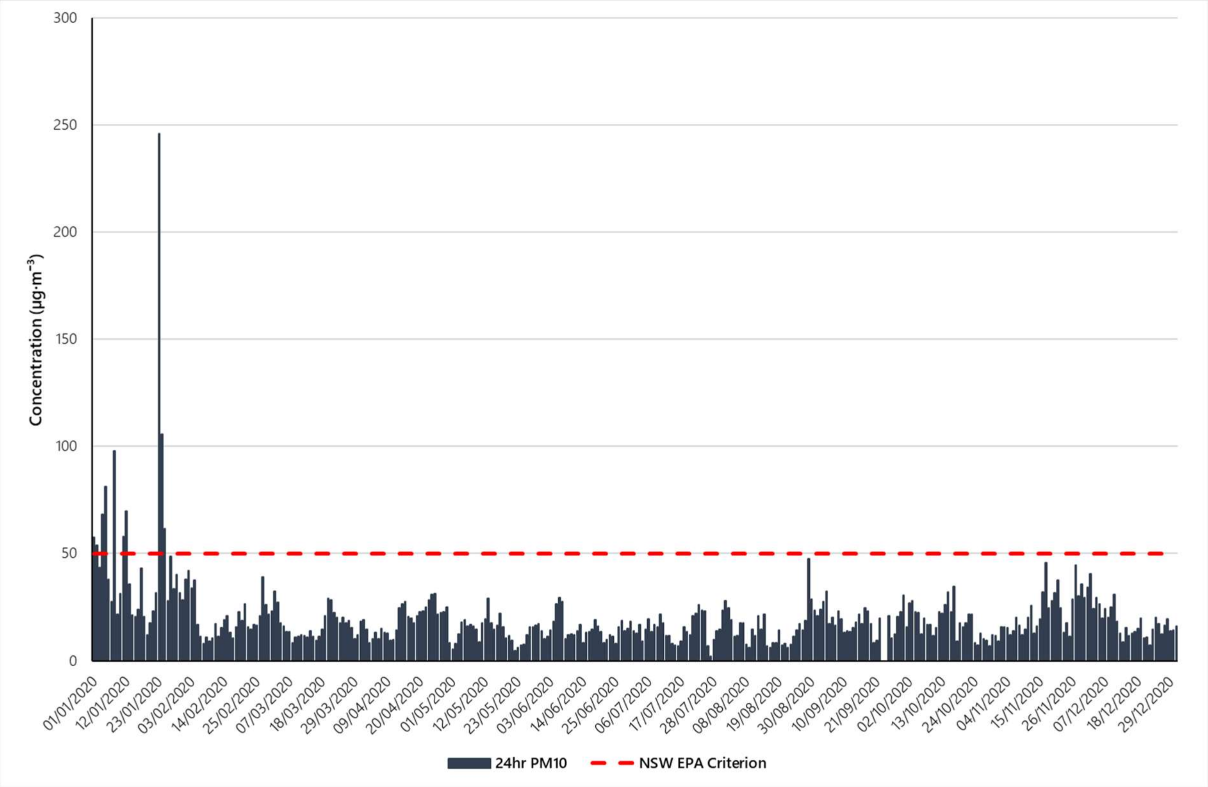
**Table D2 Background air quality statistics – Prospect AQMS (2020)**

| Pollutant | TSP | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $O_3$ |
|---|---|---|---|---|---|
| Averaging period | Annual | 24-Hour | 24-Hour | 1 hour | 1 hour |
| Units | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ |
| **Statistics** | | | | | |
| Data points (number) | 364 | 364 | 357 | 8269 | 8328 |
| Mean | 41.4 | 20.2 | 8.6 | 15.1 | 40.7 |
| Standard deviation | - | 16.9 | 7.1 | 14.9 | 27.9 |
| *Skew*[1] | - | *7.6* | *3.7* | *1.2* | *0.9* |
| *Kurtosis*[2] | - | *89.5* | *21.1* | *1.1* | *1.7* |
| Minimum | - | 2.1 | 0.8 | -6.2 | 2.1 |
| **Percentiles** | | | | | |
| $25^{th}$ | - | 12.1 | 4.6 | 4.1 | 17.1 |
| $50^{th}$ | - | 16.9 | 7.0 | 10.3 | 40.7 |
| $75^{th}$ | - | 23.0 | 9.5 | 22.6 | 57.8 |
| $90^{th}$ | - | 31.6 | 15.1 | 36.9 | 72.8 |
| $95^{th}$ | - | 39.9 | 20.2 | 45.1 | 89.1 |
| $97^{th}$ | - | 47.7 | 25.9 | 51.3 | 100.6 |
| $98^{th}$ | - | 57.8 | 30.3 | 55.4 | 109.1 |
| $99^{th}$ | - | 73.9 | 37.3 | 60.1 | 126.3 |
| **Maximum** | **-** | **245.8** | **70.8** | **88.2** | **218.3** |
| **Data Capture (%)** | **-** | **99.5** | **97.5** | **94.1** | **94.8** |

**Notes:** 1: Skew represents an expression of the distribution of measured values around the derived mean. Positive skew represents a distribution tending towards values higher than the mean, and negative skew represents a distribution tending towards values lower than the mean. Skew is dimensionless.

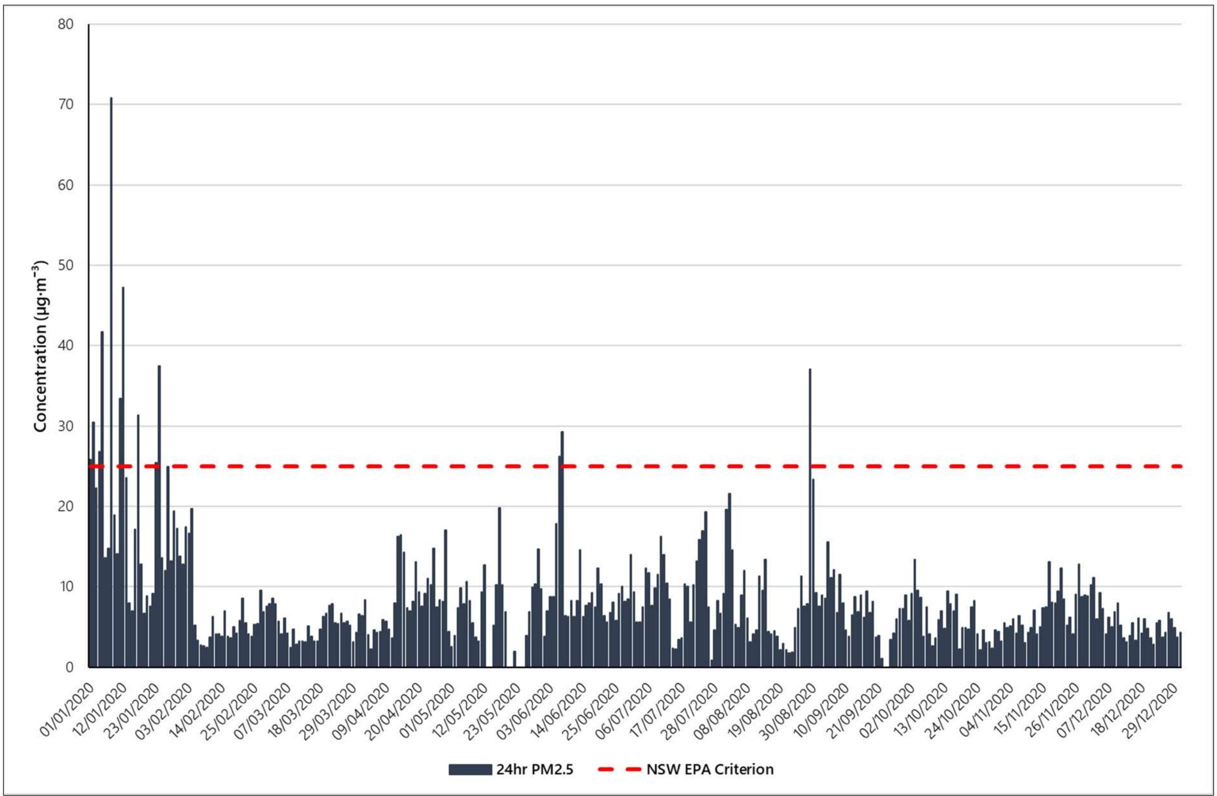
2: Kurtosis represents an expression of the value of measured values in relation to a normal distribution. Positive skew represents a more peaked distribution, and negative skew represents a distribution more flattened than a normal distribution. Kurtosis is dimensionless.

**Figure D3 PM$_{10}$ concentrations – Prospect AQMS (2020)**



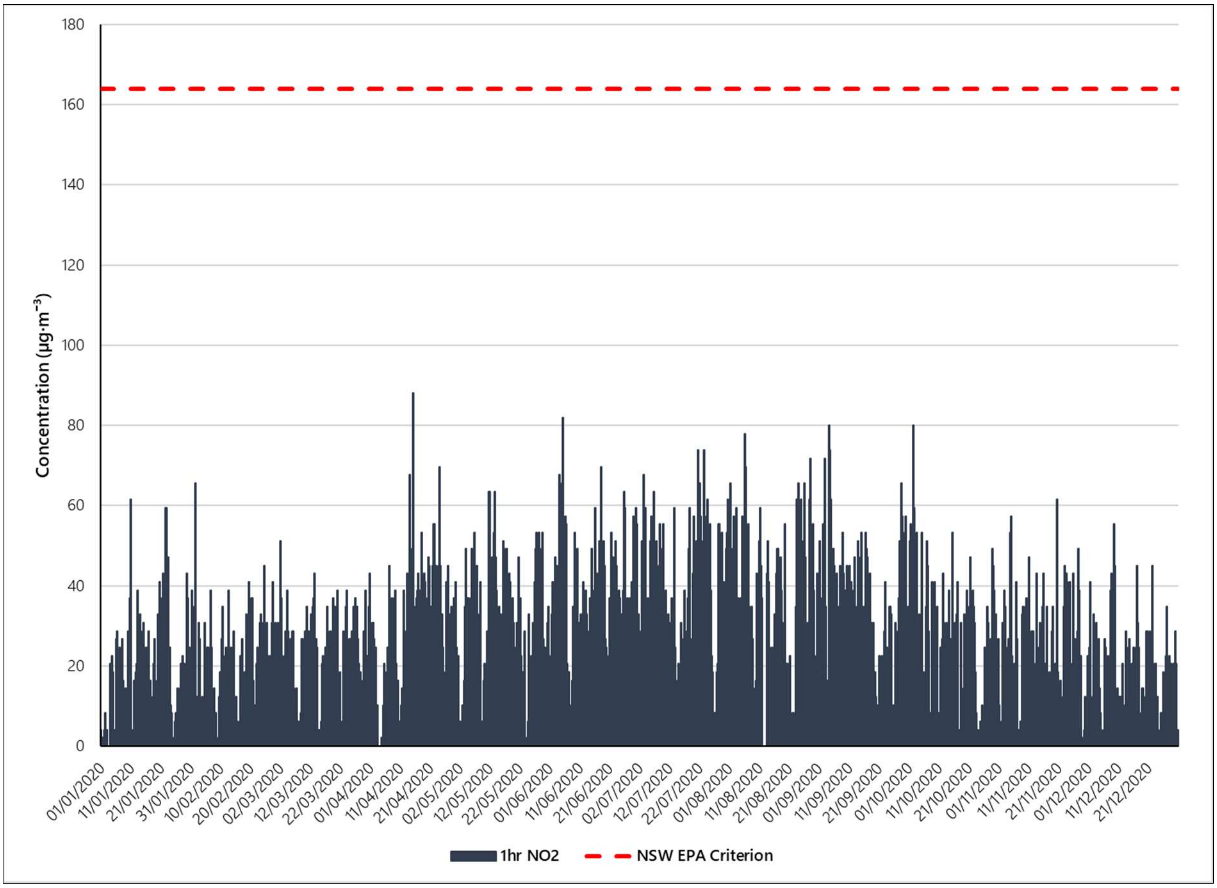

**Source:** Northstar

**Figure D4 PM$_{2.5}$ concentrations – Prospect AQMS (2020)**




**Source:** Northstar

## Figure D5 $NO_2$ concentrations – Prospect AQMS (2020)




**Source:** Northstar

**air quality | environment | sustainability**

| | |
|---|---|
| **air quality** | Northstar specialises in all aspects of air quality, dust, and odour management, covering monitoring, modelling and assessment, due diligence and process specification, licencing and regulatory advice, peer review and expert witness. |
| **environment** | Our team has extensive experience in environmental management, covering environmental policy and management plans, licencing, compliance reporting, auditing, data, and spatial analysis. |
| **sustainability** | We look beyond compliance to add value and identify opportunities.  Our services range from sustainability strategies, ecologically sustainable development reporting and assessment, to bespoke greenhouse gas and energy estimation and reporting. |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