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155-251 & 141-153 Aldington Road, Kemps Creek

Updated Air Quality Impact Assessment

Addressee(s):	Fraser Property Industrial
Site Address:	155-251 & 141-153 Aldington Road, Kemps Creek NSW
Report Reference:	21.1081.FR2V1
Date:	13 September 2023
Status:	Final

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Quality Control

Study	Status	Prepared by	Checked by	Authorised by
INTRODUCTION	Final	Northstar	LS, MD, GCG	GCG
THE PROPOSAL	Final	Northstar	LS, MD, GCG	GCG
LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar	LS, MD, GCG	GCG
EXISTING CONDITIONS	Final	Northstar	LS, MD, GCG	GCG
APPROACH TO ASSESSMENT	Final	Northstar	LS, MD, GCG	GCG
CONSTRUCTION AIR QUALITY IMPACT ASSESSMENT	Final	Northstar	LS, MD, GCG	GCG
OPERATIONAL AIR QUALITY IMPACT ASSESSMENT	Final	Northstar	LS, MD, GCG	GCG
GREENHOUSE GAS ASSESSMENT	Final	Northstar	LS, MD, GCG	GCG
MITIGATION AND MONITORING	Final	Northstar	LS, MD, GCG	GCG
CONCLUSION	Final	Northstar	LS, MD, GCG	GCG

Report Status

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Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
21	1081	Final	R2	V1
Based upon the above, the specific reference for this version of the report is:				21.1081.FR2V1

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.

Gary Graham **13 September 2023**

Non-Technical Summary

Northstar Air Quality was engaged by Frasers Property Industrial, to perform an air quality impact assessment for the construction and operation of a warehouse and logistics hub to be located at 141-153 and 155-251 Aldington Road, Kemps Creek.

Construction phase activities will involve demolition works, earthworks, construction works and associated construction vehicle traffic. The assessed air quality risk of impacts from demolition, construction, track-out and construction traffic have been assessed using published guidance adapted by Northstar and has been used in a similar context in numerous other similar studies.

That assessment showed there to be a high risk of health impacts and a medium risk of dust soiling associated with demolition activities should no mitigation measures be applied. All other construction phase activities are associated with medium risks of health impacts and low risks of dust soiling. Correspondingly, a range of mitigation measures have been outlined 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 EPA Approved Methods for the *Modelling and Assessment of Air Pollutants in New South Wales*, using an approved and appropriate dispersion modelling technique.

Results of the air quality modelling indicate all air quality criteria are predicted to be achieved. Additionally, the changing landscape of the surrounding environment, with residential locations being removed and land being developed as commercial/industrial uses, should ensure that the most sensitive locations would not be present in the future.

A greenhouse gas assessment has been performed to examine the potential impacts of the operation of the Proposal relating to emissions of greenhouse gas. A quantitative assessment of emissions has been performed with emissions compared with total national and NSW greenhouse gas emissions for context.

Emissions associated with the Proposal are anticipated to represent <0.0008 % of Australian emissions total for the year 2022 and <0.0027 % of NSW emissions totals for the year 2019.

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1. INTRODUCTION

Frasers Property Industrial (the Applicant) has engaged Northstar Air Quality Pty Ltd (Northstar) to perform an updated air quality impact assessment (AQIA) and greenhouse gas assessment (GHGA) for the construction and operation of a warehouse and logistics hub (the Proposal) at 141-153 and 155-251 Aldington Road in Kemps Creek (Lot 33 DP 258949, Lot 25-28 DP 255560 and Lot 34 DP 258949) (the Proposal site). 141-153 Aldington Road (the "Dexus site") has been included within this assessment in order to enable transitional earthworks across both of these sites.

This assessment provides an update to the previous AQIA undertaken by Northstar (Northstar Air Quality, 2021) following modification to the layout of the Proposal site.

This AQIA identifies and examines potential air quality impacts associated with operation of the Proposal, reflecting the total number of warehouses and the revised total floor area. This assessment also identifies mitigation and monitoring requirements commensurate with those anticipated impacts.

The GHGA provides a summary of greenhouse gas (GHG) emissions associated with the Proposal and compares these totals with national and state emissions.

This study supports the State Significant Development (SSD) for the Proposal and presents a range of recommended mitigation measures to minimise any identified air quality and greenhouse gas impacts, where required and relevant.

1.1. Updates to Assessment

The following updates to the previous AQIA have been undertaken for this assessment.

Table 1 Updates to AQIA

Relevant update	Addressed
Updated environmental setting to reflect updated address	Section 2.1
Update to Proposal site layout	Figure 2
Updated construction assessment to reflect additional warehouses	Section 2.3.1 Section 6
Updated greenhouse gas assessment to reflect additional warehouses	Section 5.3.2, Section 8.1
Updated operational impact assessment to reflect additional warehouses	Section 2.3.2 Section 7

1.2. Purpose of the Report

The purpose of this report is to examine and identify whether the impacts of the construction and operation of the Proposal may adversely affect local air quality, and estimate the greenhouse gas emissions from the Proposal and identify GHG mitigation opportunities.

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

- *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
- State Environmental Planning Policy (State and Regional Development) 2011.

The GHG assessment has been performed referencing the following documents:

- Australian Government Department of the Environment, Australian National Greenhouse Accounts, National Greenhouse Accounts Factors, November 2022 (DoE, 2022);
- ISO 14064-1:2018 (Greenhouse Gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of GHG emissions and removal);
- ISO 14064-2:2019 (Greenhouse Gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of GHG emission reductions or removal enhancements); and
- ISO 14064-3:2019 (Greenhouse Gases – Part 3: Specification with guidance for the validation and verification of GHG assertions) guidelines (internationally accepted best practice).

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 141-153 and 155-251 Aldington Road, Kemps Creek in the Penrith Local Government Area (LGA), with the inclusion of 141-153 Aldington Road (Dexus site) included in order to enable transitional earthworks across two sites. A map showing the location of the Proposal site is provided in Figure 1.

The closest residential property is approximately 52 m from the Proposal site boundary to the southwest, (see Section 4.1.2 of this report). A full description of the sensitivity of the surrounding land, and the identification of discrete receptor locations used in the AQIA, is provided in Section 4.1.

2.2. Overview and Purpose

The Proposal seeks to gain approval to establish eight warehouses at the Proposal site. The intended use of the warehouses is for warehouse and distribution centres.

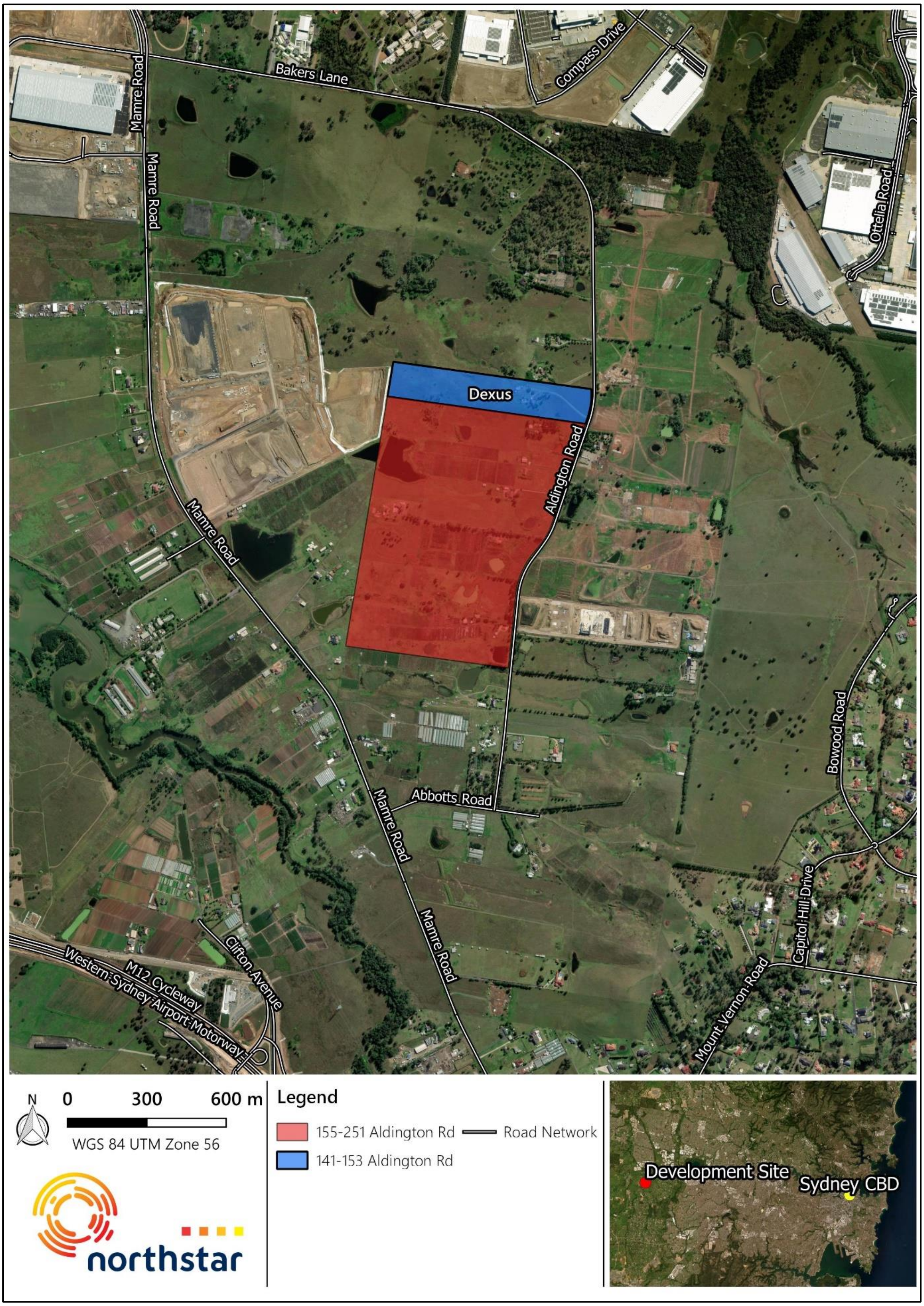
The overall scope of the proposed development is outlined as follows:

- Bulk earthworks involving cut and fill works;
- Vegetation clearing;
- Construction of eight warehouses;
- 14-lot Torrens title subdivision; and
- Estate wide infrastructure works comprising civil works and utilities.

The Proposal site would be operational on a 24-hour, 7-day basis.

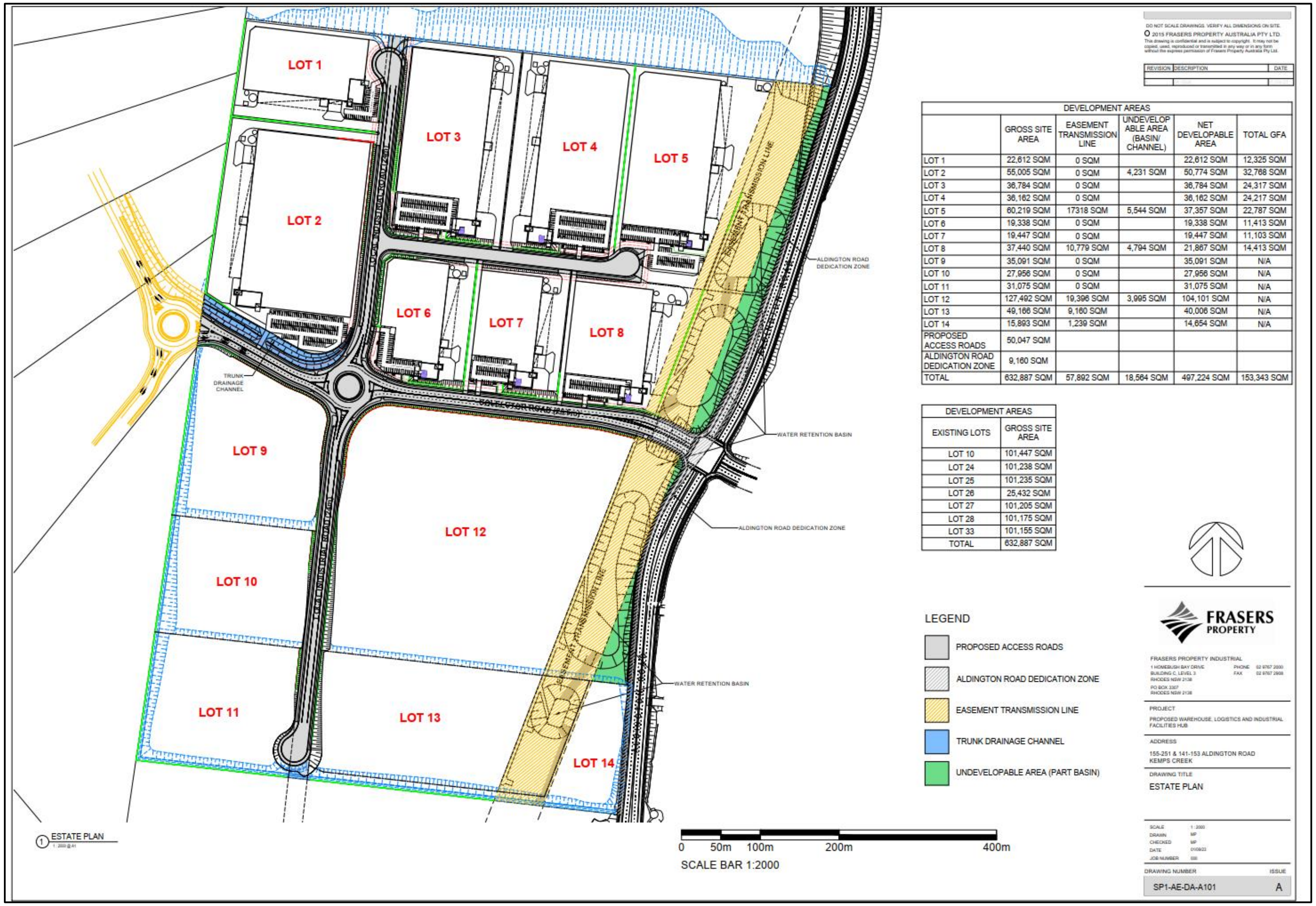
A general layout of the Proposal site is provided in Figure 2.

Figure 1 Site location



Source: Northstar

Figure 2 Proposal site layout



DEVELOPMENT AREAS					
	GROSS SITE AREA	EASEMENT TRANSMISSION LINE	UNDEVELOPABLE AREA (BASIN/ CHANNEL)	NET DEVELOPABLE AREA	TOTAL GFA
LOT 1	22,612 SQM	0 SQM		22,612 SQM	12,325 SQM
LOT 2	55,005 SQM	0 SQM	4,231 SQM	50,774 SQM	32,768 SQM
LOT 3	36,784 SQM	0 SQM		36,784 SQM	24,317 SQM
LOT 4	36,162 SQM	0 SQM		36,162 SQM	24,217 SQM
LOT 5	60,219 SQM	17318 SQM	5,544 SQM	37,357 SQM	22,787 SQM
LOT 6	19,338 SQM	0 SQM		19,338 SQM	11,413 SQM
LOT 7	19,447 SQM	0 SQM		19,447 SQM	11,103 SQM
LOT 8	37,440 SQM	10,779 SQM	4,794 SQM	21,867 SQM	14,413 SQM
LOT 9	35,091 SQM	0 SQM		35,091 SQM	N/A
LOT 10	27,956 SQM	0 SQM		27,956 SQM	N/A
LOT 11	31,075 SQM	0 SQM		31,075 SQM	N/A
LOT 12	127,492 SQM	19,396 SQM	3,995 SQM	104,101 SQM	N/A
LOT 13	49,166 SQM	9,160 SQM		40,006 SQM	N/A
LOT 14	15,893 SQM	1,239 SQM		14,654 SQM	N/A
PROPOSED ACCESS ROADS	50,047 SQM				
ALDINGTON ROAD DEDICATION ZONE	9,160 SQM				
TOTAL	632,887 SQM	57,892 SQM	18,564 SQM	497,224 SQM	153,343 SQM

DEVELOPMENT AREAS	
EXISTING LOTS	GROSS SITE AREA
LOT 10	101,447 SQM
LOT 24	101,238 SQM
LOT 25	101,235 SQM
LOT 26	25,432 SQM
LOT 27	101,205 SQM
LOT 28	101,175 SQM
LOT 33	101,155 SQM
TOTAL	632,887 SQM

Source: Frasers Property

2.3. Identification of Potential Emissions to Atmosphere

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

2.3.1. Construction Phase

Construction of the Proposal would involve demolition of existing structures, bulk earthworks, vegetation clearing, construction of an industrial warehouse development, ancillary offices, access road off Aldington Road, internal road network, car and van parking, docking areas, associated infrastructure, site access points and landscaping.

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 hand or power tools;
- Cranes;
- Commercial vans; and
- Cherry pickers.

The assessment of the potential impacts upon local air quality resulting from construction activities of the Proposal, is presented in Section 6.

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 combustion emissions from the consumption of diesel fuel in the truck movements importing and exporting materials. 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 pollutants would be particulate matter and 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_X 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.

A summary of the emission sources and potential emissions to air during the construction and operation of the Proposal, is presented in Table 2.

Table 2 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				
Wheel generated emissions – trucks	✓	✓	✓	
Exhaust emissions – truck engine	✓	✓(1)	✓	✓

Note (1) Particulate emissions from diesel combustion are predominantly less than 1 micrometre (1 µm) in diameter and are therefore assessed as $PM_{2.5}$. As $PM_{2.5}$ is essentially a subset of PM_{10}, PM_{10} has been assessed at an equivalent rate to $PM_{2.5}$ for the relevant sources.

Given the nature of the development at the Proposal site, it is not anticipated that odour would be emitted in any significant quantity during construction. Any potential contamination identified through detailed site investigation would be managed to ensure that no odour would impact upon surrounding residences.

The operation of the Proposal site is considered not likely to be significantly odorous. All goods would be stored within the warehouse and any waste materials would be stored appropriately and removed from site on a daily basis. In light of the above, 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. 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 2010. The overall objective of this 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 improve air quality across the State and this AQIA, it is imperative that this Proposal demonstrates leadership in the development of the NSW economy (in terms of activity and employment) and concomitantly not cause a detriment in achieving its objectives.

3.2. Ambient Air Quality Standards

State air quality guidelines adopted by the 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 emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Proposal.

The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC, DoE, WHO and ANZECC). Where relevant to this AQIA (coincident with the potential emissions identified in Section 2.3), the criteria have been adopted as set out in Section 7.1 of NSW EPA (2022) which are presented in Table 3.

Table 3 NSW EPA Impact Assessment Criteria

Pollutant	Averaging period	Units	Criterion	Notes
Particulates (as PM_{10})	24 hours	$\mu g \cdot m^{-3}$ (A)	50	Numerically equivalent to the AAQ NEPM(B) standards and goals.
	Annual	$\mu g \cdot m^{-3}$	25	
Particulates (as $PM_{2.5}$)	24 hours	$\mu g \cdot m^{-3}$	25	
	Annual	$\mu g \cdot m^{-3}$	8	
Nitrogen dioxide (NO_2)	1-hour	$\mu g \cdot m^{-3}$	164	
	Annual	$\mu g \cdot m^{-3}$	31	
Particulates (as TSP)	Annual	$\mu g \cdot m^{-3}$	90	
Particulates (as dust deposition)	Annual(C)	$g \cdot m^{-2} \cdot month^{-1}$	2	Assessed as insoluble solids as defined by AS 3580.10.1
	Annual(D)	$g \cdot m^{-2} \cdot month^{-1}$	4	

Notes: (A): micrograms per cubic metre of air (B): National Environment Protection (Ambient Air Quality) Measure
(C): Maximum increase in deposited dust level (D): Maximum total deposited dust level

3.3. NSW Greenhouse Gas Legislation

There is no specific GHG legislation administered within NSW. The NGER scheme is the applicable legislation within NSW.

The NSW Government is working to deliver economically efficient and environmentally effective policies and programs that do not duplicate initiatives of the Australian Government, which includes (but not necessarily limited to):

- Understanding NSW emissions;
- Providing financial support through the Climate Change Fund;
- Promoting energy efficiency (e.g. through the Energy Savings Scheme [ESS]); and
- Promoting soil carbon sequestration.

3.3.1. National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting (NGER) scheme, established by the *National Greenhouse and Energy Reporting Act* (2007) (NGER Act), is a national framework for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information specified under NGER legislation.

The objectives of the NGER scheme are to:

- Inform government policy;
- Inform the Australian public;
- Help meet Australia's international reporting obligations;

- Assist Commonwealth, state and territory government programmes and activities; and
- Avoid duplication of similar reporting requirements in the states and territories.

Further information on the NGER scheme, specifically the definitions of various scopes and types of GHG emissions which have also been adopted for the purposes of this assessment, is provided in Section 5.3.

3.4. Guidance

The GHG accounting and reporting principles adopted within this GHG assessment are based on the following financial accounting and reporting standards:

- Australian Government Department of the Environment, Australian National Greenhouse Accounts, National Greenhouse Accounts Factors, August 2022 (DoE, 2022);
- The World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) GHG Protocol: A Corporate Accounting and Report Standard (WRI, 2004);
- ISO 14064-1:2018 (Greenhouse Gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of GHG emissions and removal;
- ISO 14064-2:2018 (Greenhouse Gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of GHG emission reductions or removal enhancements);
- ISO 14064-3:2019 (Greenhouse Gases – Part 3: Specification with guidance for the validation and verification of GHG assertions) guidelines (internationally accepted best practice); and
- NSW Environmental Planning and Assessment Regulation 2000.

4. EXISTING CONDITIONS

4.1. Surrounding Land Sensitivity

4.1.1. Land Use Zoning

The land use surrounding the Proposal site is zoned IN1 (General Industrial) under the provision of the State Environmental Planning Policy (Industry and Employment) 2021. Additionally, there are some Environmental Conservation zones to the north of the Proposal.

The closest residential dwelling to the Proposal site is located approximately 52 m to the southwest.

4.1.2. Discrete Receptor Locations

Air quality assessments typically use a desk-top mapping study 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. Typically, these locations are identified as residential properties, although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations.

It is noted that the assessment criteria applied to particulates (see Table 3) is as a 24-hour averaging period, and as such the predicted impacts need to be interpreted at commercial and industrial receptor locations with care. It is considered to be atypical for a person to be at those locations for a complete 24-hour period and as such, the exposure risks at those locations would be over-estimated by adoption of those locations in the modelling assessment.

It is important to note that the selection of discrete receptor locations is not intended to represent a fully inclusive selection of all sensitive receptors across the study area. The location selected should be considered to be representative of its broader location and may be reasonably assumed to be representative of the immediate environs. In some instances, several viable receptor locations may be identified in a small area, for example a school neighbouring a medical centre. In this instance the receptor closest to the potential sources to be modelled would generally be selected and would be used to assess the risk to other sensitive land uses in the area.

It is further noted that in addition to the identified 'discrete' receptor locations, the entire modelling area is gridded with 'uniform' receptor locations (see Section 4.1.3) that are used to plot out the predicted impacts, and as such the accidental non-inclusion of a location that is 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}):

- Very high >8,000
- High >5,000
- Medium >2,000
- Low >500
- Very low <500

Using ABS data in a GIS, the population density of the area surrounding the Proposal site is presented in Figure 3.

The Proposal site and receptors are located in an area of 'very low' population densities. Generally, the broader context of the Proposal site is currently typified by employment-generating land uses and also (currently) agricultural areas.

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 4 and Figure 3. It is noted that a number of the identified industrial receptors are currently in the process of being developed and correspondingly, have been considered in this assessment. A review of the NSW Department of Planning and Environment (NSW DPE) major projects database[1] has been performed to determine whether those industrial developments are currently proposed or approved as outlined in Table 4.

[1] https://www.planningportal.nsw.gov.au/major-projects

Table 4 Receptor location used in the study

Rec	Location	Land use	Location (UTM)		Comments
			mE	mS	
R1	Aldington Road, Kemps Creek	Industrial	296399	6 252 559	Approved development
R2	Aldington Road, Kemps Creek	Industrial	296 377	6 252 877	Approved development
R3	Imperata Close, Kemps Creek	Industrial	297 157	6 253 795	Operational
R4	Aldington Road, Kemps Creek	Residential	296 537	6 251 947	-
R5	Bowood Road, Mount Vernon	Residential	297 380	6 251 639	-
R6	Bowood Road, Mount Vernon	Residential	297 678	6 252 392	-
R7	Greenview Place, Mount Vernon	Residential	298 125	6 252 777	-
R8	Aldington Road, Kemps Creek	Industrial	296 128	6 253 026	Proposed development (Dexus site)
R9	Aldington Road, Kemps Creek	Residential	296 089	6 253 475	-
R10	Mamre Road, Kemps Creek	Industrial	294 926	6 253 516	Proposed development
R11	Mamre Road, Kemps creek	Industrial	294 807	6 252 804	Proposed development
R12	Mamre Road, Kemps Creek	Industrial	295 331	6 252 416	Proposed development
R13	Mamre Road, Kemps Creek	Residential	295 410	6 252 147	-
R14	Aldington Road, Kemps Creek	Industrial	295 735	6 252 015	Proposed development

Note: The requirements of this AQIA may vary from the specific requirements of other studies, and as such the selection and naming of receptor locations, may vary between technical reports. This does not affect or reduce the validity of those assumptions.

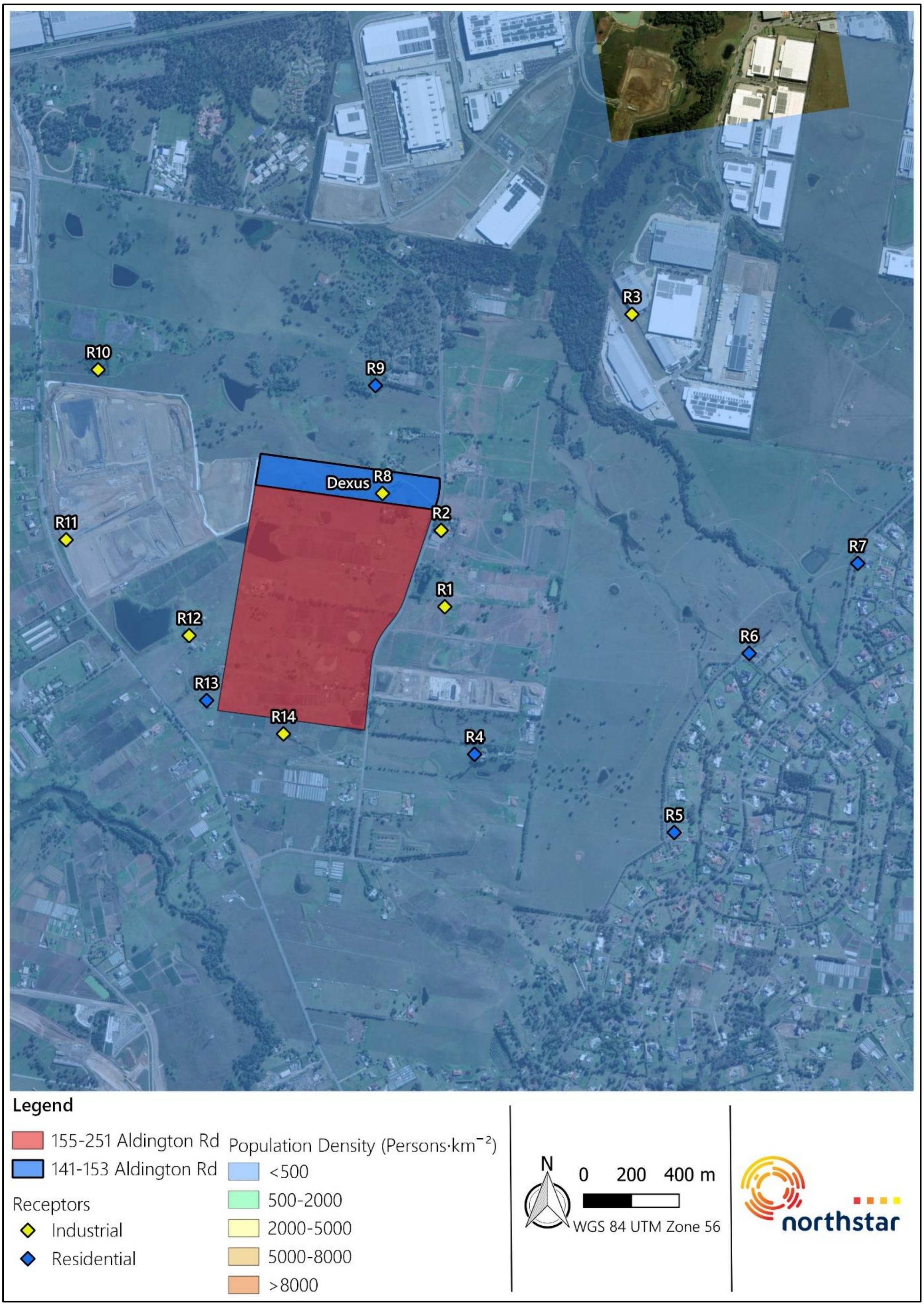
4.1.3. Uniform Receptor Locations

Additional to the sensitive receptors identified in Section 4.1.2, a grid of uniform receptor locations has been used in the AQIA to allow presentation of contour plots of predicted impacts.

4.2. Topography

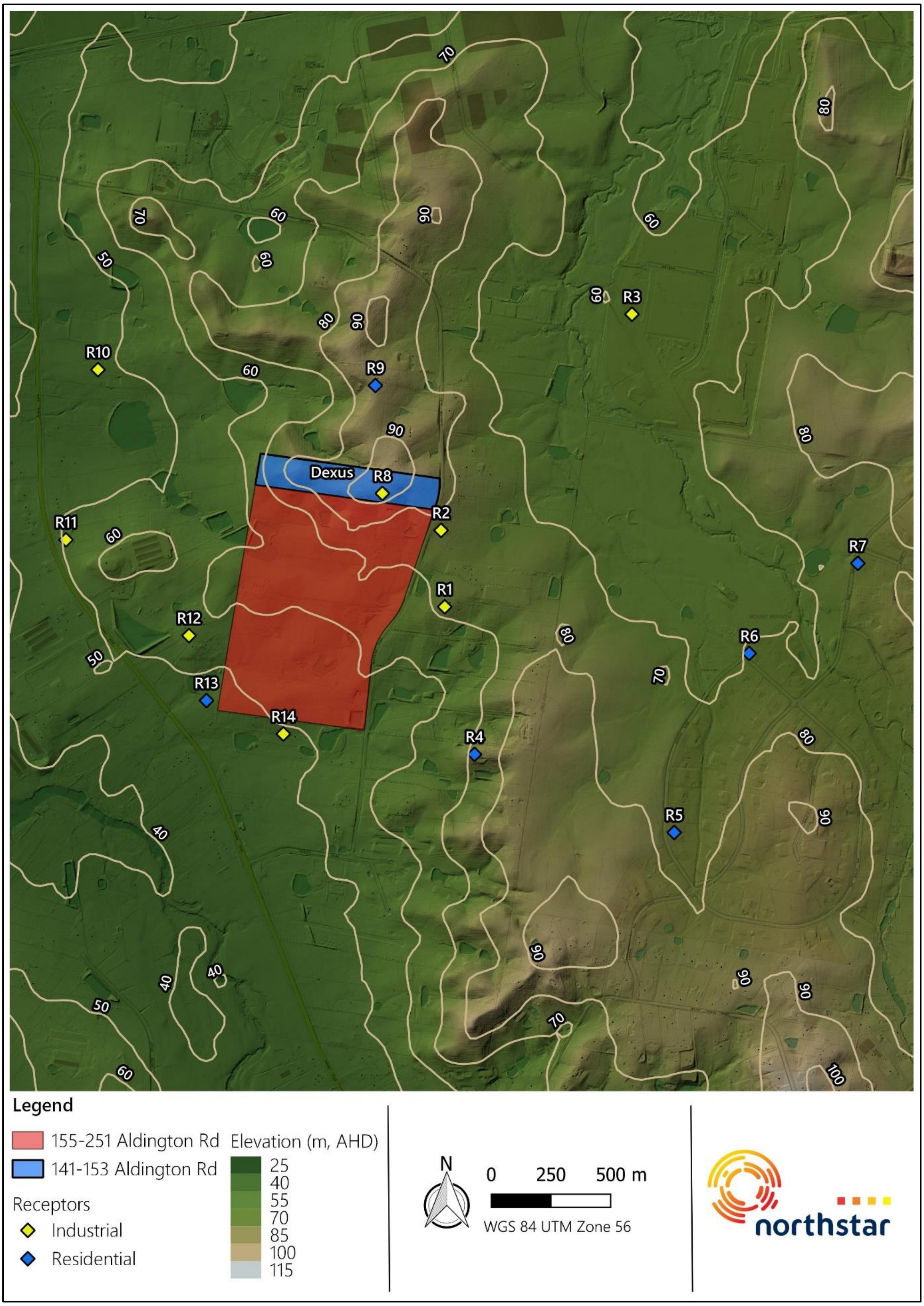
The elevation of the Proposal site is approximately 60 m to 90 m Australian Height Datum (AHD). The topography between the Proposal site and nearest sensitive receptor locations is uncomplicated. An illustration of the topography of the area is illustrated in Figure 4.

Figure 3 Population density and sensitive receptors surrounding the Proposal site



Source: Northstar

Figure 4 Topography surrounding the Proposal site



Source: Northstar Air Quality

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 a number of surrounding Automatic Weather Stations (AWS).

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 B.

Two meteorological stations operated by BoM are located within an 8 km radius of the Proposal site. A summary of the relevant AWS is provided in Table 5 below (listed by proximity).

Table 5 Details of meteorological monitoring surrounding the Proposal site

Site name	Approximate location (UTM)		Approximate distance
	mE	mS	km
Horsley Park Equestrian Centre AWS - Station # 67 119	301 708	6 252 298	5.9
Badgerys Creek AWS - Station # 67 108	289 907	6 246 949	7.9

The meteorological conditions measured at Horsley Park Equestrian Centre AWS for the period 2016-2020, are presented in Appendix B.

It is considered that Horsley Park Equestrian Centre AWS is most likely to represent the conditions at the Proposal site, based upon its proximity and lack of significant topographical features between the two locations. The wind roses presented in Appendix B indicate that from 2016 to 2020, winds at Horsley Park Equestrian Centre AWS show similar wind distribution patterns across the years assessed, with a predominant south-westerly wind direction.

The majority of wind speeds experienced at the Horsley Park Equestrian Centre AWS between 2016 and 2020 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 south-easterly, south-westerly and north-westerly directions. Winds of this speed are rare and occur during 0.3 % of the observed hours during the years. Calm winds (<0.5 $m \cdot s^{-1}$) prevail and occur more than 18 % of hours across the years.

Based on the wind distributions across the years examined (see Section 4.3 and Appendix B), data for the year 2017 has been selected as being appropriate for further assessment, as it best represents the general trend across the 5-year period studied.

4.4. 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.

The Proposal site is located proximate to a number of AQMS operated by NSW DPE. These locations (listed by proximity) are briefly summarised in Table 6.

Table 6 Closest DPE AQMS to the Proposal site

AQMS location	Distance to site (km)	2017 data	Measurements			
			PM_{10}	$PM_{2.5}$	TSP	NO_2
St Marys	5.7	✓	✓	✓	×	✓
Bringelly	8.0	✓	✓	✓	×	✓
Prospect	11.8	✓	✓	✓	×	✓

The closest active AQMS is noted to be located at St Marys and is generally considered to be the monitoring location most reflective of the conditions at the Proposal site.

Appendix C provides a detailed assessment of the background air quality monitoring data collected at the St Marys AQMS.

It is noted that none of the AQMS measure Total Suspended Particulate (TSP) which is of relevance to the expected emissions from the Proposal site. Based upon long-term historic monitoring data, a numerical relationship between TSP and PM_{10} has been established for the Sydney Metropolitan region. Based upon these data, a relationship between ambient concentrations of TSP : PM_{10} of 2.0551 : 1 is used to approximate background annual average TSP concentrations. This relationship is established and is used frequently to approximate background annual average TSP concentrations in similar locations (see Appendix C).

The impact assessment criteria used for deposited dust (see Table 3) are presented as (i) a cumulative deposition rate of 4 $g{\cdot}m^{-2}{\cdot}month^{-1}$ and (ii) a discrete deposition rate of 2 $g{\cdot}m^{-2}{\cdot}month^{-1}$. In lieu of a background deposition rate to derive a cumulative rate, the incremental impact assessment criterion (2 $g{\cdot}m^{-2}{\cdot}month^{-1}$) will be used. This is a commonly adopted approach when background deposition rates are not available.

A summary of the air quality monitoring data and assumptions used are presented in Table 7.

Table 7 Summary of background air quality used in the AQIA

Pollutant	Ave period	Measured value	Notes
Particles (as TSP) (derived from PM_{10})	Annual $\mu g \cdot m^{-3}$	33.4	Estimated on a TSP:PM_{10} ratio of 2.0551 : 1
Particles (as PM_{10}) (St Marys)	24-hour $\mu g \cdot m^{-3}$	Daily Varying	The 24-hour maximum for PM_{10} in 2017 was 49.8 $\mu g \cdot m^{-3}$ (i.e. very close to the criterion)
	Annual $\mu g \cdot m^{-3}$	16.2	
Particles (as $PM_{2.5}$) (St Marys)	24-hour $\mu g \cdot m^{-3}$	Daily Varying	The 24-hour maximum for $PM_{2.5}$ in 2017 was 38.2 $\mu g \cdot m^{-3}$ (i.e. already exceeding – see below)
	Annual $\mu g \cdot m^{-3}$	7.0	
Dust deposition	Annual $g \cdot m^{-2} \cdot month^{-1}$	2.0	Difference in NSW EPA maximum allowable and incremental impact criterion
Nitrogen dioxide (NO_2) (St Marys)	1-hour $\mu g \cdot m^{-3}$	69.6	Hourly maximum 1-hr average in 2017
	Annual $\mu g \cdot m^{-3}$	8.0	Annual average in 2017

Note: Reference should be made to Appendix C

A number of AQMS in NSW metropolitan and regional population centres recorded particulate matter concentrations above the national standard on some days during 2017. This was mainly driven by an increase in hazard reduction burns and agricultural activities (NSW OEH, 2019). The 24-hour NEPM PM_{10} standard was not exceeded on any calendar days at St Marys AQMS in 2017, however, the 24-hour NEPM $PM_{2.5}$ standard was exceeded on three calendar days in 2017 at St Marys due to exceptional events as presented in Table 8.

Extensive hazard reduction burns (HRB) throughout the NSW Greater Metropolitan Region were the major influences on elevated $PM_{2.5}$ levels throughout New South Wales. As presented in Table 8, all of these exceedances were due to hazard reduction burns[2].

Table 8 Days exceeding $PM_{2.5}$ 24-hour AAQ NEPM Standards at St Marys AQMS – 2017

Date	Max. 24-hr PM_{10} concentration ($\mu g \cdot m^{-3}$)	Max. 24-hr $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$)	Event
11 May	33.2	25.3	Hazard reduction burn at Wentworth Falls, 40 km northwest of St Marys.
15 August	40.3	38.2	Effects of hazard reduction burn from 14 August.
3 September	35.8	26.0	Effects of hazard reduction burn from 2 September.

Source: New South Wales Annual Compliance Report 2017

[2] https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Air/national-environment-protection-measure-ambient-air-quality-nsw-compliance-report-2017-180635.pdf

The AQIA has been performed to assess the contribution of the Proposal to the air quality of the surrounding area, and to ensure that no additional exceedances of the air quality criteria are experienced as a result of the construction and operation of the Proposal. A full discussion of how the Proposal impacts upon the air quality is presented in Section 6 and Section 7.

4.5. Potential for Cumulative Impacts

The area surrounding the Proposal site includes a number of developments currently undergoing approval which have been considered within this AQIA. The identified developments include:

- Westgate Kemps Creek Development located at 253-267 Aldington Road;
- Aldington Road South Development located at 155-217 Aldington Road, Kemps Creek;
- Aldington Road Estate located at 1-51 Aldington Road, Kemps Creek
- Dexus Kemps Creek Industrial Estate located at 113-152 Aldington Road, Kemps Creek
- Warehouse developments within the Kemps Creek Warehouse, Logistics and Industrial Facilities Hub co-located at 657-769 Mamre Road, Kemps Creek;
- Aspect Industrial Estate located at 804-864 Mamre Road, Kemps Creek;
- Warehouse and distribution centre located at 706-752 Mamre Road, Kemps Creek;
- Kemps Creek Data Centre located at 757-769 Mamre Road;
- Kemps Creek Resource Recovery Facility located at 788 to 804 Mamre Road, Kemps Creek;
- GPT Group industrial estate located at 754-770 and 784-786 Mamre Road, Kemps Creek; and,

Review of the documentation supporting the development applications for the identified proximate developments show that emissions during construction would be similar to those assessed for the Proposal, which can be appropriately managed through considerate dust management measures to result in minimal impacts on the surrounding environment. Cumulative impacts with the Proposal associated with construction activities for any development would therefore be anticipated to be minor.

In relation to operations, the development identified above would generally have a similar emission profile to the Proposal, and cumulative impacts would generally be anticipated to be minor.

The AQIA for the Kemps Creek Data Centre (Arup Australia, 2021) (located approximately 1.3 km to the northwest of the Proposal site) shows that infrequent NO_2 impacts may be experienced during periods of power interruption when emergency diesel fuelled generators may be present to maintain electricity supply. Short-term elevations in combustion related pollutant concentrations may be experienced in the local area, although the impacts associated with the Proposal would be likely to be significantly lower than that generated by the data centre, in that situation.

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 very minor 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 a methodology presented in the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management (IAQM)[3] . Reference should be made to Appendix D 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 illustrated in Figure 5.

[3] www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf

Figure 5 Construction phase impact risk assessment methodology

Step 1
- **SCREENING**
- A simple screening step accounting for seperation distance between the sources and the receptors

Step 2
- **RISK FROM CONSTRUCTION ACTIVITIES**
- Assess risk from activities based on the scale and nature of the works, which determines the potential dust emission magnitude

Step 3
- **SENSITIVITY OF THE AREA**
- Assess risk of dust effects from activities based on the sensitivity of the area surrounding dust-generating activities

Step 4
- **RISK ASSESSMENT (PRE-MITIGATION)**
- Based upon Steps 2 and 3, determine risks associated with the construction activities

Step 5
- **IDENTIFY MITIGATION**
- Based upon the risks assessed at Step 4, identify appropriate mitigation measures to control the risks

Step 6
- **RISK ASSESSMENT (POST-MITIGATION)**
- Based upon the mitigation measures identified at Step 5, reassess risk

The assessment approach, as illustrated above in Figure 5, is detailed in Appendix D.

5.2. Operational Phase

5.2.1. Dispersion Modelling

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF Atmospheric Dispersion Model. The modelling has been performed in CALPUFF 2-dimensional (2-D) mode. Given the uncomplex terrain and the proximity of the receptors to the Proposal site (refer Section 4.2), a detailed assessment using a 3 D meteorological dataset is not warranted.

The 2-D meteorological dataset has been developed using The Air Pollution Model (TAPM, v 4.0.5) (see Appendix B for further information).

An assessment of the impacts of the operation of activities at the Proposal site has been performed, which characterises the likely day-to-day (and hour-to-hour) operation, approximating operational characteristics which are appropriate to assess against longer term (annual average) and shorter term (24-hr and 1-hr) criteria for emissions to air.

The modelling scenario provides an indication of the air quality impacts of the operation of activities at the Proposal site and the predictions are termed 'incremental impacts'. Added to the incremental impacts are background air quality concentrations (where available and discussed in Section 4.4 and Appendix C), which represent the air quality which may be expected within the area surrounding the Proposal site, without the impacts of the Proposal itself. The addition of background assumptions to the incremental impacts derives the predicted 'cumulative impacts'.

The following provides a description of the determination of appropriate emissions of air pollutants resulting from the operation of the Proposal.

5.2.2. Emissions 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. This assessment has adopted emission factors from the US EPA AP42 emission factor compendium (US EPA, various) specifically Chapter 13 (Miscellaneous Sources) (USEPA, 2011) for the assessment of particulate matter emissions resulting from the use of paved roads by delivery vehicles. To account for gaseous emissions (of NO_X/NO_2) and particulate matter, resulting from idling vehicles at the delivery bays at the warehouse and industrial facility, emissions have been calculated using emission factors adopted from the US EPA document "*Idling Vehicle Emissions for Passenger Cars Light-Duty Trucks, and Heavy-Duty Trucks*" (US EPA, 2008).

Data has been provided by the Applicant to approximate the activities being performed at the Proposal site on a day-to-day basis. These data, and the relevant emission factors associated with each activity are presented in Table 9 and in Table 10. Emissions data associated with the activities is presented in Table 11 and in Table 12.

Commercial vehicle trip generation rates for the warehouse have been provided by the Proponent, which indicate that a total of 897 commercial vehicles are calculated to visit the Proposal site each day.

A total of 103 loading bays are associated with the Proposal. The potential for all bays to be occupied by vehicles at any one time is unlikely. Furthermore, the likelihood that all of those vehicles would be simultaneously idling is more unlikely still. However, this assessment needs to assess a potential likely worst-case scenario, especially to allow determination of the possible short term (1-hour) impacts at nearby receptor locations.

An assumption has been made that all 103 bays would be occupied simultaneously, and that the vehicles would be idling for a period of 10 minutes within each hour which is considered representative of typical loading / unloading times.

Operators of trucks actively seek to reduce operational costs and a reduction in vehicle idling time also presents associated reductions in fuel use and engine wear. Engine idling time can be reduced through:

- Implementation of operational efficiencies (booking systems, parking rather than queueing vehicles, expanded hours of operation to avoid peak periods);
- The use of idle-off devices; and
- The use of Auxiliary Power Units (APUs).

Table 9 Emission factors, particulate matter – vehicle transport

Source	Activity rate	Units	Emission factor source	Emission factor			Units
				TSP	PM_{10}	$PM_{2.5}$	
Trucks entering / leaving Proposal site	Various (see Table 11)	$VKT \cdot hr^{-1}$	AP42 - 13.2.1 Paved Roads Assumed silt loading of road is 0.015 $g \cdot m^{-2}$ (ubiquitous baseline, >10 000 AADT flow, limited access (USEPA, 2011)). Average vehicle weight assumed to be 29 t (70 % Pick Up and Delivery [PUD] vehicles at average of 20 t, 30 % B-Double at average of 50 t).	2.42	0.46	0.11	$VKT \cdot hr^{-1}$

Table 10 Emission factors – gaseous and particulate matter emissions – diesel engines

Source	Activity rate	Units	Vehicle type	Op. hours	Emission factor source	NO_X emission factor ($g \cdot hr^{-1}$)	PM_{10} emission factor ($g \cdot hr^{-1}$)	$PM_{2.5}$ emission factor ($g \cdot hr^{-1}$)
Trucks idling in bays at warehouses	Various (see Table 12)$^{(A)}$	$veh \cdot hr^{-1}$	B-Double	24	(USEPA, 2008).	33.763	1.196	1.1

Notes: A Vehicles assumed to be idling for a 10-minute period each hour

Table 11 Emission estimation, particulate matter – vehicle transport

Warehouse number	Area (m^2)	Number of daily trips (trucks)	Distance of road (km)	$VKT \cdot day^{-1}$ $^{(A)}$	TSP emission rate ($kg \cdot year^{-1}$) $^{(A)}$	PM_{10} emission rate ($kg \cdot year^{-1}$) $^{(A)}$	$PM_{2.5}$ emission rate ($kg \cdot year^{-1}$) $^{(A)}$
1	11 820	73	2.5	181.2	160.2	30.7	7.4
2	31 680	194	2.5	485.6	429.3	82.4	19.9
3	23 210	142	2.5	355.8	314.5	60.4	14.6
4	23 020	141	2.5	352.8	312.0	59.9	14.5
5	21 520	132	2.5	329.9	291.6	56.0	13.5
6	10 800	66	2.5	165.5	146.4	28.1	6.8
7	10 420	64	2.5	159.7	141.2	27.1	6.6
8	13 730	84	2.5	210.4	186.1	35.7	8.6

Note: A: VKT and emissions presented as two-way totals

Table 12 Emission estimation – gaseous and particulate matter emissions, diesel engines

Warehouse number	Number of vehicle bays	NO_X emission rate ($kg \cdot year^{-1}$) $^{(A)}$	PM_{10} emission rate ($kg \cdot year^{-1}$) $^{(A)}$	$PM_{2.5}$ emission rate ($kg \cdot year^{-1}$) $^{(A)}$
1	10	346.8	11.7	10.8
2	16	554.9	18.8	17.3
3	17	589.6	19.9	18.3
4	17	589.6	19.9	18.3
5	16	554.9	18.8	17.3
6	9	312.2	10.6	9.7
7	9	312.2	10.6	9.7
8	9	312.2	10.6	9.7

Note: A: Vehicles assumed to be idling for a 10-minute period each hour

5.3. Greenhouse Gas Assessment

The Australian Government Department of the Environment (DoE) document, "National Greenhouse Accounts Factors" Workbook (NGA Factors) (DoE, 2022), defines two types of GHG emissions (see Table 13), namely 'direct' and 'indirect' emissions. This assessment considers both direct emissions and indirect emissions resulting from the operation of the Proposal.

Table 13 Greenhouse gas emission types

Emission type	Definition
Direct	Produced from sources within the boundary of an organisation and as a result of that organisation's activities (e.g. consumption of fuel in on-site vehicles)
Indirect	Generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation (e.g. consumption of purchased electricity).

Note: Adapted from NGA Factors Workbook (DoE, 2022)

5.3.1. Emission Scopes

The NGA Factors (DoE, 2022) identifies two 'scopes' of emissions for GHG accounting and reporting purposes as shown in Table 14.

Table 14 Greenhouse gas emission scopes

Emission scope	Definition
Scope 1	Direct (or point-source) emission factors give the kilograms of carbon dioxide equivalent (CO_2-e) emitted per unit of activity at the point of emission release (i.e. fuel use, energy use, manufacturing process activity, mining activity, on-site waste disposal, etc.). These factors are used to calculate Scope 1 emissions.
Scope 2	Indirect emission factors are used to calculate Scope 2 emissions from the generation of the electricity purchased and consumed by an organisation as kilograms of CO_2-e per unit of electricity consumed. Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station.

Note: Adapted from NGA Factors Workbook (DoE, 2022)

A third scope of emissions, Scope 3 Emissions, are also recognised in some GHG assessments. The Greenhouse Gas Protocol (GHG Protocol) (WRI, 2004) defines Scope 3 emissions as "other indirect GHG emissions":

> *"Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some*

examples of Scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services."

Scope 3 emissions have not been considered within this assessment but are entirely optional.

5.3.2. Emission Source Identification

The geographical boundary set for this GHG assessment covers the Proposal and does not include the transport of materials to and from the site (as defined above). Emissions associated with Proposal construction and all associated mobile plant and equipment, are not included in this assessment. This is because their usage is not quantifiable at the current time. The ongoing energy efficiency of the Proposal's operation has been considered the main focus of this assessment.

The GHG emission sources associated with the operation of the Proposal have been identified through the review of the proposed broad activities as described in Section 2. The individual tenants of each of the warehouses/industrial facilities is not yet fully determined, and information relating to the consumption of electricity has been provided by the Applicant.

The activities/operations being performed, as part of the Proposal, which have the potential to result in emissions of GHG, are presented in Table 15 below.

Table 15 Greenhouse gas emission sources

Proposal component	Scope	Emission source description
Consumption of purchased electricity	2	Emissions associated with the generation of electricity from fossil fuel combustion

A minor quantity of Scope 1 emissions, associated with the consumption of unleaded fuel, diesel fuel or natural gas, would be anticipated during the operation of the warehouses. At this stage of development, that quantity is not able to be quantified exactly. Fuel would also be combusted in vehicles servicing the Proposal (i.e. heavy good vehicles etc.). This assessment however, has examined the energy efficiency of the Proposal Site rather than the transportation of goods and materials.

5.3.3. Emissions Estimation

Emissions of GHG from the source identified in Table 15 have been calculated using activity data for the source per annum (i.e. per kilowatt-hour (kWh) of electricity) and the relevant emission factor for each source.

The assumptions relating to activity data are outlined in Table 16 below. This value represents the operation of all warehouses and offices within the Proposal Site. This has been based on data for similar facilities in NSW, VIC and QLD as provided by Frasers. These data indicate that the operation of similar facilities result in the consumption of 34.5 kWh·m^{-2} of floor space per year, averaged across seven facilities. This average value is close to the NSW value of 37.4 kWh·m^{-2} of floor space per year (Frasers, pers. comm.) and is considered to be appropriate.

The total floor space of the Proposal, covering all warehouses and office areas is 146 200 m^2.

Table 16 Calculated activity data

Warehouse	Proposal component	Assumptions	Activity	Units
1	Consumption of purchased electricity	Based on information provided by Frasers (averaging 34.5 kWh·m^{-2}·year^{-1})	407 790	kWh yr^{-1}
2			1 092 960	
3			800 745	
4			794 190	
5			742 440	
6			372 600	
7			359 490	
8			487 415	

Emission Factors

Emissions factors used for the assessment of GHG emissions associated with the operation of the Proposal have been sourced from the NGA Factors (DoE, 2022) (refer to Table 17).

Table 17 Greenhouse gas emission factors

Emission scope	Emission source	Emission factor
Scope 2	Electricity (NSW)	0.73 kg CO_2-e·kWh^{-1}

6. CONSTRUCTION AIR QUALITY IMPACT ASSESSMENT

The methodology adapted by Northstar from IAQM *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014) has been used to assess construction phase risk. The methodology and the full risk assessment are provided in Appendix D.

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 low for dust soiling, and medium for health effects, and the dust emission magnitudes for the various construction phase activities as presented in Appendix D, the resulting risk of air quality impacts (without mitigation) is as presented in Table 18.

Table 18 Risk of air quality impacts from construction activities

Impact	Sensitivity of area	Dust emission magnitude					Preliminary risk				
		Demolition	Earthworks	Construction	Track-out	Const. traffic	Demolition	Earthworks	Construction	Track-out	Const. traffic
Dust soiling	Low	Large	Large	Large	Large	Large	Med.	Low	Low	Low	Low
Human health	Med	Large	Large	Large	Large	Large	High	Med.	Med.	Med.	Med.

Note: Med. = Medium

The risks summarised in Table 18 show that for demolition activities, there is a medium risk of adverse dust soiling impacts and a high risk of human health impacts. All other construction phase activities are associated with low risks of dust soiling impacts and medium 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 D.

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 D be performed appropriately.

6.3. Air Quality Monitoring – Construction Phase

Based on the findings of the construction phase risk assessment, it is not considered that any air quality monitoring would be required during the construction phase. Daily site inspections under the Construction Environmental Management Plan (CEMP) would allow the identification of any issues, which should be rectified as soon as practicable.

7. OPERATIONAL AIR QUALITY IMPACT ASSESSMENT

The methodology used to assess operational phase impacts is discussed in Section 5.3. This section presents the results of the dispersion modelling assessment and uses the following terminology:

- **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 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

Results are presented in this section for the predictions of particulate matter (TSP, PM_{10}, $PM_{2.5}$ and dust deposition). The averaging periods associated with the criteria for these pollutants is 24-hour and annual averages, as specified in Table 3. The emissions adopted for this scenario reflect the operational profile of the Proposal over those averaging periods (refer Section 5.2).

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

The predicted annual average particulate matter concentrations (as TSP, PM_{10} and $PM_{2.5}$) resulting from the Proposal operations are presented in Table 19 overleaf.

No contour plots of annual average TSP, PM_{10} or $PM_{2.5}$ are presented, given the minor contribution from the Proposal at the nearest relevant sensitive receptors.

Table 19 Predicted annual average TSP, PM_{10} and $PM_{2.5}$ concentrations

Receptor	Annual average concentration ($\mu g \cdot m^{-3}$)								
	TSP			PM_{10}			$PM_{2.5}$		
	Incr.	Bg.	Cumul.	Incr.	Bg.	Cumul.	Incr.	Bg.	Cumul.
Criterion	90			25			8		
Max. % of criterion	0.7	37.1	37.8	1.1	64.8	65.9	1.7	87.5	89.2
R1	0.2	33.4	33.6	<0.1	16.2	16.3	<0.1	7.0	7.1
R2	0.2	33.4	33.6	0.1	16.2	16.3	<0.1	7.0	7.1
R3	0.6	33.4	34.0	0.2	16.2	16.4	<0.1	7.0	7.1
R4	<0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R5	<0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R6	<0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R7	<0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R8	<0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R9	0.6	33.4	34.0	0.3	16.2	16.5	0.1	7.0	7.1
R10	0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R11	<0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R12	<0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R13	0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1
R14	0.1	33.4	33.5	<0.1	16.2	16.3	<0.1	7.0	7.1

Note: Incr. = incremental impact, Bg.= background concentration, Cumul. = cumulative impact (Incr. + Bg.)

The performance of the Proposal does not in itself result in any exceedances of the annual average particulate matter impact assessment criteria.

7.1.2. Annual Average Dust Deposition Rates

Table 20 overleaf presents the annual average dust deposition predicted as a result of the operations at the Proposal site. An assumed background dust deposition of 2 $g{\cdot}m^{-2}{\cdot}month^{-1}$ is presented in Table 20, although comparison of the incremental concentration with the incremental criterion of 2 $g{\cdot}m^{-2}{\cdot}month^{-1}$ is also valid (as discussed within Section 4.4).

No contour plot of annual average dust deposition is presented, given the minor contribution from the Proposal at the nearest sensitive receptors.

Table 20 Predicted annual average dust deposition

Receptor	Annual average dust deposition ($g{\cdot}m^{-2}{\cdot}month^{-1}$)		
	Incremental impact	Background	Cumulative impact
R1	<0.1	2.0	2.1
R2	<0.1	2.0	2.1
R3	<0.1	2.0	2.1
R4	<0.1	2.0	2.1
R5	<0.1	2.0	2.1
R6	<0.1	2.0	2.1
R7	<0.1	2.0	2.1
R8	<0.1	2.0	2.1
R9	<0.1	2.0	2.1
R10	<0.1	2.0	2.1
R11	<0.1	2.0	2.1
R12	<0.1	2.0	2.1
R13	<0.1	2.0	2.1
R14	<0.1	2.0	2.1
Criterion	2.0	-	4.0

The performance of the Proposal does not result in any exceedances of the annual average dust deposition impact assessment criteria.

7.1.3. Maximum 24-Hour PM_{10} and $PM_{2.5}$

Table 21 below presents the maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations predicted to occur at the nearest receptors, as a result of the Proposal operations. No background concentrations are included within this table. The predicted incremental concentrations of PM_{10} and $PM_{2.5}$ are demonstrated to be minor.

Table 21 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_{10}
Criterion	50	25
Max. % of criterion	2.1	1.7
R1	0.8	0.3
R2	0.9	0.4
R3	0.9	0.4
R4	0.2	0.1
R5	0.4	0.2
R6	0.2	<0.1
R7	0.2	<0.1
R8	0.2	<0.1
R9	0.9	0.4
R10	0.4	0.2
R11	0.3	0.1
R12	0.3	0.1
R13	1.0	0.4
R14	0.8	0.3

The predicted maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations resulting from the operation of the Proposal, with background included are presented in Table 22 and Table 23, respectively. Results are presented for those receptors at which the greatest impacts have been predicted.

The left side of the tables show the predicted concentration on days with the highest regional background, and the right side shows the total predicted concentration on days with the highest predicted incremental concentrations respectively.

For PM_{10}, the maximum cumulative impact (the left hand side of Table 22) is predicted at receptor R2, and the maximum incremental impact (the right hand side of Table 22) is predicted at receptor R13. Discussion regarding the minor exceedance at receptor R2 is provided in Section 9.2.

For $PM_{2.5}$, the maximum cumulative impact (the left hand side of Table 23) is predicted at receptor R14, and the maximum incremental impact (the right hand side of Table 23) is predicted at receptor R9.

Table 22 Summary of contemporaneous impact and background – PM_{10}

Date	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$) – R2			Date	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$) – R13		
	Incr.	Bg.	Cumul.		Incr.	Bg.	Cumul.
24-09-17	0.2	49.8	50.0	20-05-17	1.0	6.5	7.5
15-08-17	<0.1	40.3	40.4	11-10-17	0.7	20.0	20.7
12-09-17	<0.1	37.4	37.5	19-05-17	0.6	14.6	15.2
03-09-17	0.2	35.8	36.0	01-01-17	0.5	21.0	21.5
05-10-17	0.1	35.7	35.8	25-03-17	0.4	16.9	17.3
02-09-17	0.2	35.5	35.7	13-12-17	0.4	22.4	22.8
15-01-17	<0.1	35.5	35.6	20-03-17	0.4	19.0	19.4
23-09-17	<0.1	34.8	34.9	27-06-17	0.4	15.3	15.7
21-08-17	0.4	33.3	33.7	25-11-17	0.4	11.2	11.6
11-05-17	<0.1	33.2	33.3	15-11-17	0.3	10.1	10.4
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, Bg.= background concentration, Cumul. = cumulative impact (Incr. + Bg.)

Table 23 Summary of contemporaneous impact and background – $PM_{2.5}$

Date	24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – R14			Date	24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – R9		
	Incr.	Bg.	Cumul.		Incr.	Bg.	Cumul.
15-08-17	<0.1	38.2	38.3	20-04-17	0.4	4.6	5.0
03-09-17	<0.1	26.0	26.1	11-06-17	0.4	4.9	5.3
11-05-17	<0.1	25.3	25.4	23-08-17	0.4	11.2	11.6
14-08-17	<0.1	24.3	24.4	04-05-17	0.4	5.1	5.5
27-08-17	<0.1	23.7	23.8	13-07-17	0.4	8.4	8.8
02-09-17	<0.1	23.5	23.6	06-04-17	0.4	4.3	4.7
21-08-17	0.1	21.7	21.8	15-06-17	0.4	8.9	9.3
26-08-17	<0.1	21.3	21.4	16-03-17	0.4	3.9	4.3
12-05-17	<0.1	20.1	20.2	21-04-17	0.3	5.5	5.8
12-09-17	<0.1	18.6	18.7	13-05-17	0.3	17.5	17.8
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, Bg.= background concentration, Cumul. = cumulative impact (Incr. + Bg.)

The performance of the Proposal does not result in any additional exceedance of the maximum 24-hour average PM_{10} particulate matter impact assessment criterion.

7.2. Nitrogen Dioxide

The averaging periods associated with the criteria for NO_2 are 1-hour and an annual average, as specified in Table 3. The emissions adopted for this scenario, reflect the operational profile of the Proposal over those averaging periods (refer Section 5.2).

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 conservative assumption that all NO is converted to NO_2 has been adopted (i.e. 100 % of NO_X is emitted as NO_2). This is in accordance with a Method 1, Level 1 assessment as outlined within the Approved Methods. In that method, the maximum dispersion model prediction is added to the maximum background concentration to provide a cumulative impact.

The predicted maximum 1-hour and annual average NO_2 concentrations resulting from the Proposal operations, are presented in Table 24. The results indicate that predicted incremental concentrations of NO_2, are below the criteria at all surrounding receptor locations.

Table 24 Predicted 1-hour and annual average nitrogen dioxide concentrations

Receptor	Nitrogen dioxide (NO_2) concentration ($\mu g \cdot m^{-3}$)					
	1-hour average			Annual average		
	Incr.	Bg.	Cumul.	Incr.	Bg.	Cumul.
Criterion	164			31		
Max. % of criterion	38.6	42.4	81.0	9.1	25.8	34.9
R1	11.9	69.6	81.5	0.5	8.0	8.5
R2	21.2	69.6	90.8	0.6	8.0	8.6
R3	43.1	69.6	112.7	1.5	8.0	9.5
R4	6.9	69.6	76.5	0.3	8.0	8.3
R5	8.1	69.6	77.7	0.2	8.0	8.2
R6	5.1	69.6	74.7	<0.1	8.0	8.1
R7	7.7	69.6	77.3	<0.1	8.0	8.1
R8	6.3	69.6	75.9	<0.1	8.0	8.1
R9	63.3	69.6	132.9	2.8	8.0	10.8
R10	14.8	69.6	84.4	0.6	8.0	8.6
R11	8.1	69.6	77.7	0.1	8.0	8.1
R12	10.6	69.6	80.2	0.2	8.0	8.2
R13	13.3	69.6	82.9	0.5	8.0	8.5
R14	9.4	69.6	79.0	0.4	8.0	8.4

Note: Incr. = incremental impact, Bg.= background concentration, Cumul. = cumulative impact (Incr. + Bg.)

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

8. GREENHOUSE GAS ASSESSMENT

This section presents the results of the GHG assessment, compares direct emissions totals with NSW and Australian totals, and provides a range of measures which might be considered to reduce GHG emissions.

8.1. Quantification of Greenhouse Gas emissions

Based on the activity data for the operation of the Proposal and the emission factor outlined in Section 5.3, annual GHG emissions have been calculated and are presented in Table 25 below.

Indirect (Scope 2) emissions associated with the Proposal are anticipated to be 3 692.07 t CO_2-e per annum.

Table 25 Calculated proposal GHG emissions

Emission scope	Emission source	GHG emissions (t CO_2-e per annum)
Scope 2	Purchased electricity consumption (Warehouse 1)	297.69
	Purchased electricity consumption (Warehouse 2)	797.86
	Purchased electricity consumption (Warehouse 3)	584.54
	Purchased electricity consumption (Warehouse 4)	579.76
	Purchased electricity consumption (Warehouse 5)	541.98
	Purchased electricity consumption (Warehouse 6)	272.00
	Purchased electricity consumption (Warehouse 7)	262.43
	Purchased electricity consumption (Warehouse 8)	355.81
	TOTAL Scope 2	**3 692.07**

8.2. Greenhouse Gas Emissions in Context

A comparison of the calculated GHG emissions associated with the Proposal against Australian (2022) and NSW (2019) total emissions is presented in Table 26 below.

Table 26 Proposal GHG emissions in context

Emissions (t CO_2-e per annum)		
Proposal	NSW (2019)	Australia (2022)
	Total 136 600 000	Total 487 100 000
3 692	0.0027 %	0.0008 %

These data indicate that the operation of the Proposal, in its entirety, would contribute 0.0027 % of NSW total GHG emissions in 2019and 0.0008 % of Australian total GHG emissions in 2022.

9. MITIGATION AND MONITORING

9.1. 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 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 6.1, and the mitigation measures identified to manage that risk are presented in Appendix D. The identified mitigation measures are anticipated to be implemented in the Construction Environmental Management Plan (CEMP) [4].

9.2. Operational Phase Mitigation

Based on the findings of the air quality impact assessment, it is considered that the level of activity being performed at the Proposal site would result in minor incremental impacts at all surrounding receptor locations.

In the case of predicted incremental annual average particulate matter concentrations (as TSP, PM_{10} and $PM_{2.5}$), the predicted maximum ground-level concentrations (at any receptor) are predicted to be low:

- TSP: 0.6 $\mu g \cdot m^{-3}$;
- PM_{10}: 0.3 $\mu g \cdot m^{-3}$; and
- $PM_{2.5}$: 0.1 $\mu g \cdot m^{-3}$.

The maximum incremental dust deposition rate is predicted to be < 0.1 $g \cdot m^{-2} \cdot month^{-1}$.

In the case of predicted incremental 24-hour average particulate matter concentrations (as PM_{10} and $PM_{2.5}$), the predicted maximum ground-level concentrations are predicted to be minor:

[4] https://www.planning.nsw.gov.au/~/media/Files/DPE/Guidelines/guideline-for-the-preparation-of-environmental-management-plans-2004.ashx?la=en

- PM_{10}: 1.0 µg·m^{-3}; and
- $PM_{2.5}$: 0.4 µg·m^{-3}.

Accounting for the background air quality assumptions, the assessment does not predict in any additional exceedances of the impact assessment criteria.

In regard to nitrogen dioxide, the predicted maximum increment 1-hour and annual average predictions are 63.3 µg·m^{-3} and 2.8 µg·m^{-3} respectively. Accounting for the relevant background assumptions, the assessment does not predict an exceedance of the relevant impact assessment criteria.

No specific mitigation measures are considered to be required to minimise impacts on surrounding receptor locations. Good site management practices, including the observation of speed limits on site, and the minimisation of vehicle use (through avoidance of engine idling) would be sufficient to ensure that no off-site impacts are experienced.

9.3. Monitoring

Given the discussion presented above, taking into consideration the minor 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.

10. CONCLUSION

Northstar was engaged by Frasers Property Industrial, to perform an AQIA for the construction and operation of a warehouse and logistics hub to be located at 141-153 and 155-251 Aldington Road, Kemps Creek.

Construction phase activities will involve demolition works and earthworks, construction works and associated vehicle traffic. The associated risks of impacts from demolition, construction, track-out and construction traffic have been assessed using the published guidance in *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by IAQM 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 health impacts and a medium risk of dust soiling associated with demolition activities should no mitigation measures be applied. All other construction phase activities are associated with medium risks of health impacts and low risks of dust soiling. Correspondingly, a range of standard mitigation measures are available 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 Approved Methods (NSW EPA, 2022), using an approved and appropriate dispersion modelling technique. The estimation of emissions has been performed using referenced emission factors, and this is documented in Section 5.2.

The potential incremental impacts (i.e. without consideration of assumed background air quality conditions) at all the identified receptor locations, are presented in Section 7 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 discussed in Section 4.4.

All air quality criteria are predicted to be achieved. Additionally, the changing landscape of the surrounding environment, with residential locations being removed and land being developed as commercial/industrial uses, should ensure that the most sensitive locations would not be present in the future.

A GHG assessment has been performed to examine the potential impacts of the operation of the Proposal relating to emissions of GHG. A quantitative assessment of emissions has been performed with emissions compared with total national and NSW GHG emissions for context. Emissions associated with the Proposal are anticipated to represent <0.0008 % of Australian emissions total for the year 2022 and <0.0027 % of NSW emissions totals for the year 2019.

It is respectfully suggested that the SSD application should not be refused on the grounds of air quality issues.

11. REFERENCES

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APPENDIX A

Commonly used units and abbreviations

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·ha^{-1}·hr^{-1} and not 0.2 kg/ha/hr.

Commonly used SI-derived and non-SI units

g·m^{-2}·s^{-1}	gram per square metre per second	rate of mass deposition per unit area
g·s^{-1}	gram per second	rate of mass emission
kg·ha^{-1}·hr^{-1}	kilogram per hectare per hour	rate of mass deposition per unit area
kg·m^{-3}	kilogram per cubic metre	density
L·s^{-1}	litres per second	volumetric rate
m^2	square metre	area
m^3	cubic metre	volume
m·s^{-1}	metre per second	speed and velocity
mg·m^{-3}	milligram per cubic metre	mass concentration per unit volume
mg·Nm^{-3}	milligram per normalised cubic metre (of air)	mass concentration per unit volume
µg·m^{-3}	microgram per cubic metre	mass concentration per unit volume
mg·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 (1×10^{-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
AQIA	air quality impact assessment
AQMS	air quality monitoring station
AQRA	air quality risk assessment
AS/NZS	Australian Standard / New Zealand Standard
AWS	automatic weather station
BOM	Bureau of Meteorology
CEMP	construction environment management plan
CO	carbon monoxide
CO_2	carbon dioxide
DEM	digital elevation model
EETM	emission estimation technique manual
EPA VIC	Environmental Protection Authority Victoria
GIS	geographical information system
IAQM	UK Institute of Air Quality Management
NEPM	National Environment Protection Measure
NO	nitric oxide

Abbreviation	Term
NO_X	oxides of nitrogen
NO_2	nitrogen dioxide
NSW	New South Wales
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
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
SO_X	oxides of sulphur
SO_2	sulphur dioxide
SVOC	semi-volatile organic compound
TAPM	The Air Pollution Model
TAS	Tasmania
TSP	total suspended particulates
TVOC	total volatile organic compounds
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VIC	Victoria
VOC	volatile organic compound

APPENDIX B

Meteorology

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 B1.

Table B1 Details of the meteorological monitoring surrounding the Proposal site

Site name	Source	Approximate location		Approximate distance
		mE	mS	km
Horsley Park Equestrian Centre AWS - Station # 67 119	BoM	301 708	6 252 298	5.9
Badgerys Creek AWS - Station # 67 108	BoM	289 907	6 246 949	7.9

As discussed in Section 4.3, meteorological conditions at Horsley Park Equestrian Centre AWS have been examined to determine a 'typical' or representative dataset for use in dispersion modelling. Annual wind roses for the period 2016-2020 are presented in Figure B1.

The wind roses indicate that from 2016 to 2020, winds at Horsley Park Equestrian Centre AWS show generally similar wind distribution patterns across the years assessed, with predominant south-westerly wind direction with south-easterly components also evident.

The majority of wind speeds experienced at the Horsley Park Equestrian Centre AWS between 2016 and 2020 are generally in the range 1.5 meters 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 0.3 % of the observed hours during the years while calm winds (< 0.5 $m \cdot s^{-1}$) occur during 18 % of hours on average across the years 2016-2020.

Given the similarities in the wind distribution across the years examined, data for the year 2017 has been selected for further assessment. Presented in Figure B1 are the annual wind rose for the 2016 to 2020 period and the year 2017 and in Figure B2 the annual wind speed distribution for Horsley Park Equestrian Centre AWS. These figures indicate that the distribution of wind speed and direction in 2017 is very similar to that experienced across the longer-term period.

It is concluded that conditions in 2017 may be considered to provide a suitably representative dataset for use in dispersion modelling.

Figure B1 Annual wind roses – Horsley Park Equestrian Centre AWS (2016 – 2020)

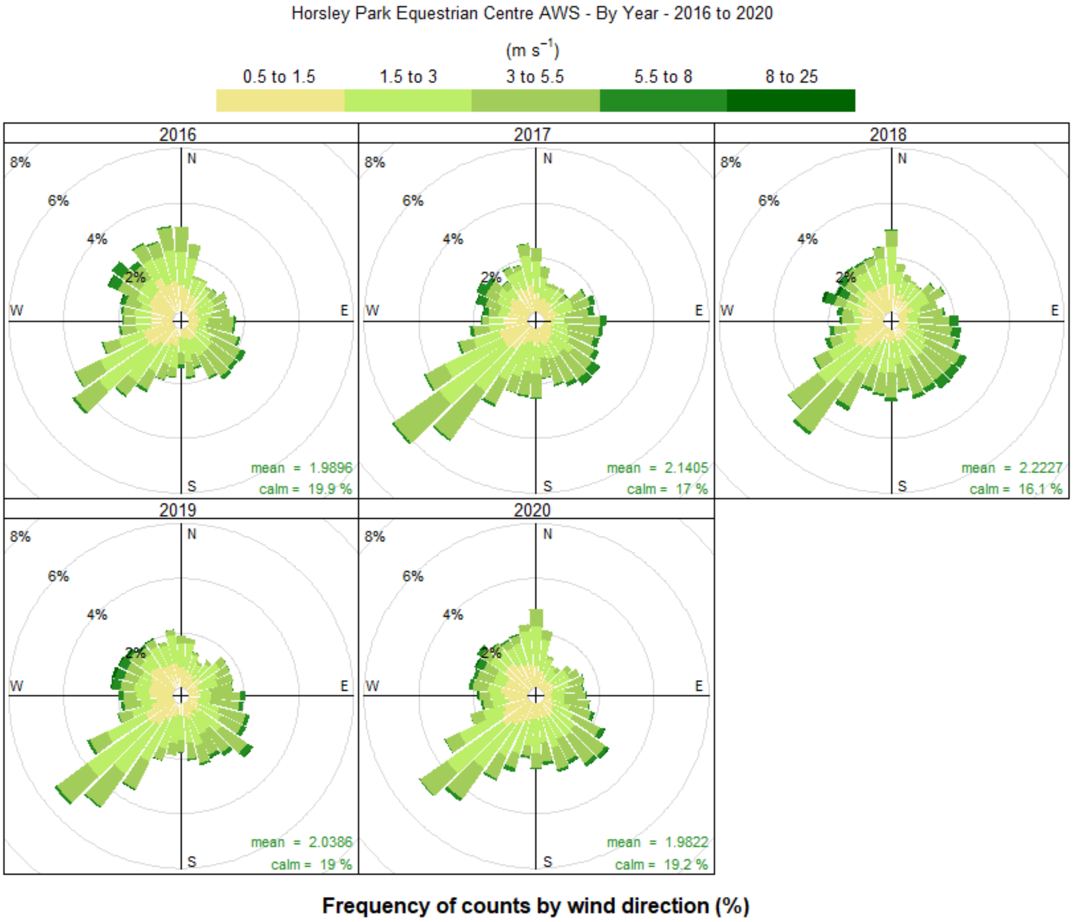
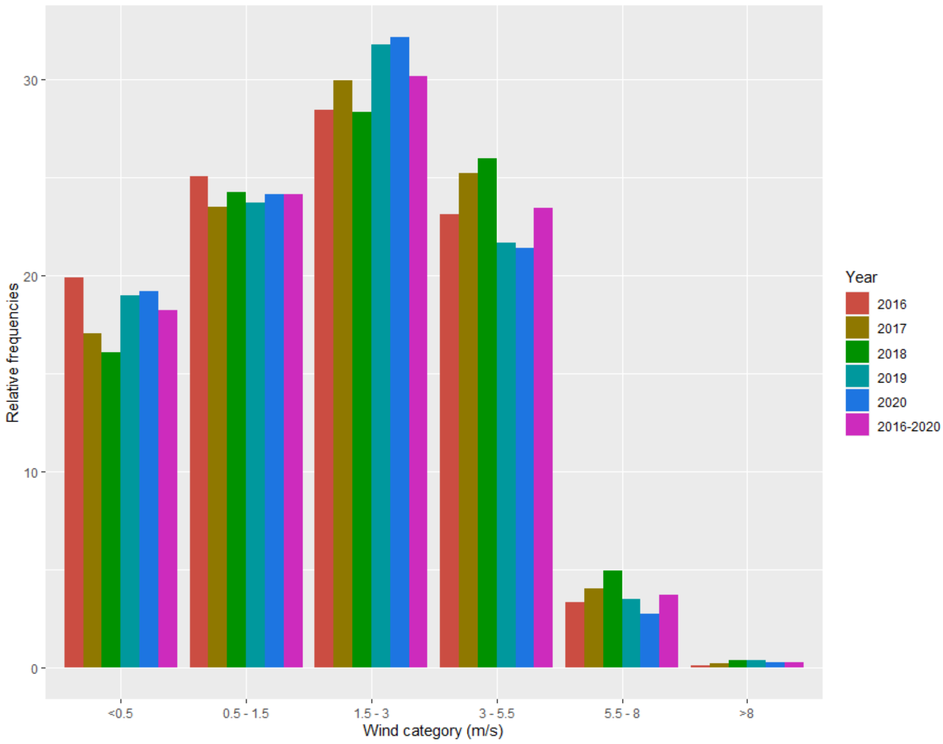


Figure B2 Annual wind speed distribution 2016 to 2020, Horsley Park Equestrian Centre AWS



The BoM and DPE data adequately addresses 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 TAPM meteorological model in a format suitable for using in the CALPUFF dispersion model (refer Section 5.2.1).

Meteorological modelling using The Air Pollution Model (TAPM, v 4.0.5) has been performed to predict the meteorological parameters required for CALPUFF. 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.

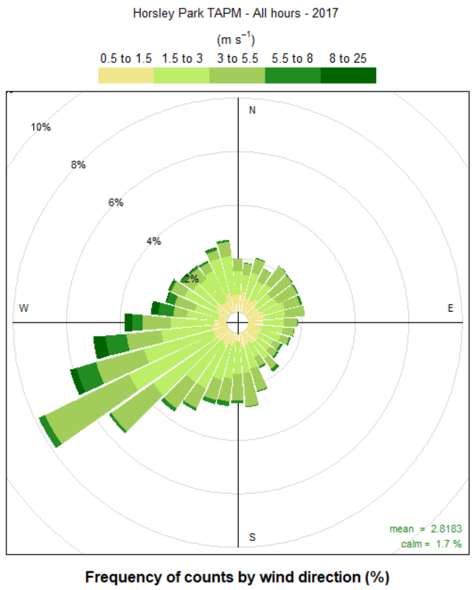
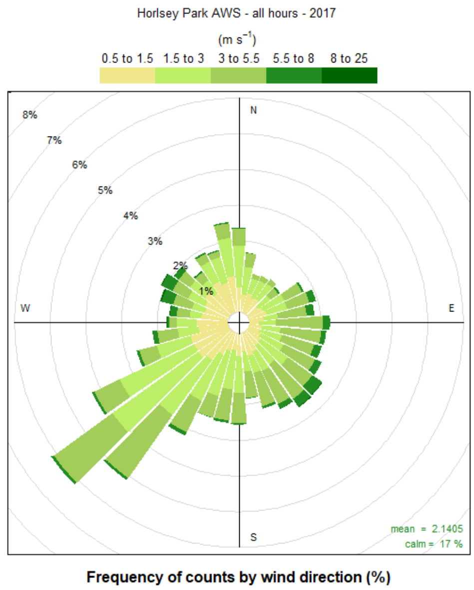
The parameters used in TAPM modelling are presented in Table B3.

A comparison of the TAPM generated meteorological data, and that observed at the Horsley Park Equestrian Centre AWS, is presented in Figure B3.

Table B3 TAPM meteorological parameters

TAPM v 4.0.5	
Modelling period	1 January 2017 to 31 December 2017
Centre of analysis	295 708 mE, 6 251 357 mN (UTM Coordinates)
Number of grid points	25 × 25 × 25
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	-

Figure B3 Modelled and observed meteorological data – Horsley Pak Equestrian Centre AWS (2017)

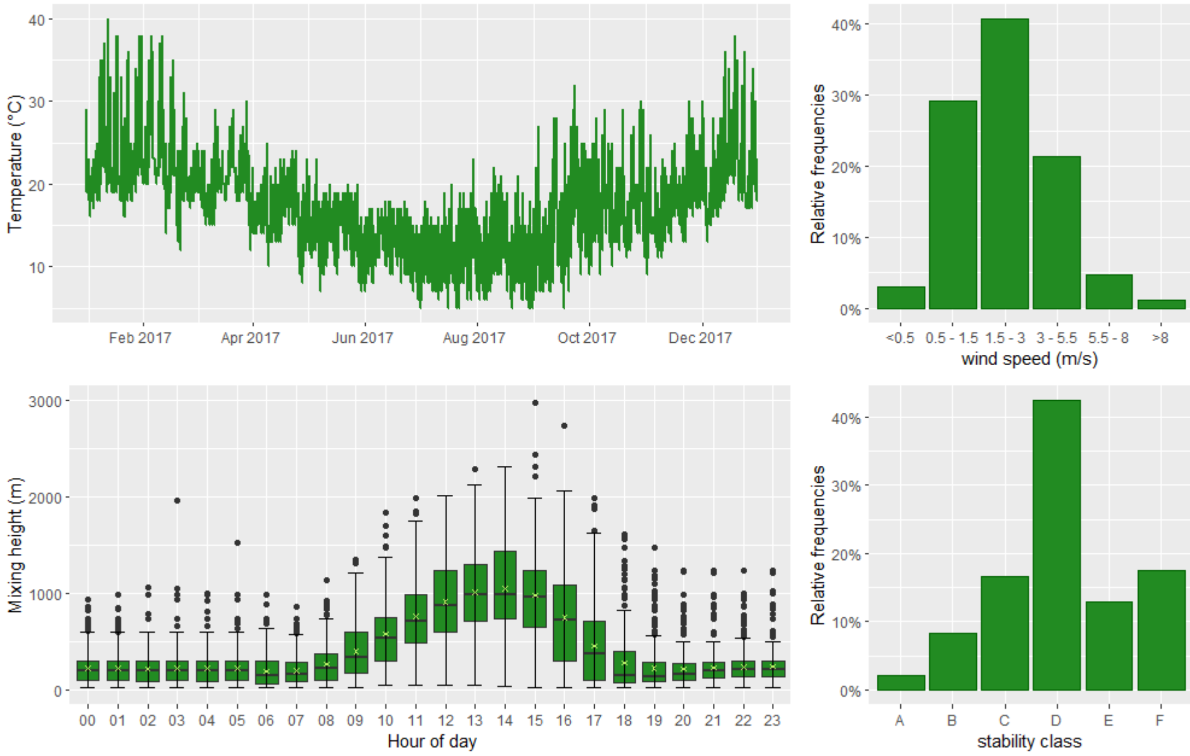
TAPM generated windrose	Observations at Horsley Park Equestrian Centre AWS
	

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 2017 period are illustrated in Figure B4.

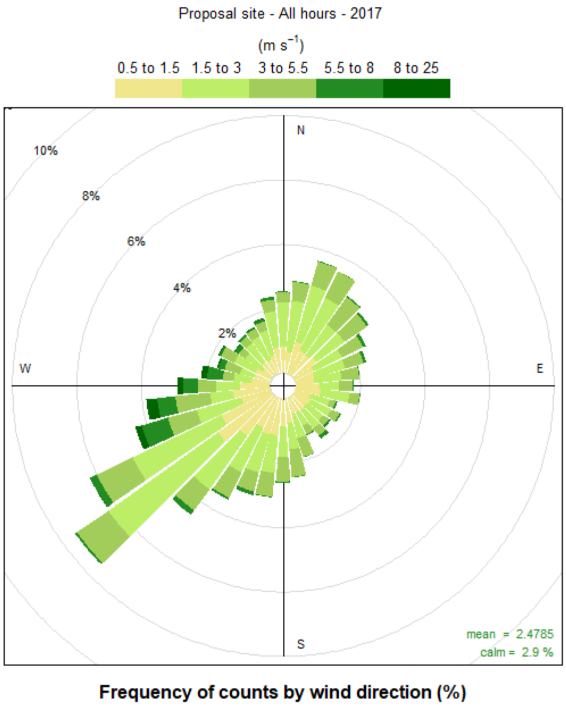
As expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and growth of the convective mixing layer.

Figure B4 Predicted mixing height, wind speed and stability class frequency at the Proposal site (2017)



The modelled wind speed and direction at the Proposal site during 2017 are presented in Figure B5.

Figure B5 Predicted wind speed and direction – Proposal site (2017)



APPENDIX C

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 the NSW Department of Planning and Environment (DPE) at a number of air quality monitoring stations (AQMS) proximate to the Proposal site. Details of the monitoring performed at these AQMS is presented in Table C1.

Table C1 Details of closest AQMS surrounding the site

AQMS location	Distance to site (km)	2017 data	Measurements			
			PM_{10}	$PM_{2.5}$	TSP	NO_2
St Marys	5.7	✓	✓	✓	×	✓
Bringelly	8.0	✓	✓	✓	×	✓
Prospect	11.8	✓	✓	✓	×	✓

Given the availability of data and its proximity to the Proposal site, data from St Marys AQMS is considered to be the most representative air quality dataset and has correspondingly been adopted for use in this assessment. Particulate matter (PM) and nitrogen dioxide (NO_2) data for the year 2017 (consistent with the selected meteorological period [refer Appendix B]) has been analysed. Summary statistics for the adopted background air quality data is provided In Table C2.

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 C1. 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 33.4 $\mu g{\cdot}m^{-3}$ being adopted.

Summary statistics for the selected data are presented in Table C2.

Figure C2 Co-located TSP and PM_{10} measurements – Lower Hunter, Sydney Metro and Illawarra

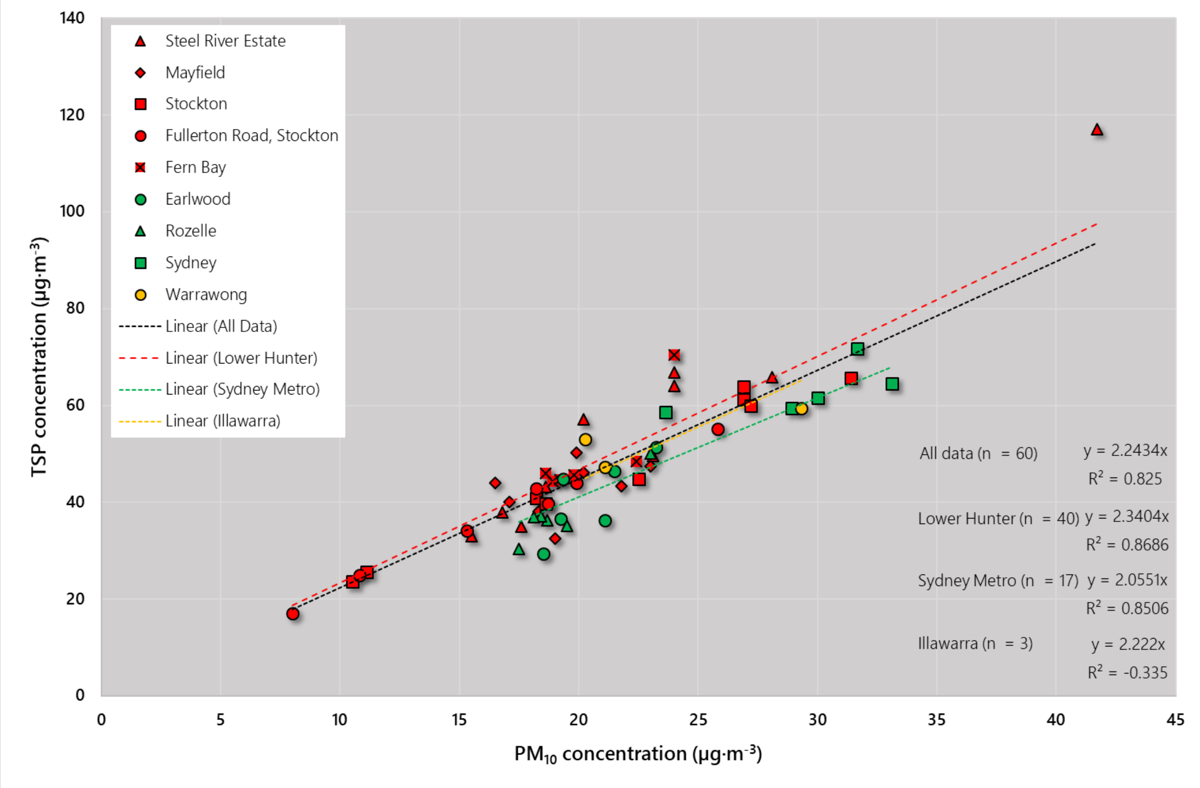


Table C2 Background air quality statistics – St Marys AQMS (20217)

Pollutant	TSP (µg·m^{-3})	PM_{10} (µg·m^{-3})	$PM_{2.5}$ (µg·m^{-3})	NO_2 (µg·m^{-3})
Averaging period	Annual	24-Hour	24-Hour	1 hour
Data Points (number)	360	360	360	8141
Mean	33.4	16.2	7.0	8.0
Standard deviation	-	7.0	4.1	9.1
Skew[1]	-	*1.1*	*2.9*	*1.6*
Kurtosis[2]	-	*1.7*	*13.8*	*3.7*
Minimum	-	4.0	1.2	-3.8
Percentiles				
25th	-	11.5	4.6	1.9
50th	-	14.6	6.2	5.6
75th	-	20.0	8.3	11.3
90th	-	26.1	10.7	20.7
95t	-	29.5	12.8	26.3
97th	-	32.6	17.0	30.1
98th	-	34.5	21.1	33.8
99th	-	35.7	23.9	39.5
Maximum	-	49.8	38.2	69.6
Data Capture (%)	-	98.63%	98.63%	92.92%

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.

Graphs presenting the daily varying PM_{10}, $PM_{2.5}$ and NO_2 data recorded at St Marys AQMS in 2017 are presented in Figure C3, Figure C4 and Figure C5 respectively.

Figure C3 PM$_{10}$ concentrations –St Marys AQMS (2016)

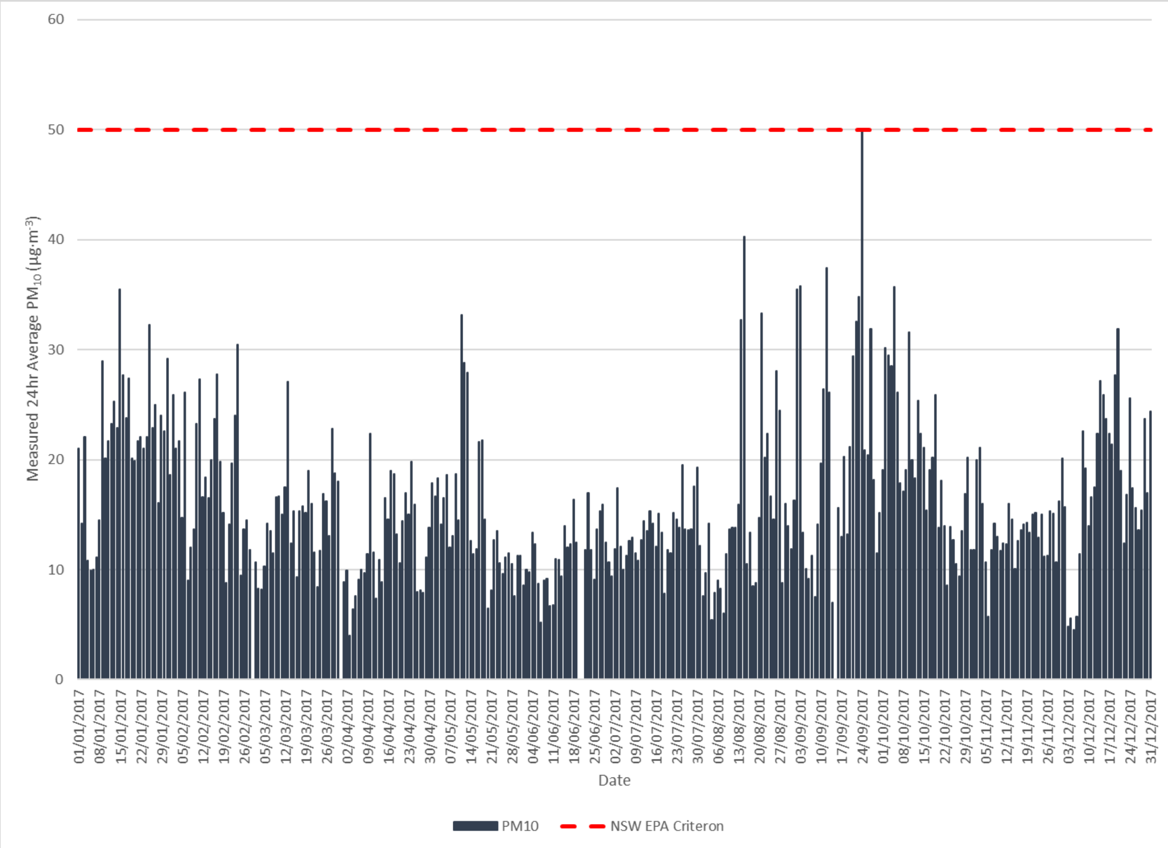


Figure C4 PM$_{2.5}$ concentrations –St Marys AQMS (2016)

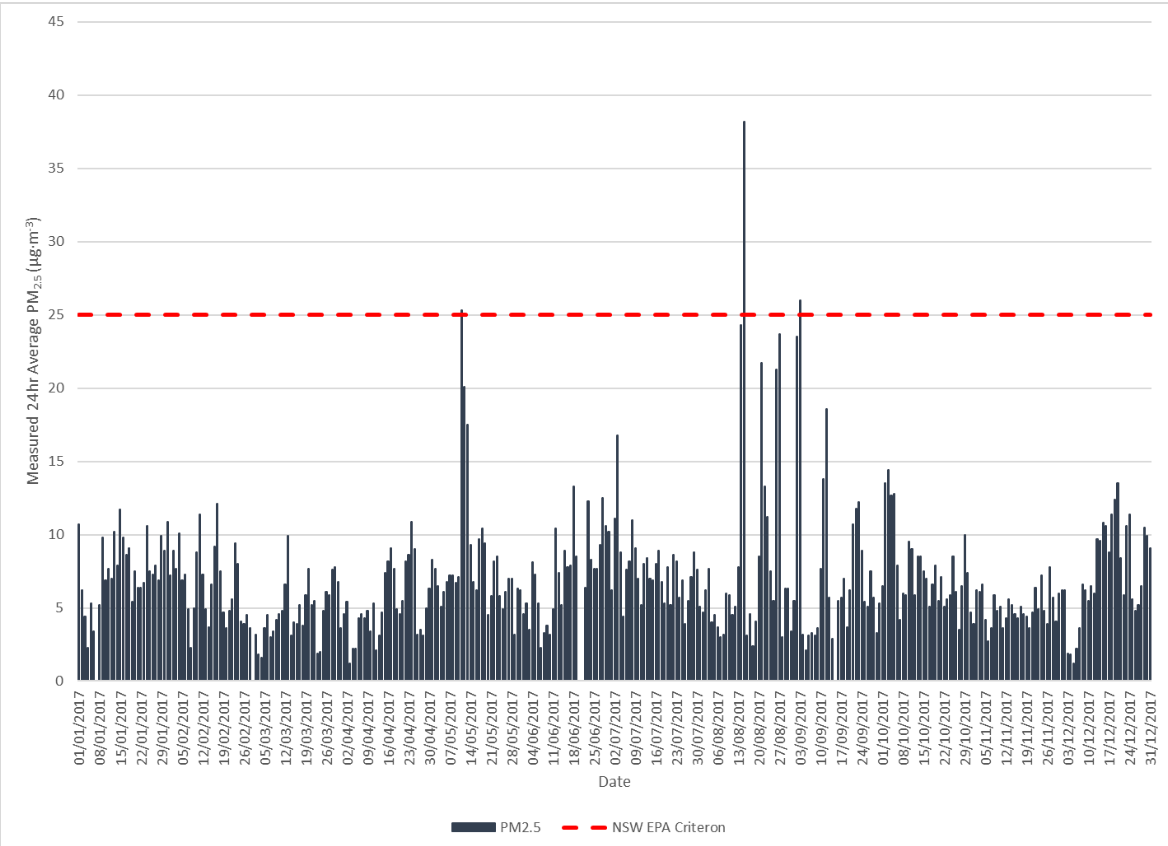
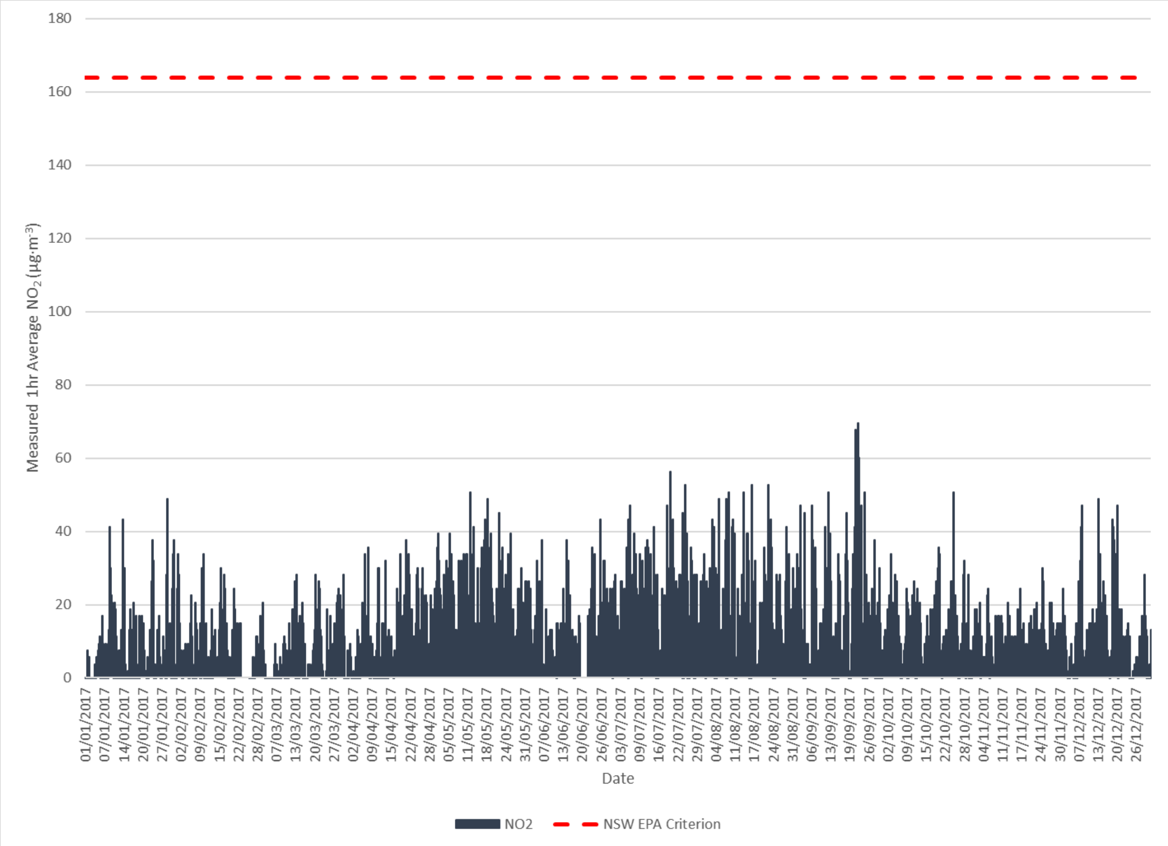


Figure C5 NO_2 concentrations – St Marys AQMS (2016)



APPENDIX D

Construction Phase Risk Assessment

Provided below is a summary of the risk assessment methodology used in this assessment. It is based upon IAQM (2014) *Guidance on the assessment of dust from demolition and construction* (version 1.1) and adapted by Northstar Air Quality.

Adaptions to the Published Methodology Made by Northstar Air Quality

The adaptions made by Northstar Air Quality 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 Air Quality 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 suggests screening out any assessment of impacts from construction activities where sensitive receptors are located:

- more than 350 m from the boundary of the site;
- more than 50 m from the route used by construction vehicles on public roads; and
- more than 500 m from the site entrance.

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

Table D1 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 D1 Construction phase impact screening criteria distances

Rec	Location	Land use	Screening distance (m)		
			Boundary (350m)	Site entrance (500m)	Construction route (50m)
R1	Aldington Road, Kemps Creek	Industrial	171	218	159
R2	Aldington Road, Kemps Creek	Industrial	55	415	41
R3	Imperata Close, Kemps Creek	Industrial	1 162	1 612	805
R4	Aldington Road, Kemps Creek	Residential	471	661	651
R5	Bowood Road, Mount Vernon	Residential	1 365	1 475	1465
R6	Bowood Road, Mount Vernon	Residential	1 441	1 495	1428
R7	Greenview Place, Mount Vernon	Residential	1 788	1 956	1762
R8	Aldington Road, Kemps Creek	Industrial	38	522	242
R9	Aldington Road, Kemps Creek	Residential	480	973	277
R10	Mamre Road, Kemps Creek	Industrial	816	1 615	257
R11	Mamre Road, Kemps creek	Industrial	744	1 412	57
R12	Mamre Road, Kemps Creek	Industrial	169	861	262
R13	Mamre Road, Kemps Creek	Residential	52	857	154
R14	Aldington Road, Kemps Creek	Industrial	61	669	343

With reference to Table D1, sensitive receptors are noted to be within the screening distance thresholds and therefore require further risk assessment as summarised in Table D2.

Table D2 Application of step 1 screening

Construction Impact	Screening Criteria	Step 1 Screening	Comments
Demolition	350 m from boundary 500 m from site entrance	Not screened	Receptors identified within the screening distance
Earthworks	350 m from boundary 500 m from site entrance	Not screened	Receptors identified within the screening distance
Construction	350 m from boundary 500 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, and track-out (the movement of site material onto public roads by vehicles) and construction traffic.

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

Table D3 Dust emission magnitude activities

Activity	Large	Medium	Small
Demolition			
total building volume*	>50 000 m^3	20 000 m^3 to 50 000 m^3	<20 000 m^3
demolition height	> 20m AGL	10 m and 20 m AGL	<10 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 area	>10 000 m^2	2 500 m^2 to 10 000 m^2	<2 500 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	>8m AGL	4m to 8m AGL	<4m 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	100 000 m^3	25 000 m^3 to 100 000 m^3	<25 000 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	10 to 50	<10
surface materials	high potential	moderate potential	low potential
unpaved road length	>100m	50m to 100m	<50m
Construction Traffic (from construction site entrance to construction vehicle origin)			

Activity	Large	Medium	Small
Demolition traffic - total building volume	>50 000 m^3	20 000 m^3 to 50 000 m^3	<10 000 m^3
Earthworks traffic total area	>10 000 m^2	2 500 m^2 to 10 000 m^2	<2 500 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	100 000 m^3	25 000 m^3 to 100 000 m^3	<25 000 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 as being approximately 63 hectares (ha) in area. The Proposal would involve the minor demolition of the existing structures and construction of the warehouse development as outlined in Section 2.2.

Based on review of layouts provided, the proposed total volume of construction is expected to be significantly greater than 100 000 m^3 (threshold for large dust emission magnitude [refer Table D3]). Given the volume of construction to be performed, it is expected that the number of vehicle movements to service the Proposal site each day would exceed 50 movements (threshold for large dust emission magnitude for trackout [refer Table D3]).

Based upon the above assumptions and the assessment criteria presented in Table D3, the dust emission magnitudes are as presented in Table D4.

Table D4 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 takes into account:

- 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 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 D5 IAQM guidance for categorising land use value

Value	High Land Use Value	Medium Land Use Value	Low Land Use Value
Health effects	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).	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 human exposure is transient.
	Examples: Residential properties, hospitals, schools and residential care homes.	Examples: Office and shop workers, but would generally not include workers occupationally exposed to PM_{10}.	Examples: Public footpaths, playing fields, parks and shopping street.
Dust soiling	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.	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.	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.
	Examples: Dwellings, museums, medium and long term car parks and car showrooms.	Examples: Parks and places of work.	Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.

Sensitivity of the Area

The assessed land use value (as described above) is then used to assess the sensitivity of the area surrounding the active construction area, taking into account 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 the IAQM document.

Sensitivity of the Area - Health Impacts

For high land use values, the method takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account, and professional judgement may be used to determine alternative sensitivity categories, taking into account the following:

- 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 / seasonal meteorological data;
- any conclusions drawn from local topography; and
- 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 the IAQM document.

The assumed existing background annual average PM_{10} concentrations, as measured at St Marys AQMS (in 2017 was 16.2 $\mu g \cdot m^{-3}$), which, along with the land use value calculated above, classifies the sensitivity of the area as low for dust health impacts and medium for dust soiling effects.

Table D6 IAQM guidance for categorising the sensitivity of an area of dust health effects

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	<200	<350
High	>30	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	26 – 30	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	22 – 26	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	≤22	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	High	High	High	Medium	Low

Note: (a) Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 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 <20m and <50m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50m may be screened out of the assessment (as per Step 1) and the corresponding sensitivity is negligible'.

Sensitivity of the Area - Dust Soiling

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in Table D7.

Table D7 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

Land Use Values	Number of receptors[a]	Distance from the source (m)[b]			
		<20	<50	<100	<350
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 <20m and <50m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50m 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 shown for each activity determine the risk category with no mitigation applied.

Table D8 Risk of dust impacts from demolition activities

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Demolition)		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table D9 Risk of dust impacts from earthworks

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Earthworks)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table D10 Risk of dust impacts from construction activities

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Construction)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table D11 Risk of dust impacts from trackout (within 100m of construction site entrance)

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Trackout)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Table D12 Risk of dust impacts from construction traffic (from construction site entrance to origin)

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Construction Traffic)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Given the sensitivity of the identified receptors is classified as low for dust soiling and medium health effects, and the dust emission magnitudes for the various construction phase activities as shown in Table D4, the resulting risk of air quality impacts (without mitigation) is as presented in Table D13.

Table D13 Risk of air quality impacts from construction activities

Impact	Sensitivity of area	Dust emission magnitude					Preliminary risk				
		Demolition	Earthworks	Construction	Track-out	Const. traffic	Demolition	Earthworks	Construction	Track-out	Const. traffic
Dust soiling	Low	Large	Large	Large	Large	Large	Med.	Low	Low	Low	Low
Human health	Med	Large	Large	Large	Large	Large	High	Med.	Med.	Med.	Med.

Note: Med. = Medium

The risks summarised in Table D13 show that for demolition activities, there is a medium risk of adverse dust soiling impacts and a high risk of human health impacts. All other construction phase activities are associated with low risks of dust soiling impacts and medium 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 D14 represents a selection of recommended mitigation measures recommended by the IAQM methodology for construction activities commensurate with the risks identified in Table D13.

Table D14 Site-specific management 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
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 local 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 500 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	Undertake 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 local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary.	H
3.2	Carry out regular site inspections to monitor compliance with the dust management plan / CEMP, record inspection results, and make an inspection log available to the local 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
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

	Identified Mitigation	Unmitigated Risk
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 local 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 Cust 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
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 to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the 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

	Identified Mitigation	Unmitigated Risk
8.5	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	H
8.6	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	H
8.7	Only remove the cover in small areas during work and not all at once	H
9	**Measures Specific to Construction**	**Medium**
9.1	Avoid scabbling (roughening of concrete surfaces) if possible	D
9.2	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
9.3	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
9.4	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust	D
10	**Measures Specific to Track-Out**	**Medium**
10.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.	H
10.2	Avoid dry sweeping of large areas.	H
10.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	H
10.4	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	H
10.5	Record all inspections of haul routes and any subsequent action in a site log book.	H
10.6	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	H
10.7	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H
10.8	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	H
10.9	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.

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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