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Yiribana Logistics Estate West

Air Quality Risk Assessment

Addressee(s):	The GPT Group
Site Address:	771-797 Mamre Road, Kemps Creek
Report Reference:	23.1031.FR2V2
Date:	29 November 2022
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Quality Control

Study	Status	Prepared by	Checked by	Authorised by
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LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar	MD, GCG	MD
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OPERATIONAL PHASE RISK ASSESSMENT	Final	Northstar	MD, GCG	MD
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Report Status

Northstar References		Report Status	Report Reference	Version
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23	1031	Final	R2	V2
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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.

pp  Martin Doyle 29 November 2022

Non-Technical Summary

Northstar Air Quality Pty Ltd was engaged by The GPT Group to perform an Air Quality Risk Assessment for the construction and operation of a proposed logistics warehouse development, located at 771-797 Mamre Road, Kemps Creek, NSW within the Yiribana Estate West development.

Construction phase activities will involve demolition, earthworks, construction works and associated vehicle traffic. The associated risks of impacts from these activities 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 the Institute of Air Quality Management (IAQM) and adapted by Northstar Air Quality for use in Australia. This methodology has been used in a similar context in numerous other similar air quality studies.

The construction assessment showed there to be a medium risk of dust soiling and health risk impacts associated with all construction phase activities. Based upon that assessment, a range of mitigation measures have been recommended to ensure that short-term impacts associated with construction activities are minimised.

The potential impacts associated with operational activities including wheel generated dust and exhaust emissions from vehicle movements on the internal roadway of the Proposal site have been assessed using a risk-assessment approach adopted from ISO 31000:2018 and IEC 31010:2019.

The risk assessment found there to be a medium risk of potential emissions to air resulting from wheel generated dust and exhaust emissions and a number of mitigation methods have been determined, including recommendations for an air quality complaints procedure.

Based upon the assumptions presented in the report and the implementation of the recommended mitigation methods, the site is assessed as being capable to not give rise to significant air quality impacts during the construction and operational phases associated with the Proposal.

CONTENTS

FIGURES

TABLES

1. INTRODUCTION

Northstar Air Quality Pty Ltd (Northstar) has been commissioned by The GPT Group (the Applicant), to perform an air quality risk assessment (AQRA) to assess the risk of potential emissions associated with the construction and operational phases of a proposed logistics warehouse development (the Proposal). The development is proposed to be located in the Yiribana Estate West at 771-797 Mamre Road, Kemps Creek, NSW (the Proposal site).

This AQRA examines and identifies potential air quality risks associated with the construction and operation of the Proposal, in accordance with the objectives and controls of the Mamre Road Precinct Development Control Plan (DCP) 2021 (Section 4.3.3) and identifies mitigation and monitoring requirements commensurate with those anticipated potential impacts.

The objectives of the Mamre Road Precinct DCP 2021 are as follows:

> *a) To maintain existing air quality or improve local air quality to protect public health.*
>
> *b) To ensure future development does not adversely affect existing air quality.*

The controls associated with the Mamre Road Precinct DCP 2021 are presented in Table 1, including the section of this report where they have been addressed.

It is noted that the controls outlined in the Mamre Road Precinct DCP 2021 requires the performance of an air quality and odour assessment in accordance with the NSW Environment Protection Authority (EPA) "Approved Methods for the Modelling and Assessment of Air Quality in NSW" document (NSW EPA, 2022). Given the limited sources and magnitude of emissions associated with the Proposal (refer Section 2.2), a risk assessment approach is considered to be appropriate. It allows the identification of potential risks and allows the application of management measures to control that risk, in accordance with the DCP.

Table 1 Mamre Road Precinct DCP controls

Control	Addressed
Any development likely to, or capable of, generating air emissions must comply with the Protection of the Environment Operations Act 1997 and associated regulations.	Section 3.1
An Air Quality and Odour Assessment is required for development that may have an adverse impact on local and regional air quality, including construction impacts on adjoining rural-residential areas.	Section 5 and Section 6
The Air Quality and Odour Assessment should be in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2017) and/or The Technical framework - assessment and management of odour from stationary sources in NSW (EPA 2006) and include but not be limited to: • Characterisation of all emissions; • Measures to mitigate air impacts, including best practice measures; and • Details of any monitoring programs to assess performance of any mitigation measures and to validate any predictions as a result of the assessment.	Section 2.3, Section 5 and Section 6 Appendix C and Appendix D
Developments that involve back up power generation of electricity with diesel equipment that has the capacity to burn more than 3 megajoules of fuel per second must include a best practice review of reasonable and feasible diesel emission reduction technology.	N/A

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 771–791 Mamre Road, Kemps Creek, NSW within the local government area (LGA) of the City of Penrith. The general location of the Proposal site is illustrated in Figure 1.

The land occupied by and surrounding the Proposal site is zoned as IN1 (General Industrial) and RE1 (Public Recreation) under the Penrith Local Environmental Plan (LEP) 2010, with the adjacent Mamre Road zoned SP2 (Special Infrastructure). The closest residential zoning is located approximately 3 kilometres (km) to the north of the Proposal site.

2.2. Overview and Purpose

Consent is sought for the construction and operation of a logistics warehouse development, comprising two warehouses at the Proposal site.

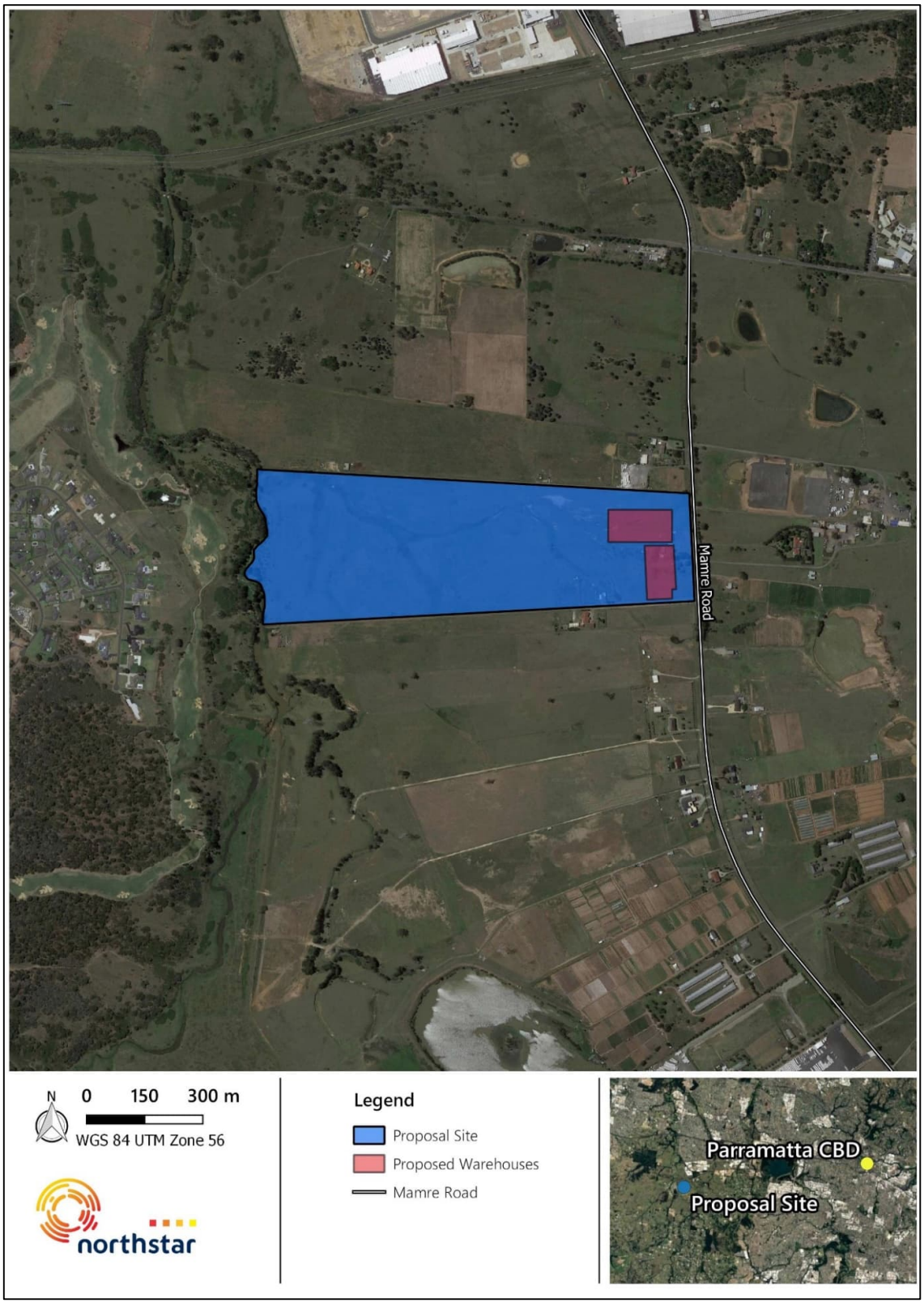
The overall scope of the proposed development is outlined as follows:

- Construction of a single occupancy warehouse building (Warehouse 1A), with a warehouse area of approximately 10 350 square meters (m^2), serviced by office space approximately 450 m^2 in area, loading docks and associated car parking of 46 spaces;
- Construction of a single occupancy warehouse (Warehouse 1B), with a warehouse area of approximately 13 610 m^2, serviced by office space approximately 455 m^2 in area, loading docks and associated car parking of 57 spaces;
- Associated landscaping; and
- Construction of a 25.6 m wide collector road.

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

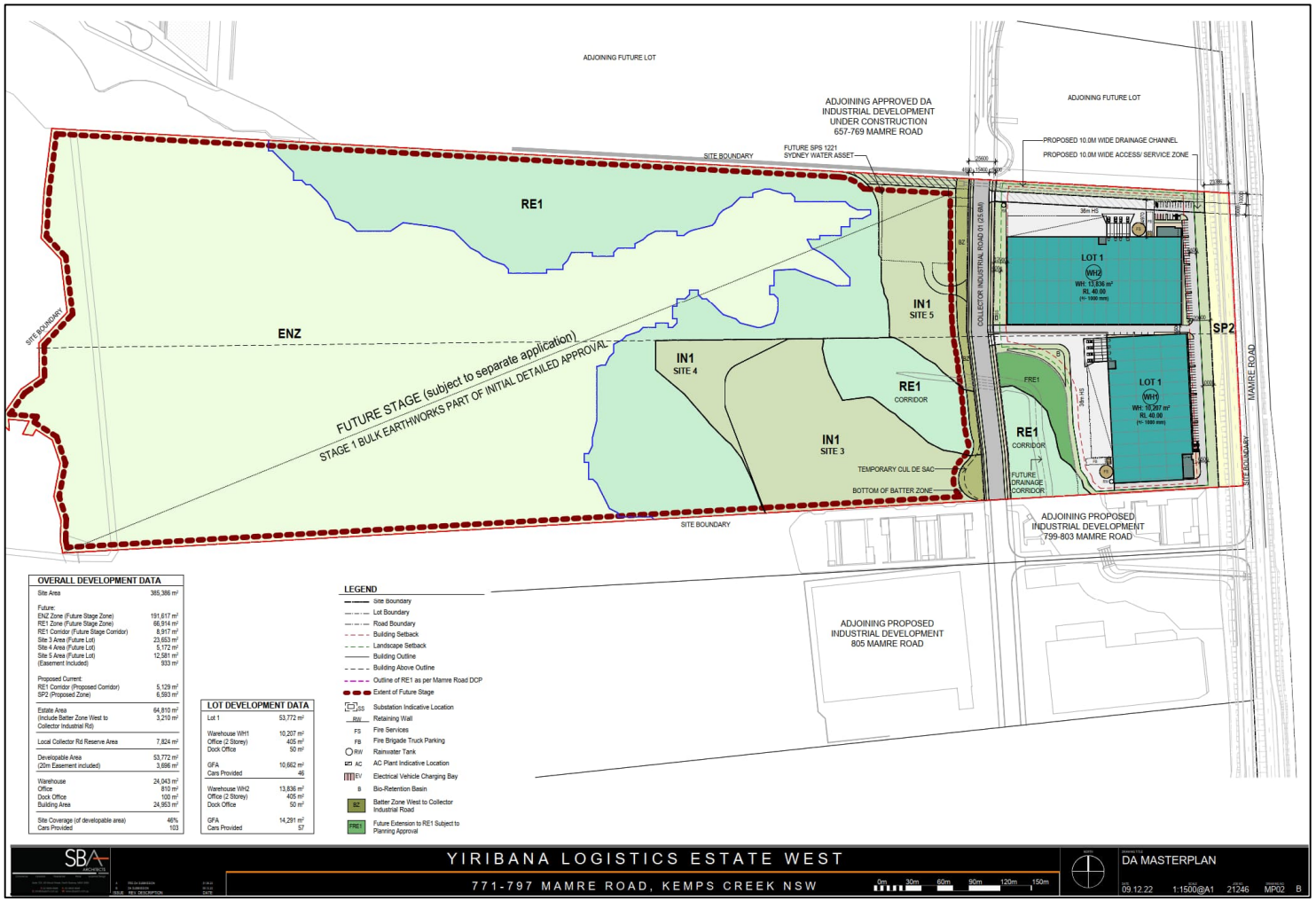
Given the nature of the Proposal described above, emissions to air would be limited, and likely to be generated as described in Section 2.2.1 and Section 2.2.2.

Figure 1 Proposal site location



Source: Northstar Air Quality

Figure 2 Proposal site layout



Source: SBA Architects

2.2.1. Construction Phase

Construction of the Proposal would involve some minor demolition works, construction of two warehouses, ancillary offices, car parking, docking areas, associated infrastructure, site access points and landscaping.

The total volume of the construction required for the Proposal is anticipated to be 352 444 m^3, assuming a ground floor footprint of 10 530 m^2 for Warehouse 1A and 13 610 m^2 for Warehouse 1B and an average building height of 14.6 m for both warehouses. Demolition works are assumed to be less than 10 000 m^3.

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.

Emissions associated with construction phase activities are likely to be limited to construction 'dust'.

The assessment of the potential risks to local air quality resulting from construction phase activities is presented in Section 5 and the methodology for the assessment is provided in Appendix C.

2.2.2. Operational Phase

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

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

The hardstand nature of the Proposal site, and the nature of the activities being performed (i.e. warehousing and distribution, with no 'dusty' activities) would result in the Proposal site roads having a low silt loading, and correspondingly the potential for wheel generated particulate matter at the Proposal site is anticipated to be minimal.

The Proposal is expected to result in the number and type of vehicles provided in Table 2. The total number of operational traffic movements for the Proposal have been based on information provided by the Applicant, which indicate that 2.31 vehicles per 100 m^2 of GFA per day are anticipated, with 27 % of those vehicles being heavy vehicles.

Table 2 Operational traffic movements

Vehicle type	Vehicle movements per day
Light vehicles	421
Heavy vehicles	155
Total	576

Given the nature of the development at this Proposal site, it is not anticipated that odour would be emitted in any significant quantity during construction or operation. Correspondingly, odour impacts have not been further considered in this AQRA.

The assessment of the potential risks to air quality during the operational phase of the Proposal is presented in Section 6. The methodology for the operational phase risk assessment is provided in Appendix D.

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. This report does not provide a quantitative assessment with which to compare against those criteria, although they are provided for information.

3.1. Protection of the Environment Operations Act

The *Protection of the Environment (Operations) Act* 1997 (POEO) is applicable to scheduled activities in NSW. Chapter 5, Part 5.4, Section 128 relates to the control of air emissions (emphasis added).

> *128 Standards of air impurities not to be exceeded*
>
> *(1) The occupier of any premises must not carry on any activity, or operate any plant, in or on the premises in such a manner as to cause or permit the emission at any point specified in or determined in accordance with the regulations of air impurities in excess of—*
>
> *(a) the standard of concentration and the rate, or*
>
> *(b) the standard of concentration or the rate,*
>
> *prescribed by the regulations in respect of any such activity or any such plant.*
>
> *(1A) Subsection (1) applies only to emissions (point source emissions) released from a chimney, stack, pipe, vent or other similar kind of opening or release point.*
>
> *(2) The occupier of any premises must carry on any activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution if—*
>
> *(a) in the case of point source emissions—neither a standard of concentration nor a rate has been prescribed for the emissions for the purposes of subsection (1), or*
>
> *(b) the emissions are not point source emissions…*

Section 129 of the POEO Act provides the requirements for the control of emissions of odour from licenced activities.

> *129 Emission of odours from premises licensed for scheduled activities*
>
> *(1) The occupier of any premises at which scheduled activities are carried on under the authority conferred by a licence must not cause or permit the emission of any offensive odour from the premises to which the licence applies…*

It is noted that the Proposal does not include any activities defined as a scheduled activity under the POEO Act, although the general principals of air pollution minimisation also apply to non-scheduled activities.

3.2. Local Government Act

Section 125 of the *Local Government Act* (1993) provides Council with authority to manage nuisance, including emissions to air from unscheduled activities.

> *125 Abatement of public nuisances*
>
> *A council may abate a public nuisance or order a person responsible for a public nuisance to abate it.*
>
> *Note :*
> *"Abatement" means the summary removal or remedying of a nuisance (the physical removal or suppression of a nuisance) by an injured party without having recourse to legal proceedings.*
>
> *"Nuisance" consists of interference with the enjoyment of public or private rights in a variety of ways. A nuisance is "public" if it materially affects the reasonable comfort and convenience of a sufficient class of people to constitute the public or a section of the public. For example, any wrongful or negligent act or omission in a public road that interferes with the full, safe and convenient use by the public of their right of passage is a public nuisance.*
>
> *It is noted that the definition of nuisance under the Local Government Act (1993) (which includes odour) is very similar in intent to the definition of 'offensive odour' provided under the POEO Act (1997).*

3.3. 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 POEO Act, 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 AQRA, 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.

3.4. 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 AQRA.

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. It is noted that this information is provided for context only and is not used in this AQRA.

Table 3 NSW EPA air quality standards and goals

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

(e) Gas volumes are expressed at 25 °C (298 K) and at an absolute pressure of 1 atmosphere (101.325 kPa)

4. EXISTING CONDITIONS

The following information provides context around the location of sensitive receptor locations surrounding the Proposal site, the prevailing meteorology and air quality of the area, and identifies other sources of air pollutants which have the potential to impact cumulatively with the Proposal.

4.1. Discrete Receptor Locations

Discrete receptor locations are identified to assist in the performance of the construction and operational phase risk assessments (refer Section 5 and Section 6). A number of industrial and residential locations have been identified and are presented in Figure 3.

It is also noted that a number of developments surrounding the Proposal site have recently been approved or are currently undergoing assessment. An online review has been performed to identify these developments which have correspondingly been adopted within this AQRA.

In accordance with the requirements of the NSW EPA, several receptors have been identified and the receptors adopted for use within this AQRA are presented in Table 4 and illustrated in Figure 2.

Table 4 is not intended to represent a definitive list of sensitive land uses, but a cross section of available locations, that are used to characterise larger areas, or selected as they represent more sensitive locations, which may represent people who are more susceptible to changes in air pollution.

It is noted that the industrial receptors identified in Table 4 and Figure 2 are currently in the process of being developed and correspondingly, the boundaries of those developments have been provided in Figure 2 for context. The relevant receptor within each industrial area has been located at the closest point to the Proposal site to ensure that appropriate emission controls during construction phase activities are adopted.

Table 4 Receptor locations used in the study

Rec	Location	Land use	Location (UTM)	
			mE	mS
R1	Mamre Road, Kemps Creek	Industrial	294 631	6 253 680
R2	Mamre Road, Kemps Creek	Industrial	294 373	6 253 921
R3	Mamre Road, Kemps Creek	Industrial	293 887	6 253 943
R4	Medinah Avenue, Luddenham	Residential	293 123	6 253 648
R5	Medinah Avenue, Luddenham	Residential	293 249	6 253 472
R6	Medinah Avenue, Luddenham	Residential	293 252	6 253 209
R7	Mamre Road, Kemps Creek	Residential	294 399	6 253 345
R8	Mamre Road, Kemps Creek	Residential	294 924	6 253 548
R9	Mamre Road, Kemps Creek	Industrial	294 692	6 253 490

Note: The requirements of this AQRA 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.

Figure 3 Sensitive receptors surrounding the Proposal site

Source: Northstar

4.2. 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 the Horsley Park Equestrian Centre Automatic Weather Station (AWS). Windroses for the period 2017 to 2021 are presented in Appendix A, which indicate the prevailing wind conditions likely to be experienced at the Proposal site are south-westerly winds.

4.3. 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.

The closest active Air Quality Monitoring Station (AQMS) to the Proposal site is St Marys AQMS, operated by NSW Department of Planning and Environment (DPE). Concentrations of a number of air pollutants have been measured at the St Marys AQMS since 1992.

Annual average PM_{10} concentrations are required as input to the construction phase risk assessment, and a review of PM_{10} concentrations in the last five years (refer Appendix B) indicates that the year 2020 is the most recent year more impacted by 'exceptional events' such as bush fires, dust storms and drought conditions (NSW DPIE, 2021) and therefore data collected in 2020 has been used within this assessment. This provides a conservative level of assessment and provides comfort that the most stringent level of controls required would be applied to the proposed construction activities at the Proposal site.

Appendix B provides a summary of the background air quality monitoring data collected at the St Marys AQMS between 2017 and 2021. It indicates that the particulate environment can often be impacted by regional particulate events, which is a common occurrence across NSW, and also identifies that concentrations of NO_2 (associated with combustion related pollutants relevant to the operational phase) are consistently below the criteria as outlined in Section 3.4.

It is important to note that annual average PM_{10} concentration for 2020 (18.9 $\mu g \cdot m^{-3}$) is the only data used further in this assessment (refer Appendix C).

4.4. Potential for Cumulative Impacts

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

- Kemps Creek Warehouse, Logistics and Industrial Facilities Hub 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; and
- Yiribana Logistics Estate located at 754-770 and 784-786 Mamre Road, Kemps Creek.

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, should those activities be performed concurrently.

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

The air quality impact assessment (AQIA) for the Kemps Creek Data Centre 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. CONSTRUCTION PHASE RISK ASSESSMENT

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

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.

5.1. 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 C, the resulting risk of air quality impacts (without mitigation) is as presented in Table 5.

Table 5 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	Med	Large	Large	Large	Large	Med	Med	Med	Med	Med
Human Health	Med	Med	Large	Large	Large	Large	Med	Med	Med	Med	Med

The risks summarised in Table 5 show that there is a *medium* risk of adverse dust soiling and human health impacts associated with all construction phase activities. These pre-mitigated risks have been assessed as such 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 C.

5.2. 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 above be performed appropriately.

5.3. 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. 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.

6. OPERATIONAL PHASE RISK ASSESSMENT

This air quality risk assessment covers aspects of the operation of the Proposal that have the potential to generate emissions to air, resulting in air quality impacts experienced at nearby sensitive receptors, as identified in Section 2.2.2. The full risk assessment, based upon the definitions provided under ISO 31000 (International Organization for Standardization, 2018), is presented in Appendix D.

Section 6.1 presents the *pre-mitigated* risk assessment, which is used to identify and prioritise the processes that may require additional controls. The corresponding controls and management options are identified and discussed in Section 6.2 and the resultant *mitigated* risk assessment is presented in Section 6.3.

6.1. Risk Assessment (Pre-Mitigation)

To ensure that the appropriate controls are implemented on each source, a risk assessment exercise has been performed to identify the major risks to offsite air quality impacts. The full risk assessment is included in Appendix D, which describes the metrics of *sensitivity* and *magnitude* that are used to derive *risk*. This risk assessment would be updated by management should any of the processes identified above be changed, or it should become apparent that the magnitude of the risk associated with any process should be updated (following complaints, for example).

Using the methodology outlined in Appendix D derives an assessment of risk (as expressed on a scale: *low - medium - high*), as summarised in Table 6. The sensitivity of receptors is driven by the presence of a residential receptor close to the Proposal site.

Table 6 Risk assessment (pre-mitigated)

Sensitivity of receptors		Impact magnitude		Risk Assessment
Location	Assessment	Process	Assessment	
Various locations at and beyond site boundary	Very High Sensitivity	Wheel generated dust	Slight	Medium
		Exhaust emissions	Slight	Medium

The findings of the risk assessment have indicated that wheel generated dust and exhaust emissions have pre-mitigated *medium* risks. Additional options for management and control of vehicle related emissions have been identified and are discussed in Section 6.2.

6.2. Control and Management

The following sections outline the controls proposed to be implemented at the Proposal site and an assessment of how these controls will act to manage the pre-mitigated risks.

6.2.1. Recommended Control Measures

It is not expected that air quality impacts resulting operational phase activities would be experienced at nearby receptors. However, the facility will implement and maintain a complaints log that will record any complaints associated with the activities performed at the Proposal site (refer Section 6.2.2).

Should complaints be received in response to emissions from the Proposal site the following controls have been identified to manage off-site impacts:

- Reduce vehicle speeds on site access roads and hardstand areas;
- Examine the surface condition of the site access road and hardstand areas, and rectify where required; and
- Implement a no idling restriction during truck loading/unloading.

It is noted that these emission controls are not anticipated to be required but are presented to provide confidence to the approval authority and Council that in the unexpected circumstance that complaints are received, there are mitigation options available to easily manage those impacts.

6.2.2. General Odour Management

The Proposal site management will operate a complaints procedure which will, as a minimum, record the number and details of complaints received regarding the environmental impacts and any action taken in response to the complaint.

Although odour impacts are not anticipated, the complaint procedure and associated complaint forms will be maintained in a proper fashion by management and will be made available for inspection by Council upon request. An example of a complaint record is provided in Appendix E.

6.3. Risk Assessment (Post Mitigation)

If the emission control methods outlined above are appropriately implemented at the Proposal site, it is anticipated that all operational phase air quality risks would be medium as presented in Table 7. As shown in Appendix D, overall risk can only be reduced further by changing the sensitivity of the surrounding land use (i.e. removing residential land uses). The mitigation measures above act to minimise the magnitude of any impacts as much as possible. The risk assessment may be re-performed should changes to receptor sensitivity or impact magnitude change over time.

Table 7 Risk assessment (mitigated)

Sensitivity of receptors		Impact magnitude		Risk Assessment
Location	Assessment	Process	Assessment	
Various locations at and beyond site boundary	Very High Sensitivity	Wheel generated dust	Negligible	Medium
		Exhaust emissions	Negligible	Medium

6.4. Air Quality Monitoring – Operational Phase

Based on the findings of the operational phase risk assessment, it is not considered that any ongoing air quality monitoring would be required.

7. CONCLUSION

Northstar was engaged by The GPT Group to perform an AQRA for the construction and operation of a new industrial warehouse development.

Construction phase activities will involve demolition, earthworks, construction works and associated vehicle traffic, including trackout activities. The associated risks of impacts from these activities have been assessed using the published guidance in (IAQM, 2014), and adapted by Northstar Air Quality for use in Australia. This methodology has been used in a similar context in numerous other similar AQRA studies.

That assessment showed there to be a *medium* risk of dust soiling and health risk impacts associated with all construction phase activities. Based upon that assessment, a range of mitigation measures are recommended to ensure that short-term impacts associated with construction activities are minimised.

The potential impacts associated with operational activities including wheel generated dust and exhaust emissions from vehicle movements on the internal roadway of the Proposal site have been assessed using a risk-assessment approach adopted from ISO 31000:2018 and IEC 31010:2019.

The risk assessment found there to be a *medium* risk of potential emissions to air resulting from wheel generated dust and exhaust emissions and a number of mitigation methods have been determined, including recommendations for an air quality complaints procedure.

Based upon the assumptions presented in the report and the implementation of the recommended mitigation methods, the site is assessed as being capable to not give rise to significant air quality impacts during the construction and operational phases associated with the Proposal.

8. REFERENCES

IAQM. (2014). *Guidance on the Assessment of Dust from Demolition and Construction.*

International Organization for Standardization. (2018). *ISO 31000:2018 Risk Management - Guidelines.*

NSW DPIE. (2021). *New South Wales Annual Compliance Report 2019.*

NSW EPA. (2022). *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.* NSW Environment Protection Authority.

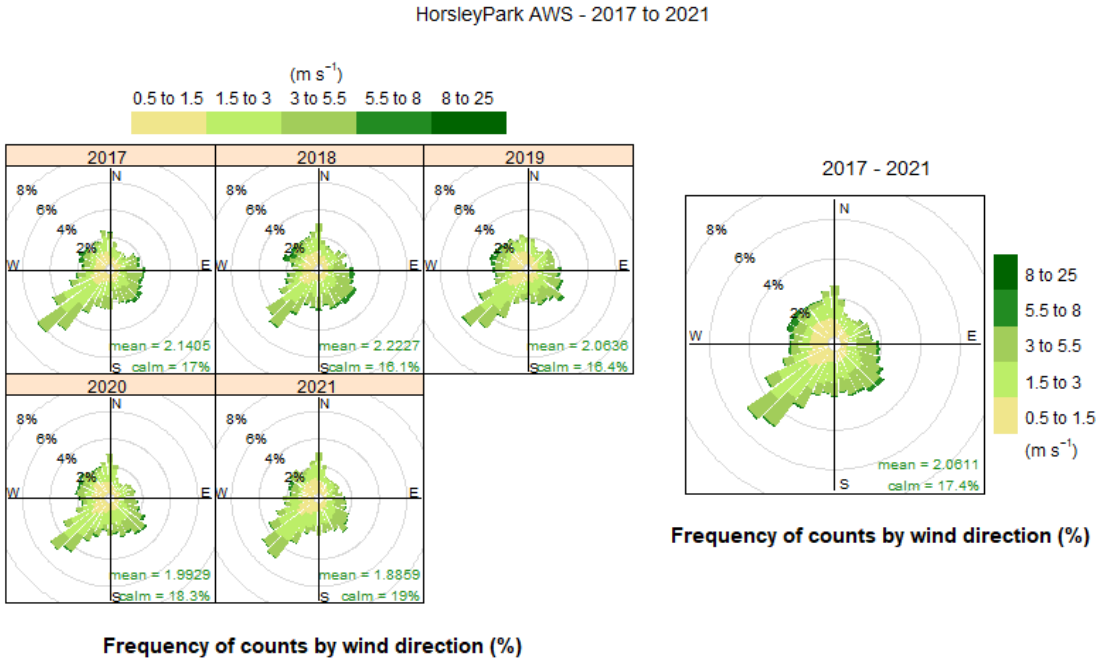
APPENDIX A

Meteorology

As discussed in Section 4.2 the meteorology surrounding the Proposal site has been reviewed to enable a characterisation of the existing conditions of the area.

To adequately describe the prevailing meteorological conditions, data collected at the Horsley Park Equestrian Centre AWS has been reviewed, and a 5-year (2017-2021) analysis of observed meteorology is provided as a series of wind roses in Figure A1.

Figure A1 Annual wind roses 2017 to 2021, Horsley Park Equestrian Centre AWS



The wind roses indicate that from 2017 to 2021, winds at the Horsley Park Equestrian Centre AWS show similar patterns across the years, with predominant south-westerly wind direction.

The majority of wind speeds experienced at the Horsley Park Equestrian Centre AWS between 2017 and 2021 are generally in the range 0.5 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 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 $m \cdot s^{-1}$) are more common and occur during 17.4 % of hours across the years.

APPENDIX B

Background Air Quality

Air quality data presented in this appendix is not used in a quantitative manner in the AQRA, and is provided for context only.

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).

Based on the sources of AQMS data available and their proximity to the Proposal site, St Marys was selected as the source of AQMS data for use in this assessment.

Graphs presenting the daily varying PM_{10}, $PM_{2.5}$ and NO_2 data recorded at St Marys for the years 2017-2021 are presented in Figure B1, Figure B2 and Figure B3 respectively.

It can be seen that particulate matter concentrations were significantly higher than the NSW EPA criteria in late 2019 and early 2020. This was predominantly driven by exceptional weather events such as drought conditions and bushfires (NSW DPIE, 2021).

NO_2 concentrations are shown to be consistently below the relevant NSW EPA air quality criteria.

Figure B1 PM_{10} measurements, St Marys 2017-2021

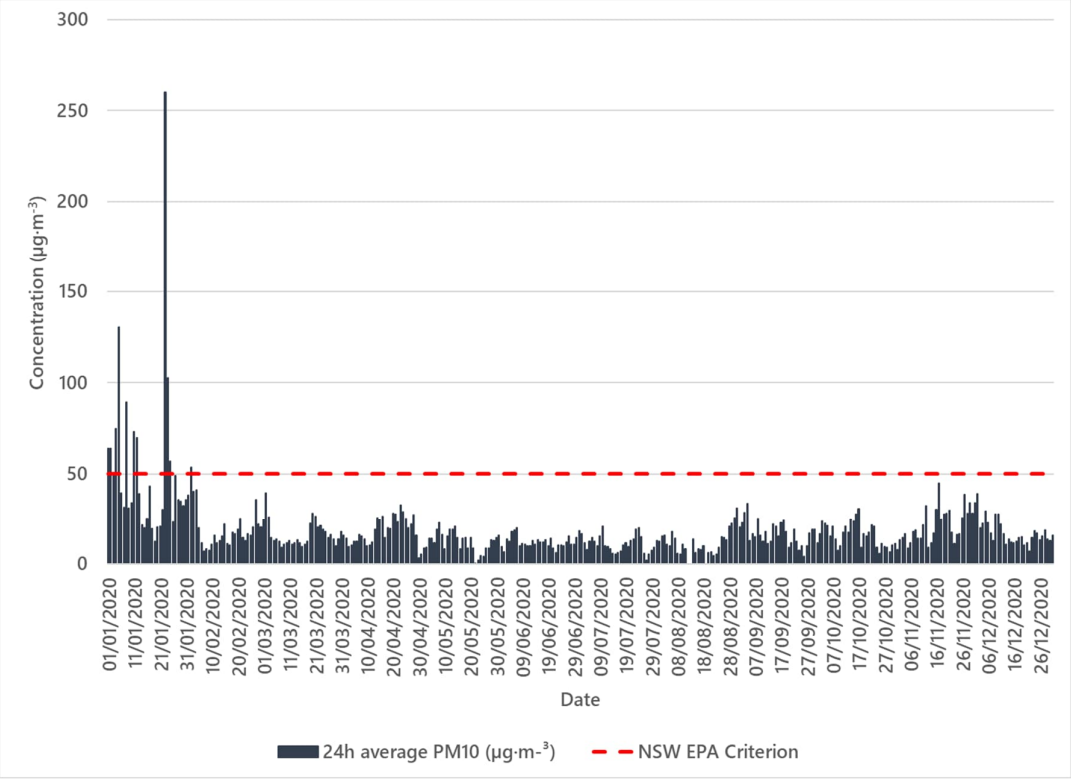


Figure B2 $PM_{2.5}$ measurements, St Marys 2017-2021

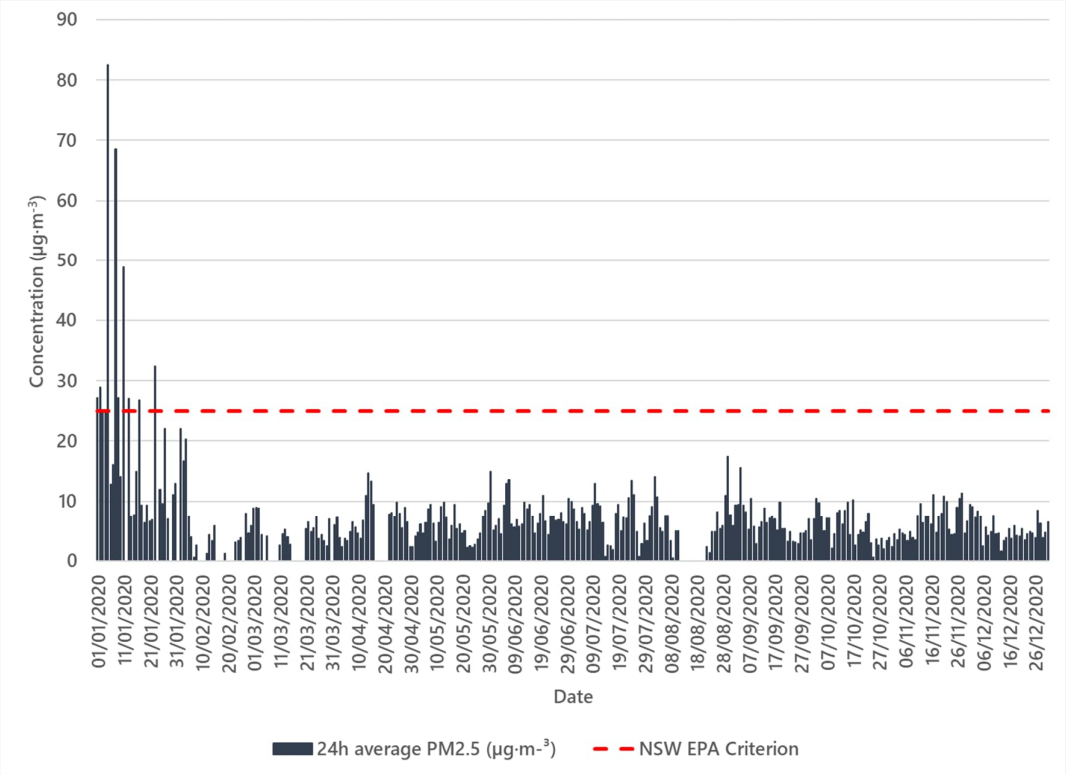
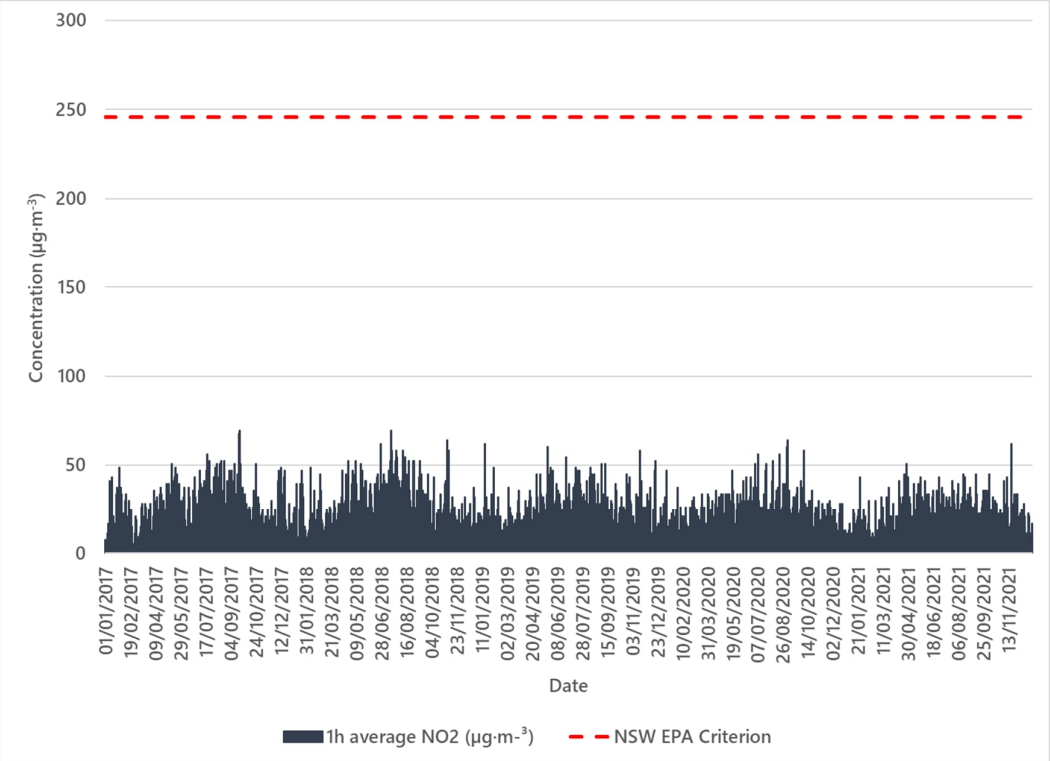


Figure B3 NO_2 Measurements, St Marys 2017-2021



APPENDIX C

Construction Phase Risk Assessment Methodology

Provided below is a summary of the risk assessment methodology used in this assessment. It is based upon IAQM (2016) *Guidance on the assessment of dust from demolition and construction* (version 1.1), and adapted by Northstar.

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 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 C1 overleaf presents the identified discrete sensitive receptors, with the corresponding estimated screening distances as compared to the screening criteria.

Table C1 Construction phase impact screening criteria distances

Rec	Location	Land use	Screening distance (m)		
			Boundary (350m)	Site entrance (500m)	Construction route (50m)
R1	Mamre Road, Kemps Creek	Industrial	1	133	35
R2	Mamre Road, Kemps Creek	Industrial	225	470	284
R3	Mamre Road, Kemps Creek	Industrial	220	869	770
R4	Medinah Avenue, Luddenham	Residential	415	1543	1543
R5	Medinah Avenue, Luddenham	Residential	261	1416	1416
R6	Medinah Avenue, Luddenham	Residential	330	1452	1452
R7	Mamre Road, Kemps Creek	Residential	41	335	335
R8	Mamre Road, Kemps Creek	Residential	261	261	251
R9	Mamre Road, Kemps Creek	Industrial	26	68	65

With reference to Table C1, sensitive receptors are noted to be within the screening distance thresholds and therefore require further risk assessment as summarised in Table C2.

Table C2 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 screening distance
Earthworks	350 m from boundary 500 m from site entrance	Not screened	Receptors identified within screening distance
Construction	350 m from boundary 500 m from site entrance	Not screened	Receptors identified within screening distance
Trackout	100 m from site entrance	Not screened	Receptors identified within screening distance
Construction Traffic	50 m from roadside	Not screened	Receptors identified within 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 trackout (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 presented in Table C3.

Table C3 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)			
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	moderately dusty soil type (e.g. silt)	soil type with large grain size (e.g. sand)

Activity	Large	Medium	Small
	when dry due to small particle size		
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 46 116 m^2 (4.6 ha) in area. For clarity, only the developable area has been considered for the area affected.

The Proposal would involve minor demolition works and the construction of the structures as illustrated in Figure 2. Based on review of plans, the total volume of the proposed buildings is assumed to be approximately 352 444 m^3 given that warehouse 1A has an area of 10 530 m^2 and warehouse 1B has an area of 13 610 m^2, with both warehouses having an approximate height of 14.6 m. Given the significant 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.

Based upon the above assumptions and the assessment criteria presented in Table C3, the dust emission magnitudes are as presented in Table C4.

Table C4 Construction phase impact categorisation of dust emission magnitude

Activity	Dust Emission Magnitude
Demolition	Medium
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, 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) is dependent on existing deposition levels.

Table C5 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	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

Value	High Land Use Value	Medium Land Use Value	Low Land Use Value
		part of the normal pattern of use of the land.	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:

The assumed existing background annual average PM_{10} concentrations, as measured at St Marys AQMS (in 2020 was 18.9 $\mu g \cdot m^{-3}$), which, along with the land use value calculated above, classifies the sensitivity of the area as *medium* for dust health impacts and *low* for dust soiling effects.

Table C6 IAQM Guidance for Categorising the Sensitivity of an Area to 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 C7.

Table C7 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 are presented in Table C8 to Table C12.

Table C8 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 C9 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 C10 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 C11 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 C12 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* for health effects, and the dust emission magnitudes for the various construction phase activities as shown in Table C4, the resulting risk of air quality impacts (without mitigation) is as presented in Table C13.

Table C13 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	Med	Large	Large	Large	Large	Med	Med	Med	Med	Med
Human Health	Med	Med	Large	Large	Large	Large	Med	Med	Med	Med	Med

The risks summarised in Table C13 show that there is a *medium* risk of adverse dust soiling and human health impacts associated with all construction phase activities 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 C14 presents a selection of recommended mitigation measures recommended by the IAQM methodology for construction activities commensurate with the risks identified in Table C13:

Table C14 Site-specific management measures

	Identified Mitigation	Unmitigated Risk
1	Communications	Medium
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	Medium
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.	N
3	Monitoring	Medium
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.	D
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
3.4	Agree dust deposition, dust flux, or real-time continuous monitoring locations with the relevant regulatory bodies. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences.	H
4	Preparing and Maintaining the Site	Medium
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

	Identified Mitigation	Unmitigated Risk
4.3	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	H
4.4	Avoid site runoff of water or mud.	H
4.5	Keep site fencing, barriers and scaffolding clean using wet methods.	H
4.6	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below	H
4.7	Cover, seed or fence stockpiles to prevent wind erosion	H
5	Operating Vehicle/Machinery and Sustainable Travel	Medium
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	D
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)	D
6	Operations	Medium
6.1	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems	H
6.2	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
6.3	Use enclosed chutes and conveyors and covered skips	H
6.4	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate	H
6.5	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	H
7	Waste Management	Medium
7.1	Avoid bonfires and burning of waste materials.	H
8	Measures Specific to Demolition	Medium
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).	D
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	H

	Identified Mitigation	Unmitigated Risk
	controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	
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
8.5	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	D
8.6	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	D
8.7	Only remove the cover in small areas during work and not all at once	D
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
11	Measures Specific to Construction Traffic (adapted)	Medium
11.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
11.2	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.	N

	Identified Mitigation	Unmitigated Risk
11.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D
11.4	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	H
11.5	Record all inspections of haul routes and any subsequent action in a site log book.	D

Step 6 – Risk Assessment (post-mitigation)

Following Step 5, the residual impact is then determined.

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

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

APPENDIX D

Operational Phase Risk Assessment Methodology

Provided below is the summary for the risk assessment methodology used for the operational phase of this assessment. It is based upon the definitions provided under ISO 31000.

The risk assessment presented in this report is performed in two stages:

- Step 1: Pre-mitigated risk: This is used to identify any significant risks and identify the need to control;
- Step 2: Control and mitigation: An examination of what constitutes best available technology (BAT) for emissions control for that process.

The risk assessment procedure adopted in this instance uses the determinations of:

- sensitivity of receptors; and
- impact magnitude; to derive
- risk.

These terms are defined and discussed in the following subsections.

Sensitivity of Receptors

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with a scale from 'very high' to 'low', as defined in Table D1.

Table D1 Methodology - sensitivity of receptors

Sensitivity		Descriptions
4	Very high	• Receptors are highly sensitive to changes in the air quality / odour environment. • Areas may be typified by extended (day-long) exposure times and/or an expectation of high amenity values. Typical examples may include residential areas, health care facilities, retirement homes
3	High	• Receptors have a high sensitivity to changes in the air quality / odour environment. • Areas may be typified by working-day exposure times and/or an expectation of high amenity values. Typical examples may include commercial zones, recreation facilities, schools, high-end office space (banking etc).
2	Medium	• Receptors have a medium sensitivity to changes in the air quality / odour environment. • Areas may be typified by up to working-day exposure times and an expectation of reasonable amenity values commensurate with the land-uses. Typical examples may include agricultural and environmental conservation spaces, industrial zones.
1	Low	• Receptors have a low sensitivity to changes in the air quality / odour environment. • Areas may be typified by short-term exposure times and a low expectation of amenity values. Typical examples may include infrastructure land uses, open and undeveloped land.

Impact Magnitude

Impact magnitude is a descriptor for the predicted scale of change to the air quality / odour environment that may be attributed to the operation of the Proposal and is evaluated on a scale from 'major' to 'negligible' as defined in Table D2.

Table D2 Methodology - impact magnitude

Magnitude		Descriptions
4	Major	• Potential impact magnitude may cause statutory objectives / standards to be exceeded. • Potential major magnitude of impacts may generate nuisance complaints, resulting in regulatory action.
3	Moderate	• Potential impact may give rise to a perceivable health and/or amenity impact. • Potential moderate magnitude of impacts may generate nuisance complaints, likely to require management but not result in regulatory action.
2	Slight	• Potential impact may be tolerated. • Potential slight magnitude of impacts is not likely to generate nuisance complaints.
1	Negligible	• Potential impact magnitude is unlikely to cause significant consequences. • Potential negligible magnitude of impacts is unlikely to generate nuisance complaints and is likely to only be perceptible within the site boundary.

Risk

The risk matrix provided in Table D3 illustrates how the definition of the impact magnitude and sensitivity of receptors interact to produce impact risk (composite risk index). For example, an air quality / odour impact of slight magnitude at a medium sensitive receptor location would be determined to be of medium risk (significance).

Table D3 Methodology –risk matrix

Sensitivity \ Magnitude	Negligible (1)	Slight (2)	Moderate (3)	Major (4)
Very High (4)	Medium (4)	Medium (8)	High (12)	High (16)
High (3)	Medium (3)	Medium (6)	Medium (9)	High (12)
Medium (2)	Low (2)	Medium (4)	Medium (6)	Medium (8)
Low (1)	Low (1)	Low (2)	Medium (3)	Medium (4)

The 'risk' derived through this methodology is presented on a simplified three-point scale:

High	A high risk that requires management, through changes to impact magnitude and/or sensitivity
Medium	An intermediate risk, and recommendations are to reduce risk as low as practicable through changes to impact magnitude and/or sensitivity
Low	No further management required, although risks should be managed

The relative risk is provided as a dimensionless product of the defined values attributed to receptor sensitivity and impact magnitude.

The determined risk (significance) may be used to highlight the relative environmental risk and to highlight the general requirement for the application of controls and mitigation. It is noted that the above approach is designed to provide an overall impact risk and is not intended to represent the defining determination for the requirement for mitigation and control. The determined risk methodology is not designed to exclude impacts with a lower determined significance from receiving mitigation and control treatments, in accordance with the principle of reducing environmental impacts to maximum extent practicable.

Step 1: Pre-Mitigated Risk Assessment

The following represents the risk assessment that is used to identify the risks associated with operation without any supplementary mitigation and identify the type and nature of controls that are required to be applied to avoid unreasonable emissions to air.

Pre-Mitigated Sensitivity of Receptors

The Proposal site is located in an area comprising industrial and residential land uses approximately 40 m from the closest residential receptor, and 1 m from the closest potential industrial receptor. Given the nature of the location, the sensitivity of receptors is determined to be very high (residential receptors).

Pre-Mitigated Impact Magnitude

In the context of the risk assessment methodology, the impact magnitude relates to the definitions presented in Table D2, and is described on a scale from major to negligible. The key considerations in the assessment of potential impact magnitude are:

- Assessing the potential emissions from the processes to give rise to off-site impacts;
- Assessing the scale, frequency and duration of those emissions.

The processes which are performed at the Proposal site that may demonstrate potential risk of emissions to air are briefly described in Section 2.2.2. These processes can be generally categorised as follows:

- Wheel generated dust; and
- Exhaust emissions.

Wheel Generated Dust

There is potential for dust emissions deriving from vehicle movements on the internal roadways surrounding the warehouses at the Proposal site. Information provided by the Applicant indicates that the total number of daily vehicle movements associated with both warehouses at the Proposal site is as presented in Table 2 576 daily vehicle movements (421 light vehicles and 155 heavy vehicles).

It is noted that the internal roadway surfaces would be paved/hardstand and correspondingly would be expected to have a low silt loading. Given the anticipated number of daily vehicle movements and the characteristics of the internal roadway the potential for wheel generated dust to be emitted to air is significantly reduced and correspondingly the impact magnitude has been determined to be slight.

Exhaust Emissions

There is also potential for diesel and petrol combustion emissions associated with vehicle movements on the internal roadways at the Proposal site. On the assumption that up to 695 vehicle movements may be anticipated each day at the Proposal site, exhaust emissions generated from the Proposal site are not expected to result in significant air quality impacts experienced at sensitive receptors, particularly with the relatively low NO_2 concentrations monitored at St Marys AQMS (refer Section 4.3 and Appendix B). The impact magnitude associated with exhaust emissions has been determined to be slight.

Based on Northstar's experience in assessing and managing air quality from similar industries, the pre-mitigated magnitudes presented in Table D4 represents the potential for air quality impacts to be experienced at sensitive receptors as a result of the processes performed at the Proposal site.

Table D4 Impact magnitude (pre-mitigated)

Process	Comments and application	Pre-mitigated magnitude
Wheel generated dust	Pre-mitigated	Slight
Exhaust emission	Pre-mitigated	Slight

Pre-Mitigated Risk

Based upon the above, the pre-mitigated risk may be determined as presented in Table D5.

Table D5 Risk (pre-mitigated)

Sensitivity of receptors		Impact magnitude		Risk Assessment
Location	Assessment	Process	Assessment	
Various locations at and beyond site boundary	Very High Sensitivity	Wheel generated dust	Slight	Medium
		Exhaust emissions	Slight	Medium

The findings of the risk assessment have indicated that wheel generated dust and exhaust emissions have pre-mitigated *medium* risks. Additional options for management and control of vehicle related emissions have been identified and are discussed below.

Step 2: Control and Mitigation

It is not expected that air quality impacts resulting from operational phase activities would be experienced at nearby receptors. However, the facility will implement and maintain a complaints log that will record any complaints associated with the activities performed at the Proposal site (refer Section 6.2).

Should complaints be received in response to emissions from the Proposal site the following controls have been identified to manage off-site impacts:

- Reduce vehicle speeds on site access roads and hardstand areas;
- Examine the surface condition of the site access road and hardstand areas, and rectify where required; and
- Implement a no idling restriction during truck loading/unloading.

It is noted that these emission controls are not anticipated to be required but are presented to provide confidence to the approval authority and Council that in the unexpected circumstance that complaints are received, there are mitigation options available to easily manage those impacts.

Step 3: Post Mitigation Risk

If the emission control methods outlined above are appropriately implemented at the Proposal site, it is anticipated that all operational phase air quality risks would be medium as presented in Table D6. As shown in Table D3, overall risk can only be reduced further by changing the sensitivity of the surrounding land use (i.e. removing residential land uses). The mitigation measures above act to minimise the magnitude of any impacts as much as possible. The risk assessment may be re-performed should changes to receptor sensitivity or impact magnitude change over time.

Table D6 Risk (mitigated)

Sensitivity of receptors		Impact magnitude		Risk Assessment
Location	Assessment	Process	Assessment	
Various locations at and beyond site boundary	Very High Sensitivity	Wheel generated dust	Negligible	Medium
		Exhaust emissions	Negligible	Medium

APPENDIX E

Example Complaint Record

Complainant Contact Details			
Date and time complaint received			
Contact details for complainant			
Complaint Details			
Date and time start	/ / : am|pm		
Date and time stop	/ / : am|pm		
Location(s) of the impact			
Description of the impact			
Persistence *see note 1*	☐ Constant ☐ Intermittent		
Intensity (odour) *see note 2*	☐ 6 extremely strong	☐ 4 strong	☐ 2 weak
☐ generally ☐ at its worst	☐ 5 very strong	☐ 3 distinct	☐ 1 very weak
Prevailing weather conditions at the time of the complaint			
General description (dry, rain, windy, still etc)			
Temperature			
General wind direction *see note 3*			
General wind strength *see note 4*			
Operational details, actions, resolution			
Operations during complaint			
Identified causes			
Actions taken			
Cause resolved	☐ Yes ☐ No		
Follow up required	☐ Yes ☐ No		
Complainant informed of outcome	☐ Yes ☐ No		
Signed			
Date	/ /		

Notes

1. Persistence. Please record the descriptor that best describes the extent of the observation:

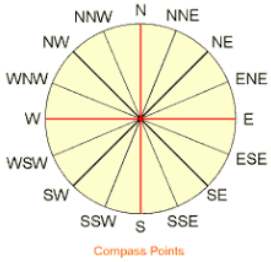
Constantly: air quality impact was observed virtually constantly between the stated start and stop times

Intermittently: air quality impact was observed intermittently between the stated start and stop times

2. Odour Intensity. Using the scale below, estimate how intense the odour was generally or at its worst (as appropriate)

6	Extremely strong: Overpowering odour triggering a physical reaction (i.e. gaging, eyes watering etc.) or an involuntary action (i.e. turning away from odour, covering nose etc.).	3	Distinct: Mid way between a weak and strong odour, this is a clearly defined odour, immediately recognisable and tolerable.
5	Very strong: A strong odour that may initiate an involuntary action that you subsequently control. Odour is barely tolerable and exposure is uncomfortable	2	Weak: This is a clearly defined odour (i.e. without uncertainty/guessing), immediately recognisable but not yet strong enough to be considered distinct and readily tolerable.
4	Strong: A clearly defined odour that is immediately recognisable and is tolerable but mildly uncomfortable.	1	Very weak: A very faint odour. The VDI definition of a very weak odour requires the odour to be clearly defined without uncertainty or guessing involved.

3. Wind Direction.



4. Wind Strength

0	Calm	Calm. Smoke rises vertically
1	Light air	Wind motion visible on smoke
2	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	Leaves and smaller twigs in constant motion
4	Moderate breeze	Dust and loose paper raised. Small branches move
5	Fresh breeze	Moderate branches move. Small trees begin to sway.
6	Strong breeze	Large branches in motion. Overhead wires whistle. Umbrella use is difficult. Empty rubbish bins tip.
7+	Near gale	Wind effects greater than above