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STACK SYD01 Data Centre (SSD-82211208)

Construction Air Quality Assessment – HV Connection

Addressee(s):	STACK Infrastructure
Site Address:	78 Lockwood Road, Erskine Park
Report Reference:	25.1138.FR3V2
Date:	18 March 2026
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Quality Control

Report	Reference	Status	Prepared by	Checked by	Authorised by
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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. A draft report is provided on a 'without prejudice' basis and may be subject to change.

D Alder **18 March 2026**

NON-TECHNICAL SUMMARY

Northstar Air Quality Pty Ltd was commissioned by STACK Infrastructure (the Applicant) to perform an air quality assessment for the proposed construction of a high voltage connection route to connect the TransGrid Sydney West Substation to the proposed STACK SYD01 data centre development located at 78 Lockwood Road, Erskine Park (SSD-82211208).

Potential construction phase impacts have been assessed using an adaptation of a published risk-based assessment methodology within a graphical information system and proposing control measures to minimise their potential impact.

The findings of the air quality assessment indicate that a *low* to *medium* risk of human health and dust soiling impacts may be experienced at locations surrounding the Proposal site. Based upon that assessment, a range of mitigation measures are recommended to ensure that short-term impacts associated with construction activities are minimised.

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

CONTENTS

FIGURES

TABLES

1. INTRODUCTION

STACK Infrastructure (the Applicant) has commissioned Northstar Air Quality Pty Ltd (Northstar) to perform an air quality assessment (AQA) for the proposed construction of a high voltage (HV) connection route (the Proposal) linking the TransGrid Sydney West Substation to the proposed STACK SYD01 Data Centre at 78 Lockwood Road, Erskine Park (SSD-82211208).

This report has been prepared as a supplementary HV assessment to accompany the existing SSDA documentation for the STACK SYD01 Data Centre development.

The supplementary assessment addresses the external HV cable connection route required as part of the broader Data Centre works and associated substation infrastructure. The HV route follows existing roadways from the SSDA site via Lenore Drive and connects to the TransGrid Sydney West Substation.

The AQA presents an assessment of potential air quality impacts associated with construction activities for the Proposal. Construction phase impacts have been evaluated using an adaptation of a published risk-based assessment methodology, and appropriate mitigation and management measures have been identified to manage potential risks.

For the purposes of this report the works described above, including the HV cable route to the STACK SYD01 Data Centre are collectively referred to as the 'Proposal site'.

This report should be read in conjunction with the Air Quality Impact Assessment (AQIA) prepared for the STACK SYD01 Data Centre site.

Appendix A provides a list of abbreviations, nomenclature and units used in this AQIA.

2. THE PROPOSAL

The Proposal includes the installation of two (2) HV cables from the STACK SYD01 Data Centre Switchyard via road reserve within Lenore Drive to the TransGrid Sydney West Substation.

Key components of the Proposal include:

- External HV cable works extending from the STACK SYD01 Data Centre Switchyard to the TransGrid Sydney West Substation, including:
  - Two (2) x 330 kV underground transmission cable circuits comprising six (6) cables installed within six (6) conduits;
  - Two (2) smaller conduits for optical fibre infrastructure;
  - Approximately two (2) to four (4) joint bays per circuit, where sections of cable would be located at intervals of approximately 600 m to 800 m along the transmission cable route;
  - Associated link boxes and sensor boxes at each joint bay to enable cable testing and maintenance activities.

Two (2) 330 kV circuits have been confirmed as technically feasible. The proposed configuration comprises nominal 2 500 mm^2 copper cables designed to support a continuous ultimate load demand of 500 MVA under N-1 contingency conditions which is consistent with system studies and redundancy requirements. The cable and trench configurations have been developed to account for mechanical and electrical performance requirements, including current rating and thermal performance, as well as environmental constraints, constructability considerations, site conditions and third-party utility crossings.

2.1. Environmental Setting

The Proposal site comprises the overall potential area of direct disturbance by the Proposal, which may be temporary (for construction) or permanent (for operational infrastructure) and extend below the ground surface. The Proposal site runs along the Lenore Drive road reserve and includes a crossing of Ropes Creek. Land impacted by the works includes 78 Lockwood Road, Erskine Park (Lot 101 in DP 1268632) as well as Lots 15, 16 and 17 in DP 1157491 situated along Lenore Drive.

The Proposal site falls within the following land use zones:

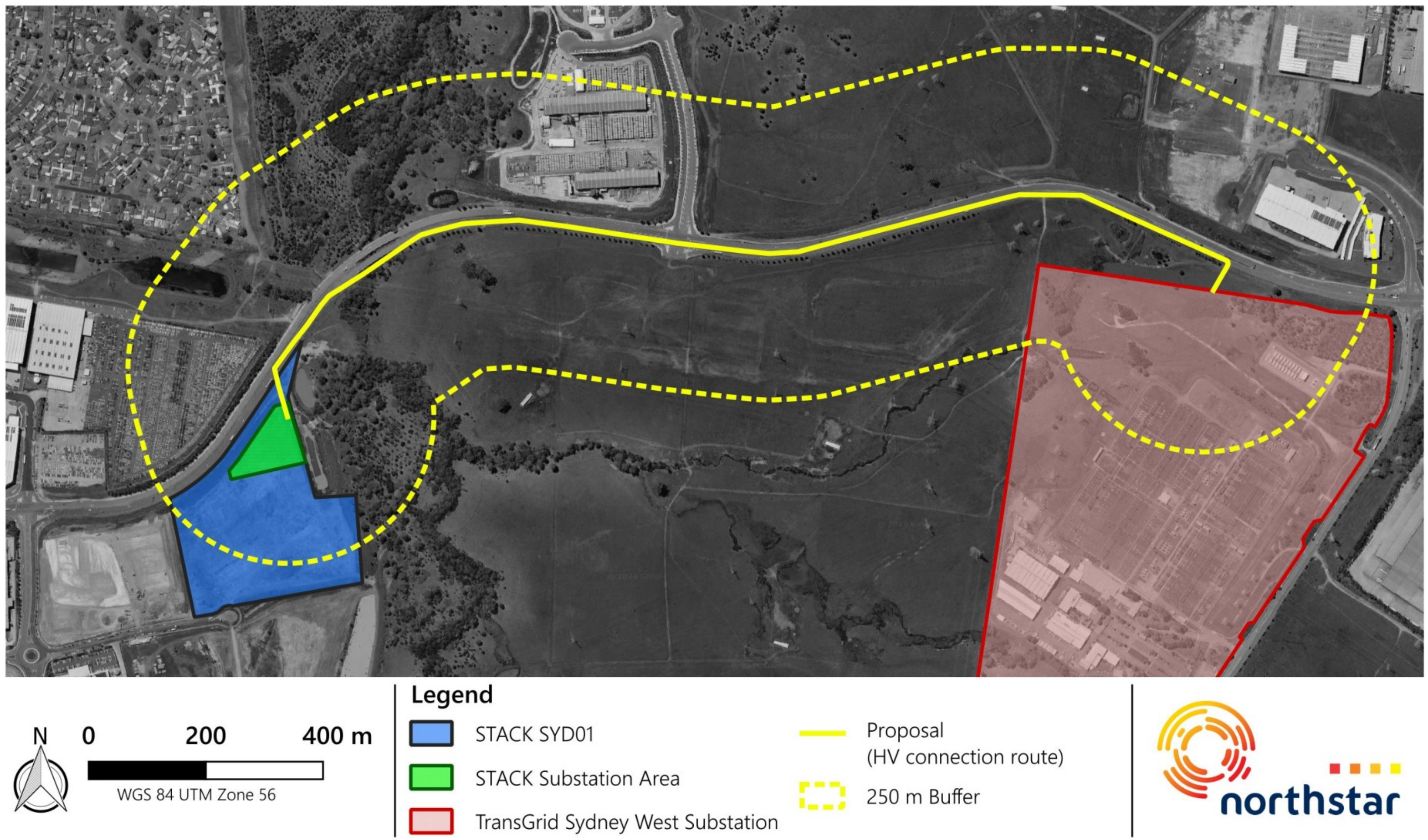
- IN1 – General Industrial;
- C2 – Environmental Conservation; and,
- SP2 – Infrastructure.

The Proposal site is illustrated in Figure 1.

For the purposes of this AQA, the scope has been limited to a 250 m buffer around the Proposal. The 250 m buffer distance has been selected as it is the maximum screening distance determined by the UK Institute of Air Quality Management (IAQM) for construction dust assessments (IAQM, 2024), which has been adapted for this AQA. This threshold distance represents the distance over which construction dust impacts may be reasonably expected to be experienced and is therefore appropriate for use in this AQA. The methodology is further discussed in Appendix B.

The associated 250 m buffer for assessment is also included within Figure 1.

Figure 1 Proposal site location (HV connection route)



Source: Northstar

2.2. Overview

The key construction phase activities associated with the Proposal are anticipated to include (in no order):

- Clearing of vegetation, where required.
- Establishment and securing of work sites and construction laydown areas.
- Trenching and excavation along the HV transmission cable route.
- Horizontal directional drilling (HDD) for trenchless crossings, where required.
- Handling of excavated material, including temporary stockpiling, reuse and/or off-site disposal.
- Installation of cable conduits or ducting to house the HV cables.
- Construction of cable access points, including joint bays and pull pits.
- Cable pulling, lowering and jointing within trenches and conduits.
- Cable termination at feeder bays and joint locations.
- Construction of special crossings (e.g. road, rail or utility crossings).
- Backfilling of trenches and reinstatement of disturbed surfaces.
- Installation of associated infrastructure (e.g. mechanical protection, barriers and ancillary works).
- Testing and commissioning of the installed cables.
- Site clean-up and rehabilitation activities.
- Associated vehicle movements, plant operation and equipment mobilisation.

The Proposal includes the installation of two (2) 330 kV underground circuits linking the STACK SYD01 data centre to the TransGrid Sydney West Substation. Each circuit would run along an alignment that crosses Lenore Drive, then turn south to connect into the substation at separate termination points. At the point where the circuits enter the substation and specifically where the cables intersect the substation at right angles, a trench deeper than standard may be necessary. Additional protective measures such as the installation of a concrete barrier may also be implemented to safeguard the cables.

Construction activities at the Proposal site are expected to be progressive. Vegetation will be cleared and topsoil removed prior to installation in each section of the route. It is anticipated that the cable trench would be excavated to a maximum depth of 4 m below ground level (BGL) for HV cable installation with excavated material temporarily stockpiled adjacent to the trench. Sections of cable will be lowered into the trench using side-booms, after which the stockpiled material would be returned and compacted. The substation bench extension would be sized to accommodate the new feeder bays, with exact dimensions confirmed during detailed design.

While the Proposal would most likely be constructed in sections, a conservative assumption has been made for this assessment that all works occur simultaneously.

Standard construction hours would be adopted where reasonable and feasible, from 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm on Saturdays.

2.3. Identified Potential Emissions to Air

Due to the nature of the construction works and the layout of the Proposal as described in the preceding sections, it is assumed that no demolition works would be required. Subsequently, earthworks activities including trenching and backfilling, and vehicle movements are considered to be the primary activities associated with potential emissions to air.

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

- Cranes, dozers and excavators;
- HDD boring machinery;
- Graders and rollers;
- Concrete transit mixer trucks; and
- Light and heavy-duty vehicles.

Construction phase activities carried out as part of the Proposal would be anticipated to have the potential to generate short-term emissions of particulates (construction dust). Generally, these are associated with uncontrolled (or 'fugitive') emissions and may typically be experienced at surrounding land uses at short distances from the construction activities as amenity impacts, such as dust deposition and/or visible dust plumes, rather than associated with health-related impacts. Construction particulate matter is generally typified by heavier size fractions, and the risk of health impacts associated with smaller particles (less than 10 micrometres (µm) in diameter) is likely to be low.

Localised engine exhaust emissions from construction machinery and vehicles may impact upon the surrounding environment. Given the scale of the proposed works, it is considered that fugitive construction dust emissions would have the greatest potential to give rise to downwind air quality impacts. Construction phase vehicle emissions are therefore not considered further in this AQA. It is noted however that the construction mitigation recommendations (refer Appendix B) include measures to minimise and manage these potential impacts.

The applied methodology is discussed in Section 5 and the assessment is presented in Section 6.

3. LEGISLATION, REGULATION AND GUIDANCE

3.1. Federal Air Quality Standards

3.1.1. National Environment Protection (Ambient Air Quality) Measure

The *National Environment Protection (Ambient Air Quality) Measure* (Ambient Air Quality NEPM) was promulgated in July 1998 and established ambient air quality standards for six key pollutants across Australia and provides a standard method for monitoring and reporting on air quality. Air quality standards and performance monitoring goals for the six key air pollutants include:

- Carbon monoxide (CO);
- Lead (Pb);
- Nitrogen dioxide (NO_2);
- Particles (particulate matter with an aerodynamic diameter of 10 microns (µm) or less (PM_{10});
- Photochemical oxidants, as ozone (O_3); and
- Sulphur dioxide (SO_2).

The Ambient Air Quality NEPM was varied in July 2003 to include advisory reporting standards for fine particulate matter with an aerodynamic equivalent diameter of 2.5 microns (µm) or less ($PM_{2.5}$) and in February 2016 (NEPC, 2016), introducing varied standards for PM_{10} and $PM_{2.5}$.

The air quality standards and goals as set out in the (revised) Ambient Air Quality NEPM for the pollutants considered within this assessment are presented in Table 1.

Table 1 National Environment Protection (Ambient Air Quality) Measure standards and goals

Pollutant	Averaging period	Criterion and units[a]	Allowable exceedances per year
Particles (as PM_{10})	1 day	50 $\mu g \cdot m^{-3}$	None
	1 year	25 $\mu g \cdot m^{-3}$	None
Particles (as $PM_{2.5}$)	1 day	25 $\mu g \cdot m^{-3}$	None
	1 year	8 $\mu g \cdot m^{-3}$	None

Notes: (a) micrograms per cubic metre of air

3.1.2. National Clean Air Agreement

The National Clean Air Agreement (NCAA) (Australian Government, 2015) was agreed by Australia's Environment Ministers on 15 December 2015. The NCAA establishes a framework and work plans for the development and implementation of various policies aimed at improving air quality across Australia.

A series of published work plans, developed in collaboration with the NCAA, outline a comprehensive program of activities aimed at addressing air quality priorities. These plans encompass both longstanding concerns such as the improvements to gaseous and particulate matter standards, and new initiatives, as well as scoping projects focused on various air quality issues.

Of relevance to the standards adopted as benchmarks for the performance of the Proposal, the previous standards were augmented by an annual average PM_{10} concentration standard of 25 $\mu g \cdot m^{-3}$, and the advisory reporting standards for $PM_{2.5}$ considered as standards.

3.2. NSW EPA Approved Methods – Ambient Air Quality Criteria

State air quality guidelines adopted by the NSW EPA are published in the Approved Methods (NSW EPA, 2022) which has been consulted during the preparation of this assessment report.

The Approved Methods lists the statutory approaches 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 2.

Table 2 NSW EPA impact assessment criteria – criteria pollutants

Pollutant	Averaging period	Criterion	Units	Notes
Particulates (as PM_{10})	24 hours	50	$\mu g \cdot m^{-3}$ (a)	Numerically equivalent to the AAQ NEPM(b) standards and goals.
	annual	25	$\mu g \cdot m^{-3}$	
Particulates (as $PM_{2.5}$)	24 hours	25	$\mu g \cdot m^{-3}$	
	annual	8	$\mu g \cdot m^{-3}$	
Particulates (as TSP)	annual	90	$\mu g \cdot m^{-3}$	
Particulates (as dust deposition)	annual(c)	2	$g \cdot m^{-2} \cdot month^{-1}$	Assessed as insoluble solids as defined by AS 3580.10.1
	annual(d)	4	$g \cdot m^{-2} \cdot month^{-1}$	

Notes: (a): micrograms per cubic metre of air
(b): National Environment Protection (Ambient Air Quality) Measure
(c): Maximum increase in deposited dust level expressed as grams per square metre per month as an annual average
(d): Maximum total deposited dust level expressed as grams per square metre per month as an annual average

The air quality standards presented in Table 2 represent the standards to be achieved for the Proposal. It is noted however, that this AQA does not include a quantitative assessment of emissions and impacts (i.e. dispersion modelling) associated with the Proposal and consequently a risk based assessment has been performed.

4. EXISTING CONDITIONS

4.1. Surrounding Land Sensitivity

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 (see Section 3). 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.

Given the linear nature of the Proposal, the selection of individual receptor locations has not been performed. Sensitive receptor areas have been identified based on review of land use zoning in an area within 250 m of the Proposal site (the screening distance is discussed in Appendix B).

Land use zones designed by the relevant NSW environmental planning instruments (EPI) under the *Environmental Planning and Assessment Act* 1979 have been adopted to identify land uses within the screening distance as part of this AQA as presented in Figure 2.

The land use zones that have been identified within the 250 m screening distance are as follows:

- C2 - Environmental Conservation;
- IN1 - General Industrial;
- R2 – Low Density Residential
- RE1 – Public Recreation; and,
- SP2 Infrastructure.

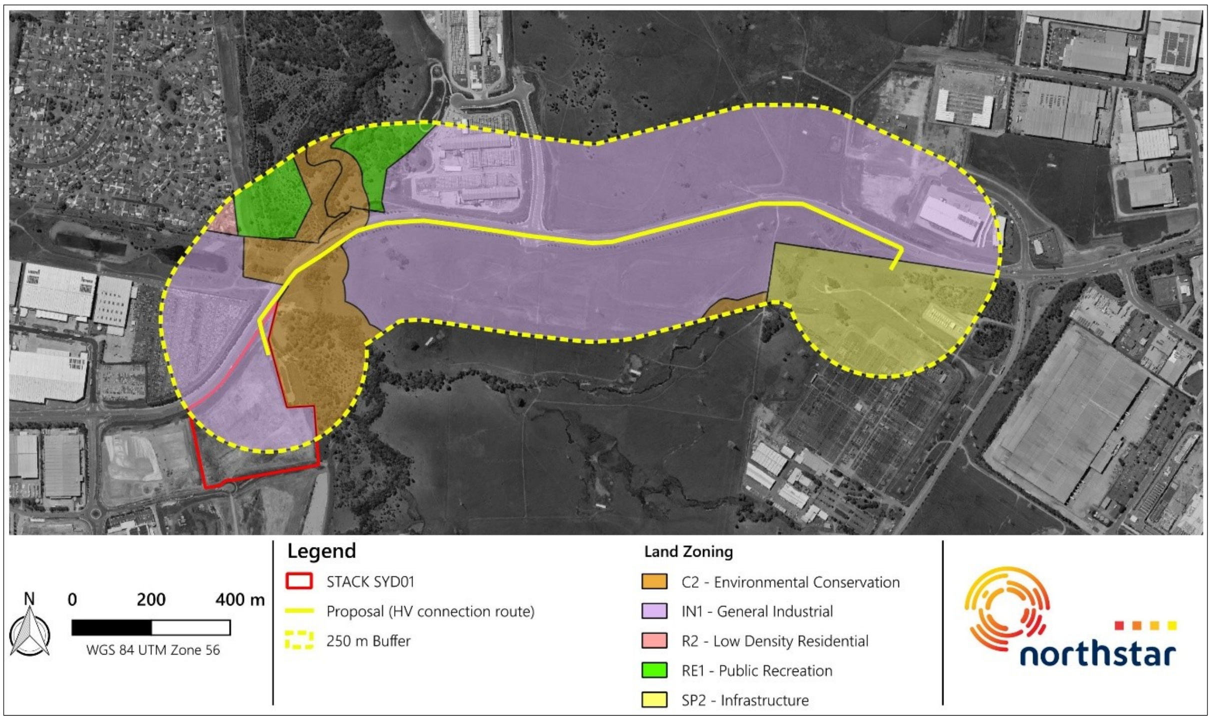
It is noted that a residential zone (R2 – Low Density Residential) is located within the screening area, with the nearest residential dwelling located approximately 200 m to the northwest of the Proposal at Cetus Place, Erskine Park.

Additionally, SP2 Infrastructure is a special purpose zone used for major infrastructure such as transport networks, utilities and public facilities e.g. power stations. The SP2 Infrastructure within the 250 m screening distance include 'SP2 Electricity Transmission & Distribution', 'SP2 Local Road' and 'SP2 Water Supply System' (refer Figure B1).

Further discussion on land use zones can be found in Appendix B.

Note that this AQA has been performed on the assumption that childcare centres, whilst allowable in certain land use zones (IN1 General Industrial under the Industry and Employment SEPP) would not likely be present in the area surrounding the Proposal site given the nature of the area (refer Appendix B). This AQA should be updated should this assumption not be valid at commencement of construction.

Figure 2 Land uses encompassing the Proposal site



Source: Northstar

4.2. Background Air Quality

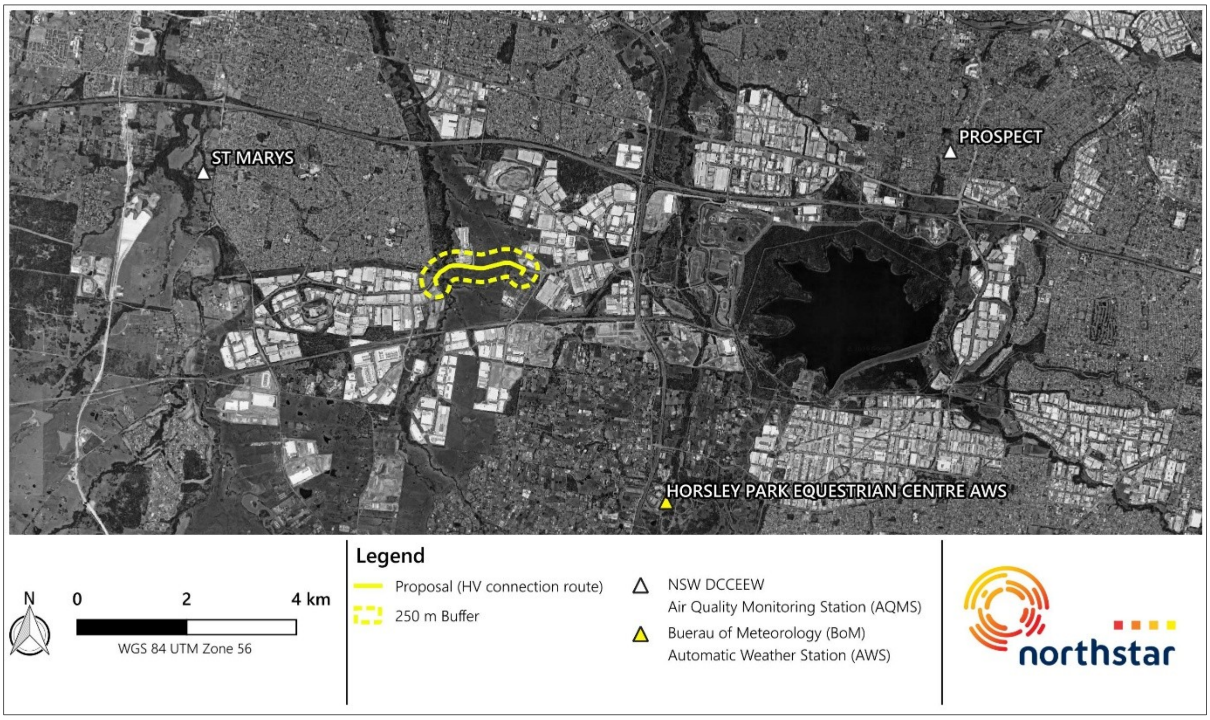
The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional, and global). The relative contributions of sources at each of these scales to the air quality at a location will vary based on a wide number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

Particulate matter concentrations are measured by NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) at two air quality monitoring stations (AQMS) located within a 10 km radius of the Proposal. These stations are summarised in Table 3 and illustrated in Figure 3.

Table 3 AQMS surrounding the Proposal

NSW DCCEEW AQMS	Distance to Proposal (km)	Approximate location (UTM 56S)		Measurements	
		mE	mS	PM_{10}	$PM_{2.5}$
St Marys	4.7	293 170	6 258 083	✓	✓
Prospect	9.7	306 745	6 258 646	✓	✓

Figure 3 Location of monitoring stations surrounding the Proposal site



Source: Northstar

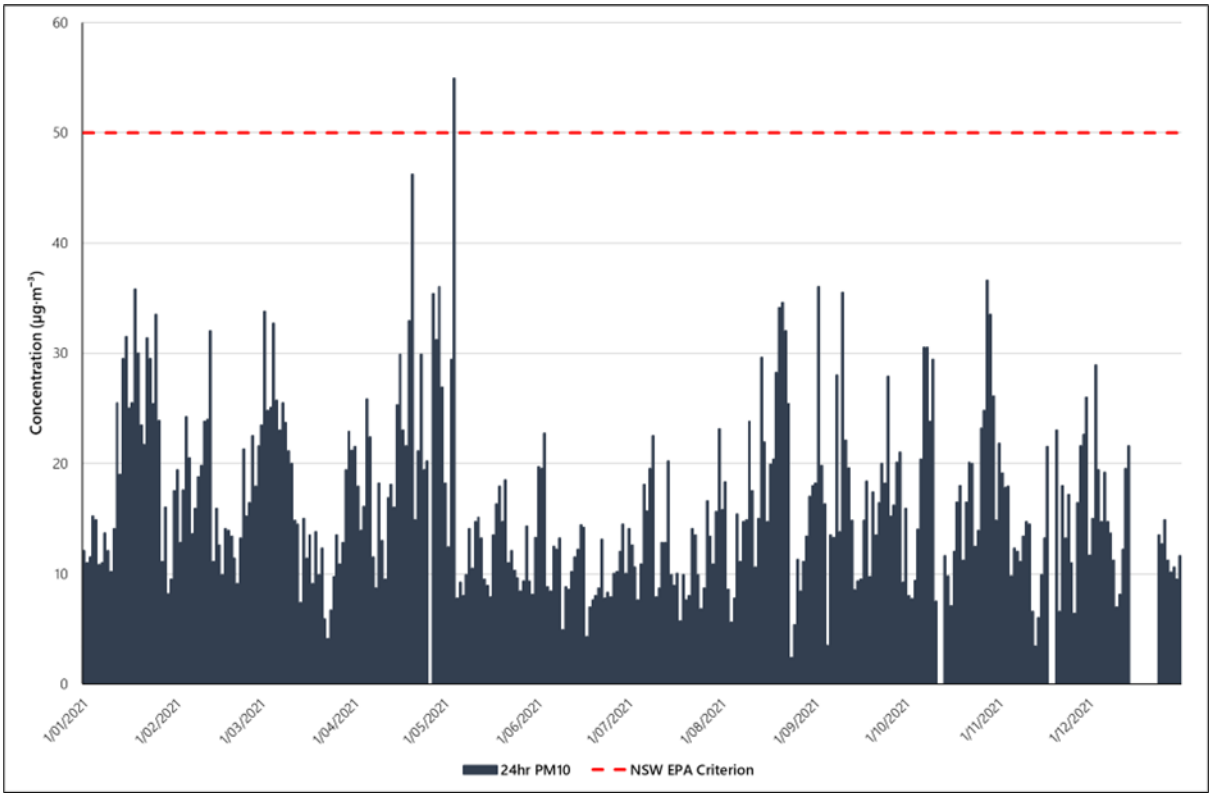
To correspond with the air quality impact assessment (AQIA) completed for the STACK SYD01 Data Centre, PM_{10} and $PM_{2.5}$ data at St Marys AQMS have been analysed for the year 2021. The 24-hour average PM_{10} and $PM_{2.5}$ concentrations measured at St Marys AQMS are presented in Figure 4 and Figure 5. The data in Figure 4 and Figure 5 show that 24-hour average concentrations of PM_{10} and $PM_{2.5}$ at St Marys AQMS exceeded the NSW EPA criteria (refer Section 3.2) once during 2021 on 4 May. Review of the 2021 NSW Annual Compliance Report indicates that the exceedances were influenced by hazard reduction burning (NSW DPE, 2023).

Table 4 provides further information regarding the annual average PM_{10} and $PM_{2.5}$ concentrations measured at St Marys AQMS, the number of exceedances experienced in each reported year, and the corresponding maximum concentration.

Table 4 PM_{10} and $PM_{2.5}$ Statistics – St Marys AQMS (2020 to 2025)

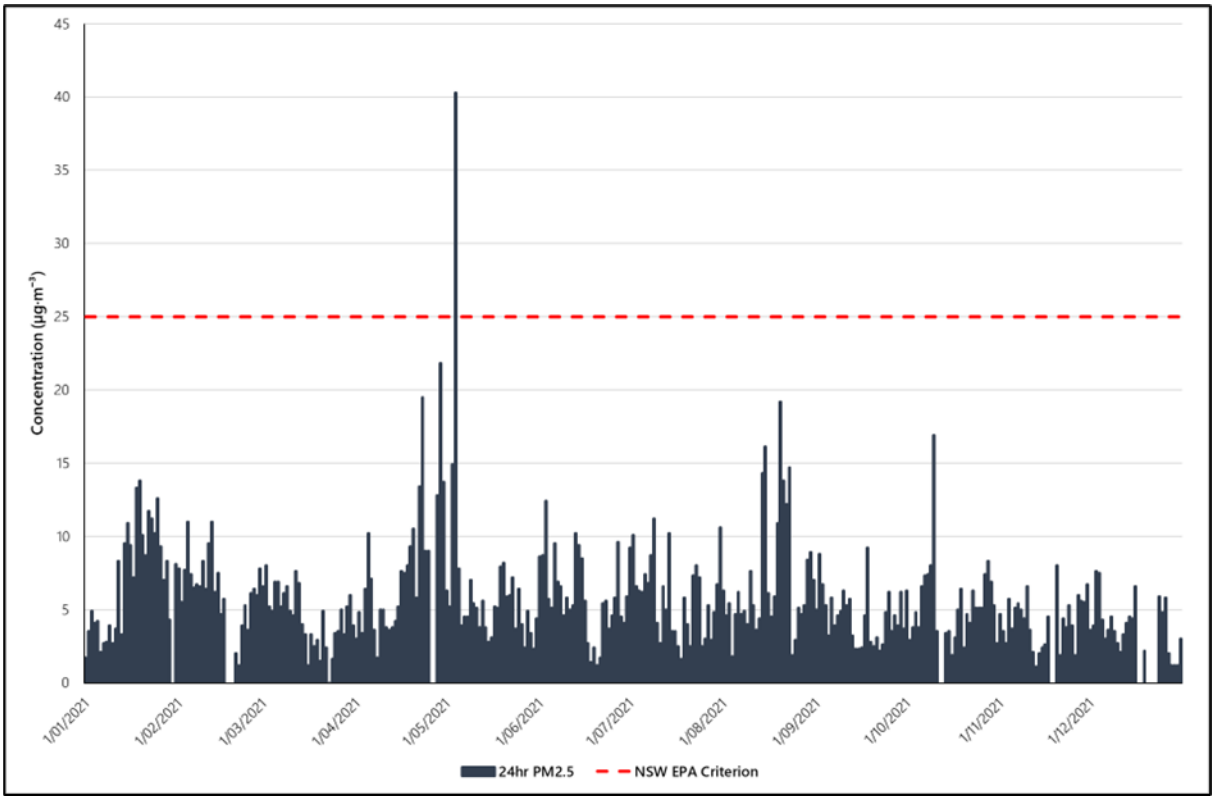
Reported year	PM_{10} concentrations ($\mu g \cdot m^{-3}$)			$PM_{2.5}$ concentrations ($\mu g \cdot m^{-3}$)		
	Annual	24-hour maximum	24-hour exceedances	Annual	24-hour maximum	24-hour exceedances
2020	18.9	260.3	11	7.6	82.5	9
2021	16.2	54.9	1	5.8	40.3	1
2022	12.0	29.7	0	3.9	12.6	0
2023	16.1	42.5	0	5.8	36.8	2
2024	17.0	43.2	0	5.6	17.5	0
2025	17.6	54.5	2	5.6	27.8	1

Figure 4 Daily varying (24-hour) PM_{10} concentrations – St Marys AQMS (2021)



Source: Northstar

Figure 5 Daily varying (24-hour) $PM_{2.5}$ concentrations – St Marys AQMS (2021)



Source: Northstar

4.3. Meteorology

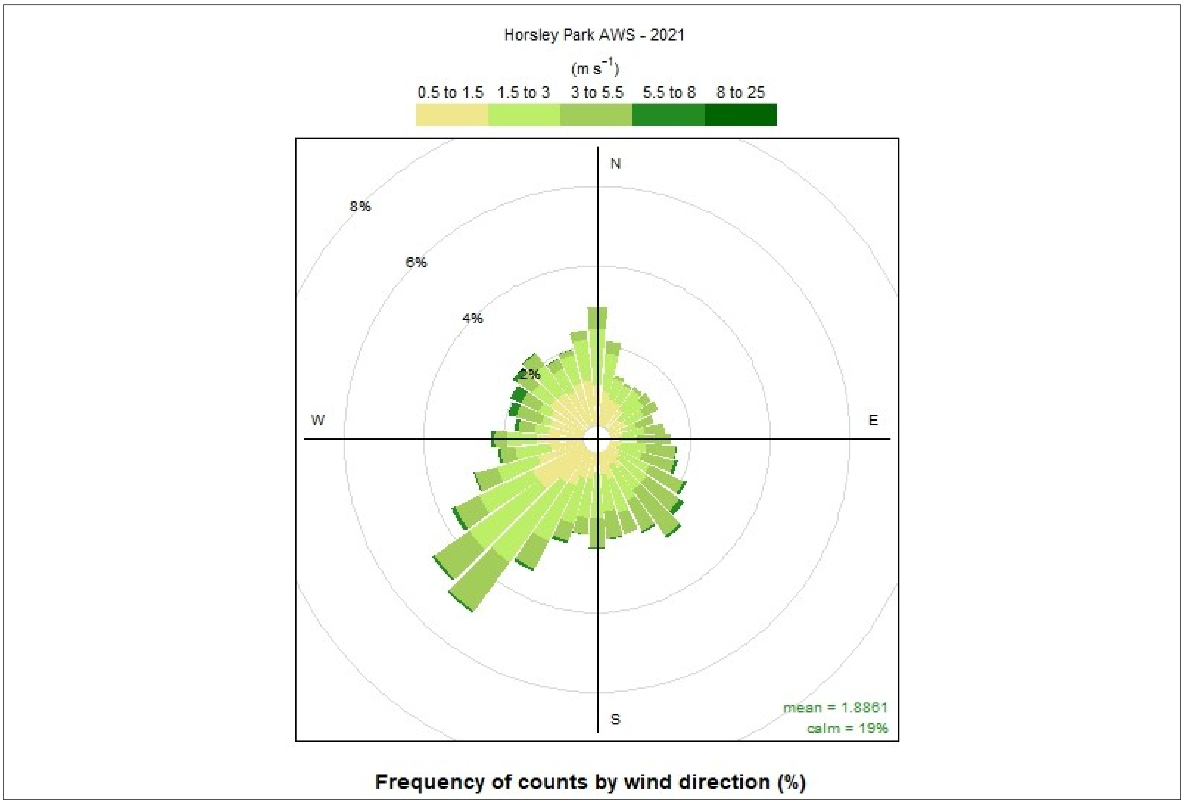
The meteorology experienced within an area can govern the generation (in the case of wind dependent emission sources), dispersion, transport, and eventual fate of pollutants in the atmosphere.

The meteorological conditions surrounding the Proposal site have been characterised using data collected by the Australian Government Bureau of Meteorology (BoM) at the closest and most representative station which is Horsley Park Equestrian Centre Automatic Weather Station (AWS) (Station ID: 067119) which is located approximately 5.7 km to the south east of the Proposal site, as shown in Figure 3.

Data from Horsley Park Equestrian Centre AWS for the year 2021 have been analysed to characterise the meteorological environment surrounding the Proposal site for consistency with the Erskine Park Data Centre AQIA. The wind roses presented in Figure 6 indicate that in 2021, winds at Horsley Park Equestrian Centre AWS experienced predominant south westerly wind directions.

The majority of wind speeds experienced at Horsley Park Equestrian Centre AWS during 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 mostly north westerly directions. Winds of this speed are rare and occur during 0.02 % of the observed hours during the years. Calm winds (less than 0.5 $m \cdot s^{-1}$) are more common and occur during 19.0 % of hours on average during 2021.

Figure 6 Annual wind rose – Horsley Park Equestrian Centre AWS (2021)



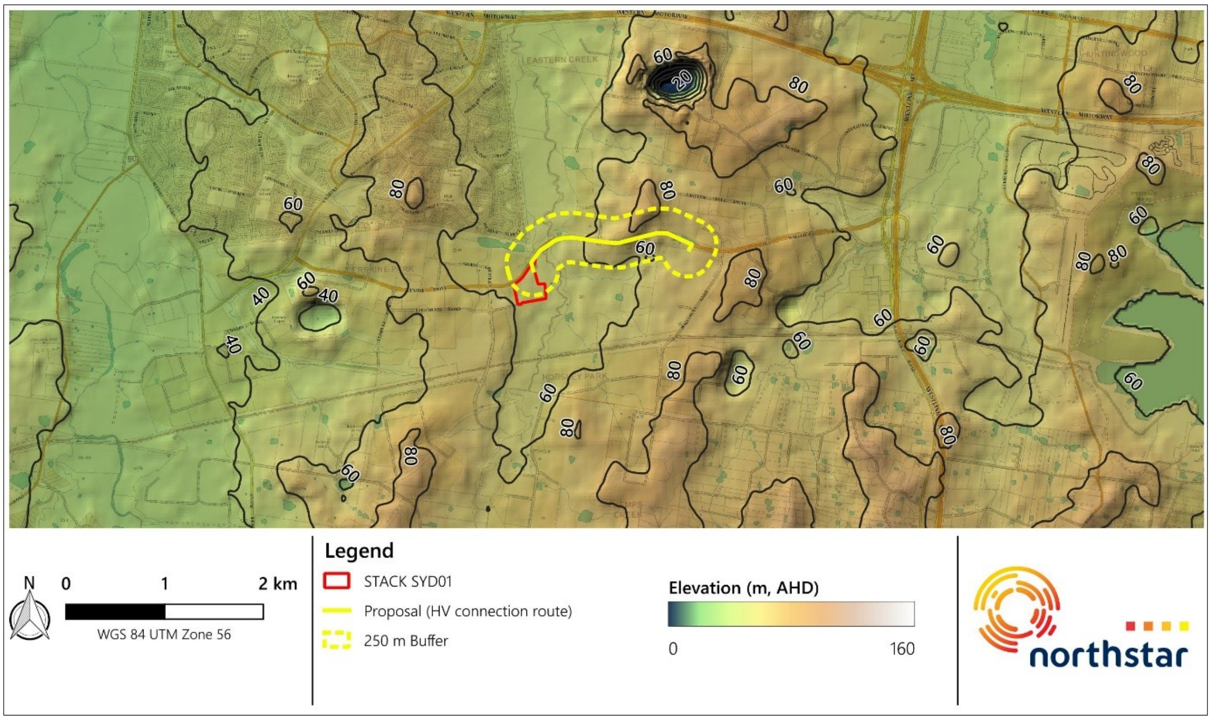
Source: Northstar

4.4. Topography

The elevation of the Proposal site ranges between approximately 50 m to 70 m Australian Height Datum (AHD) as presented in Figure 7. The path that a pollutant may take between the source of emission, and the point of impact can be altered by the local topography.

From the perspective of an AQA, the more 'complicated' the topography (i.e. the greater the vertical range in height over horizontal distance, such as hills and valleys), the more likely pollutant dispersion would be affected by terrain-affected airflow. The topography between the Proposal site and nearest sensitive receptor locations is not considered to be 'complicated' (from an air quality perspective) and therefore no further consideration of topographical effects would be required to support the conclusions drawn from this AQA.

Figure 7 Topography surrounding the Proposal site



Source: Northstar

5. METHODOLOGY

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

Modelling of dust from construction activities 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. This approach is consistent with that adopted by Northstar and other environmental consultancies that specialise in air quality across Australia.

For this risk assessment, Northstar has adapted a methodology presented in the *Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management (IAQM, 2024).

Reference should be made to Appendix B for the detailed methodology.

6. AIR QUALITY ASSESSMENT

The following section outlines the findings of the risk assessment as described in Section 5 and Appendix B.

6.1. Risk (Pre-Mitigation)

The impact magnitudes for the various distances from the Proposal and the sensitivity of the identified land uses within 250 m of the Proposal are outlined in Appendix B. The resulting risk of air quality impacts (without mitigation) is presented in Figure 8.

The preliminary risk assessment illustrated in Figure 8 indicates that with no mitigation measures there is a *low to medium* risk of human health and dust soiling (amenity) impacts associated with construction activities within a 250 m buffer of the Proposal. This preliminary risk assessment is used to identify appropriate mitigation controls to be applied to activities during the construction phase.

Figure 8 illustrates the distribution of construction risk along the 250 m buffer of the Proposal as it relates to adjacent land use categories. It shows that majority of the 250 m buffer intersects with land uses linked to *low* and *medium* risk from construction activities, and none are associated with *high* risk from construction activities.

Whilst it would be possible to apply low risk mitigation measures along the *low*-risk areas of the alignment, the application of a consistent set of controls across the entire alignment is preferable operationally, as it would ensure the CEMP is more easily adopted and followed by contractors.

Consequently, it is recommended that mitigation measures associated with *medium* risk sites be applied along the entire alignment to ensure construction dust will be adequately managed.

The recommended mitigation measures for the Proposal are outlined in Appendix B.

Figure 8 Risk of air quality impacts from construction phase activities

Source: Northstar

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 using effective mitigation. Experience shows that this is typically feasible.

Given the size of the Proposal, land use values surrounding the proposed alignments, and the activities to be performed, residual impacts associated with fugitive dust emissions from the Proposal would be anticipated to be negligible, should the implementation of the mitigation measures outlined in Appendix B be performed appropriately.

7. DISCUSSION AND CONCLUSION

7.1. Mitigation and Monitoring

Based on the findings of the construction phase air quality assessment, with no mitigation measures applied there is anticipated to be a *low* risk to *medium* risk of human health and adverse dust soiling (amenity) effects associated with construction phase activities.

A range of mitigation and management measures are presented in Appendix B, which would result in the risks associated with construction across the entire alignment being reduced to a *negligible* risk.

Given the potential scale of impacts, air quality monitoring is not considered to be required and is not proposed.

7.2. Conclusion

STACK Infrastructure has engaged Northstar on behalf of the Proponent to perform an AQA for the proposed construction of a HV connection route between the TransGrid Sydney West substation and the STACK SYD01 data centre development.

Potential construction impacts have been assessed using a published risk-based assessment methodology that has been adapted to reflect the specific operations of the Proposal. The assessment indicates that a range of mitigation measures can be applied during the construction phase to ensure that the risks (both health and amenity) to the surrounding community would not be significant.

This risk-based assessment has been performed on the basis of land uses gazetted at the time of reporting. Should those land uses change prior to the commencement of construction, then it is recommended that this assessment be revisited.

Note that this AQA has been performed on the assumption that childcare centres, whilst allowable in certain land use zones, would not likely be present in the area surrounding the Proposal site, given the nature of the area (refer Appendix B). This AQA should be updated should this assumption not be valid at commencement of construction. It is anticipated that additional controls would be able to be implemented to manage any potential risks to that land use sensitivity, if required.

8. REFERENCES

Australian Government. (2015). *National Clean Air Agreement - Towards a clean future for all Australians - December 2015.*

IAQM. (2024). *Guidance on the Assessment of Dust from Demolition and Construction.*

NEPC. (2016). *National Environment Protection (Ambient Air Quality) Measure as amended, National Environment Protection Council.*

NSW DPE. (2023). *New South Wales Annual Compliance Report 2021.*

NSW EPA. (2022). *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.*

APPENDIX A

Commonly Used Abbreviations and Units

Units Used in the Report

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

Commonly used SI units

The following units are commonly used in Northstar reports.

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

Multiples of SI and non-SI units

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

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

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

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

For example:

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

Commonly used SI-derived and non-SI units

Symbol	Name	Quantity
m^2	square metre	area
m^3	cubic metre	volume
$m{\cdot}s^{-1}$	metre per second	speed and velocity
$\mu g{\cdot}m^{-3}$	microgram per cubic metre	mass concentration per unit volume
$mg{\cdot}m^{-3}$	milligram per cubic metre	mass concentration per unit volume
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
AQA	air quality assessment
AQMS	air quality monitoring station
AWS	automatic weather station
BOM	Bureau of Meteorology
CEMP	construction environment management plan
CO	carbon monoxide
GIS	geographical information system
IAQM	UK Institute of Air Quality Management
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
NO_X	oxides of nitrogen
NO_2	nitrogen dioxide
OEMP	operational environmental management plan
O_3	ozone
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
SA EPA	South Australian Environment Protection Authority
SO_2	sulphur dioxide
TSP	total suspended particulates
UTM	Universal Transverse Mercator
VOC	volatile organic compound

APPENDIX B

Construction Phase Dust Risk Assessment

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

Step 1 – Screening Based on Separation Distance

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

- More than 250 m from the boundary of the site;
- More than 50 m from the route used by construction vehicles on public roads; and
- More than 250 m from the site entrance.

As discussed in Section 4.1, for the purposes of this AQA, selection of individual receptor locations has not been performed rather, sensitive receptor areas have been identified based on review of land use zoning within a 250 m screening distance from the Proposal in accordance with the separation distances outlined above.

It is noted that a residential zone (R2 – Low Density Residential) is located within the screening area, with the nearest residential dwelling located approximately 200 m to the north west of the Proposal at Cetus Place, Erskine Park.

The identified land uses within the screening distance are presented in Figure 2.

Step 2 – Define the Potential Dust Emission Magnitude (DEM)

Step 2 of the assessment categorises dust-generating activities as demolition, earthworks, construction, track-out (material transported onto public roads), and construction traffic by their 'dust emissions magnitude' (DEM) which are defined in Table B1 below.

It is noted that the Proposal does not include any explicit demolition activities.

Table B1 Dust emission magnitude (DEM) activities

Activity	Small	Medium	Large
Demolition			
Total building volume	< 12 000 m^3	12 000 m^3 to 75 000 m^3	> 75 000 m^3
Demolition height	< 6 m AGL	6 m and 12 m AGL	> 12 m AGL
Onsite crushing	no	no	yes
Onsite screening	no	no	yes
Demolition of materials with high dust potential	no	yes	yes
Demolition timing	wet months only	any time of the year	any time of the year
Earthworks			
Total area	< 18 000m^2	18 000 m^2 to 110 000 m^2	> 110 000 m^2
Soil types	soil type with large grain size (e.g. sand)	moderately dusty soil type (e.g. silt)	potentially dusty soil type (e.g. clay)
Heavy earth moving vehicles	< 5 heavy earth moving vehicles active at any one time	5 to 10 heavy earth moving vehicles active at any one time	> 10 heavy earth moving vehicles active at any time
Formation of bunds	< 3 m AGL	3 m to 6 m AGL	> 6 m AGL
Construction			
Total building volume	< 12 000 m^3	12 000 m^3 to 75 000 m^3	> 75 000 m^3
Concrete batching	no	yes	yes
Sandblasting	no	no	yes
Materials	metal cladding or timber	concrete	concrete
Trackout			
Outward heavy vehicles movements per day	< 20	20 to 50	> 50
Surface materials	low potential	moderate potential	high potential
Unpaved road length	< 50 m	50 m to 100 m	> 100 m
Construction traffic (from construction site entrance to construction vehicle origin)			
Demolition traffic - total building volume	< 12 000 m^3	12 000 m^3 to 75 000 m^3	> 75 000 m^3
Earthworks traffic total area	< 18 000m^2	18 000 m^2 to 110 000 m^2	> 110 000 m^2
Earthworks traffic soil types	soil type with large grain size (e.g. sand)	moderately dusty soil type (e.g. silt)	potentially dusty soil type (e.g. clay)
Construction traffic total building volume	< 12 000 m^3	12 000 m^3 to 75 000 m^3	> 75 000 m^3
Total traffic outward heavy vehicles Movements per day	< 20	20 to 50	> 50

As outlined previously, no demolition activities are anticipated to be performed. The total earthworks area associated with the Proposal including excavation of cable trenches and preparation of roads and footings for expansion bays is anticipated to be less than 18 000 m^2 (refer Table B1). Open trenching is anticipated to comprise of a 2.1 km double circuit trench with a maximum surface width of 3.6 m which results in an estimated disturbance area of approximately 7 560 m^2 which corresponds to a small DEM in accordance with Table B1.

Construction of the HV cable route will involve installation within a single trench along the Lenore Drive road reserve. Works are anticipated to be completed in two staged sections, with trenching, conduit installation and backfilling carried out progressively to minimise the extent of open excavation and disruption to traffic. The trench will typically be up to 2 m wide and 2 m deep, increasing locally at service crossings. Prior to excavation, site preparation will include establishment of work areas, installation of environmental and traffic controls and non-destructive identification of existing utilities.

Horizontal Directional Drilling (HDD) is likely to be employed along Ropes Creek where open trenching is not feasible, involving excavation of launch and receival pits, drilling of a guided bore and installation of conduits via pullback. Following conduit installation, cables will be installed via joint bays along the route with cable pulling and jointing completed in stages. Excavation and construction of joint bays, including associated concrete pits for ancillary infrastructure will be required. Temporary and permanent restoration works will be completed progressively including reinstatement of road pavement and surrounding surfaces. Given the likely use of concrete, a conservative assumption of a medium DEM has been adopted (refer Table B1).

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 be between 20 to 50 movements (threshold for medium DEM for trackout [refer Table B1]). Traffic management measures, including staged lane closures and contraflow arrangements are to be implemented to maintain access and ensure safety, with detailed measures to be defined in the Construction Environmental Management Plan (CEMP). Based upon the above assumptions and the assessment criteria presented in Table B1, the DEMs are as presented in Table B2.

Table B2 Construction phase impact categorisation of dust emission magnitude (DEM)

Activity	Dust emission magnitude (DEM)
Demolition	N/A
Earthworks and enabling works	Small
Construction	Medium
Trackout	Medium
Construction traffic routes	Medium

Accordingly, for the purposes of a conservative assessment, any activities carried out within 250 m of the Proposal are considered to represent a *medium* emission magnitude.

Step 3 – Categorising Land Use Value

Individual receptor locations may be attributed different land use values based on specific land use, and may be classified as having low, medium or high 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 Table B3. It is noted that user expectations of amenity levels (dust soiling) are dependent on existing deposition levels.

Table B3 IAQM guidance for categorising land use value

Land use value	Low	Medium	High
Dust soiling	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics, or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of normal land use.	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 normal land use	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 normal land use
Examples	*Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*	*Parks and places of work.*	*Dwellings, museums, and other culturally important collections, medium- and long-term car parks and car showrooms*
Health impacts	Locations where human exposure is transient.	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for 8 hours or more).	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 8 hours or more).

Land use value	Low	Medium	High
Examples	*Public footpaths, playing fields, parks, and shopping street.*	*Office and shop workers but would generally not include workers occupationally exposed to PM_{10}.*	*Residential properties, hospitals, schools, and residential care homes.*

Specific to this assessment, each land use identified within the screening distance (refer Section 4.1) has been assigned a land use sensitivity as shown in Table B4.

As detailed in Section 2.1, the Proposal spans across two LGAs notably Penrith and Blacktown. It is noted that most of the cable route falls within land subject to the now-repealed State Environmental Planning Policy (SEPP) (Western Sydney Employment Area) 2009, which has been replaced by SEPP (Industry and Employment) 2021. The Industry and Employment SEPP 2021 are the primary planning instrument for these jurisdictions which means that land zoning is governed by this SEPP, although Penrith and Blacktown LEPs would still remain relevant for permissible uses and development consenting purposes. It is also noted that the Industry and Employment SEPP were amended in 2024 via the SEPP (Industry and Employment) Amendment (Western Sydney Employment Area) 2024 to enable updated mapping and support future development within specific parts of the Western Sydney Employment Area.

Figure B1 provides a map outlining the Industry and Employment SEPP areas. Correspondingly, sensitivity values for the surrounding land uses have been assigned based on the land uses permitted in each relevant zone, whether under the SEPP or the individual LEPs.

Under the Industry and Employment SEPP, land zoned IN1 General Industrial permits a variety of uses including small-scale local services such as commercial, retail and community facilities including childcare facilities which support employment-generating uses in the zone. Industrial areas are generally classified as having medium land-use sensitivity. The presence of a childcare facility within the area increases the sensitivity classification to high.

A review of the IN1 General Industrial land zoning within the 250 m screening distance confirms that no childcare facilities or schools are present within the assessed area surrounding the Proposal. On this basis, a medium land-use sensitivity classification has been applied to IN1 General Industrial zoned areas.

Table B4 Land use sensitivity surrounding the Proposal

Land use	Sensitivity value
C2 - Environmental Conservation	Low
IN1 - General Industrial	Medium
R2 – Low Density Residential	High
RE1 – Public Recreation	Low
SP2 - Infrastructure	Low

Step 4 - Risk Assessment (Pre-Mitigation)

The risk matrix developed from the combination of impact magnitude and land use sensitivity is presented in Table B5.

Table B5 Risk assessment matrix (Pre-mitigated DEM)

Land use sensitivity	Level of risk (Pre-mitigated DEM)			
	Negligible	Small	Medium	Large
Low	Negligible	Negligible	Low Risk	Low Risk
Medium	Negligible	Low Risk	Medium Risk	Medium Risk
High	Negligible	Low Risk	Medium Risk	High Risk

Given the land use sensitivities and DEMs identified for the Proposal, the resulting risk of air quality impacts (without mitigation) is as presented in Figure 8 (Section 6.1).

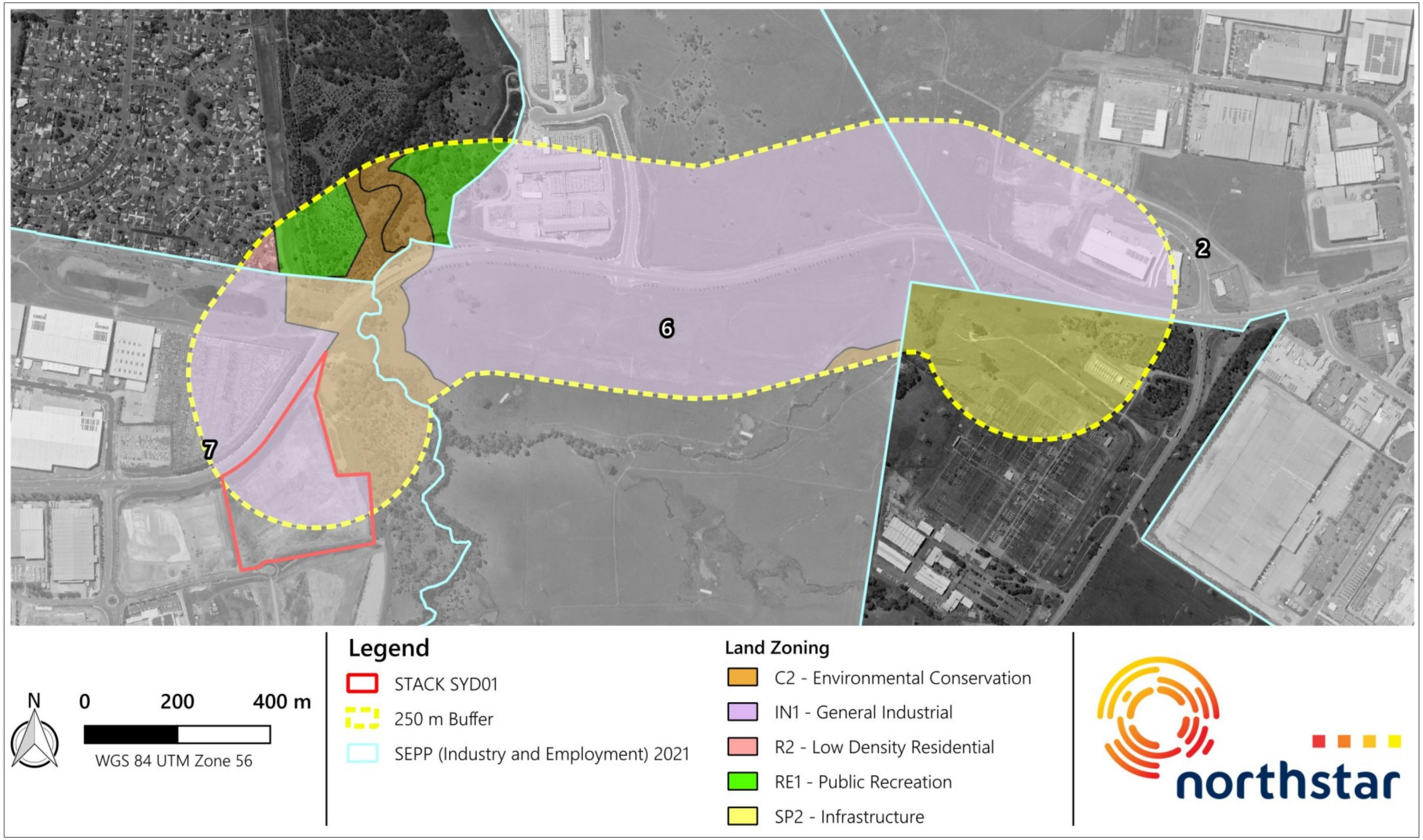
The preliminary risk assessment illustrated in Figure 8 indicates that with no mitigation measures there is a *low* to *medium* risk of human health and dust soiling (amenity) impacts associated with construction phase activities within 250 m of the proposed disturbance footprint. *Medium* risks are identified in land uses associated with R2 – Low Density Residential and IN1 General Industrial, given that those areas would include locations where people reside and work and therefore may be expected to be exposed to potential adverse air quality for eight hours or more per day (refer Table B3).

Figure 8 illustrates the distribution of construction risk along the 250 m buffer of the Proposal as it relates to adjacent land use categories. It shows that majority of the 250 m buffer intersects with land uses linked to *low* and *medium* risk from construction activities and none associated with *high* risk from construction activities.

Whilst it would be possible to apply low risk mitigation measures along the *low*-risk areas of the alignment, the application of a consistent set of controls across the entire alignment is preferable operationally, as it would ensure the CEMP is more easily adopted and followed by contractors.

Consequently, it is recommended that mitigation measures associated with *medium* risk sites be applied along the entire alignment to ensure construction dust will be adequately managed.

Figure B1 SEPP (Industry and Employment) 2021 Land Application



Source: Northstar

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 of *low*, *medium*, *or high* risk.

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).

The mitigation measures presented in Table B6 represents a selection of recommended mitigation measures recommended by the IAQM methodology (IAQM, 2024) for construction activities commensurate with the risks identified in Figure 8.

As previously stated, given that the Proposal intersects with areas associated with both *low* and *medium* risks to experiencing adverse air quality impacts, mitigation measures associated with *medium* risk construction activities have been recommended for the entire alignment to ensure that the CEMP can be more easily adopted and followed by contractors.

Note that these measures are wide-ranging and all may not be applicable to the construction works proposed. They should be reviewed prior to inclusion in any CEMP for the Proposal.

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, land use values surrounding the proposed alignments 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.

Table B6 Site-specific mitigation measures

	Identified mitigation measures	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 in a prominent location. 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 SA EPA and/or Department for Energy and Mining, 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	Conduct daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to SA EPA and/or Department for Energy and Mining, when requested.	D
3.2	Carry out regular site inspections to monitor compliance with the dust management plan / CEMP, record inspection results, and maintain an inspection log to be made available to SA EPA and/or Department for Energy and Mining, when requested.	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**	**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	Implement sediment and erosion controls along right(s) of way (ROW).	H
4.3	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

	Identified mitigation measures	Unmitigated risk
4.4	Cover, seed, or fence long term topsoil stockpiles where necessary 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.	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	Vehicles will comply with existing speed limits 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 SA EPA and/or Department for Energy and Mining, where appropriate).	D
5.5	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	N
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	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
6.4	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 earthworks**	**Medium**
8.1	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	D
9	**Measures specific to construction**	**Medium**
9.1	Avoid scabbling (roughening of concrete surfaces) if present (e.g., compressor station foundations).	D
9.2	Ensure sand and other aggregates are stored within areas where project erosion and sediment controls are in place, and that dust suppression measures are implemented were required to prevent excessive dust generation.	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

Identified mitigation measures		Unmitigated risk
9.4	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.	D
10	**Measures specific to trackout**	**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 the construction right(s) of way (CROW) and access tracks for integrity and complete maintenance, where required and as soon as reasonably practicable.	H
10.5	Install hardstand where practicable and implement measures such as watering down, where required.	H
10.6	Access gates to be located at least 10 m from receptors where possible.	H

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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.
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