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HumeLink

Air Quality Impact Assessment
EIS Technical Report 17

HUMELINK

EIS Technical Report 17 – Air Quality Impact Assessment

Prepared for Transgrid

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PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Tenancy 202 Submarine School, Sub Base Platypus, 120 High Street
North Sydney NSW 2060 Australia
T: +61 2 9427 8100
E: sydney@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Transgrid (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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EXECUTIVE SUMMARY

Background

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink.

HumeLink would connect to existing substations near Wagga Wagga and Bannaby. In addition, HumeLink would connect to a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500/330 kV substation), which is subject to a separate major project assessment and approval (reference SSI-9717, EPBC, 2018/836).

The project would support the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the Wagga Wagga and Tumut Renewable Energy Zones. The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the State's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

Furthermore, by connecting with major interconnectors, HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market (NEM). The NEM incorporates around 40,000 kilometres of transmission lines across Queensland, NSW, Australian Capital Territory, Victoria, South Australia and Tasmania.

Construction of the project is targeted to commence in 2024, subject to the required planning and regulatory approvals. Once construction has commenced, the project is estimated to take approximately 2.5 years to construct and become operational in 2026.

This report assesses the air quality impacts of HumeLink and addresses portions of the Planning Secretary's Environmental Assessment Requirements (SEARs), as described in **Section 1.4**.

Methodology

The methodology for the air quality impact assessment included the following:

- identification of relevant air pollutants
- review of the legislation and policy context related to air quality
- definition of the air quality study area and identification of sensitive receptors in the study area
- description of the existing environment based on analysis of meteorological and ambient air quality monitoring data, satellite images, National Pollutant Inventory and NSW Environment Protection Authority (NSW EPA) Environment Protection Licences (EPLs)
- qualitative assessment of dust emissions due to construction activities (that is, particulate matter including nuisance dust) applying the United Kingdom Institute of Air Quality Management's *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM Guidance)

EXECUTIVE SUMMARY

- risk-based assessment of impacts due to emissions of dust during operation and products of combustion during construction and operation
- cumulative impact assessment with respect to other approved projects within the vicinity of the project footprint
- recommendation of mitigation measures to minimise potential impacts on air quality.

Due to the size of the project footprint, the transmission line was split into six sections to allow the assessment to consider the proximity of sensitive receptors in further detail.

Impact assessment

The emphasis of the IAQM Guidance is on classifying the **risk** of dust impacts from a construction site based on the scale of the proposed work and sensitivity of the surrounding environment (with no mitigation measures applied) (refer to **Section 7.1**).

The **risk** of adverse effects occurring at the sensitive receptor locations if **no mitigation measures** were applied to control emissions were concluded to be as summarised in **Table ES-1**. This is considered to be a conservative approach as the major source of dust emissions related to construction of the transmission line would occur only where the structures are installed and would be short-term and temporary. There are likely to be many locations within each of these six sections where minimal (if any) dust-generating activities would occur and/or there are no sensitive receptors that could experience any adverse effects.

Mitigation measures were identified (refer to **Section 10.3**) to reduce the risk to acceptable levels such there is negligible risk of adverse air quality effects at the sensitive receptors.

Emissions due to dust emissions from operations, and products of combustion from vehicles and plant for both construction and operation were assessed using a qualitative risk-based assessment and shown to pose a negligible risk of adverse effects to air quality.

For the purposes of the assessment, it has been assumed that concrete batching plants would be located at least 100 metres from sensitive receptor(s), crushing and screening activities would be located at least 500 metres from sensitive receptor(s), and where diesel-fuelled generators are proposed for use at the construction compounds, a minimum separation distance of 500 metres to the nearest sensitive receptor(s) would be present.

EXECUTIVE SUMMARY

Table ES-1 Summary of dust risk without and with mitigation measures

Activity	Dust risk		Location
	No mitigation	With mitigation	
Construction of the transmission line	Low to High	Negligible	Referring to the following transmission line sections: • High: - Section 1: Wagga 330 kV substation to Wondalga - Section 4: Adjungbilly to Yass - Section 5: Yass to Roslyn • Medium: - Section 3: Wondalga to Adjungbilly - Section 6: Roslyn to Bannaby • Low: - Section 2: Wondalga to future Maragle 500 kV substation
Substations	Low	Negligible	All
Construction compounds and Tumbarumba accommodation facility (AC1)	Negligible	N/A	Snubba Road compound (C16) Honeysuckle Road compound (C07) Red Hill Road compound (C08) Maragle 500 kV compound (C05)
	Low	Negligible	All - with the exception of Snubba Road compound (C16), Honeysuckle Road compound (C07), Red Hill Road compound (C08) and Maragle 500 kV Compound (C05)

Mitigation measures

In tandem with outcomes of this assessment, Transgrid will draw on their extensive experience in the management of dust emissions for similar projects and the management of dust emissions and air quality management would be implemented through an Air Quality Management Plan (AQMP), which would include the following measures:

- potential sources of air pollution
- air quality management objectives consistent with any relevant published EPA and/or DPE guidelines
- mitigation and suppression measures to be implemented
- methods to manage work during strong winds or other adverse weather conditions
- a progressive rehabilitation strategy for exposed surfaces
- monitoring of air quality within the project footprint (if needed)
- methods for dealing with complaints.

CONTENTS

CONTENTS

CONTENTS

Attachments

CONTENTS

TABLES

CONTENTS

FIGURES

CONTENTS

GLOSSARY, ACRONYMS and ABBREVIATIONS

Abbreviation or term	Description
%	percentage
ACT	Australian Capital Territory
Air NEPM	National Environment Protection (Ambient Air Quality) Measure
AQMS	air quality monitoring station
BoM	Bureau of Meteorology
CO	carbon monoxide
DPE	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPL	Environmental Protection Licence
g	gram
ha	hectare
IAQM Guidance	United Kingdom Institute of Air Quality Management's *Guidance on the Assessment of Dust from Demolition and Construction* 2014
kg	kilogram
kL	kilolitre
km	kilometre
kV	kilovolt
L	litre
LGA	Local Government Area
m	metre
m^2	square metre
m/s	metres per second
mAHD	Metres Australian Height Datum
$\mu g/m^3$	micrograms per cubic metre
mm	millimetres
NEM	National Electricity Market
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
O_3	ozone
^oC	degrees Celsius
Pb	lead
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
POEO Act	*Protection of the Environment Operations Act 1997*
POEO (Clean Air) Regulation 2021	Protection of the Environment Operations (Clean Air) Regulation 2021
ppm	parts per million

GLOSSARY, ACRONYMS and ABBREVIATIONS

Abbreviation or term	Description
project footprint	The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
QLD	Queensland
REZ	Renewable Energy Zone
SA	South Australia
SEARs	Planning Secretary's Environmental Assessment Requirements
SO_2	sulfur dioxide
TAS	Tasmania
the Approved Methods	*NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2022)
TSP	total suspended particulate
VIC	Victoria
VOC	volatile organic compound

1 Introduction

1.1 Overview

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition, meet our future energy demands and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to evolve.

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley. The location of the project is shown on **Figure 1-1**.

HumeLink would involve construction of a new substation east of Wagga Wagga as well as connection to existing substations at Wagga Wagga and Bannaby and a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500 kV substation). The future Maragle 500 kV substation is subject to a separate major project assessment and approval (reference SSI-9717, EPBC 2018/836).

The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the Wagga Wagga and Tumut Renewable Energy Zones (REZs). The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the State's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

Furthermore, HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market (NEM) by connecting with other major interconnectors. The NEM incorporates around 40,000 kilometres of transmission lines across Queensland (QLD), NSW, Australian Capital Territory (ACT), Victoria (VIC), South Australia (SA) and Tasmania (TAS).

Construction of the project is targeted to commence in 2024, subject to the required planning and regulatory approvals. Once construction has commenced, the project is estimated to take approximately 2.5 years to build and would become operational by the end of 2026.

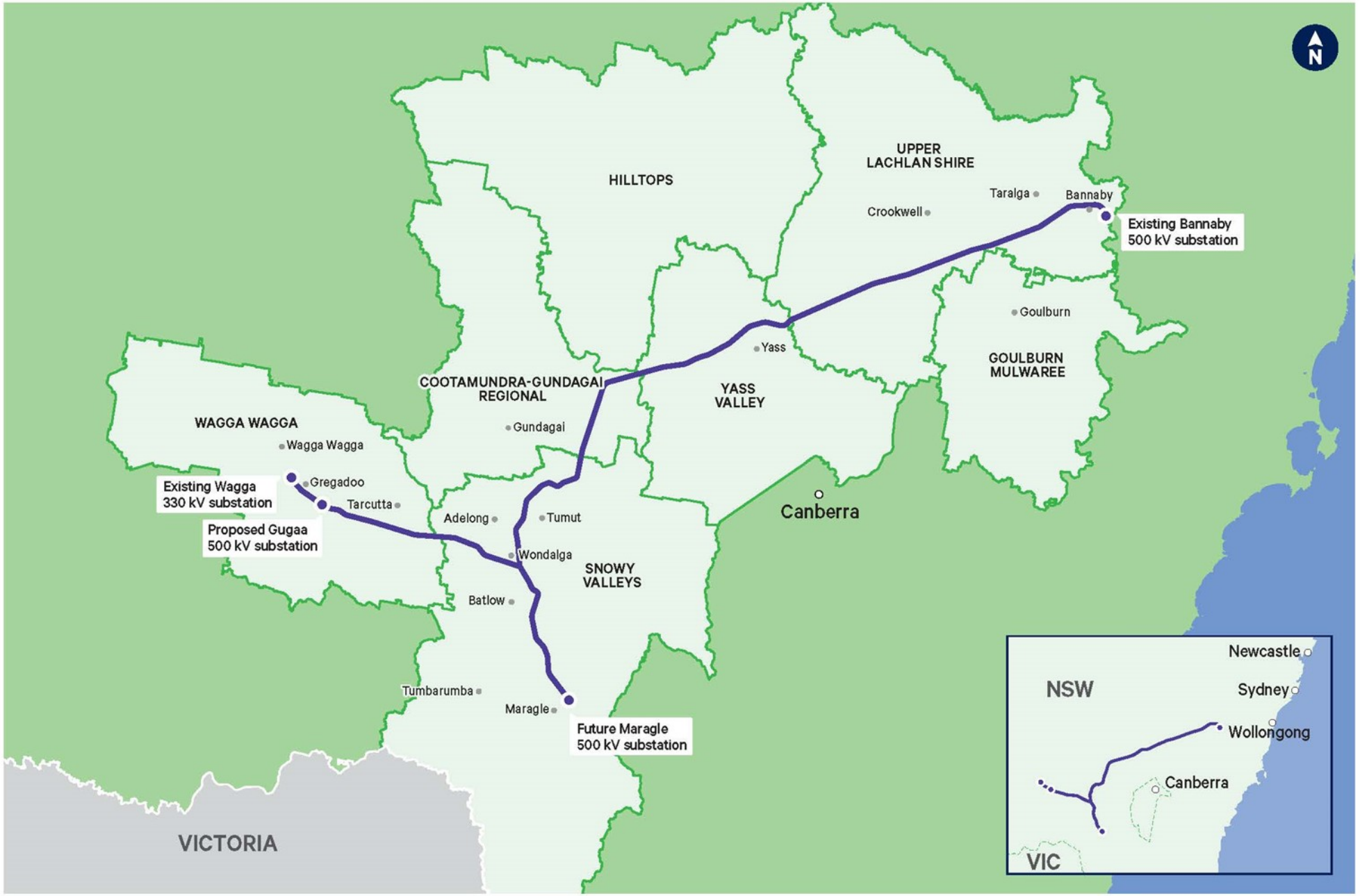
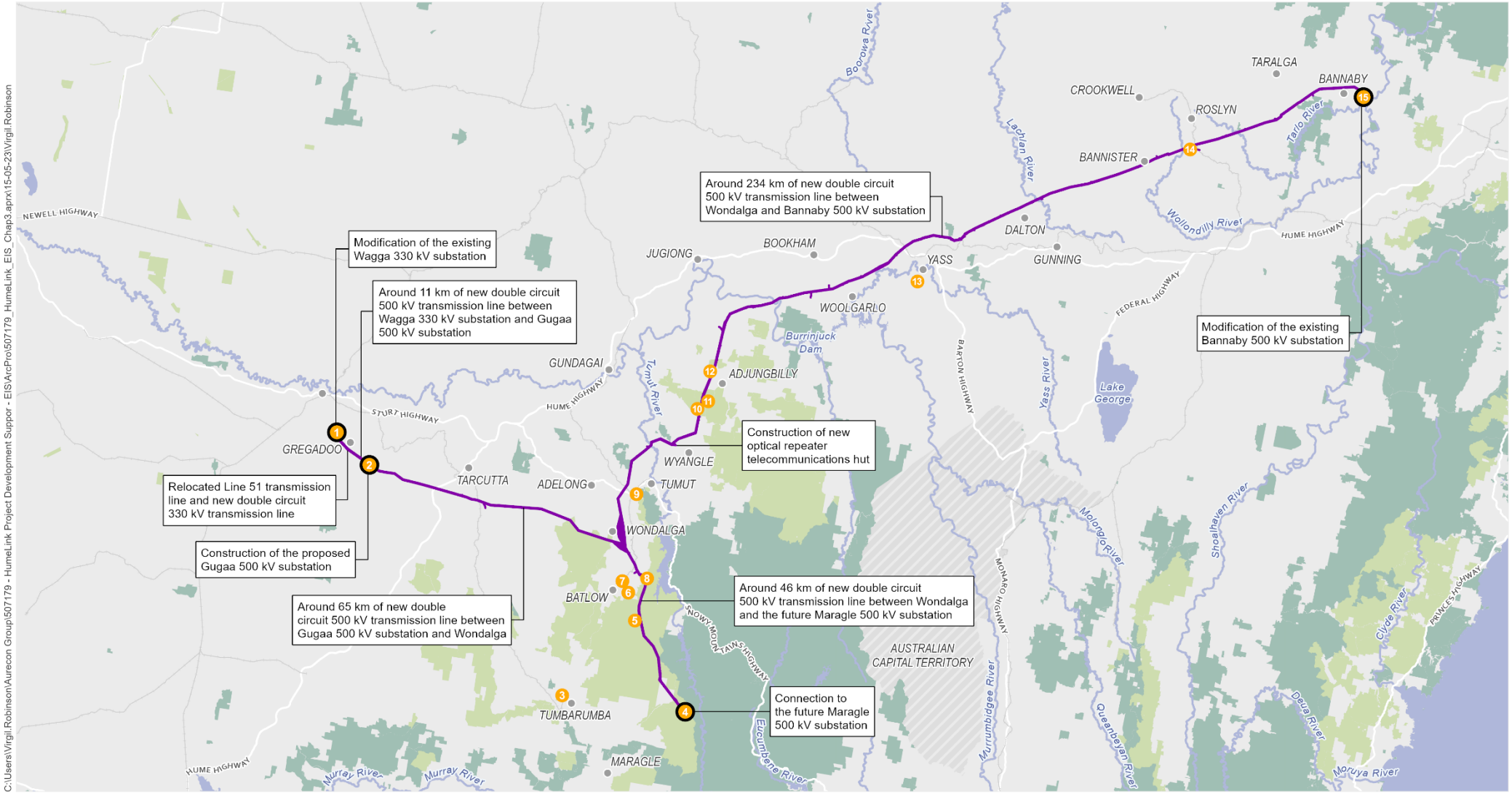


Figure 1-1 Location of the project

1.2 Key components

The project includes the following key components (refer to **Figure 1-2**):

- construction and operation of around 360 kilometres of new double circuit 500 kV transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle
- construction of a new 500/330 kV substation at Gregadoo (Gugaa 500 kV substation) approximately 11 kilometres south-east of the existing Wagga 330/132 kV substation (Wagga 330 kV substation)
- demolition and rebuild of a section of Line 51 (around two kilometres in length) as a double circuit 330 kV transmission line connecting into the Wagga 330 kV substation
- modification of the existing Wagga 330 kV substation and Bannaby 500/330 kV substation (Bannaby 500 kV substation) to accommodate the new transmission line connections
- connection of transmission lines to the future Maragle 500/330 kV substation (Maragle 500 kV substation, approved under the Snowy 2.0 Transmission Connection Project (SSI-9717))
- provision of one optical repeater telecommunications hut and associated connections to existing local electrical infrastructure
- establishment of new and/or upgraded temporary and permanent access tracks
- ancillary works required for construction of the project such as construction compounds, worker accommodation facilities, utility connections and/or relocations, brake and winch sites, and helipad/helicopter support facilities.



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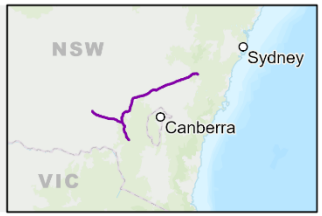
Project footprint
National park and reserve
State forest
Waterbody
Waterway
Major road
Railway
Substation location

Construction ancillary facilities

1. Wagga 330 kV substation compound (C01)
2. Gregadoo Road compound (C06)
3. Tumbarumba accommodation facility (AC1)
4. Maragle 500 kV substation compound (C05)
5. Snubba Road compound (C16)
6. Bowmans Lane compound (C15)
7. Memorial Avenue compound (C14)
8. Snubba Road compound (C03)
9. Snowy Mountains Highway compound (C02)
10. Honeysuckle Road compound (C07)
11. Red Hill Road compound (C08)
12. Adjungbilly Road compound (C09)
13. Yass substation compound (C10)
14. Woodhouselee Road compound (C11)
15. Bannaby 500 kV substation compound (C12)



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000
0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 1-2: Key components of the project

1.3 Purpose and scope of this report

The purpose of this technical report is to assess the potential air quality impacts from construction and operation of the project to support the Environmental Impact Statement (EIS) being completed for the project in accordance with Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

The report:

- outlines the key legislative requirements and policy guidelines relating to the project
- outlines the methodology used to assess the air quality impacts
- describes the existing environment, including topography, climate, current ambient air quality and location of sensitive receptors in relation to the project
- assesses the impact of the project on air quality in the study area using a risk-based approach
- identifies mitigation and management measures to minimise potential air quality impacts.

1.4 Secretary's environmental assessment requirements

The NSW Department of Planning and Environment (DPE) provided the Planning Secretary's Environmental Assessment Requirements (SEARs) for the EIS on 14 March 2022 (Application Number: SSI-36656827). The requirements specific to this air quality impact assessment, and where these aspects are addressed in this technical report are outlined in **Table 1-1**.

Table 1-1 Secretary's environmental assessment requirements for air quality

Key issue	SEARs requirement	Where addressed
Air	An assessment of the air quality impacts of the project.	**Chapter 7** (Construction) **Chapter 8** (Operation)

1.5 Structure of this report

The structure and content of this report is as follows:

- **Chapter 1 – Introduction** outlines the background and need for the project, and the purpose and structure of this report.
- **Chapter 2 – Project description summary** describes the key components of the project.
- **Chapter 3 – Air pollutants of concern** identifies the key air pollutants of concern.
- **Chapter 4 – Legislative and policy context** provides an outline of the key legislative requirements and policy guidelines relating to air emissions from the project.
- **Chapter 5 – Methodology** provides an outline of the methodology used to assess the potential air quality impacts.
- **Chapter 6 – Existing environment** describes the existing topography, climate and ambient air quality.
- **Chapter 7 – Construction impacts** assesses the potential air quality impacts associated with the construction of the project.
- **Chapter 8 – Operational impacts** assesses the potential air quality impacts associated with the operation of the project.

- **Chapter 9 – Cumulative impacts** assess the potential for cumulative air quality impacts with respect to known future developments within the vicinity of the project.
- **Chapter 10 – Management of impacts** identifies the mitigation measures to be adopted to manage air quality impacts from the project.
- **Chapter 11 – Conclusion** provides a conclusion of the potential impacts of the project on air quality.
- **Chapter 12 – References** identifies the reports and documents referenced in performing the assessment and preparing this report.

The following attachments also form part of this report:

- **Attachment A**: Climate Plots.

1.6 Key project terms

The key project terms used in this report relevant to the air quality assessment of the project are as follows:

- Project footprint: The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
- Air quality study area: The air quality study area comprises a 350 metre and 500 metre buffer around the project footprint.

2 Project description summary

The project description in this chapter is based on a concept design and indicative construction methodology for the project. The design and construction methodology would continue to be refined and confirmed during detailed design and construction planning by the construction contractors. Further details on the project are provided in Chapters 3 and 4 of the EIS.

2.1 Summary of key components of the project

Key components of the project are summarised in **Table 2-1** while **Figure 2-1** illustrates an indicative transmission line structure.

Table 2-1 Summary of key components of the project

Component	Description
Transmission lines and supporting infrastructure	
Transmission lines and structures	The project includes the construction of 500 kV transmission line sections between: - Wagga 330 kV substation and Gugaa 500 kV substation (approximately 11 km) - Gugaa 500 kV substation and Wondalga (approximately 65 km) - Wondalga and Maragle 500 kV substation (approximately 46 km) - Wondalga and Bannaby 500 kV substation (approximately 234 km). The transmission line section between the Wagga 330 kV substation and proposed Gugaa 500 kV substation would operate at 330 kV under HumeLink. The project also includes the rebuild of approximately 2 km of Line 51 as a new 330 kV transmission line between the Wagga 330 kV substation and around Ivydale Road, Gregadoo. This would be adjacent to the new transmission line between the existing Wagga 330 kV and proposed Gugaa 500 kV substations. The 500 kV transmission lines would be supported on a series of free-standing steel lattice structures that would range between around 50 m up to a maximum of 76 m in height and generally spaced between 300 to 600 m apart. The typical transmission line structure height would be around 60 m. Earth wire and communications cables would be co-located on the transmission line structures. The 330 kV structures for the rebuild of Line 51 would range between 24 m and 50 m in height and have a typical height of 40 m. Indicative configurations of transmission line structures that may be used as part of the project are shown in **Figure 2-1**. The type and arrangement of the structures would be refined during detailed design. The footings of each structure would require an area of up to 300 m^2 to 450 m^2, depending on ground conditions and the proposed structure type. Additional disturbance at each structure site may be required to facilitate structure assembly and stringing.

Component	Description
Transmission line easements	The easements for the 500 kV transmission lines are typically 70 m wide. However, a number of locations may require wider easements of up to 110 m wide at transposition locations[1] and up to 130 m wide where the new transmission line would parallel the relocated section of Line 51. The easement provides a right of access to construct, maintain and operate the transmission line and other operational assets. The easement also generally identifies the zone of initial vegetation clearance and ongoing vegetation management to ensure safe electrical clearances during the operation of the lines. Vegetation management beyond the easement may also occur where nearby trees have the potential to fall and breach safety clearances.
Telecommunications hut	Telecommunications huts, which contain optical repeaters, would be required to boost the signal in the optical fibre ground wire (OPGW). One telecommunications hut would be required for the project. The telecommunications hut would be located adjacent to existing transmission line structures. Cables would be installed between the transmission line structure and the local power supply. The telecommunications hut would be surrounded by a security fence. A new easement would be established for the telecommunications hut power connection. The project also involves a telecommunications connection of OPGW between two proposed transmission line structures and the future Rye Park Wind Farm substation (SSD-6693). This removes the need for an additional telecommunications hut in this area of the project.
Substation activities	
Construction of the proposed Gugaa 500 kV substation	A new 500/330 kV substation would be constructed at Gregadoo, about 11 km south-east of the Wagga 330 kV substation. The substation would include seven new 500/330 kV transformers and three 500 kV reactors. The proposed Gugaa 500 kV substation is expected to occupy an area of approximately 22 ha.
Modification of the existing Bannaby 500 kV substation	The existing Bannaby 500 kV substation on Hanworth Road, Bannaby would be expanded to accommodate connections for new 500 kV transmission line circuits. The modification would include changes to the busbars, line bays, bench and associated earthworks, steelwork, drainage, external fence, internal/external substation roads, secondary containment dams, sediment containment dams, cabling, and secondary systems. All of the work would be restricted to the existing substation property.
Modification of the existing Wagga 330 kV substation	The existing Wagga 330 kV substation on Ashfords Road, Gregadoo would be reconfigured to accommodate new bays for two new 500 kV transmission line circuits within the existing substation property. This would include modifications to the busbars, line bays, existing line connections, bench and associated earthworks, relocation of existing high voltage equipment, drainage, external fence, internal substation roads, steelwork, cabling, and secondary systems.
Connection to the future Maragle 500 kV substation	The project would connect to the future Maragle 500 kV substation approved under the Snowy 2.0 Transmission Connection Project (SS1-9717). Construction of the Maragle substation is proposed to be undertaken between 2023 and 2026. Further detail on the Snowy 2.0 Transmission Connection project is available at the Department of Planning and Environment's Major Projects website: www.planningportal.nsw.gov.au/major-projects/project/10591. kV

[1] Transposition is the periodic swapping of positions of the conductors of a transmission line in order to improve transmission reliability.

Component	Description
Ancillary facilities	
Access tracks	Access to the transmission line structures and the substations would be required during construction and operation. Wherever possible, existing roads, tracks and other existing disturbed areas would be used to minimise vegetation clearing or disturbance. Upgrades to existing access tracks may be required. In areas where there are no existing roads or tracks, suitable access would be constructed. This may include waterway crossings.
Construction compounds	Construction compounds would be required during construction to support staging and equipment laydown, concrete batching, temporary storage of materials, plant and equipment and worker parking required to construct the various elements of the project. Fourteen potential construction compound locations have been identified. The proposed use of the construction compounds and their proposed boundaries/layout would be refined as the project design develops in consultation with relevant stakeholders and the construction contractors.
Worker accommodation	Existing accommodation facilities within towns adjacent to the project would provide temporary accommodation for the majority of the construction workers. However, a potential shortage in accommodation has been identified close to the project footprint. A potential option to provide additional temporary worker accommodation during the construction period is the establishment of a temporary worker accommodation facility at the corner of Courabyra Road and Alfred Street, Tumbarumba to accommodate about 200 construction workers. The worker accommodation facility would consist of demountable cabins and would be connected to existing utilities. All required amenities for the accommodation facility would be provided including services and worker parking for light and heavy vehicles. However, the ultimate delivery of the project may include multiple temporary worker accommodation facilities in various forms, which would be outlined in the Worker Accommodation Strategy for the project. The strategy will be developed in consultation with councils, and other relevant stakeholders. Any new or changed worker accommodation facility would be subject to additional environmental assessment, as required.
Helipad/helicopter facilities	To facilitate construction of the project, helicopters may be used to deliver materials/equipment and transfer personnel to construction areas particularly within high alpine regions. To enable helicopters to operate safely and allow easy access to the site, a helicopter landing pad would be required. The helipad is expected to occupy an area of around 30 m by 30 m and would be remediated after construction. These areas would typically be located on existing disturbed land not subject to inundation and a reasonable distance from waterways, sensitive receivers and drainage lines. Eight locations have been identified and assessed as potential helipad locations. The exact locations to be used would be confirmed during detailed design by the construction contractors. In addition to this, the existing facilities at the Wagga Wagga Airport and Tumut Airport may be used.
Utility connections, adjustments and protection	The project would require utility connections, adjustments and protection. Such works include interfaces with other transmission lines and connections to existing services for temporary facilities. Potential impacts to existing services and utilities would be confirmed during detailed design and any proposed relocation and/or protection works would be determined in consultation with the relevant asset owners.

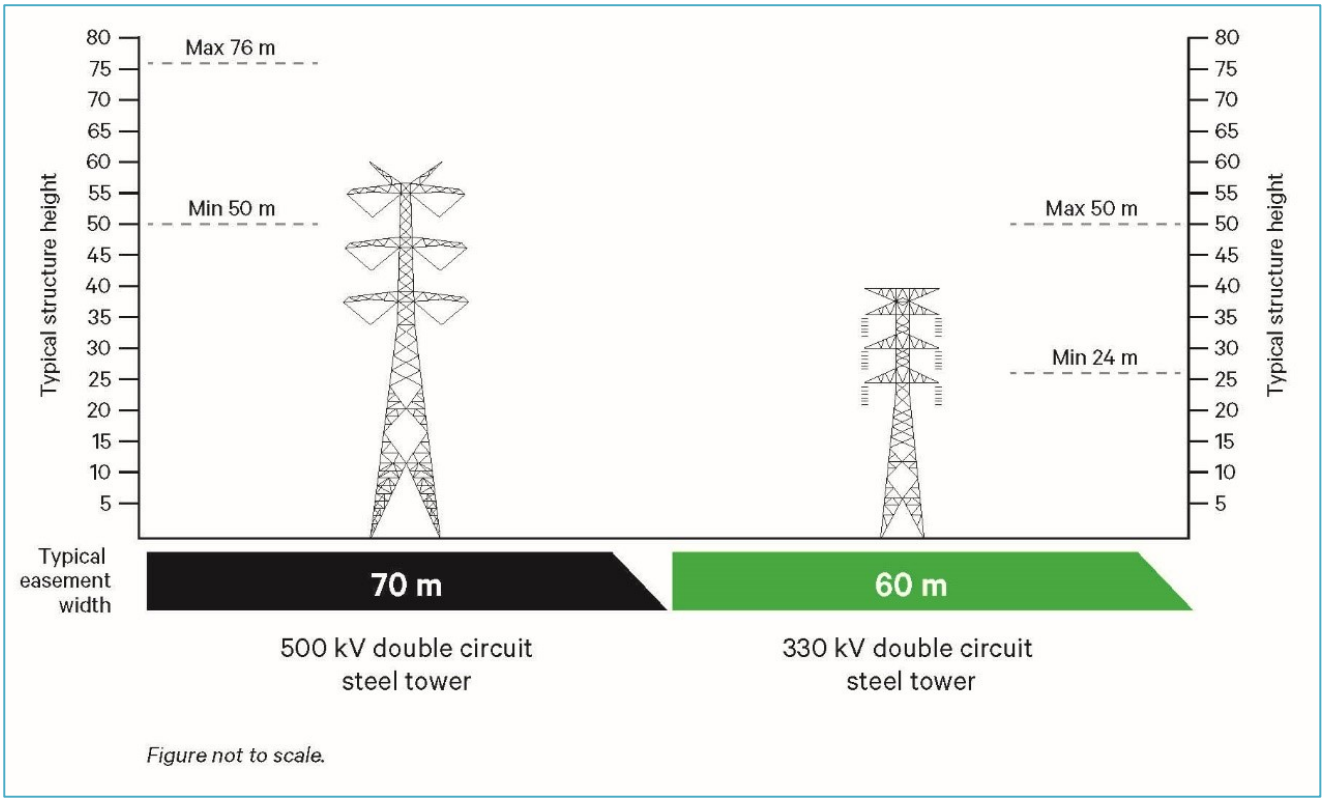


Figure 2-1 Indicative transmission line structures

2.2 Construction of the project

2.2.1 Construction activities

Key construction activities would generally include (but are not limited to):

- site establishment works, such as:
  - clearing of vegetation and topsoil
  - establishment of construction compounds and helipad/helicopter facilities
  - utility relocations and/or adjustments
  - construction of new access tracks and waterway crossings and/or upgrade of existing access tracks to transmission line structures
  - road improvement works
  - establishment of environmental management measures and security fencing
  - construction of temporary worker accommodation
- construction of the transmission lines, including:
  - earthworks and establishment of construction benches and brake and winch sites for each transmission line structure
  - construction of footings and foundation work for the new transmission line structures including boring and/or excavation, steel fabrication works and concrete pours
  - erection of the new transmission line structures

- stringing of conductors, overhead earth wires and OPGW
- installation of associated transmission line structure fittings inclusive of all earthing below ground level

- relocation of a section of Line 51, including:
  - demolition of the existing section of Line 51
  - erection of new transmission line structures for the rebuild of Line 51 in a new location
  - stringing of conductors, overhead earth wires and OPGW
  - installation of associated transmission line structure fittings inclusive of all earthing below ground level
- construction of the proposed Gugaa 500 kV substation, including:
  - bulk earthworks to form the substation bench, access roads, drainage and oil containment structures
  - installation of concrete foundations, bund walls, fire walls, noise walls and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment work and associated concrete pits, pipes and tanks including excavation
  - installation of new ancillary and equipment control buildings
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - erection of the substation site boundary security fencing, including site access gates
  - connection of the proposed transmission lines to the substation
- modification of the existing Wagga 330 kV substation to enable the proposed connection and operation of the new transmission lines, including:
  - demolition and removal of redundant electrical equipment, fencing and cabling
  - bulk earthworks to form the extended substation bench and modified drainage structures
  - installation of concrete foundations and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of electrical conduits, electrical trenches, and modified site stormwater drainage including excavation
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - installation of fencing, lighting and other security features
  - testing and commissioning

  - connection of the proposed transmission lines to the substation
- modification of the existing Bannaby 500 kV substation to enable the proposed connection and operation of the new transmission lines, including:
  - bulk earthworks to form the extended substation bench, new access road, modified stormwater drainage, modified oil containment and modified sediment control structures
  - installation of concrete foundations, retaining walls, bund walls, fire walls and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment works and associated concrete pits, pipes and tanks including excavation
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - installation of fencing, lighting and other security features
  - demolish redundant fencing including footings and kerbs
  - testing and commissioning
  - connection of the proposed transmission lines to the substation
- connection of the proposed transmission lines to the future Maragle 500 kV substation, including:
  - stringing conductors between transmission line structures and the future Maragle 500 kV substation gantry (including overhead earth wire (OHEW) and OPGW)
  - installing droppers from the future substation gantry to the switchgear
- construction of the telecommunications hut, including:
  - bulk earthworks to form the pad for the hut
  - excavation and preparation for concrete foundations
  - installation of reinforced concrete and piled foundations
  - excavation and installation of electrical equipment conduits, trenches and general site drainage work
  - installation of the building, site wiring and electrical equipment
  - installation of security fencing and site access gates
  - excavation and installation of electrical equipment conduits, trenches and general site drainage works
  - installation of the building, site wiring and electrical equipment
  - installation of security fencing and site access gates
- installation of buried cabling from the 500 kV transmission line structures to Rye Park Wind Farm substation
- testing and commissioning of new electrical infrastructure
- demobilisation and rehabilitation of areas disturbed by construction activities.

A number of activities are expected to commence in accordance with the project conditions of approval before the key construction activities outlined above. These activities are considered pre-construction minor work and would comprise low impact activities that would begin after planning approval but prior to approval of the Construction Environmental Management Plan.

The indicative earthwork volumes for the project are presented in **Table 2-2**.

Table 2-2 Indicative earthworks volumes

Site	Indicative cut volume (cubic metres)	Indicative fill volume (cubic metres)
Wagga 330 kV substation	5,020	410
Gugaa 500 kV substation	339,430	280,110
Bannaby 500 kV substation	37,990	22,060
Transmission line – construction of structures, telecommunications hut and associated construction compound establishment	60,000	Nil
Transmission line – construction of access tracks	223,590	115,690
Total	**666,030**	**418,270**

2.2.2 Construction program

Construction of the project is targeted to commence in 2024 and is estimated to take about 2.5 years to complete. The project is expected to be fully operational by the end of 2026 (refer to **Figure 2-2**).

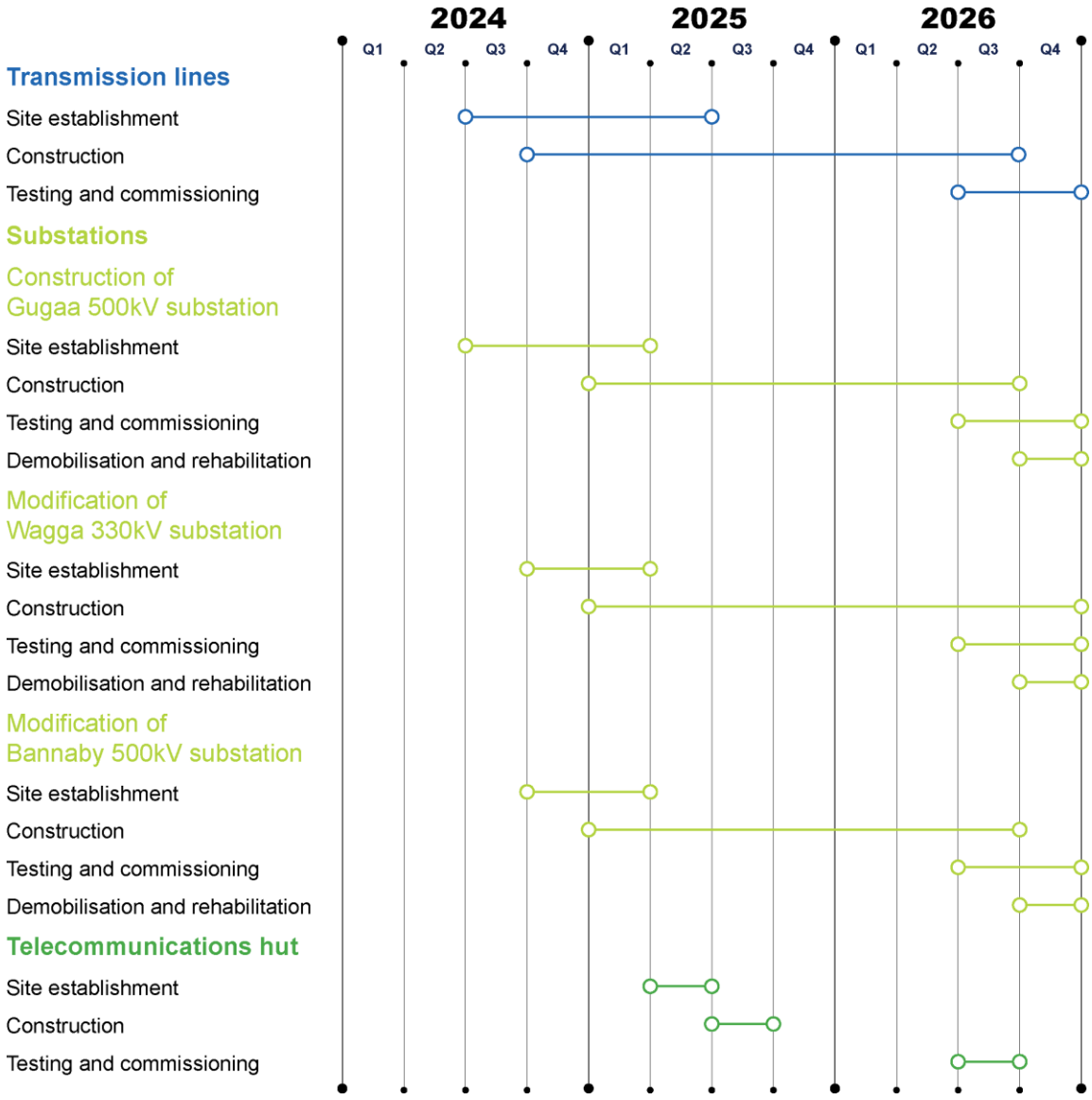


Figure 2-2: HumeLink indicative construction program

Indicative duration of construction activities

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Durations of any particular construction activity, and inactive/respite periods, may vary for a number of reasons including (but not limited to):

- multiple work fronts
- resource and engineering constraints
- works sequencing and location.

Figure 2-3 presents an indicative duration of construction activities associated with an individual transmission line structure.

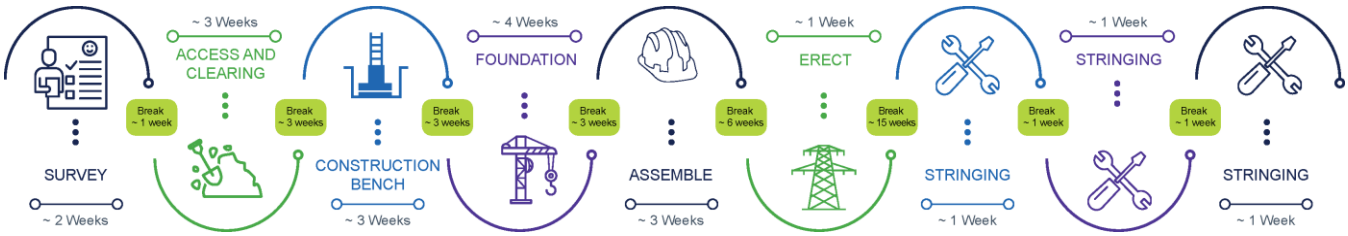


Figure 2-3: Indicative duration and sequence of construction activities for transmission line structures

Construction of the proposed Gugaa 500 kV substation could take up to 2.5 years.

2.2.3 Construction hours

It is expected that construction activities would largely be undertaken during standard construction hours. However, there would be times when working outside of standard construction hours would be required (as defined by the *Interim Construction Noise Guideline* (DECC, 2009)), subject to approval. As the details of construction methodology and project needs are developed, these hours will be refined for certain activities.

Where extended hours are proposed for activities in proximity to sensitive receivers, additional measures would be implemented, and the work would be managed through an out-of-hours work protocol.

A series of work outside the standard construction hours is anticipated to include (but is not limited to) the following:

- transmission line construction at crossings of a main road or railway as these locations are expected to have restricted construction hours requiring some night work for activities such as conductor stringing over the crossing(s)
- work where a road occupancy licence (or similar) is required, depending on licence conditions
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- limited substation assembly work (eg oil filling of the transformers)
- connection of the new assets to existing assets under outage conditions (eg modification and/or connection work at Bannaby 500 kV substation, Wagga 330 kV substation and Maragle 500 kV substation), which is likely to require longer working hours
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages
- situations where agreement is reached with affected sensitive receivers
- activities that do not generate noise in excess of the applicable noise management level at any sensitive receiver.

2.2.4 Construction plant and equipment

An indicative list of construction plant and equipment likely to be required during construction is provided below.

- air compressors
- backhoe
- bobcat
- bulldozers
- concrete agitator
- concrete pump
- cranes (various sizes up to 400 tonnes)
- crawler crane with grab attachments
- drill and blast units and associated support plant/equipment
- drones
- dumper trucks
- elevated work platform
- excavators (various sizes)
- flatbed Hiab truck
- fuel trucks
- generators
- graders
- helicopter and associated support plant/equipment
- mulchers
- piling rig
- pneumatic jackhammers
- rigid tippers
- rollers (10-15 and 12-15 tonne)
- semi-trailers
- tilt tray trucks
- trenchers
- transport trucks
- watercarts
- winches.

2.2.5 Construction traffic

Construction vehicle movements would comprise vehicles transporting equipment, waste, materials and spoil, as well as workers' vehicles. A larger number of heavy vehicles would be required during the main civil construction work associated with the substations. Non-standard or oversized loads would also be required for the substation work (eg for transformer transport) and transportation of transmission line structure materials and conductors.

Hume Highway, Sturt Highway, Snowy Mountains Highway, Batlow Road and Gocup Road are the main national and state roads proposed to provide access to the project footprint. These roads would be supported by regional and local roads throughout the LGAs of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional and Upper Lachlan Shire that connect to the project footprint.

2.2.6 Construction workers

The construction worker numbers would vary depending on the stage of construction and associated activities. During peak construction activities, the project could employ up to 1,200 full-time equivalent construction workers across multiple work fronts. It is expected that the maximum number of construction workers at any one location would not exceed 200.

2.2.7 Testing and Commissioning

Prior to energisation of the infrastructure, a series of pre-commissioning activities would be conducted. This would include testing the new transmission lines and substation earthing, primary and secondary equipment.

2.2.8 Demobilisation and rehabilitation

Demobilisation and site rehabilitation would be undertaken progressively throughout the project footprint and would include the following typical activities:

- demobilisation of construction compounds and worker accommodation facility
- removal of materials, waste and redundant structures not required during operation of the project
- removal of temporary fencing and environmental controls.

2.3 Operation and maintenance of the project

The design life of the project is 50 years, which can be extended to more than 70 years for some assets.

The substations and transmission lines would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). The project would require about five workers (in addition to Transgrid's existing workers) during operation for ongoing maintenance activities. Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment
- general building, asset protection zone and access road/track
- vegetation clearing/trimming within the easement
- fire detection system inspection and maintenance
- stormwater drainage systems maintenance.

It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the work required).

3 Identification of air pollutants of concern

In order to identify the relevant legislative criteria and assessment methodologies, it is necessary to first identify the air pollutants of concern and associated emission sources.

Emissions to air likely to be generated during construction and operation of the project, and the associated key pollutants of interest for the project, have been identified in **Section 3.1** to **Section 3.5** and summarised in **Table 3-1**.

3.1 Dust

Dust generated by construction activities (nuisance impacts):

- Fugitive dust generated by the construction activities outlined at **Section 2.2.1** needs to be considered, mainly in relation to deposited dust. This deposited dust can cause nuisance by settling on surfaces and possessions, affecting visibility and contaminating tank water supplies. High rates of dust deposition can also adversely affect vegetation by blanketing leaf surfaces.
- There is also potential that crushing, and screening activities may occur at some locations during construction, which would also be a potential source of fugitive dust. The locations and scale of these activities would be confirmed once the construction contractors are engaged.
- During operation, fugitive dust emissions are expected to be minimal.

3.2 Suspended particulate matter

Suspended particulate matter from vehicle movements during construction and operation:

- Suspended particulate matter refers to a category of airborne particles, typically less than 30 microns (µm) in diameter, which is referred to in air quality assessments as total suspended particulate (TSP). Particulate matter with an aerodynamic diameter of 10 µm or less is referred to as PM_{10}. The PM_{10} size fraction is sufficiently small to penetrate the airways of the lungs. $PM_{2.5}$ (2.5 µm or less) particulates are generally small enough to be drawn in and deposited into the deepest portions of the lungs. The finer $PM_{2.5}$ size fraction is mostly generated by combustion processes (including vehicle engines), while PM_{10} is more often associated with mechanical processes, including those undertaken at construction sites, such as excavation, loading/unloading soils, wheel-generated dust, wind erosion etc. The incomplete combustion of fuel in diesel powered vehicles can generate particulate in the form of black soot.
- Potential adverse health impacts associated with exposure to elevated levels of $PM_{2.5}$ and PM_{10} include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

3.3 Gaseous products of combustion

Gaseous emissions associated with both construction and operation from the combustion of fossil fuels (diesel, petrol, LPG etc) in vehicles, helicopters and generators include carbon monoxide (CO), oxides of nitrogen (NO_x), sulfur dioxide (SO_2) and volatile organic compounds (VOCs). A summary of the key sources of each is given below:

- CO is an odourless, colourless gas formed from the incomplete burning of fuels in motor vehicles. It can be a common pollutant at the roadside and highest concentrations are found at the kerbside with concentrations decreasing rapidly with increasing distance from the road. CO in urban areas results almost entirely from vehicle emissions and its spatial distribution follows that of traffic flow.
- NO_X is a general term used to describe any mixture of nitrogen oxides formed during combustion. In atmospheric chemistry, NO_X generally refers to the total concentration of nitric oxide (NO) and NO_2. NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO is converted to NO_2 soon after leaving the engine exhaust.
- Engine exhausts can contain emissions of SO_2 due to impurities in the fuel. The sulfur content in diesel fuel has significantly reduced over the years and consequently ambient SO_2 concentrations in Australian cities are typically well below regulatory criteria.
- VOCs may be emitted as a result of the incomplete combustion of fuel. VOC concentrations in urban areas are reducing significantly due to the improved combustion processes offered by modern engines.

3.4 Other VOCs

VOCs from equipment refuelling, fuel storage, and the use and storage of oils, greases and cleaning solvents:

- The use of oils, greases and cleaning liquids are all anticipated to be minor activities on site during both construction and operation, and as such do not need further assessment. Fuel storage and refuelling areas used during the project construction would be located away from sensitive receptor locations and would also have no potential for air quality impacts. These emissions have therefore not been considered further in this assessment.

3.5 Odour

Odours from the use of chemicals and storage of fuel and other products on site:

- It is understood that no significant quantities of odorous chemicals or VOCs (which can be potentially odorous) would be stored or used on site during either construction or operation. As such, any minor odours associate with the use of chemical and fuels have not been considered further in this assessment.

Odours from wastewater treatment facilities:

- The temporary Tumbarumba accommodation facility (AC1) would be connected to the sewerage system and no onsite septic system is proposed. The need for other wastewater treatment facilities would be confirmed during the detailed design stage by the construction contractor.

- However, should wastewater treatment facilities be required as part of the project, appropriate siting and design of these systems can be expected to enable any localised odour impacts to be managed/mitigated so that adverse amenity impacts at sensitive receptor locations do not occur and as such these have not been considered further in this assessment.

Table 3-1 Air pollutants of concern

Project activity	Emission source	Emission Type
CONSTRUCTION[a]		
Land clearing and bulk earthworks	Emissions associated with cut and fill activities for land clearing and bulk earthworks, including dozers, excavators and wheel-generated dust	Dust
	Emissions from diesel combustion in mobile plant used for land clearing and bulk earthworks	Products of combustion
	Emissions from diesel combustion in power generation (generators) for construction compounds	Products of combustion
Vehicle movements transporting staff and equipment	Emissions from diesel combustion in light vehicles, trucks, etc within the study area	Products of combustion
OPERATION		
Vehicle movements transporting staff and equipment	Emissions from wheel-generated dust on unpaved roads generated during routine inspection, maintenance or emergency	Dust
	Emissions from diesel and petrol combustion in light and heavy vehicles for maintenance activities[b]	Products of combustion

Note:

(a) Odours from wastewater treatment have been excluded as a minor source.

(b) The use of avgas in helicopters for aerial surveys has been excluded as a minor source.

4 Legislative and policy context

4.1 Commonwealth

4.1.1 National Environment Protection Council Act 1994

The National Environment Protection Council (NEPC) was established under the *National Environment Protection Council Act 1994* (NEPC Act). The primary functions of the NEPC are to:

- to prepare National Environment Protection Measures (NEPMs)
- to assess and report on the implementation and effectiveness of the NEPMs in each state and territory.

NEPMs are a special set of national objectives designed to assist in protecting or managing aspects of the environment eg air quality.

The NEPM relevant to air quality for the project is:

- *National Environment Protection (Ambient Air Quality) Measure 2021*.

4.1.1.1 National Environment Protection (Air Quality) Measure

The *National Environment Protection (Ambient Air Quality) Measure* (NEPC, 2021) (Air NEPM) contains standards for key pollutants that are required to be achieved nationwide, with due regard to population exposure, which are designed to protect human health and wellbeing. Air NEPM standards apply at performance monitoring locations, with each station located in such a manner that it obtains a representative measure of air quality likely to be experienced by the general population in a region or sub-region of 25,000 people or more.

The Air NEPM include air quality standards and performance monitoring goals for the following key air pollutants:

- carbon monoxide (CO)
- lead (Pb)
- nitrogen dioxide (NO_2)
- particulate matter with an aerodynamic equivalent diameter of 10 microns or less (PM_{10})
- particulate matter with an aerodynamic equivalent diameter of 2.5 microns or less ($PM_{2.5}$)
- photochemical oxidants, as ozone (O_3)
- sulfur dioxide (SO_2).

The Air NEPM air quality standards are provided in **Table 4-1**.

Table 4-1 Air NEPM Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration	Units
PM_{10}	24 hours	50	$\mu g/m^3$
	Annual	25	$\mu g/m^3$
$PM_{2.5}$	24 hours	25 (20 by 2025)	$\mu g/m^3$
	Annual	8 (7 by 2025)	$\mu g/m^3$
CO	8 hours	9	ppm
NO_2	1 hour	0.08	ppm
	Annual	0.015	ppm
SO_2	1 hour	0.10	ppm
	24 hours	0.02	ppm

4.2 State

4.2.1 Protection of the Environment Operations Act 1997 and Protection of the Environment Legislation Amendment Act 2011

The *Protection of the Environment Operations Act 1997* (POEO Act) is a key piece of environment protection legislation administered by the NSW Environment Protection Authority (NSW EPA), which enables the Government to establish instruments for setting environmental standards, goals, protocols, and guidelines.

The following sections of the POEO Act are of general relevance to the project:

- Section 117 of the POEO Act states that the wilful or negligent release of ozone depleting substances such as chlorofluorocarbons (CFCs) to the atmosphere carries the highest of all penalties under NSW environmental law.
- Sections 124 and 125 of the POEO Act state that any plant located at a premise should be maintained in an efficient condition and operated in a proper and efficient manner to reduce the potential for air pollution.
- Section 126 of the POEO Act requires that materials (eg waste materials stored/handled at the project) are managed in a proper and efficient manner to prevent air pollution (eg odour).
- Section 128 of the POEO Act states:

    1. *The occupier of a premises must not carry out any activity or operate any plant in or on the premises in such a manner to cause or permit the emission at any point specified in or determined in accordance with the regulation of air impurities in excess of [the standard of concentration and/or the rate] prescribed by the regulations in respect of any such activity or any such plant.*
    2. *Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.*

- Chapter 3 of the POEO Act details the types of environment protection licences (EPLs) that may be issued for scheduled activities. The following activities would be deemed to be scheduled activities if the relevant limits are exceeded:
    - Cement or lime works – under Clause 6 of Schedule 1 of the POEO Act, an EPL may be required if the amount of cement or lime handled (not including the production of pre-mixed concrete (concrete batching) exceeds:
        - 150 tonnes of cement or lime per day, or
        - 30,000 tonnes of cement or lime per year
    - Crushing, grinding or separating – Clause 16(2) of Schedule 1 of the POEO Act deems this to be a scheduled activity that requires an EPL if the crushing, grinding or separating plant has the capacity to process:
        - more than 150 tonnes of materials per day, or
        - 30,000 tonnes of materials per year
    - helicopter related activities – Clause 20(1) of the POEO Act deems this to be a scheduled activity that requires an EPL if:
        - the activity has an intended use of more than 30 flight movements per week (where take-off and landing are separate flight movements), and
        - the activity is conducted within one kilometre of a residence not associated with the landing, take-off or parking of helicopters.

An EPL is not anticipated to be required for the project based on the activities described in **Section 2.1**. The need for an EPL is considered further in **Section 5.8** of this report.

The *Protection of the Environment Legislation Amendment Act 2011* introduced changes to the way pollution incidents are reported and managed. Whilst most of the changes apply to EPL holders under the POEO Act, it also introduced obligations that require anyone carrying on an activity or occupying a premises who becomes aware of a pollution incident to report it immediately if there is a risk of 'material harm to the environment', which is defined in Section 147 of the POEO Act as follows:

> *"(a)…harm to the environment is material if:*
>
> *(i) it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or*
>
> *(ii) It results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (or such other amount as is prescribed by the regulations), and*
>
> *(b) loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment."*

4.2.2 Protection of the Environment Operations (Clean Air) Regulation 2022

The POEO (Clean Air) Regulation 2022 (the Regulation) is the core regulatory instrument for air quality issues in NSW. In relation to industry, the Regulation:

- sets maximum limits on emissions from activities and plant for a number of substances
- deals with the transport and storage of volatile organic liquids
- restricts the use of high sulfur liquid fuel
- imposes operational requirements for certain afterburners, flares, vapour recovery units and other treatment plant.

The project would be required to comply with the content of the Regulation during construction and operation.

4.2.3 NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in NSW

NSW EPA is the NSW regulatory authority responsible for air quality regulation and associated activities.

The NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2022) (the Approved Methods) lists the statutory methods for modelling and assessing air pollutants from stationary sources and specifies criteria which reflect the environmental outcomes adopted by the EPA. The Approved Methods are referred to in the Regulation for assessment of impacts of air pollutants and are also appropriate air quality criteria for the project when developing Air Quality Management Plans.

The impact assessment criteria listed in the Approved Methods that are relevant to this assessment are presented in **Table 4-2**. However, as no dispersion modelling was completed, it is not possible to determine the contribution of the project to these criteria. A review of the existing air quality in the vicinity of the project and comparison with the impact assessment criteria has been completed and considered in the risk assessment as presented in **Section 6.3** and **Section 7.1**.

Table 4-2 NSW EPA impact assessment criteria

Pollutant	Averaging time	Impact assessment criteria
Total suspended particulate (TSP)	Annual	90 µg/m^3
PM_{10}	24 hours	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hours	25 µg/m^3
	Annual	8 µg/m^3
Dust deposition	Annual • total • increase above background	 4 g/m^2/month 2 g/m^2/month
CO	15 minutes	87 ppm
	1 hour	25 ppm
	8 hours	9 ppm
NO_2	1 hour	8 pphm
	Annual	1.5 pphm
SO_2	1 hour	0.10 ppm (0.075 ppm from 2025)
	24 hours	0.02 ppm

4.2.4 NSW EPA Odour Technical Framework and Notes

The NSW EPA publications, *Technical Framework: Assessment and management of odour from stationary sources in NSW* (NSW DEC, 2006a) and the associated *Technical Notes* (the Odour Policy) (NSW DEC, 2006b), provide a policy framework for assessing and managing activities that emit odour and offer guidance on dealing with odour issues.

At the time of writing it was not anticipated that there would be any significant sources of odour due to the project.

4.2.5 NSW Clean Air Strategy 2021 - 2030

The *NSW Clean Air Strategy 2021–2030* (NSW Government, 2022) is a key piece of environmental guidance which aims to achieve ongoing reductions in the impacts of air pollution on the people of NSW, while supporting liveable communities, healthy environments and the NSW economy. The NSW Government will implement actions to achieve further health gains for communities across NSW. The Strategy sets out five themes to mitigate community exposure to poor air quality, both during extreme events and on a day-to-day basis. These are:

- better preparedness for pollution events
- cleaner industry
- cleaner transport, engines and fuels
- healthier households
- better places.

The *NSW Clean Air Strategy 2021–2030* aims to achieve ongoing reductions in the impacts of air pollution on the people of NSW, while supporting liveable communities, healthy environments and the NSW economy.

Of all the five themes, HumeLink would particularly support cleaner industry through the provision of a reliable, affordable and sustainable electricity future, including:

- support private sector investment in new clean energy generation, under the NSW Electricity Infrastructure Roadmap, to replace ageing fossil fuel-powered generators as they retire in coming decades
- ensure potential air quality impacts are properly considered in the planning and regulation of all new energy projects.

4.2.6 Guidelines on recommended separation distances

Separation distances (or 'buffer' distances) refer to the appropriate level of separation between a source of emissions and sensitive land uses in order to avoid the impacts of intended and unintended emissions on people. The application of minimum recommended separation distances provides a valuable screening tool to judge whether a detailed assessment is required to evaluate the potential risk of conflicting land use/activities. This approach relies on the knowledge that impacts on the environment generally decrease with increasing distance from the source of emissions. Separation distances are determined on an understanding of the types of emissions associated with various industries and their potential impacts on people. These distances can vary based on the scale and size of the industry, location topography, prevailing winds and other factors.

There are no separation guidelines issued by NSW EPA, hence guidelines set by other regulatory agencies in Australia have been referred to. These include:

- ACT: *Separation Distance Guidelines for Air Emissions* (ACT Government, 2018)
- Northern Territory: Guideline: *Recommended Land Use Separation Distances* (NTEPA, 2017)
- South Australia: *Evaluation Distances for Effective Air Quality and Noise Management* (EPA SA, 2016)
- Victoria: *Recommended Separation Distances for Industrial Residual Air Emissions*[2] (EPAV, 2013)
- Western Australia: *Recommended Separation Distances for Industrial Residual Air Emissions* (WA EPA, 2015).

These recommended separation distances have been developed to be applied to sensitive uses, such as residential residences, schools, hospitals and childcare centres. The most conservative separation distances provided in the above documentation that are relevant to the project activities are provided in **Table 4-3**.

[2] EPA Victoria released an updated draft separation guideline in December 2022 that is open for public consultation until February 2023 (https://engage.vic.gov.au/separation-distances-and-landfill-buffers).There are no changes to the recommended distance for Concrete plants compared with the 2013 document referenced.

Table 4-3 Recommended separation distances

Activity	Scale	Recommended minimum separation distance (metres)	Reference	Relevance to the project
Electric power generation	Electrical power generation using fuel other than natural gas:		NTEPA, 2017	Locations where diesel-fuelled generators would be used (such as construction compounds)
	Greater than or equal to 10 megawatts in aggregate	1,000		
	Greater than or equal to 100 kilowatts but less than 10 megawatts in aggregate	500		
Concrete plant	Greater than 5,000 tonnes per year	100	EPAV, 2013	Locations where concrete batching plants would be located that would produce greater than 5,000 tonnes per annum (such as construction compounds)
Crushing, grinding or milling	Rock, ores or minerals excluding lease or private mine or wet sand	500	ACT Government, 2018	Locations where crushing or grinding activities would be undertaken (such as construction compounds)
Screening of materials	Premises on which material extracted from the ground is screened, washed, crushed, ground, milled, sized or separated.		NTEPA, 2017	Locations where screening of materials would be undertaken (such as construction compounds)
	Greater than 5,000 but less than 50,000 tonnes per year	500		
	Greater than 50,000 tonnes per year	1,000		
Crushing of building material	Crushing or cleaning of waste building or demolition material	1,000	WA EPA, 2015	Locations where crushing of waste building or other demolition materials would be undertaken (such as construction compounds)
Extractive industries	Hard rock quarrying (including blasting), crushing and screening	1,500	WA EPA, 2015	Locations where blasting would be required (such as construction compounds)

5 Methodology

This chapter describes the methods used to assess the potential impacts of the project on air quality.

5.1 Overview of approach

The following provides a high-level summary of the approach taken to assess the air quality impacts of the project:

- identification of relevant air pollutants to determine relevant legislation (**Chapter 3**)
- definition of the air quality study area and identification of sensitive receptors (**Section 5.3**)
- qualitative assessment of dust emissions due to construction activities (that is, particulate matter including nuisance dust) (**Section 5.4**)[3,4]
- risk-based assessment of impacts due to emissions of dust during operation and products of combustion during construction and operation (**Section 5.6**)
- identification of activity data for use in the assessment (**Section 5.7**)
- review of local topography, existing air quality, meteorology for the study area (**Chapter 6**)
- assessment of air quality impacts during construction (**Chapter 7**)
- assessment of air quality impacts during operation (**Chapter 8**)
- cumulative impact assessment (**Chapter 9**)
- recommendation of mitigation measures (**Chapter 10**).

5.2 General assessment approach

The air quality impacts associated with dust emissions from construction of the project have been assessed via application of the United Kingdom Institute of Air Quality Management's *Guidance on the Assessment of Dust from Demolition and Construction* (hereafter referred to as the IAQM Guidance) (IAQM, 2014) (refer to **Section 5.4** for details).

The air quality impacts associated with dust emissions from operations and emissions due to combustion from mobile equipment (for both construction and operation) have been assessed qualitatively using a risk-based approach, based on ISO 31000 risk management principles (ISO, 2018) (refer to **Section 5.5** and **Section 5.6**, respectively).

It is important to note that the IAQM Guidance uses the term 'impact' to describe a change in PM_{10} concentrations or dust deposition due to the activities at a construction site, and 'effect' to describe the consequences of any impacts at sensitive receptors.

[3] The IAQM Guidance states that professional judgement should also be applied to determine how proposed activities will affect the dust emission magnitude. For example, scale of activities, use of mobile crushing and screening equipment, concrete batching plant, blasting etc

[4] The assessment of impacts related to construction activities is focussed on the major dust-generating activities at the substations, construction compounds and along the transmission line. Minor construction activities, such as the telecommunication hut(s) and utility work have not been explicitly assessed. Regardless of this, appropriate management measures would be implemented to minimise the potential for adverse air quality impacts.

The emphasis of the IAQM Guidance is on classifying the **risk** of adverse dust impacts from a construction site based on the scale of the proposed works and sensitivity of the surrounding environment (with no mitigation measures applied) (refer to **Section 7.1**) and identification of mitigation measures commensurate with the risk (refer to **Section 10.3**) to reduce the risk to acceptable levels ie such there is negligible risk of adverse air quality effects at the sensitive receptors.

The construction activities associated with the transmission line will move along the 360 kilometre length over time and would be temporary and short-term in any single location.

5.3 Air quality study area and sensitive receptors

The first step in the assessment was to identify the air quality study area and location of sensitive receptors in relation to the project footprint, as detailed below.

In accordance with the IAQM Guidance, as shown on **Figure 5-1**, a 350 metre buffer has been mapped on either side of the project footprint between the existing Bannaby 500 kV substation, the Wagga 330 kV substation and the future Maragle 500 kV substation to identify potentially affected sensitive receptors during construction.

The IAQM Guidance also recommends consideration of sensitive receptors up to 500 metres from access to the construction site, and therefore a 500 metre buffer on either side of the project footprint is also shown on **Figure 5-1** with the land within this buffer considered to form the air quality study area. This allows for a conservative assessment as any other access tracks would be within the project footprint.

Only those sensitive receptors inside the 350 metre and 500 metre buffers around the project footprint are considered by the IAQM Guidance to have the potential to be affected by air emissions during the construction period. However, professional judgment has been applied during the assessment to take account of current uncertainties related to, for example, the scale of activities, use of mobile crushing and screening equipment, concrete batching plant, blasting etc.

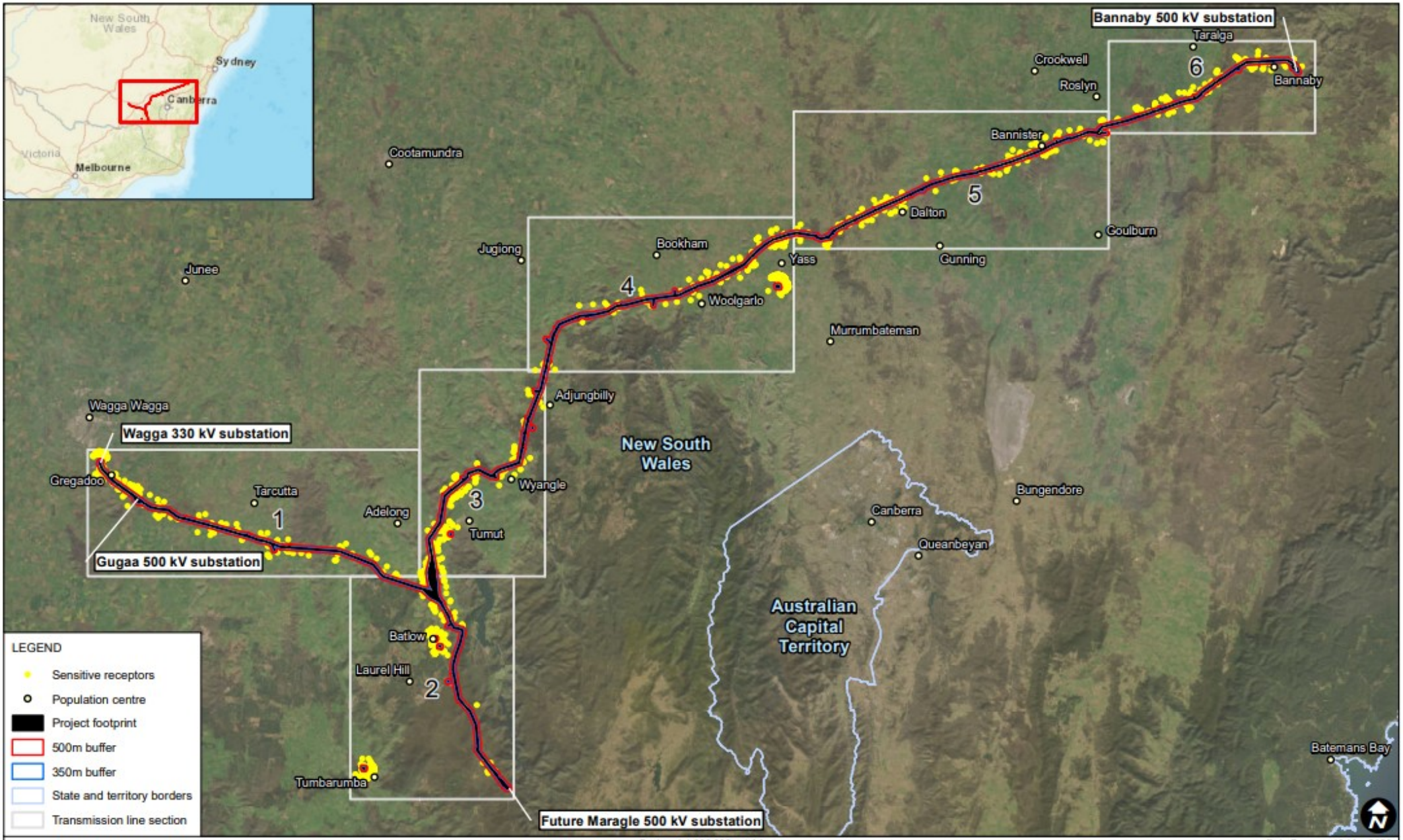
The project covers a total length of approximately 360 kilometres and comprises transmission line construction, substation works and several construction compounds and an accommodation facility (refer to **Table 2-1**). In order to identify the relative locations of sensitive receptors in the vicinity of each it has been necessary to consider each of the construction compound locations in isolation, and to split the transmission line into sections (refer to **Section 7.1.1.1**).

Sensitive receptors identified within the buffers have been identified and included in the assessment and where relevant, professional judgement has also been applied to determine how proposed activities would affect the dust emission magnitude.

The identified sensitive receptors[5] in the study area are shown in **Figure 5-1**, together with the buffers per the IAQM Guidance and the six sections of the transmission line discussed in **Section 7.1.1.1**.

Due to the number of identified sensitive receptors in the study area it has not been possible to label them on **Figure 5-1**. However, the specific sensitive receptors that have potential to be affected by air emissions are discussed in further detail in **Chapter 7**.

[5] The NSW EPA Approved Methods defines a sensitive receptor as "*A location where people are likely to work or reside; this may include a* residences, school*, hospital, office or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receptors.*".



\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig 5-1 Basemap A4.mxd

5.4 Construction dust assessment

The IAQM Guidance uses the four-step qualitative process outlined in **Section 5.4.1** to **Section 5.4.4** for assessing the risk of adverse effects due to dust emissions from construction activities.

5.4.1 Step 1 – Screening the need for a detailed assessment

Step 1 of the assessment involves screening the need for a detailed assessment. Based on the IAQM Guidance, a detailed assessment is considered required where there is a sensitive receptor within:

- 350 metres of the boundary of the site, or
- 50 metres of the route(s) used by construction vehicles on public roads, up to 500 metres from the site entrance.

This step is noted as having deliberately been chosen to be conservative and would require assessments for most projects in urban settings. Professional judgement has also been applied in undertaking the screening assessment for this project to determine how proposed activities would affect the dust emission magnitude. For example, scale of activities, use of mobile crushing and screening equipment, concrete batching plant, blasting etc.

Application of Step 1 to the project is presented in **Section 7.1.1**.

5.4.2 Step 2 – Assessment of the risk of dust impacts

In accordance with the IAQM Guidance, the risk of dust arising in sufficient quantities to cause annoyance and/or health impacts is assessed using four risk categories: negligible, low, medium and high risk. A risk rating is allocated to a site based on two factors:

- the scale and nature of the works, which categorises the potential dust emission magnitude as small, medium or large (Step 2A)
- the sensitivity of the area to dust impacts (Step 2B), which is defined as low, medium or high sensitivity.

Step 2a – Assessment of potential dust emission magnitude

Step 2a of the assessment method provides “dust emissions magnitudes” for each of four dust generating activities: demolition, earthworks, construction, and track-out (the movement of site material onto public roads by vehicles). depending on the scale and nature of the works. The dust emission magnitudes are described as *large*, *medium* or *small*, with the definitions for the scale and nature each activity given in the IAQM Guidance shown in **Table 5-1**.

In order to provide a conservative assessment of potential impacts from the project, the dust emission magnitude for each activity adopts the largest dust emission magnitude. For example, if at least one of the parameters specified in the ‘large’ definition is satisfied, the activity is classified as having a large dust emission magnitude.

Application of Step 2a to the project is presented in **Section 7.1.2.1**.

Table 5-1 IAQM Guidance categories and definitions for dust emission magnitude

Activity		Dust emission magnitude	Activity description
Demolition	Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time	Large	Total building volume >50,000 m^3, potentially dusty construction material (eg concrete), on-site crushing and screening, demolition activities > 20 m above ground level;
		Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level
		Small	Total building volume <20,000 m^3, construction material with low potential for dust release (eg metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.
Earthworks	Covers the processes of soil-stripping, ground-levelling, excavation and landscaping	Large	Total site area greater than 10,000 m^2, potentially dusty soil type (eg clay, which would be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t.
		Medium	Total site area 2,500 m^2 to 10,000 m^2, moderately dusty soil type (eg silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t.
		Small	Total site area less than 2,500 m^2, soil type with large grain size (eg sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.
Construction	Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure would include a residential residences, office building, retail outlet, road, etc	Large	Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting.
		Medium	Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (eg concrete), piling, on site concrete batching
		Small	Total building volume less than 25,000 m^3, construction material with low potential for dust release (eg metal cladding or timber).
Track-out	The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network	Large	More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 metres of unpaved road length.
		Medium	Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 metres and 100 metres of unpaved road length.
		Small	Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 metres of unpaved road length.

Step 2b – Assessment of the sensitivity of the area

Step 2b of the assessment process involves defining the sensitivity of the area. The sensitivity of the area considers:

- the specific sensitivities that identified receptors have to dust deposition (including human health effects)
- the proximity and number of those receptors
- the local background annual average PM_{10} concentrations
- other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

Individual receptors are classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health effects. The IAQM Guidance provides information on the sensitivity of different receptor types to dust deposition and health effects as summarised in **Table 5-2**. It is noted that community expectations of amenity levels (dust deposition) is also dependent on existing deposition levels.

Application of Step 2b to the project is presented in **Section 7.1.2.2**.

Table 5-2 IAQM Guidance for receptor sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust deposition (nuisance dust)	Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by deposition, 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 deposition; or The people or property would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by deposition; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	Examples: residences, 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.*

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
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 will generally not include workers occupationally exposed to PM_{10}.*	*Examples: Public footpaths, playing fields, parks and shopping street.*

The sensitivity of the identified individual receptors (as described in **Table 5-2**) was then used to assess the *sensitivity of the area* surrounding the active construction area. Taking into account the proximity and number of those receptors, the local background PM_{10} concentration (in the case of potential health effects) and other site-specific factors.

Additional factors considered when determining the sensitivity of the area are:

- 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
- the duration of the potential impact (as a receptor may be willing to accept elevated dust levels for a known short duration, or may become more sensitive or less sensitive (acclimatised) over time for long-term impacts)
- any known specific receptor sensitivities which go beyond the classifications given in the IAQM Guidance.

The IAQM Guidance for assessing the sensitivity of an area to dust deposition is shown in **Table 5-3**. The sensitivity of the area was derived for each of activity relevant to the project (eg, construction, earthworks etc).

Table 5-3 IAQM Guidance for categorising the sensitivity of an area to dust deposition effects

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<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: Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered. For example, if there are seven high sensitivity receptors < 20 metres of the source and 95 high sensitivity receptors between 20 and 50 metres, then the total of number of receptors < 50 metres is 102. The sensitivity of the area in this case would be high.

For high sensitivity receptors, the IAQM Guidance takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As the UK air quality objectives differ from the ambient air quality criteria adopted for use in this assessment (ie, an annual average of 25 micrograms per cubic metre for PM_{10}), the IAQM Guidance has been modified to match Australian criteria. This approach is consistent with the IAQM Guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories. A modified version of the IAQM Guidance for assessing the *sensitivity of an area* to health effects is shown in **Table 5-4**.

Table 5-4 IAQM Guidance for categorising the sensitivity of an area to dust health effects

Receptor sensitivity	Annual average PM_{10} concentration	Number of receptors [a], [b]	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>25 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	21-25 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	17-21 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<17 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	21-25 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	17-21 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<17 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Notes: (a) Estimate the total within the stated distance (eg the total within 350 metres 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.

(b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residences, just include the number of properties.

Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b were then used in the matrices shown in **Table 5-5** (demolition), **Table 5-6** (earthworks and construction) and **Table 5-7** (track-out) to determine the risk category **with no mitigation applied**.

The risk assessment for the project is presented in **Section 7.1.2.3**.

Table 5-5 Risk category for demolition activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 5-6 Risk category for earthworks and construction activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 5-7 Risk category for track-out activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

5.4.3 Step 3 – Site-Specific Mitigation

Once the risk categories are determined for each of the relevant activities, the IAQM Guidance provides recommended management measures based on whether the site is a low, medium or high risk site (refer to **Chapter 10**).

Application of Step 3 to the project is presented in **Section 7.1.3**.

5.4.4 Step 4 – Residual Impacts

Following Step 3, the residual impact (ie impact remaining after management measures have been considered) is then determined.

Application of Step 4 to the project is presented in **Section 7.1.4**.

5.5 Operational dust assessment

Operational dust emissions were assessed qualitatively using a risk-based approach, based on ISO 31000 risk management principles (ISO, 2018), that consider a range of impact descriptors to derive the risk, namely:

- nature of impact
- receptor sensitivity
- magnitude of impact.

The following provides additional detail on each of the impact descriptors.

5.5.1 Nature of impact

The nature of impact were described in terms of the overall impact of emissions on the environment:

- beneficial: the impact would cause a beneficial effect on the receiving environment
- neutral: the impact would cause neither a beneficial nor adverse effect
- adverse: the impact would cause an adverse effect on the receiving environment.

5.5.2 Receptor sensitivity

Receptor sensitivity may vary with the anticipated impact or effect. A receptor may be determined to have varying sensitivity to different environmental changes. For example, a receptor could have a high sensitivity to changes in air quality, but a low sensitivity to noise impacts. Sensitivity may also be derived from statutory designation which is designed to protect the receptor from such impacts.

Sensitivity terminology may vary depending on the environmental effect, but generally this may be described in accordance with the broad categories outlined in **Table 5-8**, which have been used in this assessment to define the sensitivity of receptors to products of combustion.

Table 5-8 Receptor sensitivity to air quality impacts

Sensitivity	Criteria
Very high	Receptors of very high sensitivity to air pollution (eg dust or odour) such as hospitals and clinics, retirement homes, painting and furnishing businesses, hi-tech industries, and food processing.
High	Receptors of high sensitivity to air pollution, such as schools, residences, food retailers, glasshouses and nurseries, horticultural land, and offices.
Medium	Receptors of medium sensitivity to air pollution, such as farms, outdoor storage, light, and heavy industry.
Low	All other air quality sensitive receptors not identified above.

5.5.3 Magnitude of impact

The magnitude of impact describes the anticipated scale of the environmental change in terms of how that impact may cause a change to baseline conditions.

Table 5-9 outlines the criteria used in this assessment to define the magnitude of potential air quality impacts identified for the project.

Table 5-9 Criteria for determining the magnitude of impacts

Magnitude	Description
Substantial	Impact is predicted to cause significant consequences on the receiving environment (may be adverse or beneficial)
Moderate	Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse)
Slight	Predicted impact may be tolerated.
Negligible	Impact is predicted to cause no significant consequences.

5.5.4 Significance of impact

The risk-based matrix provided in **Table 5-10** illustrates how receptor sensitivity and magnitude of impact interact to determine the impact significance.

Table 5-10 Impact significance matrix

Receptor Sensitivity[a]	Impact magnitude[b]			
	Substantial	Moderate	Slight	Negligible
Very High	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
Medium	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Notes:

(a) Receptor sensitivity is defined by Table 5-8

(b) Impact magnitude is defined by Table 5-9

5.6 Products of combustion assessment

For both construction and operations, emissions of products of combustion from mobile equipment were assessed using the same risk-based approach detailed in **Section 5.5** for operational dust emissions.

During construction only, up to six of the construction compounds are expected to use diesel-fuelled generators for electrical power. As such, consideration has also been given to the recommended separation distance for fuel burning of 500 metres discussed at **Section 4.2.6.**

5.7 Activity data used in calculations

5.7.1 Construction activities

A summary of the activity data used in assessment of air quality impacts for the construction phase due to products of combustion is presented in **Table 5-11**. To estimate the emissions from products of combustion, the diesel and petrol emission factors for miscellaneous industrial and light duty vehicles were sourced from the NPI *Emission Estimation Technique Manual for Combustion Engines* (DSEWPC, 2008). These are shown in **Table 5-12** (miscellaneous industrial vehicles) and **Table 5-13** (light duty vehicles).

In order to facilitate the construction of the project, helicopters may be used to deliver materials and equipment, particularly within the more elevated sections of the project footprint. Where a helipad has been proposed, the potential air quality impacts have been considered in the risk assessment for dust emissions. It is not anticipated that products of combustion from helicopter usage would be at a level to cause concern and therefore they have not been considered further.

Table 5-11 Activity data used in the products of combustion risk assessment for the construction phase

Emission source	Activity data	Total value	Notes
Consumption of diesel	Transmission line land clearing and construction, including transport of construction materials	3,315 kL	9,208 L/km of line route 360 km of transmission line
	Bannaby 500 kV substation modification	4,182 kL	5,500 L/day for 25 months
	Gugaa 500 kV substation construction	8,240 kL	9,341 L/day for 29 months
	Wagga 330 kV substation modification	3,446 kL	4,196 L/day for 27 months
	Transmission line construction compounds	205 kL	5,694 L/month/compound; 1.5 sites active for 24 months
	Light vehicle use for survey works, supervision, engineering and management support	545 kL	18,173 L/month for 30 months
Consumption of unleaded petrol	Bannaby 500 kV substation modification	279 kL	367 L/day for 25 months
	Gugaa 500 kV substation construction	542 kL	615 L/day for 29 months
	Wagga 330 kV substation modification	249 kL	303 L/day for 27 months

Table 5-12 NPI emission factors for miscellaneous industrial vehicles

Pollutant	Diesel emission factor (kg/L)[(a)]	Unleaded petrol emission factor (kg/L) [(b)]
CO	0.018	0.38
Formaldehyde	0.0008	0.000682
NO_x	0.044	0.0171
$PM_{2.5}$	0.003	0.000898
PM_{10}	0.004	0.000968
PAHs	0.00000165	0.0000000072
SO_2	0.00002394	0.00036
VOC	0.0041	0.0143

Notes:

(a) Source: Table 35 of DSEWPC, 2008 multiplied by 3 to convert from kg/kWh to kg/L (per footnote 3 of Table 35)

(b) Source: Table 40 of DSEWPC, 2008 multiplied by 2 to convert from kg/kWh^3 to kg/L (per footnote 3 of Table 40)

Table 5-13 NPI emission factors for light duty vehicles

Pollutant	Diesel emission factor (kg/L)[(a)]
CO	0.0194
Formaldehyde	-
NO_x	0.0889
$PM_{2.5}$	0.00234
PM_{10}	0.00237
PAHs	0.000000165
SO_2	0.0000167
VOC	0.00423

Note:

(a) Source: Table 15 of DSEWPC, 2008 divided by 1000 to convert from kg/m^3 to kg/L

5.7.2 Operational activities

A summary of the activity data used in assessment of air quality impacts due to products of combustion for the operational phase is presented in **Table 5-14**. To estimate the emissions from products of combustion, the diesel and petrol emission factors for miscellaneous industrial vehicles were sourced from the NPI *Emission Estimation Technique Manual for Combustion Engines* (DSEWPC, 2008). These are shown in **Table 5-12**.

Table 5-14 Assumption used to estimate emissions due to products of combustion during operation

Emission source	Activity data	Total value	Notes
Consumption of diesel	Bannaby 500 kV substation modification	4.85 kL/year	404 L/month
	Gugaa 500 kV substation construction	11.63 kL/year	969 L/month
	Wagga 330 kV substation modification	4.85 kL/year	404 L/month
	Transmission line /tracks	1.44 kL/year	120 L/month
Consumption of unleaded petrol	Bannaby 500 kV substation modification	2.03 kL/year	169 L/month
	Gugaa 500 kV substation construction	4.57 kL/year	381 L/month
	Wagga 330 kV substation modification	2.03 kL/year	169 L/month

5.8 Limitations, uncertainty and key assumptions

Air quality experienced at any location is 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 varies, 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 risk-based assessments applied are related to the scale of anticipated activity based on preliminary design information provided by Transgrid.

At the time of writing there is a degree of uncertainty about the exact location of the access tracks and proximity to sensitive receptors. To address this, a conservative approach has been taken in the assessment of impacts from dust emissions that may result from the construction and use of access tracks, with professional judgment applied to identify receptors outside the 500 metre buffer that have potential to be adversely impacted. In finalising the locations of access tracks, Transgrid will consider locations of nearby sensitive receptors to maintain appropriate separation distances as far as possible.

The IAQM method is not explicitly designed for assessing the impact of linear projects (such as HumeLink). The major source of dust emissions related to construction of the transmission line will occur where the structures are installed. Due to the uncertainty related to the exact location of the structures and proximity to sensitive receptors, a conservative approach has been taken by splitting the transmission line into six sections (refer to **Section 7.1.1.1**). In reality there are likely to be many locations within each of these sections where minimal (if any) dust-generating activities would occur.

In addition, it is not known if the helicopter-related activities, cement or lime handling, or crushing, grinding or separating activities would be at a scale that would require an EPL (as discussed in **Section 4.2.1**) or require further assessment:

- Blasting may be required within the project footprint, such as at the proposed Gugaa 500 kV substation and/or the Bannaby 500 kV substation, depending on geotechnical conditions. This would be confirmed during detailed design and would be subject to further assessment once details are available.
- A concrete batching plant is to be located at Bannaby 500 kV substation compound (C12), with the maximum likely raw materials usage expected to be approximately 40 tonnes per day. On that basis, an EPL would not be required and thus a detailed air quality impact assessment is not expected to be required. The nearest sensitive receiver is located about one kilometre from the site and outside the minimum recommended separation distance. Accordingly, no further assessment is required (refer to **Table 4-3**). It is expected that the minimum separation distance would be achieved as the nearest potential residence identified is approximately one kilometre away. This would be confirmed during detailed design and, if required, would be subject to further assessment in relation to potential air quality impacts for any nearby sensitive receptors.
- It is not currently known where, or at what scale, crushing and screening activities might occur. This would be confirmed during detailed design and, if required, would be subject to further assessment in relation to potential air quality impacts for any nearby sensitive receptors. If no further detailed assessment is completed, it is recommended that a minimum separation distance of 500 metres be implemented (refer to **Table 4-3**).
- Consistent with the recommended separation distance in **Table 4-3**, it has been assumed that a minimum distance of 500 metres between the generators and the sensitive receptors would be achieved. Should this not be feasible, a more detailed assessment may be required once further details on locations and fuel consumption rates are available.
- Due to the low-risk nature of the project with respect to air quality, any baseline ambient air monitoring to be collected for the project, and as such data collected by the NSW Government has been used to characterise the existing air quality. Due to these data being collected predominantly in locations with higher populations (and thus higher emissions to air) than the majority of the project footprint, the assessment is considered to be conservative.

A number of assumptions have been relied upon in completing the air quality risk assessments, including:

- The location of sensitive receptors are as shown on **Figure 1-1.**
- Location and the scale of proposed construction activities are based on the project description provided to SLR from Transgrid, including estimates of disturbance areas, cut and fill volumes and traffic movements.
- Water would be available for dust suppression as required.
- Appropriate separation distances can be provided for fixed combustion units (eg power generators for construction sites) and fuel storage and refuelling depots, so they are not located closer than 500 metres to sensitive receptor locations.
- Existing ambient air quality in the vicinity of the project footprint would be similar to that at the nearest NSW Government air quality monitoring station (refer to **Section 6.3.2.4**).

6 Existing environment

6.1 Topography

The topography of the study area is widely variable, with elevation ranging from approximately 220 metres above the Australian height datum (mAHD) to 1,232 mAHD.

At the west end of the project around Wagga Wagga the topography is relatively flat, with elevation ranging from approximately 220 mAHD to 338 mAHD. Between Tumut and Yass, the topography is considerably hilly, with elevation ranging from approximately 261 mAHD to 768 mAHD. The east end of the project area between Yass and Bannaby has more hills and areas of steep terrain, particularly between Dalton and Bannaby, with elevation ranging between 537 mAHD and 928 mAHD. The area with the highest elevation, ranging between approximately 1,012 mAHD and 1,232 mAHD, is located between Batlow and the Maragle State Forest.

6.2 Climate

Historical meteorological data in the vicinity of the study area was reviewed to characterise the existing local meteorological conditions.

The Bureau of Meteorology (BoM) collects meteorological data at numerous stations across Australia. Many of these only collect data twice a day at 9am and 3pm. However, there are also many automatic weather stations that collect data on a continuous basis. These have been referred to in this report to provide climate statistics.

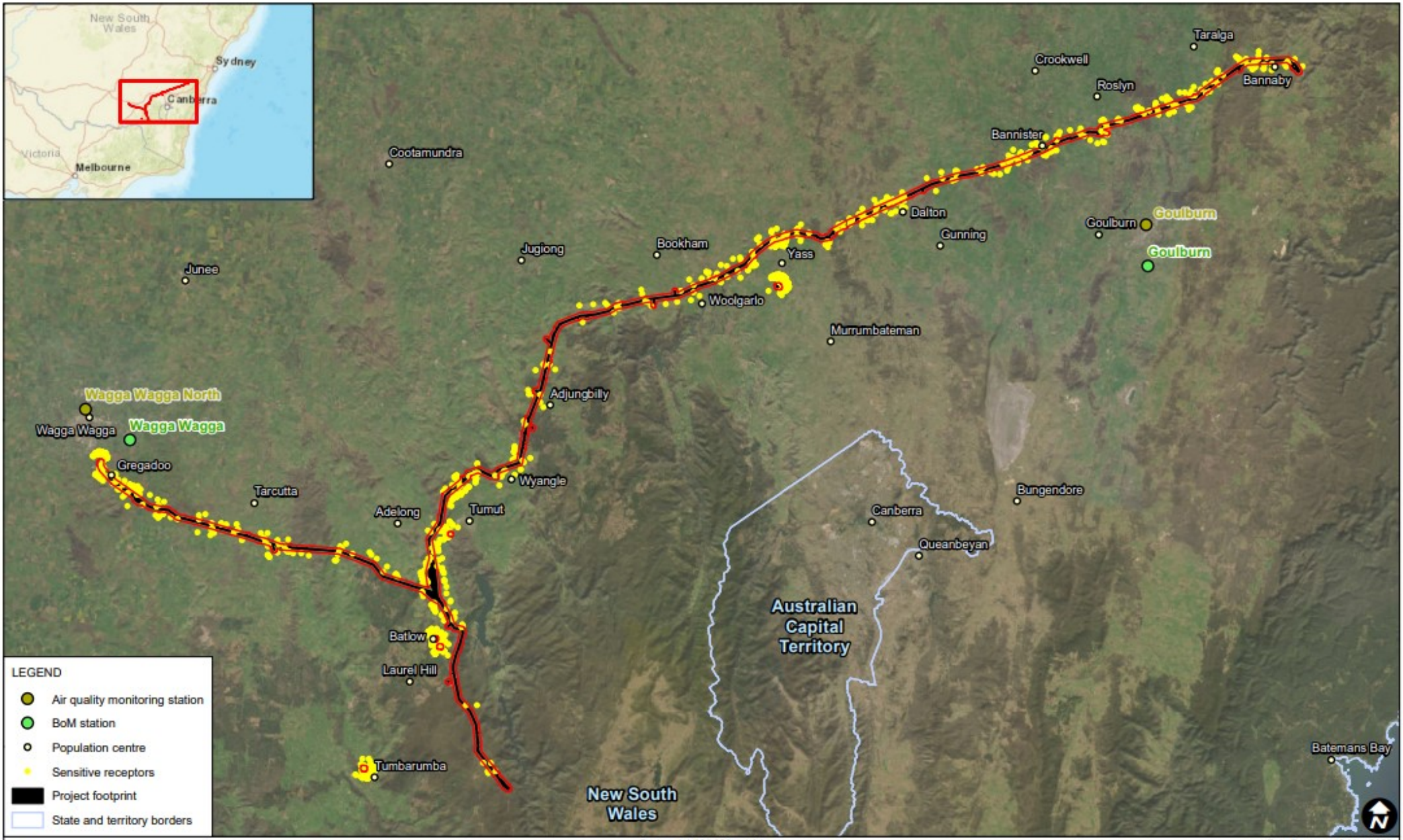
The following four automatic weather stations are located in the vicinity of the project footprint:

- Moss Vale (ID 068239) – located approximately 30 kilometres south-east of Bannaby 500 kV substation
- Goulburn (ID 070330) – located approximately 50 kilometres south-west of Bannaby 500 kV substation and approximately 30 kilometres south of the project footprint
- Cabramurra (ID 072161) – located approximately 15 kilometres south-east of the future Maragle 500 kV substation
- Wagga Wagga (ID 072150) – located approximately seven kilometres to the north-east of Wagga 330 kV substation.

Table 6-1 provides a basic summary of the BoM stations and **Figure 6-1** shows the locations of each in relation to the project footprint.

Table 6-1 Summary of BoM stations near the project footprint

Stations	Station number	Coordinates	Elevation (m)
Moss Vale	068239	150.42 °E; 34.53 °S	678.4
Goulburn	070330	149.73 °E 34.81°S	640.0
Cabramurra	072161	148.38 °E; 35.94 °S	1482.4
Wagga Wagga	072150	147.46 °E; 35.16 °S	212.0



Scale: 1:1,000,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 13-Mar-2023
Project number: 610.30622

Data Source:

SLR

HUMELINK
AIR QUALITY IMPACT ASSESSMENT
METEOROLOGICAL AND AMBIENT AIR QUALITY MONITORING LOCATIONS

FIGURE 6-1

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig 6-1 Monitoring Locations A4.mxd

6.2.1 Climate statistics

The key climate statistics for each of the BoM stations discussed in Section 6.2 are presented in Table 6-2 and presented graphically in Attachment A: Climate Plots.

Wagga Wagga has recorded the highest mean maximum temperature of the four BoM stations, at 31.9 degrees Celsius , whilst Cabramurra has recorded the lowest mean minimum temperature of - 0.8 degrees Celsius. All four BoM stations recorded relatively high levels of annual rainfall. However, Cabramurra recorded the highest annual average rainfall of 1,225 millimetres (mm), with an average number of rainy days (rain greater than or equal to one millimetres) of 100.2 days per annum. The highest mean maximum 9am relative humidity of 88 per cent was recorded in winter at Goulburn Airport and Wagga Wagga, while the lowest mean minimum 3pm relative humidity of 29 per cent was recorded in summer at Wagga Wagga.

Table 6-2 Key climate statistics

Parameter	Units	BoM weather station			
		Moss Vale	Goulburn Airport	Cabramurra	Wagga Wagga
Temperature					
Mean maximum	°C	23.6 (January)	28.2 (January)	21.6 (January)	31.9 (January)
Mean minimum	°C	2.5 (July)	0.3 (July)	-0.8 (July)	2.8 (July)
Rainfall					
Annual average rainfall	mm	712.9	558.4	1225	571.4
Annual average number of rainy days	days	84.2	68.9	100.2	72.3
Humidity					
Mean maximum at 9am	%	83 (March, May, June)	88 (June)	84 (June, July)	88 (July)
Mean minimum at 3pm	%	51 (January, September, October)	39 (December)	52 (January)	29 (January)

6.2.2 Wind conditions

Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from north). The bar at the top of each wind rose diagram represents winds blowing from the north (ie northerly winds) and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the width of the bar corresponds to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

Data from 2017 to 2021 for each of the BoM weather stations discussed in **Section 6.2** are presented as seasonal wind roses in **Section 6.2.2.1** to **Section 6.2.2.4** and indicate that wind conditions between the automatic weather stations can vary considerably, which may be expected given the changes in elevation and topography across the project footprint. Given the distance between the BoM weather stations and the project footprint, and the intervening topography, it is likely that wind conditions at specific project worksites and compounds etc would be different again to the conditions recorded at the BoM sites identified above.

The description of wind speeds (measured in metres per second (m/s)) in **Section 6.2.2.1** to **Section 6.2.2.4** references the Beaufort Wind Scale, which measures wind speed according to the impact the wind has on the land and sea, as outlined in **Table 6-3**, and is consistent with terminology used by the BoM.

Table 6-3 Beaufort wind scale

Beaufort Scale #	Description	Wind speed (m/s)	Description on land
0	Calm	0 – 0.5	Smoke rises vertically
1	Light air	0.5 – 1.5	Smoke drift indicates wind direction
2 -3	Light/ gentle breeze	1.5 – 5.3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
4	Moderate winds	5.3 – 8.0	Raises dust and loose paper, small branches are moved
5	Fresh winds	8.0 – 10.7	Small trees in leaf begin to sway, crested wavelets form on inland waters
6	Strong winds	>10.7	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

Source: http://www.bom.gov.au/lam/glossary/beaufort.shtml

6.2.2.1 Moss Vale

The annual wind rose for Moss Vale (**Figure 6-2**) indicates the predominant wind directions in the area are from the west and north-northeast. Calm wind conditions (wind speed less than 0.5 metres per second) were recorded 4.3 per cent of the time throughout the five-year period.

The average seasonal wind roses for the years 2017 to 2021 shown in **Figure 6-2** indicate that:

- In summer, wind speeds are mostly moderate to fresh winds (ranging between 5.5 metres per second to 10.5 metres per second) and predominantly blow from between north-northeast and south-southeast, with very few winds from the south or west. Calm wind conditions are predicated to occur for approximately 2.1 per cent of the time during the summer months.
- In autumn, winds are mostly moderate to fresh winds (ranging between 5.5 metres per second to 10.5 metres per second) and blow predominantly from the west and north-northeast, with very few winds from the east. Calm wind conditions are predicated to be approximately 6.7 per cent of the time during the autumn months.
- In winter, winds are mostly moderate to strong winds (ranging between 5.5 metres per second to greater than 10.7 metres per second) and blow from the south-west and west directions, with very few winds from the eastern quadrant. Calms occurred approximately 5.4 per cent of the time during the winter months.
- In spring, winds are mostly moderate to fresh winds (ranging between 5.5 metres per second to 10.5 metres per second) and blow predominantly from the north-northeast and west, with few winds from the south quadrant. Calms occurred approximately 3.0 per cent of the time during the summer months.

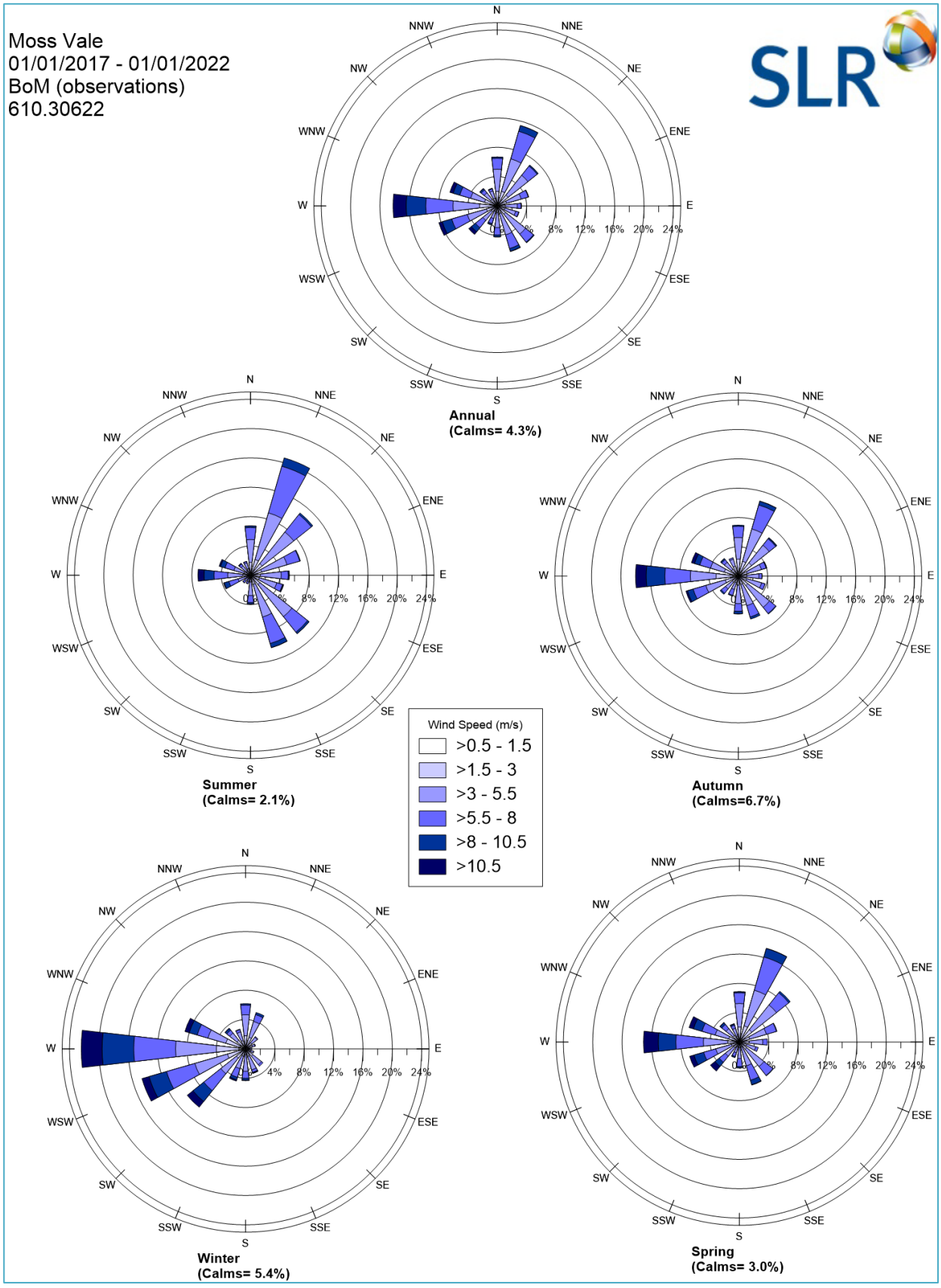


Figure 6-2 Moss Vale – annual and seasonal wind rose (2017 – 2021)

6.2.2.2 Goulburn

The annual wind rose for Goulburn (**Figure 6-3**) indicates the predominant wind directions in the area are from the west-northwest and northwest. Calm wind conditions (wind speed less than 0.5 metres per second) were recorded 13.5 per cent of the time throughout the five-year period.

The average seasonal wind roses for the years 2017 to 2021 shown in **Figure 6-3** indicate that:

- In summer, wind speeds are mostly gentle to moderate (ranging between 3.3 metres per second to eight metres per second) and predominantly blow from the eastern and western quadrants, with very few winds from the north and south. Calm wind conditions are predicated to occur for approximately 8.1 per cent of the time during the summer months.
- In autumn, winds are mostly moderate to fresh (ranging between 5.5 metres per second to 10.5 metres per second) and blow predominantly from the west-northwest, with very few winds from the north and south. Calm wind conditions are predicated to be approximately 17.4 per cent of the time during the autumn months.
- In winter, winds are mostly moderate to fresh (ranging between 5.5 metres per second to 10.5 metres per second) and blow predominately from the west-northwest, and occasionally from the north-west. There are very few winds from the eastern quadrant. Calms occurred approximately 16.6 per cent of the time during the winter months.
- In spring, winds are mostly gentle to moderate (ranging between 3.3 metres per second to 8 metres per second) and blow predominantly from the west-northwest, and occasionally from the west and north-west. There are very few winds from the southern quadrant. Calms occurred approximately 11.6 per cent of the time during the summer months.

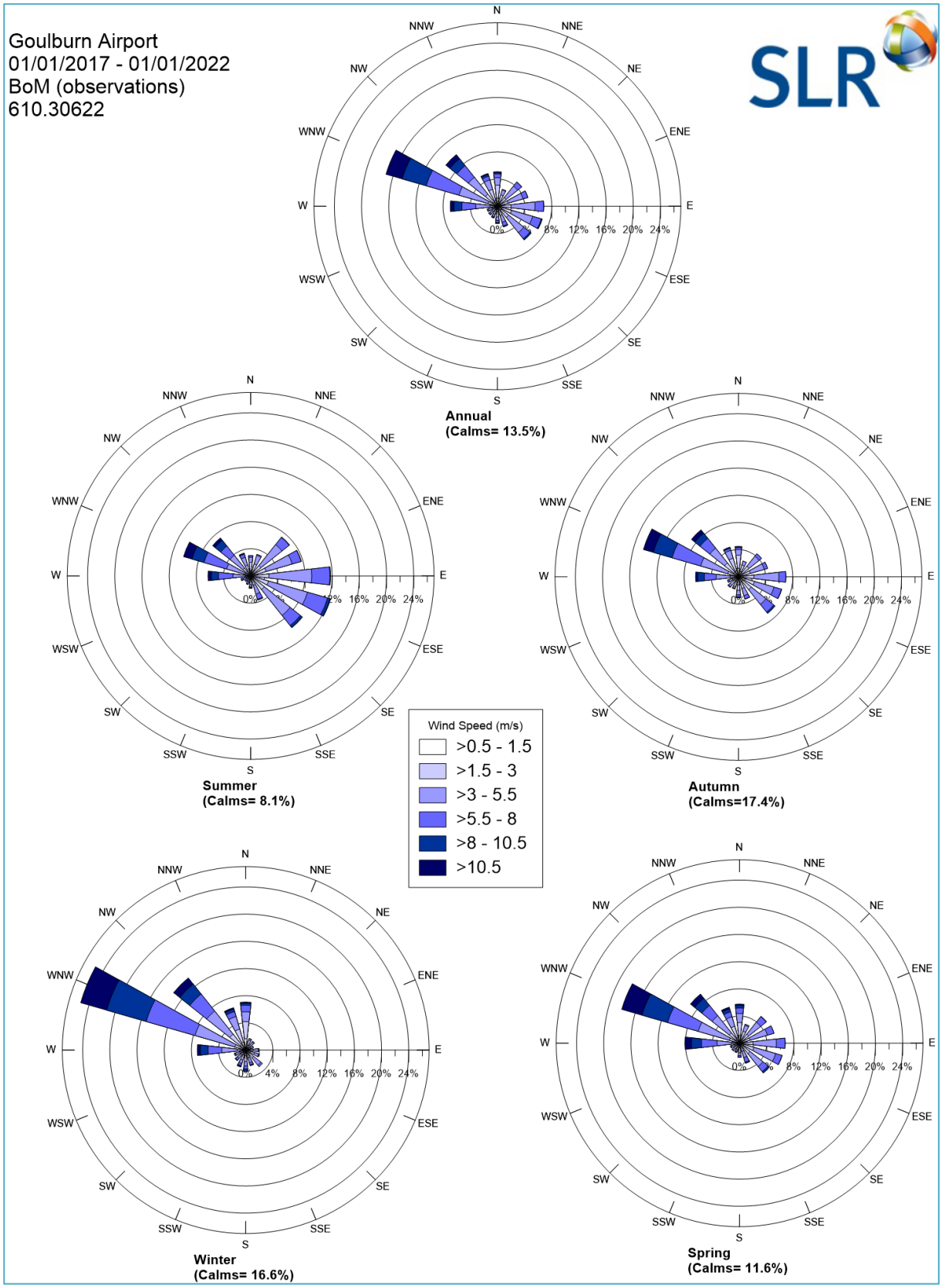


Figure 6-3 Goulburn – annual and seasonal wind rose (2017 – 2021)

6.2.2.3 Cabramurra

The annual wind rose for Cabramurra (**Figure 6-4**) indicates the predominant wind directions in the area are from the west and west-northwest. Calm wind conditions (wind speed less than 0.5 metres per second) were recorded 4.1 per cent of the time throughout the five-year period.

The average seasonal wind roses for the years 2017 to 2021 shown in **Figure 6-4** indicate that:

- In summer, wind speeds are mostly gentle to moderate (ranging between 3.3 metres per second to 7.9 metres per second) and predominantly blow from between west and west-northwest, with very few winds from the east and south directions. Calm wind conditions occur for approximately 1.2 per cent of the time during the summer months.
- In autumn, winds are mostly gentle to moderate (ranging between 3.3 metres per second to 7.9 metres per second) west to west-northwest, with very few winds from the south. Calm wind conditions are predicated to be approximately 3.9 per cent of the time during the autumn months.
- In winter, winds are mostly gentle to fresh winds (ranging between 3.3 metres per second to 10.7 metres per second) and blow from the west and west-northwest directions, with very few winds from the southern quadrant. Calms occurred approximately 8.6 per cent of the time during the winter months.
- In spring, winds are mostly gentle to fresh winds (ranging between 3.3 metres per second to 10.7 metres per second) and blow predominantly from west, with few winds from the south quadrant. Calms occurred approximately 2.5 per cent of the time during the spring months.

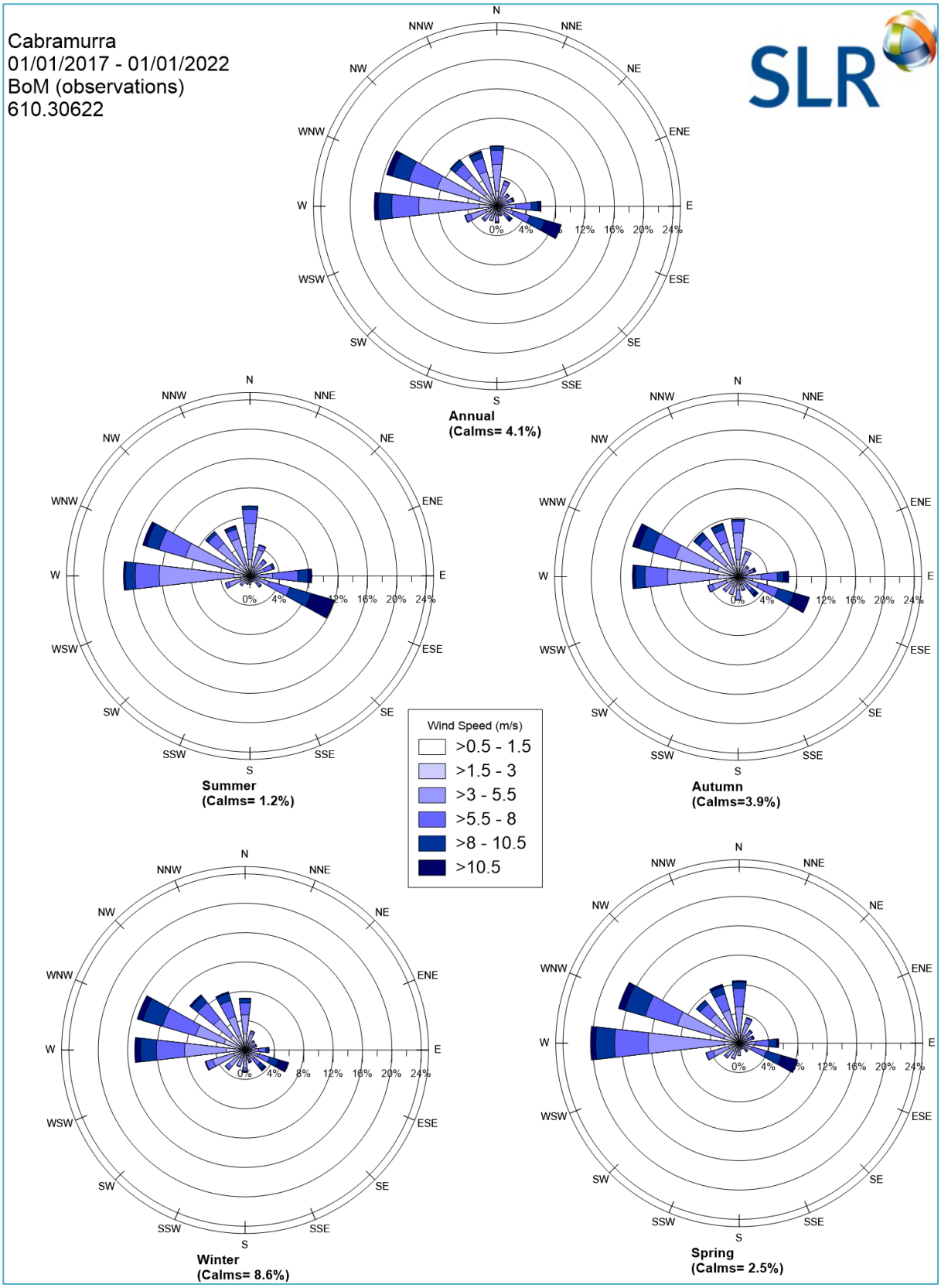


Figure 6-4 Cabramurra – annual and seasonal wind roses (2017 – 2021)

6.2.2.4 Wagga Wagga

The annual wind rose for Wagga Wagga (**Figure 6-5**) indicates the predominant wind directions in the area are from the northeast and east. Calm wind conditions (wind speed less than 0.5 metres per second) were recorded 6.7 per cent of the time throughout the five-year period.

The average seasonal wind roses for the years 2017 to 2021 shown in **Figure 6-5** indicate that:

- In summer, wind speeds are mostly gentle to moderate (ranging between 3.3 metres per second to 7.9 metres per second) and emanate from most directions, predominantly from between east-northeast to east. Calm wind conditions are predicated to occur for approximately 3.7 per cent of the time during the summer months.
- In autumn, winds are mostly light to moderate (ranging between 1.5 metres per second to 5.5 metres per second) and blow predominantly from the east, with very few winds from the south. Calm wind conditions are predicated to be approximately 7.5 per cent of the time during the autumn months.
- In winter, winds are mostly light/gentle breeze (ranging between 1.5 metres per second to 5.5 metres per second) and blow from the east, and occasionally from the west. There are very few winds from the southern quadrant. Calms occurred approximately 10.4 per cent of the time during the winter months.
- In spring, winds are mostly light/gentle breeze to moderate (ranging between 1.5 metres per second to 7.9 metres per second and blow predominantly from east and north-east, with few winds from the southern quadrant. Calms occurred approximately 5.2 per cent of the time during the summer months.

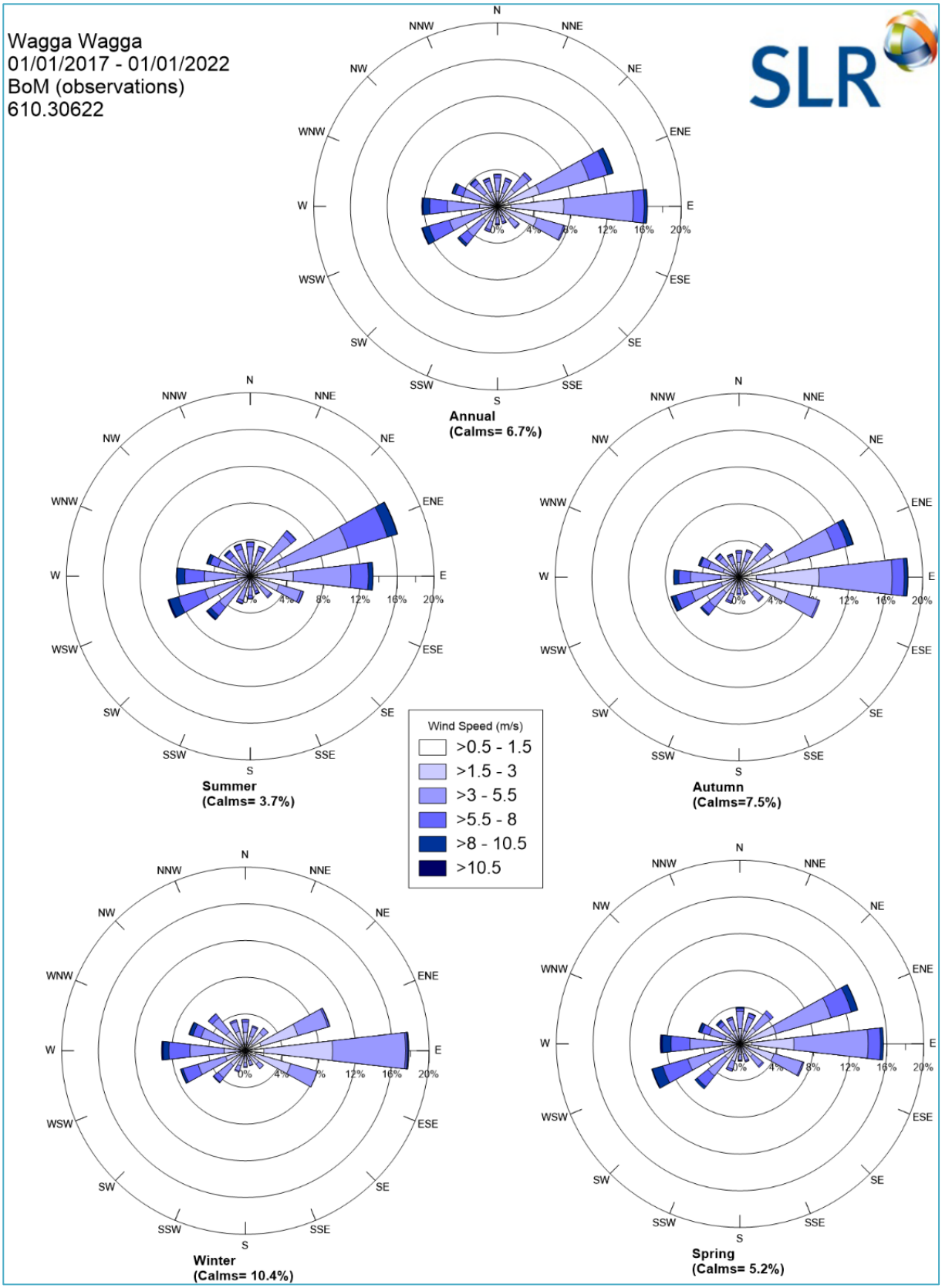


Figure 6-5 Wagga Wagga – annual and seasonal wind roses (2017 – 2021)

6.3 Ambient air quality

6.3.1 Existing emission sources

A review of the National Pollutant Inventory database and NSW EPA EPLs was completed in June 2022 to identify existing emission sources within five kilometres of the project footprint. The identified sources are summarised in **Table 6-4** and the location of each is shown on **Figure 6-6**.

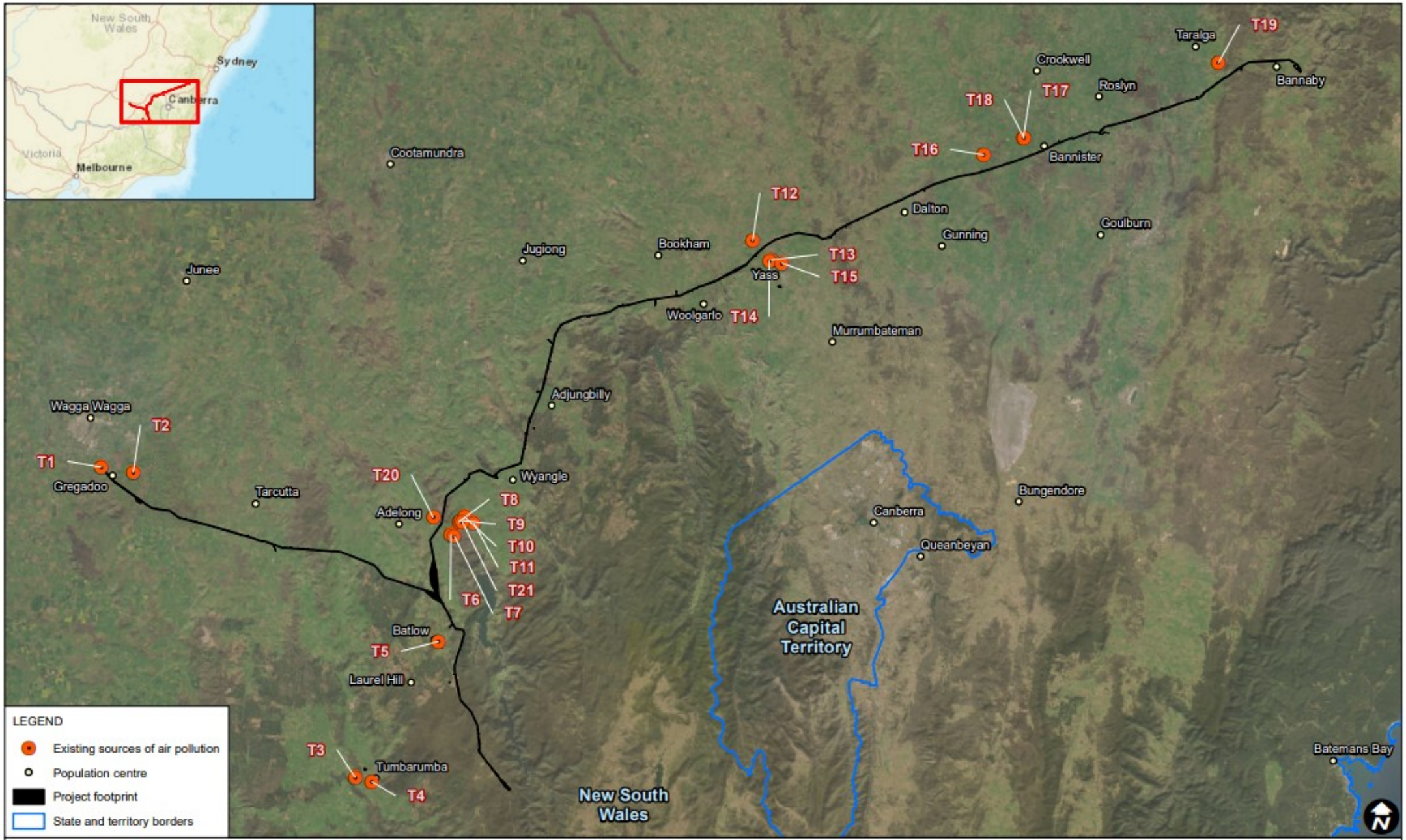
None of the existing sources identified collect or publicly report ambient air quality monitoring data. In order to characterise the existing air quality it has therefore been necessary to depend on data collected by the NSW Government, as discussed in **Section 6.3.2.**

Table 6-4 Existing sources of emissions to air in vicinity of the project footprint

Map ID	Information Source	Distance from project footprint (km)	Facility name	Main activity	Emissions to air
T1	EPL - 6671	0.43	Wagga Wagga Landfill Flare	Landfill flare	CO, chromium (iii) compounds, copper and compounds, lead and compounds, mercury and compounds, NO_x, PM_{10}, $PM_{2.5}$, polycyclic aromatic hydrocarbons, SO_2, total VOCs, zinc and compounds, odour
T2	EPL - 3261	3.0	Ladysmith Feedlot	Beef feedlot	Ammonia, odour, dust
T3	EPL - 1307	2.5	Hyne & Son Pty. Limited	Wood preservation	Arsenic and compounds, beryllium and compounds, cadmium and compounds, CO, chromium (iii) compounds, chromium (vi) compounds, copper and compounds, formaldehyde (methyl aldehyde), lead and compounds, mercury and compounds, nickel and compounds, NO_x, PM_{10}, $PM_{2.5}$, polychlorinated dioxins and furans, polycyclic aromatic hydrocarbons, SO_2, total VOCs
T4	EPL - 448	2.5	Tumbarumba Sewage Treatment Works	Sewage treatment processing by small plants	Odour
T5	EPL - 1774	4.1	Batlow Sewage Treatment Plant	Sewage treatment processing by small plants	Odour
T6	EPL - 1459	2.8	AKD Gilmore Facility	Wood preservation	Arsenic and compounds, chromium (vi) compounds, copper and compounds
T7	EPL - 20596	3.0	Bellette Landfill Gilmore	Waste disposal by application to land	Odour, dust
T8	EPL - 882	2.9	Borg Manufacturing Pty Limited	Wood or timber milling or processing	Dust

Map ID	Information Source	Distance from project footprint (km)	Facility name	Main activity	Emissions to air
T9	EPL - 63	3.8	AKD NSW Pty Limited	Wood preservation	Arsenic and compounds, beryllium and compounds, cadmium and compounds, CO, chromium (iii) compounds, chromium (vi) compounds, copper and compounds, lead and compounds, mercury and compounds, nickel and compounds, NO_x, PM_{10}, $PM_{2.5}$, polychlorinated dioxins and furans, polycyclic aromatic hydrocarbons, SO_2, total VOCs
T10	EPL - 210	4.3	Tumut Wastewater Treatment Works	Sewage treatment processing by small plants	Odour
T11	EPL - 2503	4.9	Tumut Water Filtration Plant	Miscellaneous licensed discharge to waters (at any time)	N/A
T12	EPL - 1805	2.3	Yass Water Treatment Plant	Miscellaneous licensed discharge to waters (at any time)	N/A
T13	EPL - 20691	2.6	Southeastern Livestock Exchange (SELX)	Animal accommodation	Odour, dust
T14	EPL - 20877	2.5	Martins Fertilisers	Composting	Odour, dust
T15	EPL - 1730	4.5	Yass Sewage Treatment Plant	Sewage treatment processing by small plants	Odour
T16	EPL - 21280	3.1	Biala Wind Farm	Electricity works (wind farms)	Dust (negligible)
T17	EPL - 20365	0.05	Gullen Range Wind Farm	Electricity works (wind farms)	Dust (negligible)
T18	EPL - 20911	0.70	Crookwell 2 Wind Farm	Electricity works (wind farms)	Dust (negligible)
T19	EPL - 20429	1.7	Taralga Wind Farm	Electricity works (wind farms)	Dust (negligible)

Map ID	Information Source	Distance from project footprint (km)	Facility name	Main activity	Emissions to air
T20	NPI - 489680	1.8	Visy Pulp and Paper Mill Tumut	Integrated unbleached Kraft pulp and paper manufacturing	Arsenic and compounds, beryllium and compounds, cadmium and compounds, carbon monoxide, chromium (iii) compounds, copper and compounds, hydrochloric acid, lead and compounds, mercury and compounds, nickel and compounds, NO_x, PM_{10}, $PM_{2.5}$, polychlorinated dioxins and furans, polycyclic aromatic hydrocarbons, SO_2, total VOCs, odour
T21	NPI - 487636	4.1	Borg Plantations Tumut	Warehouse timber lamination	Formaldehyde (methyl aldehyde), odour



Scale: 1:1,000,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 13-Mar-2023
Project number: 610.30622

Data Source:

SLR

HUMELINK
AIR QUALITY IMPACT ASSESSMENT
EXISTING SOURCES OF AIR POLLUTION

FIGURE 6-6

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig 6-6 Existing Sources A4.mxd

6.3.2 Background air quality data review

The primary land uses within the study area are agriculture and livestock. It can be assumed that the primary contribution from these land uses to local air quality are:

- particulates (dust) from cultivating and harvesting activities
- dust from livestock
- products of fuel combustion (including particulates) from agricultural equipment, local road and air traffic.

Along the project footprint, there are also built-up areas towards the towns of Goulburn, Yass, Tumut, Batlow and Wagga Wagga. It would be expected that the marginally greater use of vehicles and commercial activities within built-up areas would contribute to background air quality conditions in these locations.

The existing air quality conditions are likely to vary along the length of the project footprint due to the large extent of the study area, the various land uses and proximity to built-up areas. However, as the project footprint generally maintains a considerable distance from urban areas, the background air quality in the study area is expected to be good (ie low concentrations of pollutants), except during episodic events such as dust storms or bush fires.

As no baseline ambient air monitoring was required to be collected for the project, air pollutant data recorded by the closest NSW Government air quality monitoring station (AQMS) to the project footprint were obtained for the last five calendar years 2017 to 2021 (inclusive).

The three closest monitoring stations are shown on **Figure 6-1** and include:

- Bargo AQMS: located approximately 47 kilometres north-east of Bannaby 500 kV substation
- Goulburn AQMS: located approximately 43 kilometres south-west of Bannaby 500 kV substation
- Wagga Wagga North AQMS: located approximately 10.5 kilometres north of Wagga 330 kV substation.

Section 6.3.2.1 to **Section 6.3.2.3** summarise the data from the identified monitoring stations. A summary of the assumed existing background concentrations of particulate matter for the purposes of the construction dust assessment is presented in **Section 6.3.2.4**.

6.3.2.1 Bargo AQMS

Recorded particulate concentrations for Bargo (PM_{10} and $PM_{2.5}$) are summarised in **Table 6-5** (red font indicates an exceedance of the relevant criterion) and presented graphically in **Figure 6-7** and **Figure 6-8.**

Table 6-5 Summary of Bargo AQMS monitoring data (2017 – 2021)

Pollutant	NO_2		PM_{10}		$PM_{2.5}$	
Averaging period	Maximum 1-hour average (pphm)	Annual Average (pphm)	Maximum 24-hour average ($\mu g/m^3$)	Annual average ($\mu g/m^3$)	Maximum 24-hour average ($\mu g/m^3$)	Annual average ($\mu g/m^3$)
Criterion	***8***	***1.5***	***50***	***25***	***25***	***8***
2017	6.6	0.6	53.5	13.9	20.9	6.3
2018	4.8	0.6	60.8	16.9	38.1	6.8
2019	6.6	0.6	188.9	21.2	170.7	10.4
2020	4.5	0.5	265.7	15.9	121.9	7.8
2021	5.3	0.4	63.9	11.8	65.3	5.3
2017 - 2021	-	*0.5*	-	*15.9*	-	*7.3*

Red font indicates an exceedance of the relevant criterion

Notes:

[1] For 2017 - one exceedance of the 24-hour average PM_{10} was recorded.

[2] For 2018 - four exceedances of the 24-hour average PM_{10} and two exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[3] For 2019 - 21 exceedances of the 24-hour average PM_{10} and 21 exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[4] For 2020 - six exceedances of the 24-hour average PM_{10} and 14 exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[5] For 2021 - one exceedance of the 24-hour average PM_{10} and four exceedances of the 24-hour average $PM_{2.5}$ were recorded.

A review of the data shows that exceedances of the 24-hour average PM_{10} criterion were recorded by the Bargo AQMS in all five years, exceedances of the 24-hour average $PM_{2.5}$ criterion were recorded in 2019 to 2021 (inclusive), and exceedances of the annual average $PM_{2.5}$ criterion were recorded in 2019 and 2020. There were no exceedances of the annual average PM_{10} criterion.

A review of the available compliance monitoring reports indicates that the exceedances recorded by the Bargo AQMS were primarily due to exceptional events, such as bushfire emergencies, dust storms and hazard reduction burns. The high number of exceedances recorded by the Bargo AQMS in 2019 and 2020 was due to 'Black Summer' bushfire smoke that blanketed much of NSW for a significant period during November and December 2019 and January 2020.

Ambient concentrations of NO_2 were all below the relevant criteria for all years investigated, as shown in **Figure 6-9**.

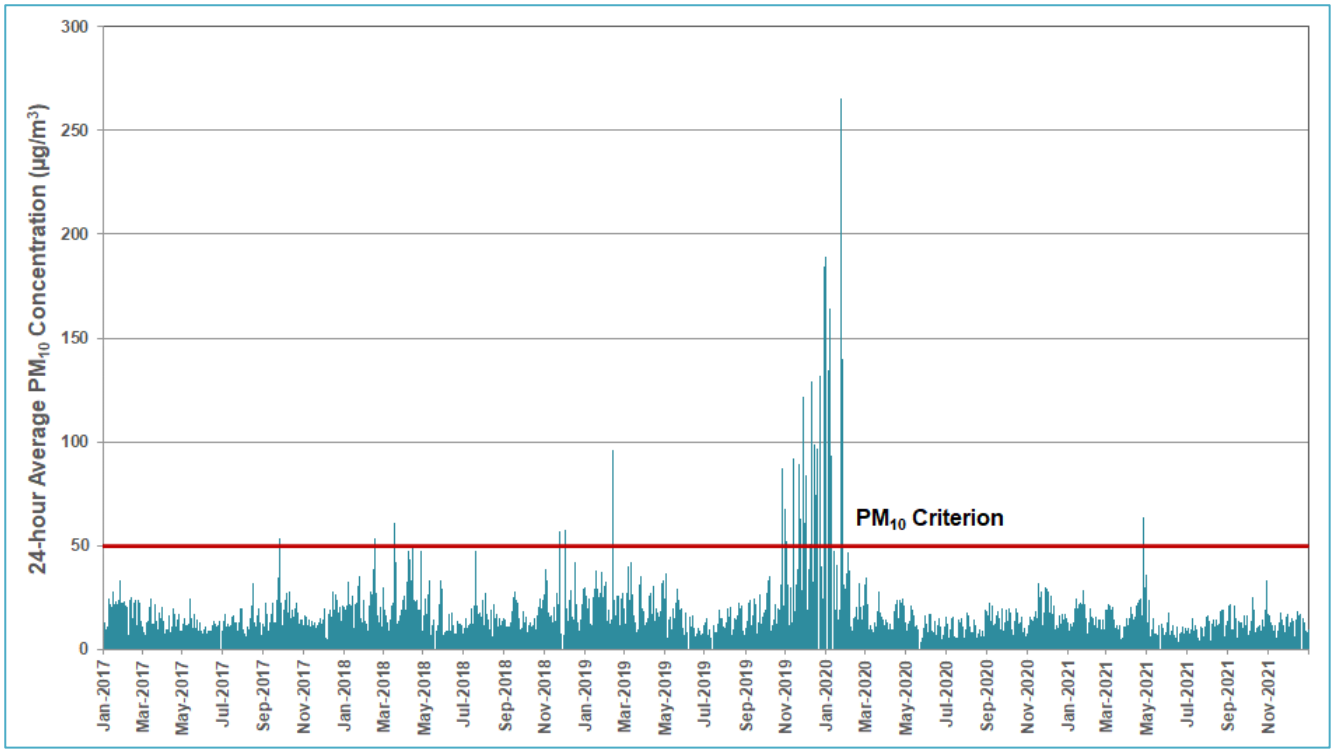


Figure 6-7 Measured 24-hour average PM_{10} concentrations – Bargo AQMS (2017 -2021)

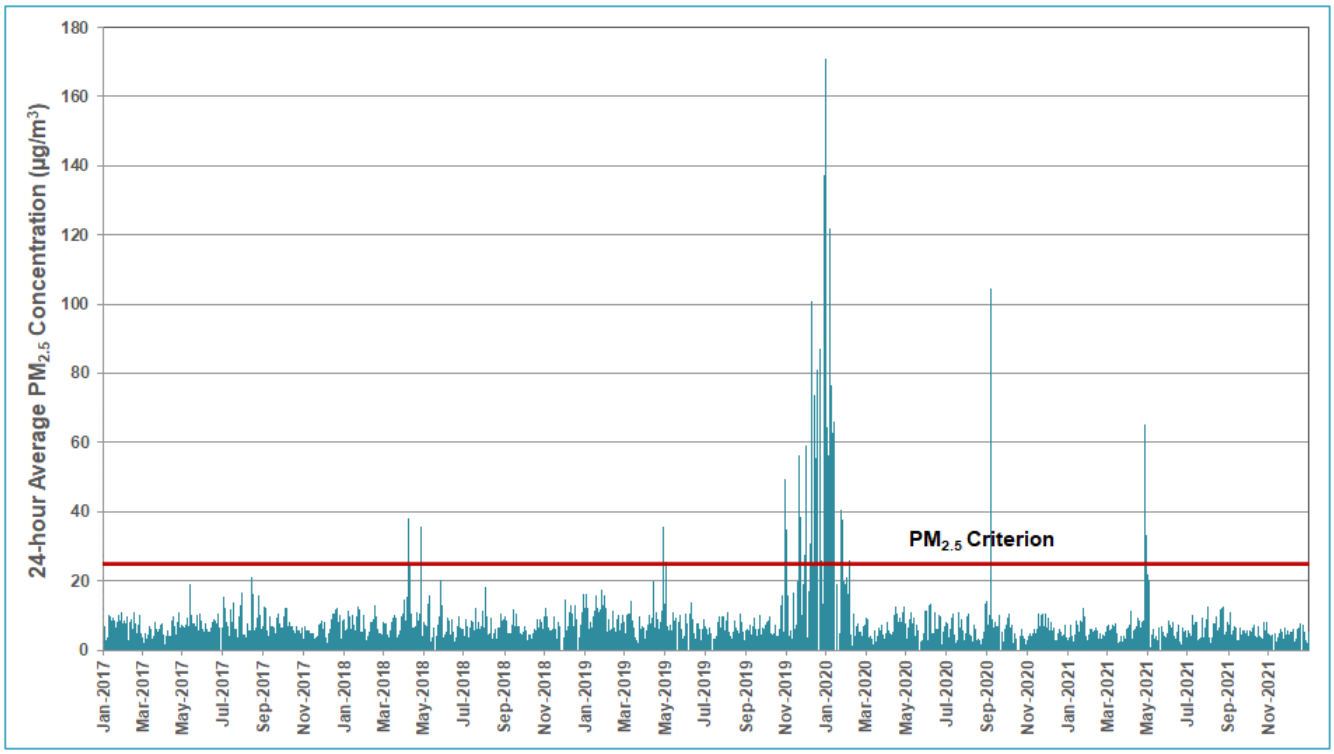


Figure 6-8 Measured 24-hour average $PM_{2.5}$ concentrations – Bargo AQMS (2017 -2021)

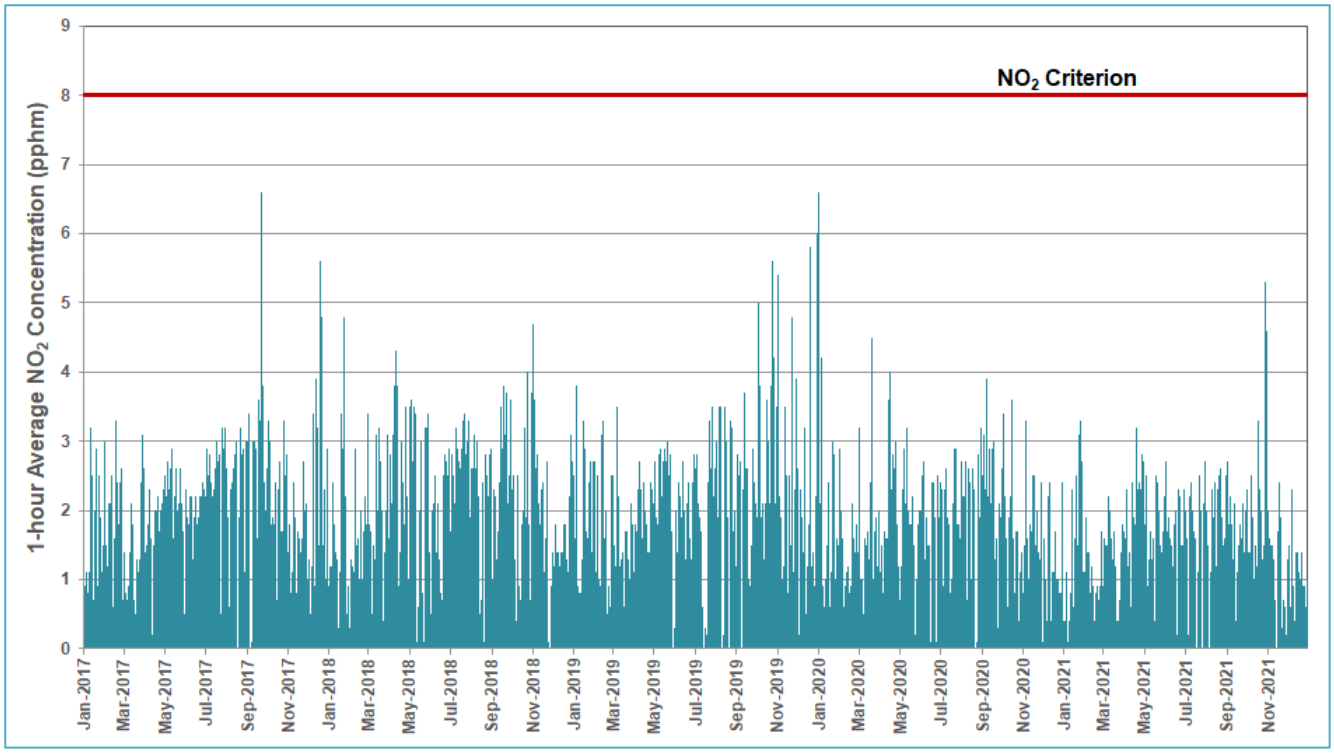


Figure 6-9 Measured 1-hour average NO_2 concentrations – Bargo AQMS (2017 – 2021)

6.3.2.2 Goulburn AQMS

Goulburn AQMS was commissioned in 2019 and thus only three full years of data are available for the period between 2019 to 2021.

Recorded particulate concentrations for Goulburn (PM_{10} and $PM_{2.5}$) are summarised in **Table 6-6** (red font indicates an exceedance of the relevant criterion) and presented graphically in **Figure 6-10** and **Figure 6-11.**

Table 6-6 Summary of Goulburn AQMS monitoring data (2019 – 2021)

Pollutant	NO_2		PM_{10}		$PM_{2.5}$	
Averaging period	Maximum 1-hour average (pphm)	Annual Average (pphm)	Maximum 24-hour average (µg/m³)	Annual average (µg/m³)	Maximum 24-hour average (µg/m³)	Annual average (µg/m³)
Criterion	***8***	***1.5***	***50***	***25***	***25***	***8***
2019	16.1	0.4	494.1	84.3	333.7	60.4
2020	9.9	0.3	556.7	19.2	516.1	11.8
2021	2.9	0.3	30.1	9.2	25.4	5.6
2019-2021	-	*0.4*	-	*37.2*	-	*25.9*

Notes:

[1] For 2019 - 24 exceedances of the 24-hour average PM_{10} and 28 exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[2] For 2020 - 18 exceedances of the 24-hour average PM_{10} and 16 exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[3] For 2021 - zero exceedances of the 24-hour average PM_{10} and one exceedance of the 24-hour average $PM_{2.5}$ were recorded.

A review of the data shows that exceedances of the 24-hour average PM_{10} criterion were recorded by the Goulburn AQMS in 2019 and 2020, exceedances of the 24-hour average $PM_{2.5}$ criterion were recorded in all years (2019 – 2021), and exceedances of the annual average $PM_{2.5}$ criterion were recorded in 2019 and 2020. Exceedances of the annual average PM_{10} criterion were recorded for the years 2019 and 2020.

As with Bargo AQMS, a review of the available compliance monitoring reports indicates that the exceedances recorded by the Goulburn AQMS were again primarily due to exceptional events, such as bushfire emergencies, dust storms and hazard reduction burns. The high number of exceedances recorded by the Goulburn AQMS in 2019 and 2020 was also due to the Black Summer bushfire smoke that blanketed much of NSW for a significant period in late 2019 and early 2020.

Ambient concentrations of NO_2 were below the criteria in 2021 but there were exceedances of the one-hour average during the Black Summer bushfire event in 2019 and 2020, as shown in **Figure 6-12**.

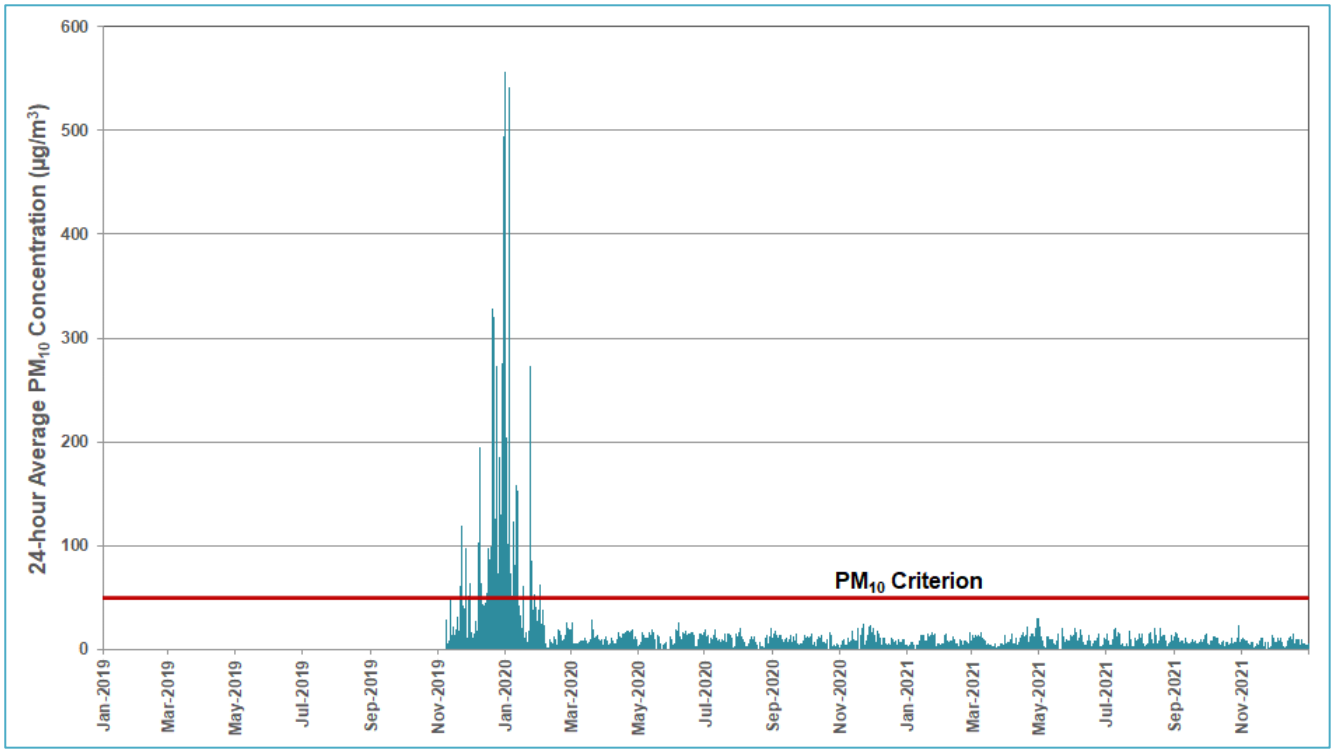


Figure 6-10 Measured 24-hour average PM_{10} concentrations – Goulburn AQMS (2019 -2021)

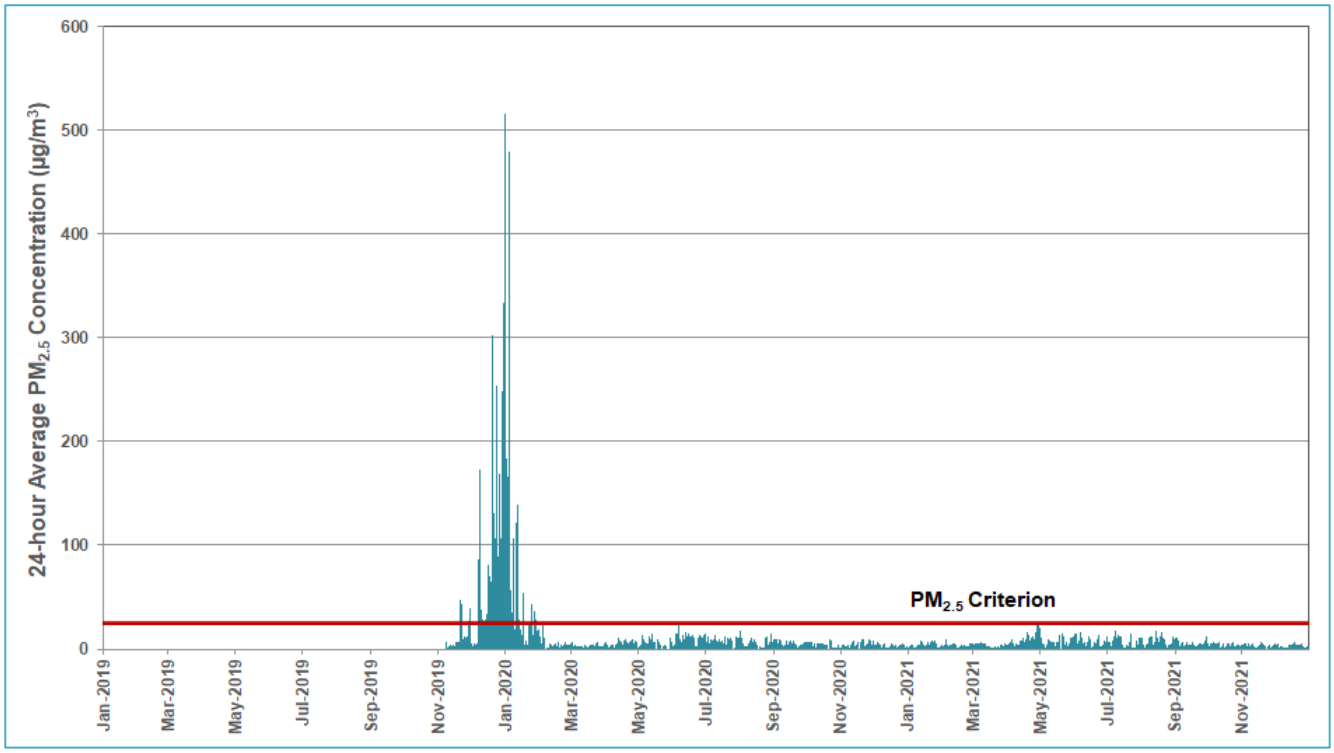


Figure 6-11 Measured 24-hour average $PM_{2.5}$ concentrations – Goulburn AQMS (2019 -2021)

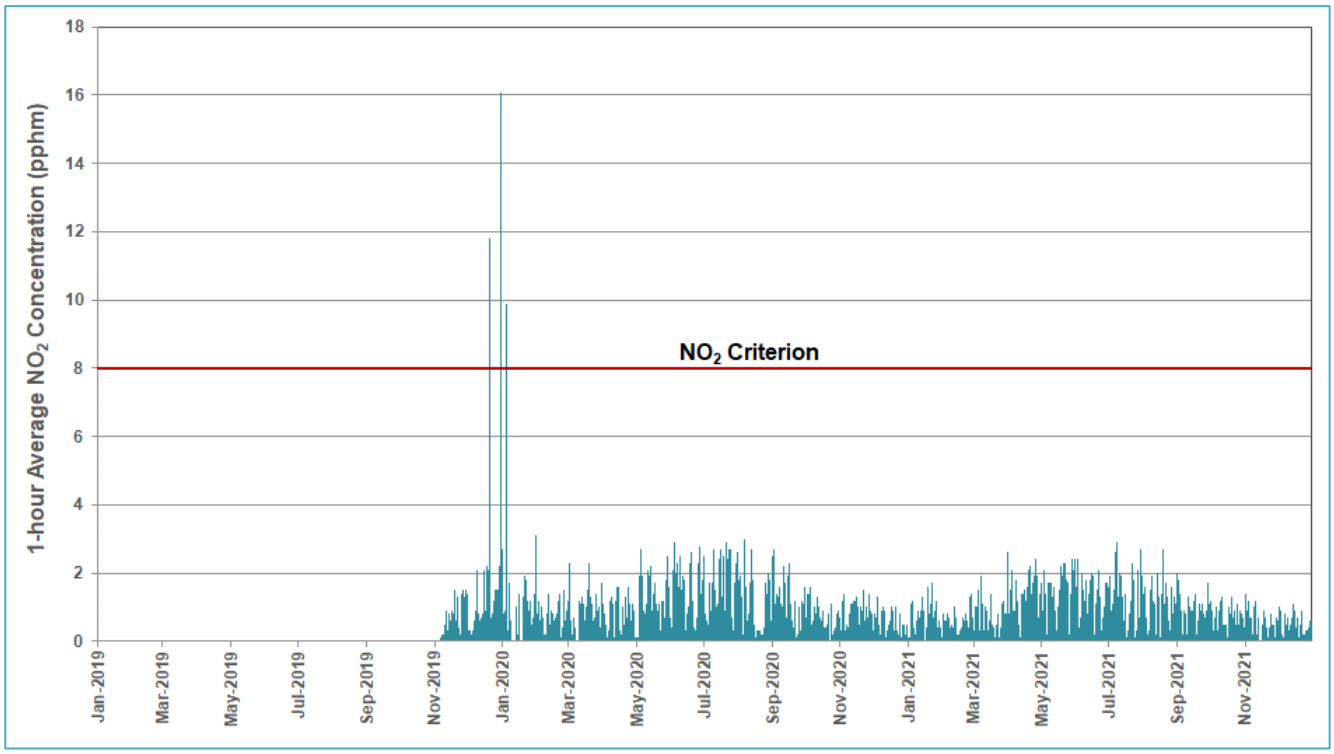


Figure 6-12 Measured 1-hour average NO_2 concentrations – Goulburn AQMS (2019 – 2021)

6.3.2.3 Wagga Wagga North AQMS

Recorded particulate concentrations for Wagga Wagga North (PM_{10} and $PM_{2.5}$) are summarised in **Table 6-7** (red font indicates an exceedance of the relevant criterion) and presented graphically in **Figure 6-13** and **Figure 6-14.**

Table 6-7 Summary of Wagga Wagga North AQMS monitoring data (2017 - 2021)

Pollutant	PM_{10}		$PM_{2.5}$	
Averaging period	Maximum 24-hour average ($\mu g/m^3$)	Annual average ($\mu g/m^3$)	Maximum 24-hour average ($\mu g/m^3$)	Annual average ($\mu g/m^3$)
Criterion	***50***	***25***	***25***	***8***
2017	171.6	20.6	32.5	8.1
2018	127.2	27.4	21.6	8.4
2019	251.7	35.3	239.6	11.3
2020	295.3	23.2	559.5	10.7
2021	69.1	17.7	25.4	6.3
2017 - 2021	-	*24.9*	-	*9.0*

Notes:

[1] For 2017 - 10 exceedances of the 24-hour average and four exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[2] For 2018 - 34 exceedances of the 24-hour average PM_{10} and zero exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[3] For 2019 - 63 exceedances of the 24-hour average PM_{10} and 17 exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[4] For 2020 - 25 exceedances of the 24-hour average PM_{10} and 13 exceedances of the 24-hour average $PM_{2.5}$ were recorded.

[5] For 2021 - seven exceedance of the 24-hour average PM_{10} and one exceedances of the 24-hour average $PM_{2.5}$ were recorded.

A review of the data shows that exceedances of the 24-hour average PM_{10} criterion and the 24-hour average $PM_{2.5}$ criterion were recorded in all five years, except for $PM_{2.5}$ in 2018. Exceedances of the annual average $PM_{2.5}$ criterion were recorded for all years, excluding 2021. Exceedances of the annual average PM_{10} criterion were recorded for 2018 and 2019. Overall, the data collected in Wagga Wagga is typically higher than the other monitoring locations.

A review of the available compliance monitoring reports indicates that the exceedances recorded by the Wagga Wagga North AQMS were again primarily due to exceptional events, such as bushfire emergencies, dust storms and hazard reduction burns. The high number of exceedances recorded by the Wagga Wagga North AQMS in 2019 and 2020 was again due to the Black Summer bushfire smoke.

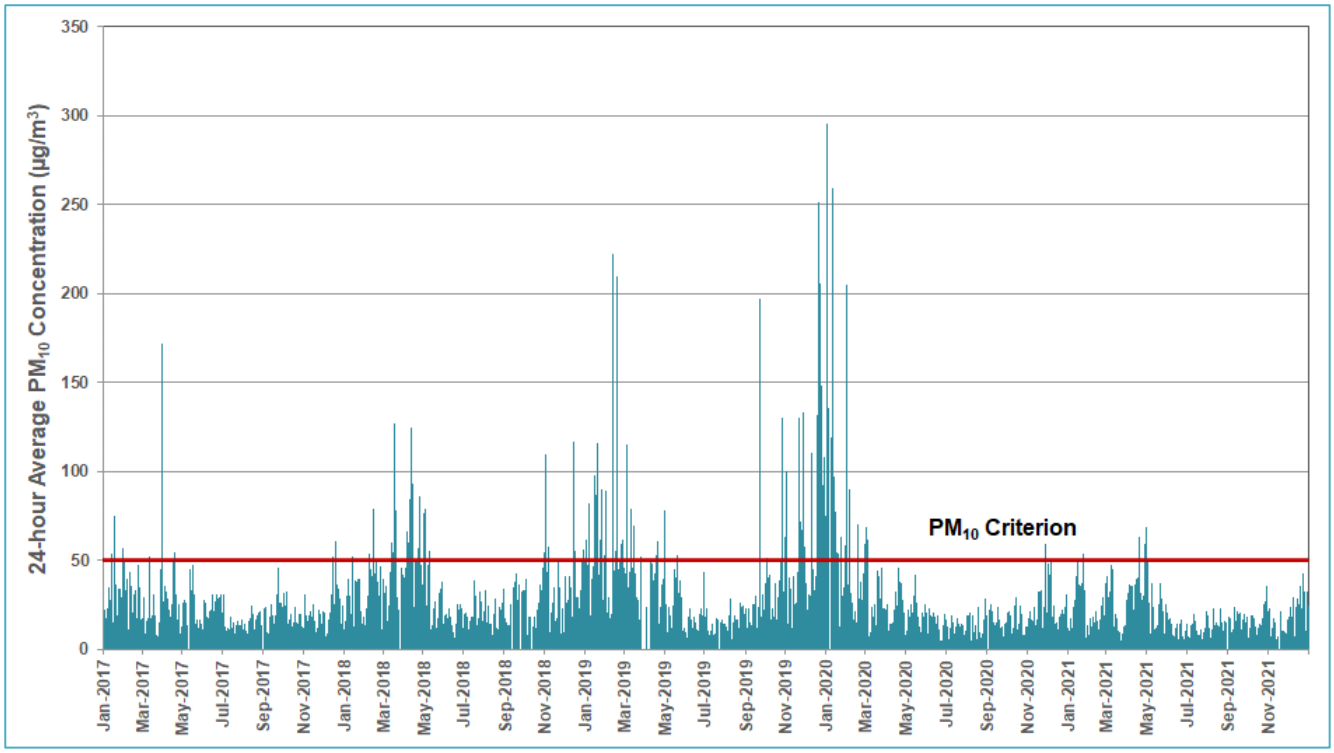


Figure 6-13 Measured 24-hour average PM_{10} concentrations – Wagga Wagga North AQMS (2017 – 2021)

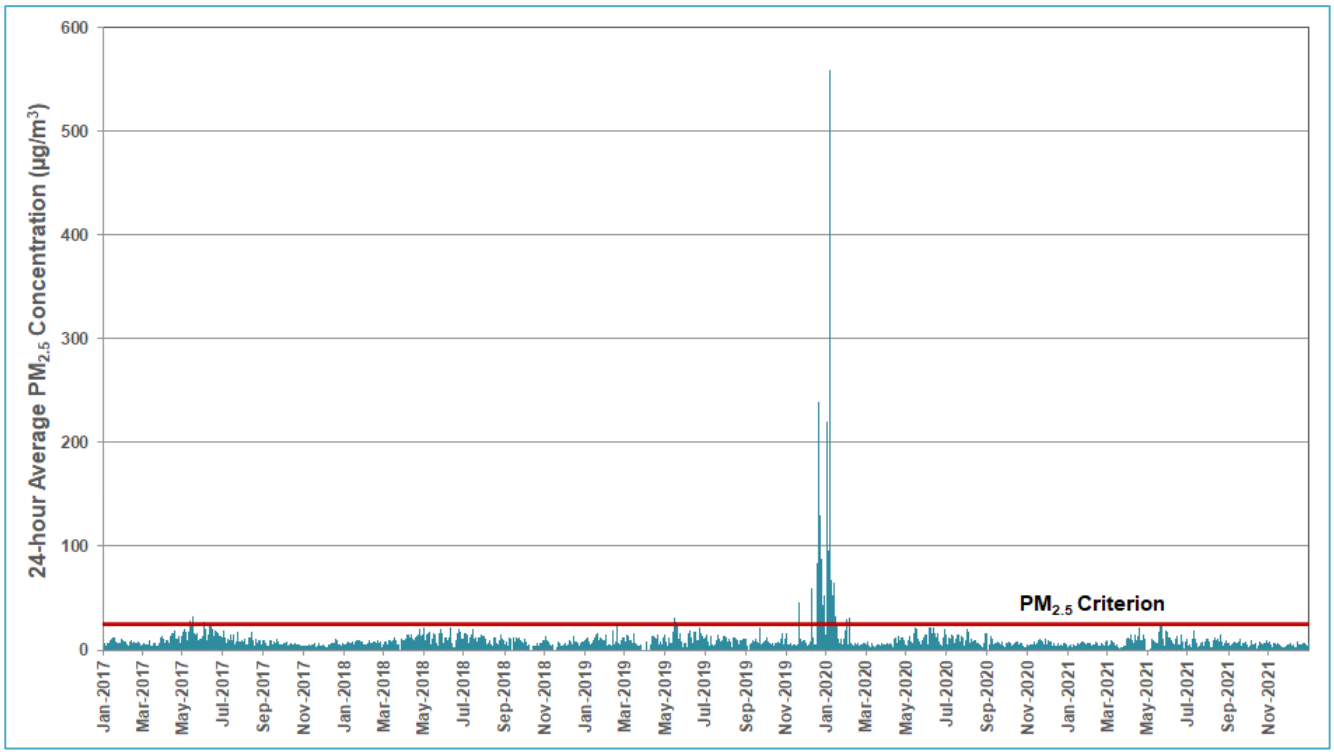


Figure 6-14 Measured 24-hour average $PM_{2.5}$ concentrations – Wagga Wagga North AQMS (2017 – 2021)

6.3.2.4 Assumed background concentrations PM_{10} for construction assessment

The annual average background PM_{10} concentrations assumed for the assessment of construction impacts applying the IAQM Guidance were based on the five-year average of the air quality monitoring data discussed in **Section 6.3.2.1** to **Section 6.3.2.3**, and are as presented in **Table 6-8**. Due to the clear influence of the Black Summer fires, data for the period November 2019 to January 2020 (inclusive) were removed from the analysis.

Table 6-8 Assumed background concentrations for construction dust risk assessment – annual average PM_{10} ($\mu g/m^3$)

Project footprint location	Assumed annual average PM_{10} concentration ($\mu g/m^3$)	AQMS data source
Construction compounds		
C01 - Wagga 330 kV substation compound	22.7	Wagga Wagga North
C02 - Snowy Mountains Highway compound	22.7	Wagga Wagga North
C03 - Snubba Road compound	22.7	Wagga Wagga North
C05 – Maragle 500 kV substation compound	22.7	Wagga Wagga North
C06 - Gregadoo Road compound	22.7	Wagga Wagga North
C07 - Honeysuckle Road compound	22.7	Wagga Wagga North
C08 - Red Hill Road compound	22.7	Wagga Wagga North
C09 - Adjungbilly Road compound	22.7	Wagga Wagga North
C10 - Yass substation compound	10.0	Goulburn
C11 - Woodhouselee Road compound	10.0	Goulburn
C12 - Bannaby 500 kV substation compound	14.3	Bargo
C14 - Memorial Avenue compound	22.7	Wagga Wagga North
C15 - Bowmans Lane compound	22.7	Wagga Wagga North
C16 - Snubba Road compound	22.7	Wagga Wagga North
Accommodation facility		
AC1 – Tumbarumba accommodation facility	22.7	Wagga Wagga North
Substations		
Gugaa 500 kV substation	22.7	Wagga Wagga North
Bannaby 500 kV substation	14.3	Bargo
Wagga 330 kV substation	22.7	Wagga Wagga North
Maragle 500 kV substation	22.7	Wagga Wagga North
Transmission line		
Transmission line section 1	22.7	Wagga Wagga North
Transmission line section 2	22.7	Wagga Wagga North
Transmission line section 3	22.7	Wagga Wagga North
Transmission line section 4	22.7	Wagga Wagga North
Transmission line section 5	10.0	Goulburn
Transmission line section 6	14.3	Bargo

7 Construction impacts

7.1 Dust emissions

During construction, dust emissions can occur during site preparation activities (eg demolition, land clearing and earth moving). Emissions can vary substantially from day to day, depending on:

- the activities being undertaken (earthmoving, number of vehicles and plant, etc)
- the duration of the activities
- the size of the site
- the meteorological conditions (wind speed, direction and rainfall)
- the proximity of receptors to the activities
- the adequacy of mitigation measures applied to reduce or eliminate dust
- the sensitivity of receptors to dust.

A large proportion of the dust emissions during construction would result from construction plant and vehicles moving over temporary roads or access tracks and open ground. If mud is tracked onto local roads, dust emissions can occur at some distance from the originating site. The scale of these impacts depends on the dust suppression and other mitigation measures applied.

A qualitative risk assessment has been undertaken in accordance with the IAQM Guidance to assess the potential dust impacts of dust emissions during construction.

7.1.1 IAQM Guidance Step 1 – screening the need for a detailed assessment

As described in **Section 5.4.1**, according to the IAQM Guidance, a detailed assessment is required where sensitive receptors are located:

- within 350 metres of the boundary of a site (in this case, the project footprint)
- 50 metres from route(s) used by construction vehicles on a public highway
- up to 500 metres from the site entrance(s).

As the project covers a total length of approximately 360 kilometres and comprises various construction components (as listed in **Table 2-1**), sensitive receptors have been identified for the different sections of the transmission line (refer to **Section 7.1.1.1**), substations (refer to **Section 7.1.1.2**) and the construction compounds/worker accommodation facility (refer to **Section 7.1.1.3**).

All sensitive receptors within 500 metres have been considered. Where crushing and screening equipment, or concrete batching plants are proposed, professional judgement and where relevant, consideration of the recommended separation distances shown in **Table 4-3,** has been applied to assess whether the above screening distances in the IAQM Guidance are adequate.

7.1.1.1 Transmission line

As noted in **Section 5.8**, the IAQM method is not explicitly designed for assessing the impact of linear projects (such as HumeLink).

Due to the length of the project, and the need to consider impacts of construction activities at a local level, the potential impact on air quality of construction activities has been considered in six sections (refer to **Figure 5-1**):

- Transmission line section 1: Wagga 330 kV substation to Wondalga
- Transmission line section 2: Wondalga to future Maragle 500 kV substation
- Transmission line section 3: Wondalga to Adjungbilly
- Transmission line section 4: Adjungbilly to Yass
- Transmission line section 5: Yass to Roslyn
- Transmission line section 6: Roslyn to Bannaby.

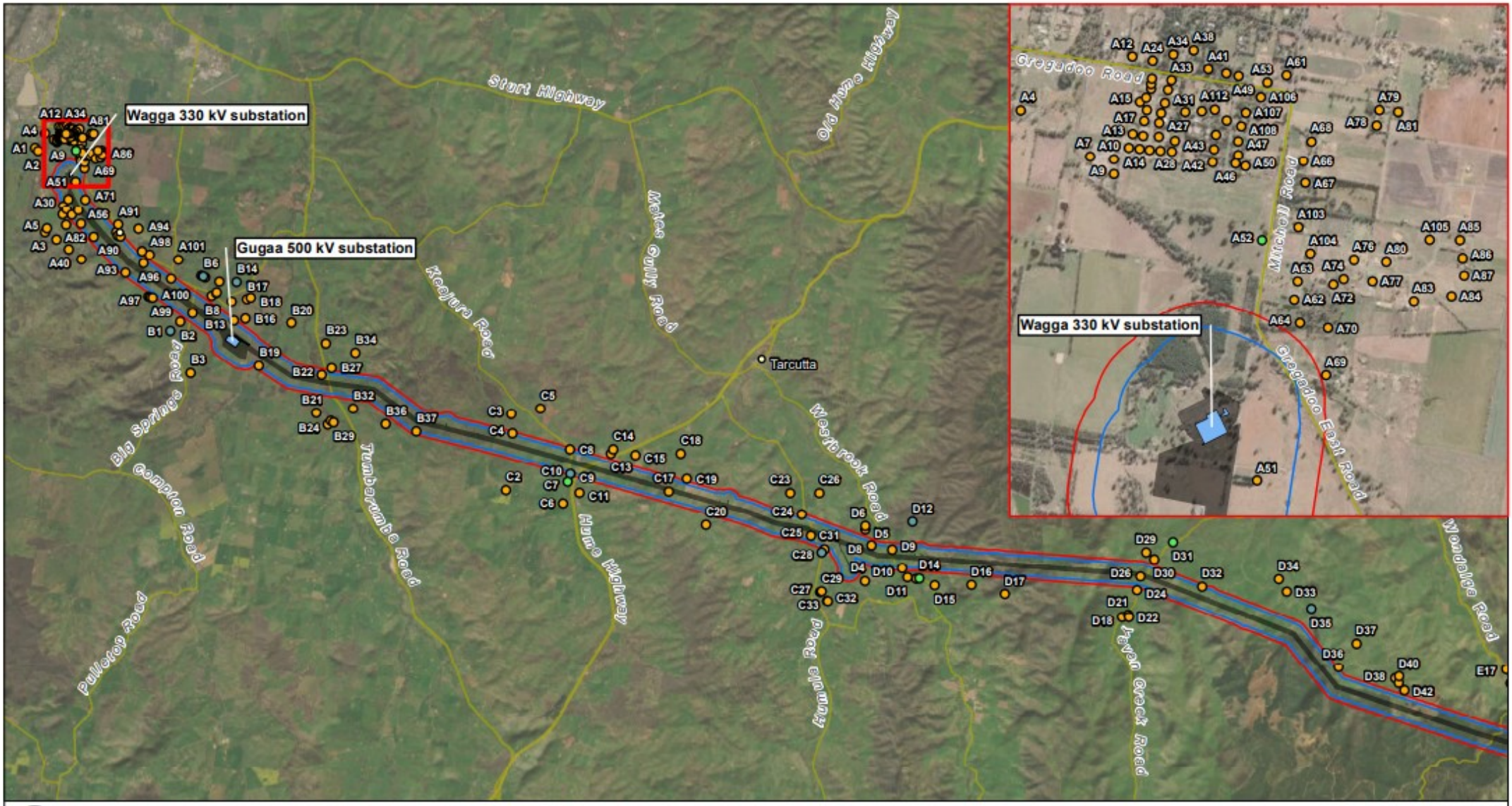
Sensitive receptors identified within 350 metres and 500 metres of the project footprint are listed in **Table 7-1** and shown in **Figure 7-1** to **Figure 7-6**.

As there are sensitive receptors within 350 metres and 500 metres of the project footprint in all six sections of the transmission line, based on the IAQM Guidance, further assessment is required.

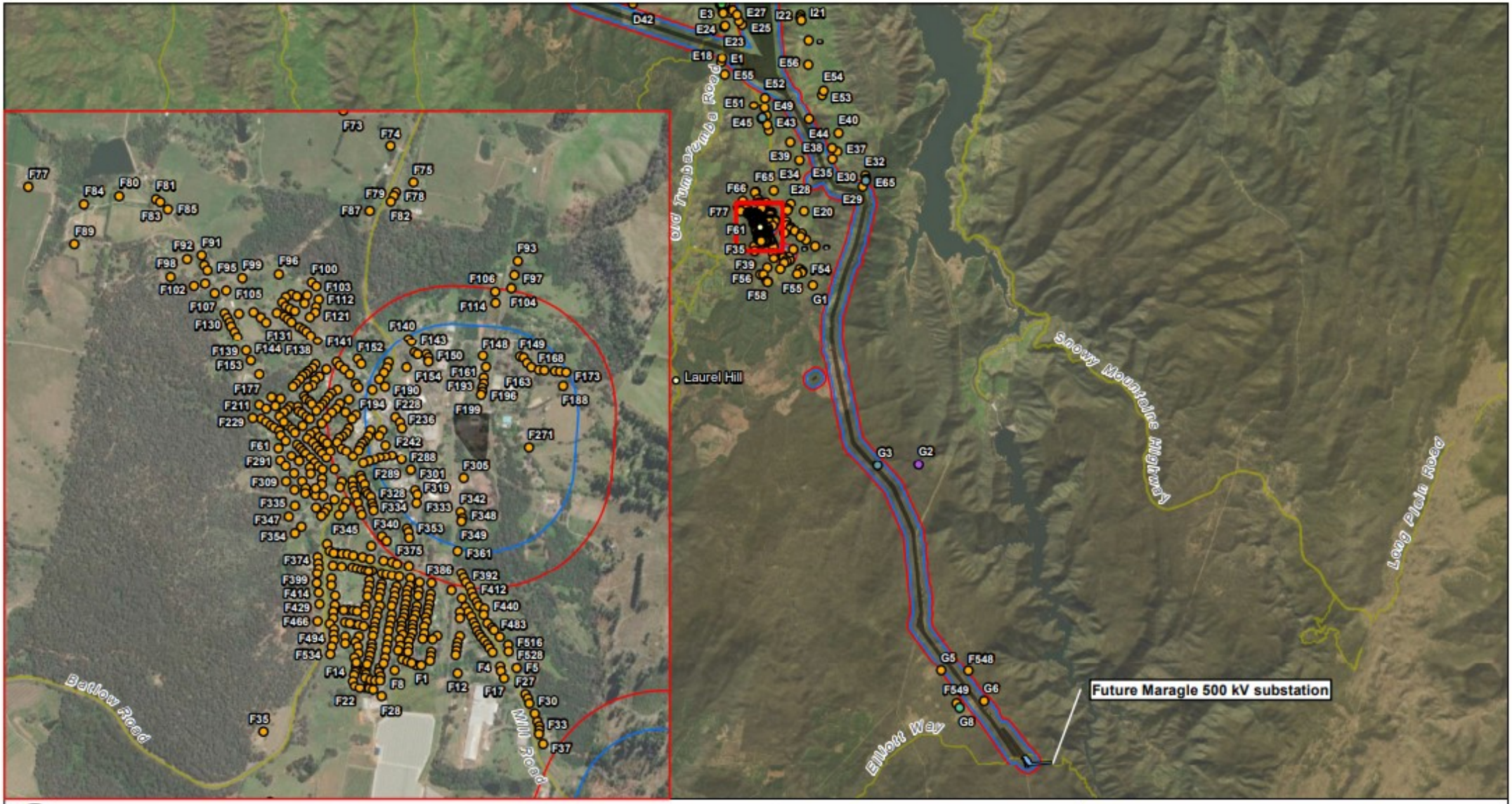
This is considered to be a conservative approach as the major source of dust emissions related to construction of the transmission line would occur only where the structures are installed. There are likely to be many locations within each of these six sections where minimal (if any) dust-generating activities would occur and/or there are no sensitive receptors that could experience any adverse effects.

Table 7-1 Step 1: Screening assessment - transmission line – identified sensitive receptors

Location ID	Sensitive receptors within 350 m	Receptor type	Sensitive receptors within 350m to 500 m	Receptor type	Further assessment needed?
Transmission line section 1 (**Figure 7-1**)	A37, A39, A45, A51, A56, A57, A65, A82, A90, A93, A96, B4, B19, B22, C17, C25, D8, D9, D26	Residences	A30, A71, A89, A92, A102, B13, B37, C4, C8, C9, C10, C24, C31, D10, D32	Residences	Yes
Transmission line section 2 (**Figure 7-2**)	E25, E29, E44, F41, F42, F43, F44, F46, F47, F140, F143, F145, F146, F147, F148, F149, F150, F151, F154, F156, F157, F161, F162, F163, F164, F168, F169, F170, F172, F173, F174, F180, F182, F184, F188, F190, F193, F194, F196, F199, F228, F236, F242, F245, F246, F253, F255, F267, F271, F281, F284, F285, F288, F289, F301, F305, F319, F324, F333, F342, F348, F349, G3, G6, H2, H4, H9, H11, H16	Residences	E18, E26, E27, F38, F40, F45, F48, F49, F106, F114, F152, F155, F158, F160, F166, F176, F186, F192, F195, F198, F201, F205, F208, F217, F221, F222, F225, F231, F243, F249, F254, F257, F260, F262, F264, F270, F273, F275, F278, F283, F290, F294, F304, F307, F308, F311, F312, F314, F320, F321, F323, F326, F328, F332, F334, F336, F340, F341, F344, F352, F353, F355, F356, F357, F361, F377, F386, F392, F396, F405, G5, H17, H292, H293	Residences	Yes
Transmission line section 3 (**Figure 7-3**)	I14, I19, I25, I28, J12, J24, J30, K15, K23	Residences	I18, I32, I57, I60, I61, I62, J8, J9, J15, J34, J35, J36	Residences	Yes
Transmission line section 4 (**Figure 7-4**)	K44, K50, L5, L12, L31, L50, L52, N7, N16, N72, Q67	Residences	K46, K47, K52, L2, L11, L19, L29, L64, L66, N12	Residences	Yes
Transmission line section 5 (**Figure 7-5**)	N27, N36, N40, N43, N44, N48, N55, N60, O1, O4, O21, O28, O30, O31, O34, O36, O41, O52, O53, P2, P3, P16, P24, P28, P30, P34, P37, P38, P41, P42, Q5, Q6, Q7, Q8, Q22, Q29, Q54, Q60, Q61, Q68	Residences	N20, N21, N42, O11, O46, O47, O48, O49, O51, O57, Q4, Q9, Q23, Q25	Residences	Yes
	O13	Place of worship	Q3	Place of worship	
Transmission line section 6 (**Figure 7-6**)	Q12, Q20, Q33, Q34, Q44, R1, R15, R23, S3, S28, S31, S36	Residences	Q51, R14, R20, R22, S9, S18, S23, S34, T1, U1	Residences	Yes



\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig 7-1 Transmission line DDP All.mxd



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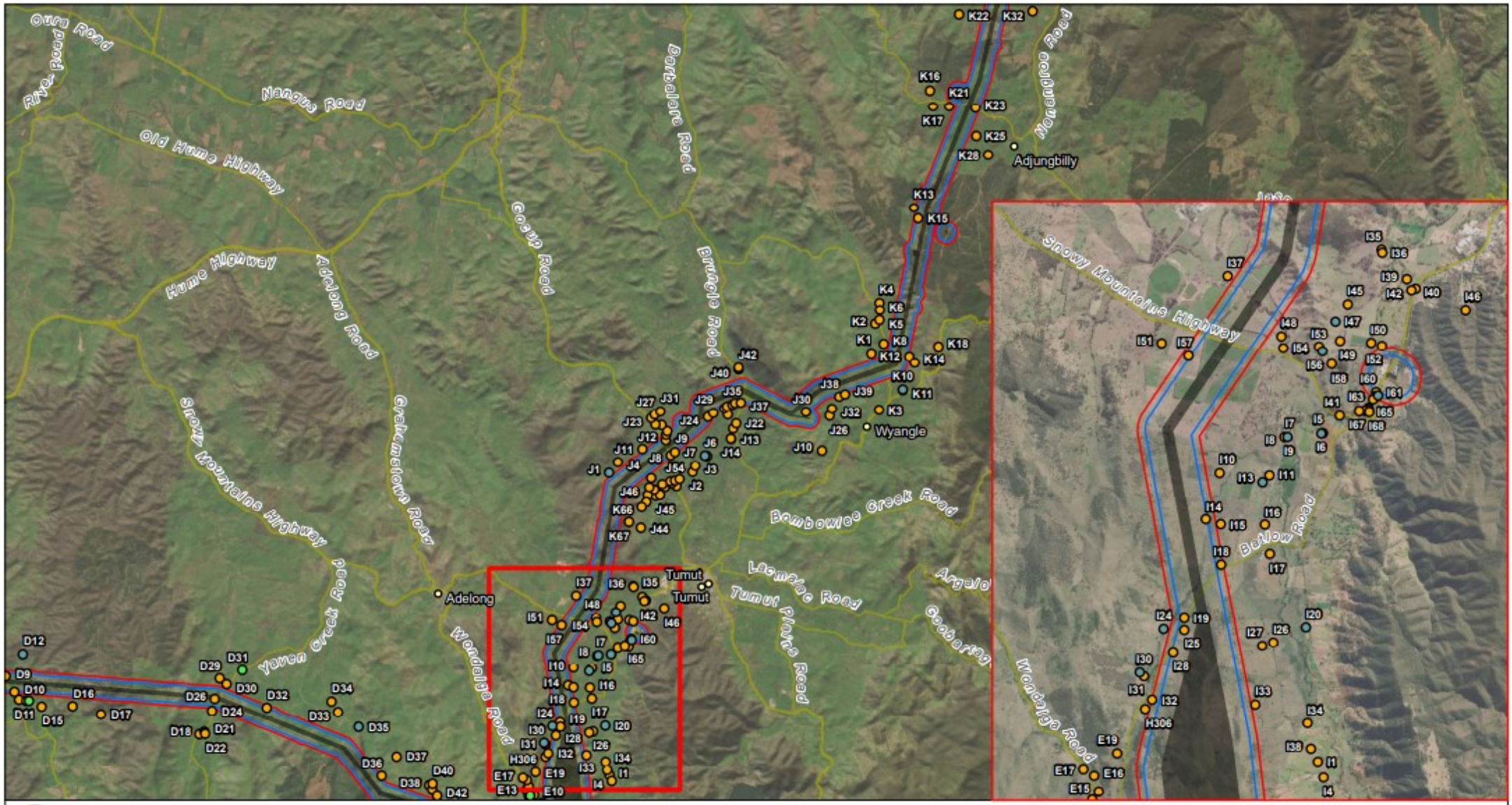
AIR QUALITY IMPACT ASSESSMENT

TRANSMISSION LINE SECTION 2
SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-2

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig 7-2 Transmission line DDP All.mxd



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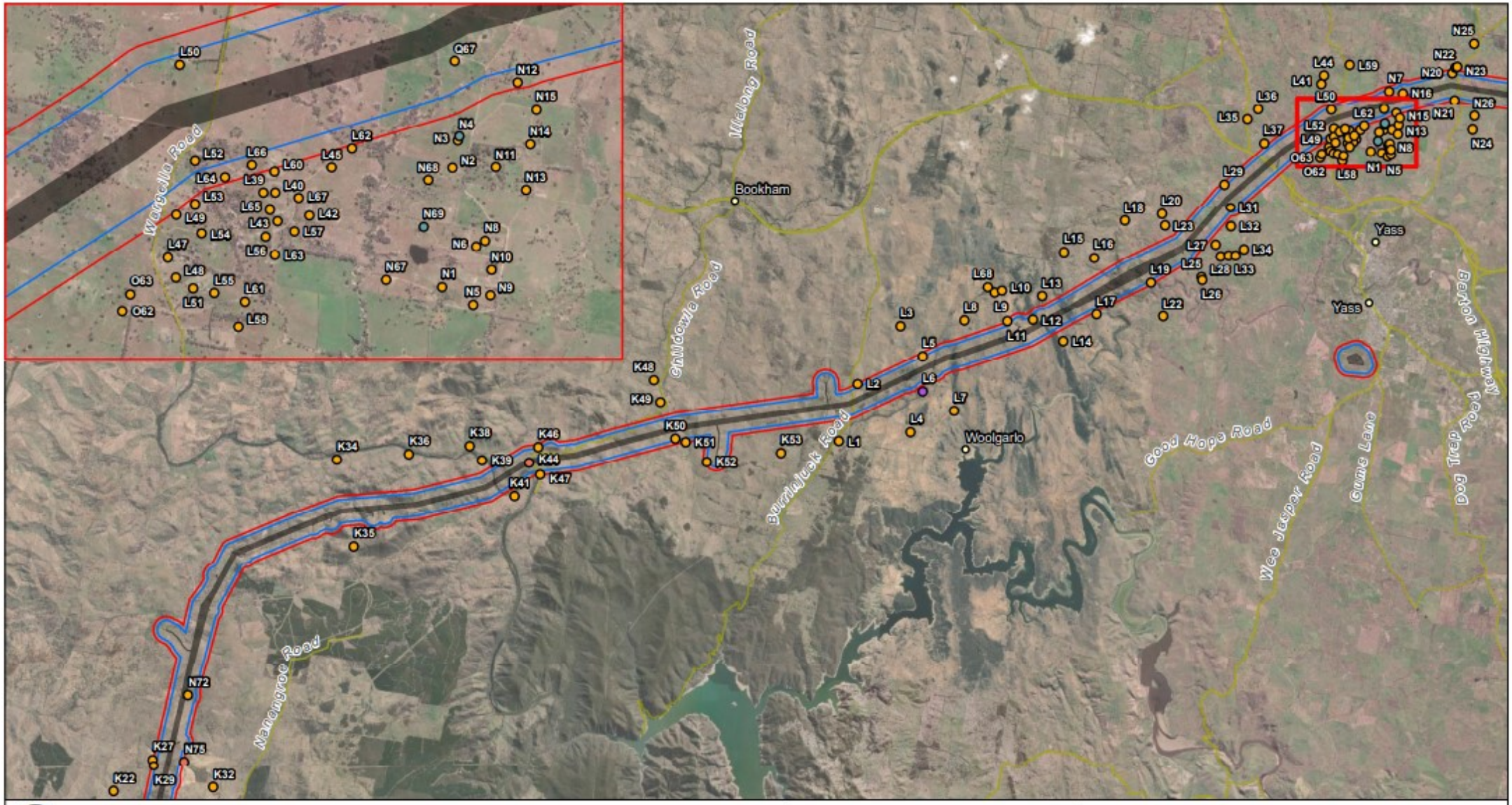
AIR QUALITY IMPACT ASSESSMENT

TRANSMISSION LINE SECTION 3
SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-3

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig 7-3 Transmission line DDP All.mxd



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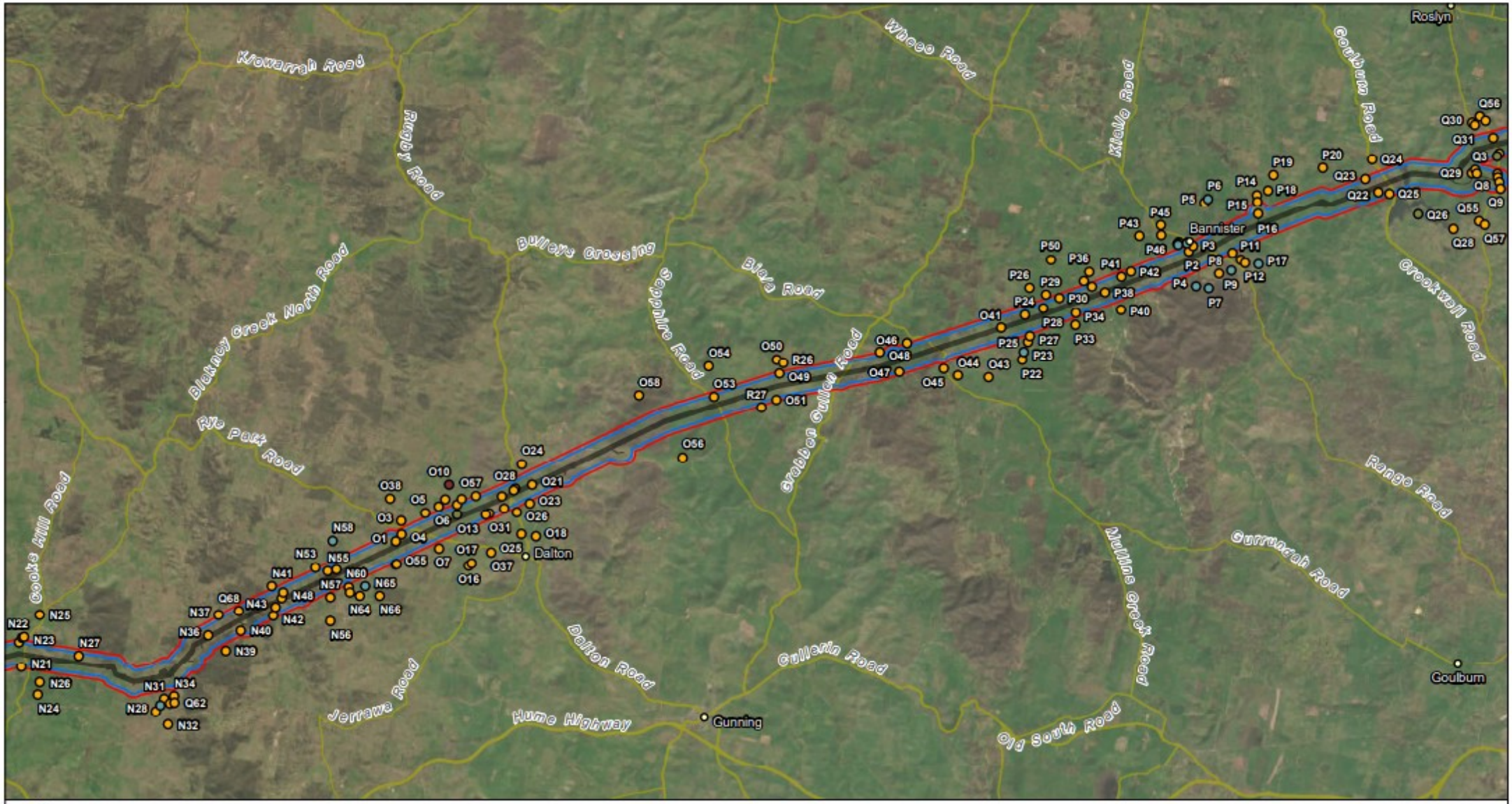
TRANSMISSION LINE SECTION 4
SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-4

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig 7-4 Transmission line DDP All.mxd



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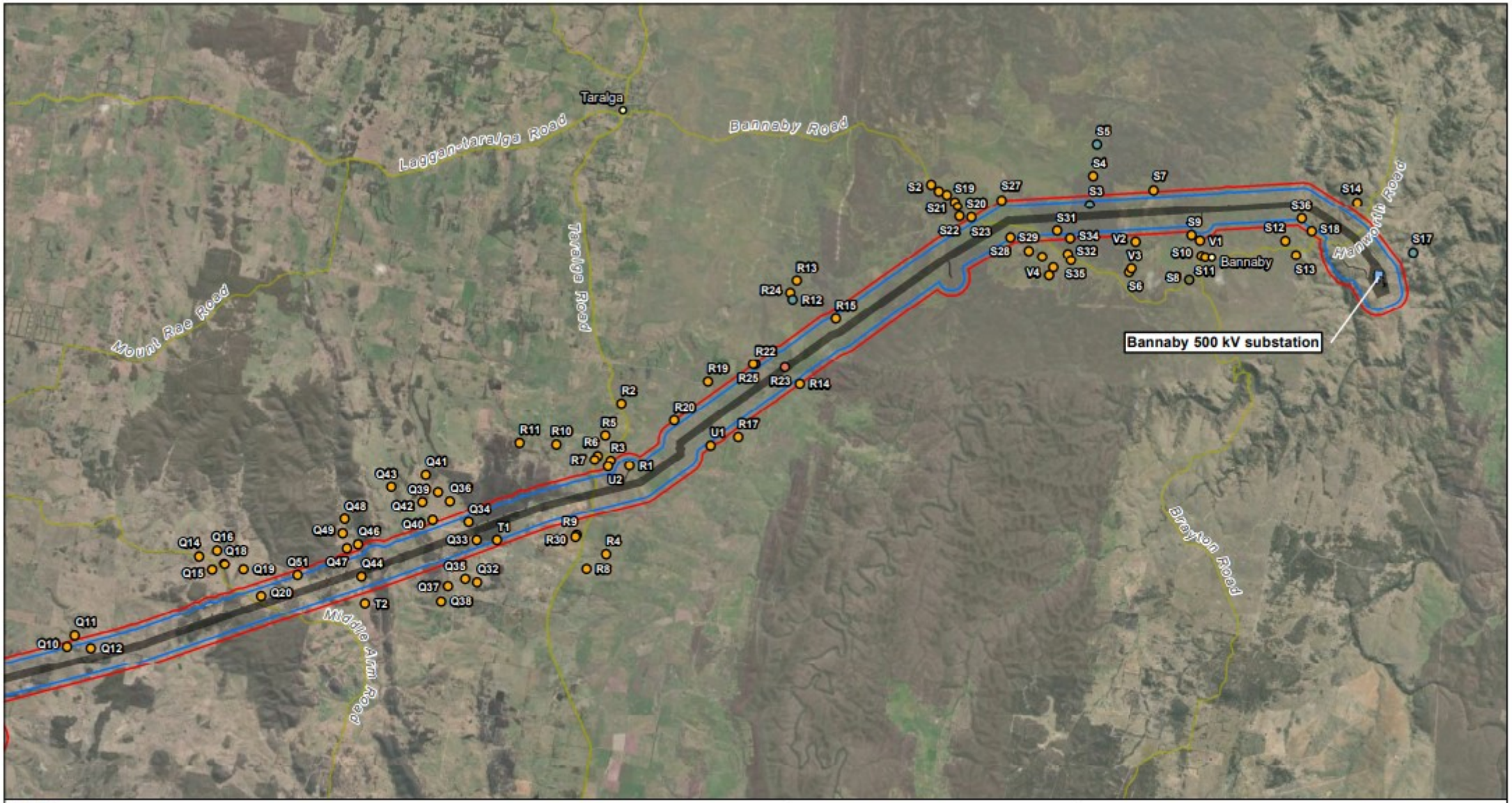
AIR QUALITY IMPACT ASSESSMENT

TRANSMISSION LINE SECTION 5
SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-5

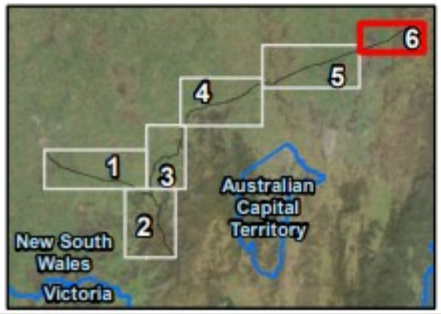
\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig 7-5 Transmission line DDP All.mxd



0 2.5 5 Kilometres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:148,000 at A4
Project Number:	610.30622
Date:	07-Mar-2023
Drawn by:	AN

Population centre
Substation
Project footprint
350 m buffer
500 m buffer
Dilapidated dwelling
Place of worship
Possible dwelling
Dwelling
Major Road
Minor Road



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AIR QUALITY IMPACT ASSESSMENT

TRANSMISSION LINE SECTION 6
SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-6

\\au.sir.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig 7-6 Transmission line DDP All.mxd

7.1.1.2 Substations

This sections presents the IAQM screening assessment (refer to **Table 7-2**) for the following substation activities:

- modification of the existing Wagga 330 kV substation
- construction of the proposed Gugaa 500 kV substation
- connection to the future Maragle 500 kV substation
- modification of the existing Bannaby 500 kV substation.

It is noted that the site location numbers shown on the figures are the same as those shown on **Figure 1-2**.

Gugaa 500 kV substation

The project footprint at the proposed Gugaa 500 kV substation and the IAQM screening distances are shown in **Figure 7-7**.

There are no sensitive receptors within the IAQM screening distances. Therefore, based on the IAQM Guidance, direct application of the IAQM Guidance would conclude that no further assessment is required. The closest receptor (B13) is located approximately 600 meters from the site boundary. However, the indicative earthworks at the proposed Gugaa 500 kV substation are the largest of the project, with cut and fill volumes of 339,430 cubic metres and 280,110 cubic metres respectively (refer to **Table 2-2**) and it is therefore considered to present a greater risk than the other work sites. As such, it is considered that further assessment should be completed. This approach is consistent with the application of professional judgement noted in the IAQM Guidance discussed at **Section 5.1.**

It is also noted that blasting may be required at this location, depending on geotechnical conditions. This would be confirmed during detailed design and would be subject to further assessment.

Wagga 330 kV substation

The project footprint at the existing Wagga 330 kV substation, the IAQM screening distances and the location of identified sensitive receptors are shown in **Figure 7-8**.

There is one sensitive receptor (A51) located within the 350 metre IAQM screening distance from the existing Wagga 330 kV substation. Therefore, based on the IAQM Guidance, further assessment is required.

Bannaby 500 kV substation

The project footprint of the proposed modification at the existing Bannaby 500 kV substation and the IAQM screening distances are shown in **Figure 7-9**.

As there are no sensitive receptors within the 350 metre or 500 metre IAQM screening distances from the Bannaby 500 kV substation, direct application of the IAQM Guidance would conclude that no further assessment is required. The closest receptor (S18) is located approximately one kilometre from the access point to this location.

However, as the Bannaby 500 kV substation compound (C12) is also located within this property, it is considered there is potential for cumulative impacts between activities related to the modification of the substation and activities at the construction compound. As such, it is considered that further assessment should be completed. This approach is consistent with the application of professional judgement noted in the IAQM Guidance discussed at **Section 5.1.**

It is also noted that blasting may be required at this location, depending on geotechnical conditions. This would be confirmed during detailed design and may be subject to further assessment.

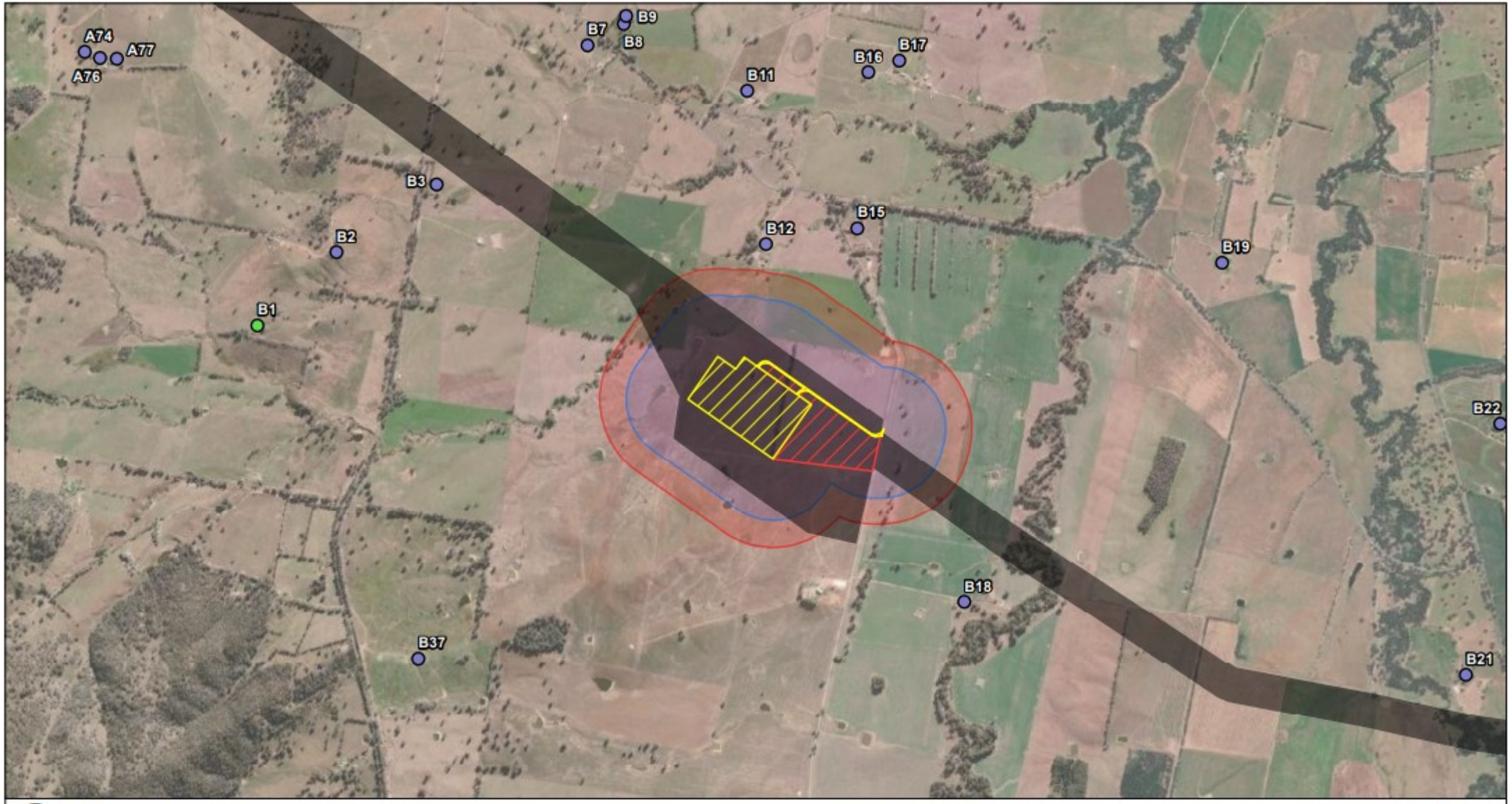
Maragle 500 kV substation

The project footprint at the future Maragle 500 kV substation and the IAQM screening distances are shown in **Figure 7-10.**

It is noted that there are no dust-generating activities related to the project proposed at this location and as such no further assessment is needed.

Table 7-2 Step 1: Screening assessment – substations

Location ID	Sensitive receptors within 350 m	Sensitive receptors within 350 m to 500 m	Receptor type	Further assessment needed?	Notes
Gugaa 500 kV substation (**Figure 7-7**)	None	None	Residence	Yes	The closest sensitive receptor (B13) is located approximately 600 metres from the site boundary. As the indicative earthworks are the largest of the project it is considered that further assessment should be completed.
Wagga 330 kV substation (**Figure 7-8**)	A51	None	Residence	Yes	There is one sensitive receptor (A51) located within the 350 metre IAQM screening distance from the existing Wagga 330 kV substation.
Bannaby 500 kV substation (**Figure 7-9**)	None	None	None	Yes	There are four sensitive receptors (S12, S13, S18, S36) approximately 1 km of the access road to this site. As the Bannaby 500 kV substation compound (C12) is also located within this property, it is considered there is potential for cumulative impacts between activities related to the modification of the substation and activities at the construction compound. As such it is considered that further assessment should be completed.
Maragle 500 kV substation (**Figure 7-10**)	None	None	None	No	No dust generating activities associated with this project at this location.



0 250 500 1,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:30,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

- Dwelling
- Possible dwelling
- Substation
- Construction compound
- Project footprint
- 350 m buffer
- 500 m buffer

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PROPOSED GUGAA 500 KV SUBSTATION AND GREGADOO ROAD COMPOUND (C06) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-7

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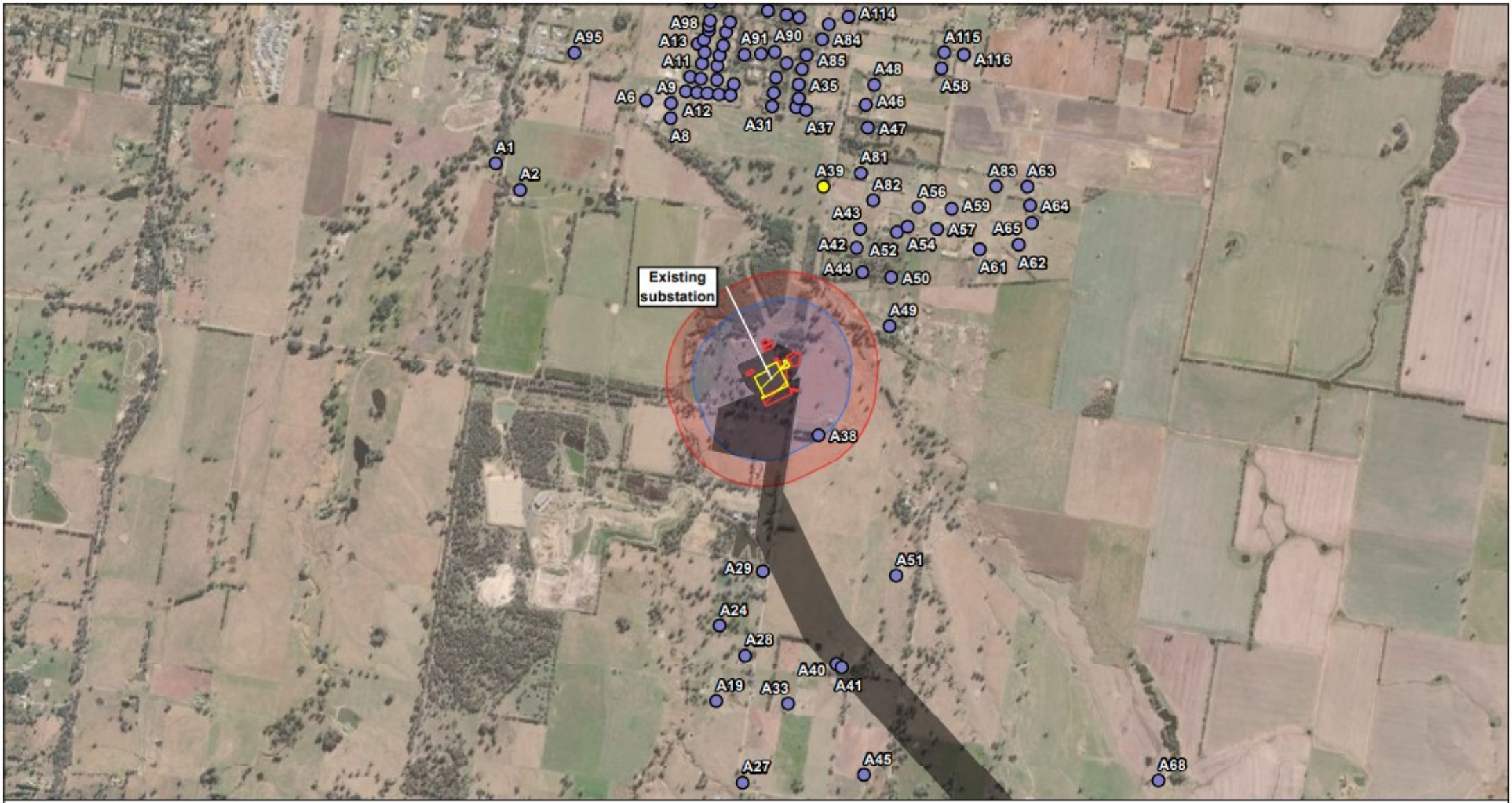
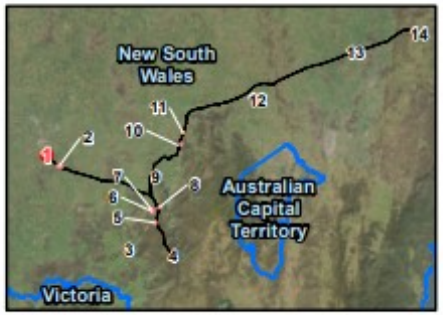


0 250 500 1,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:30,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

- Dwelling
- Other
- Substation
- Construction compound
- Project footprint
- 350 m buffer
- 500 m buffer



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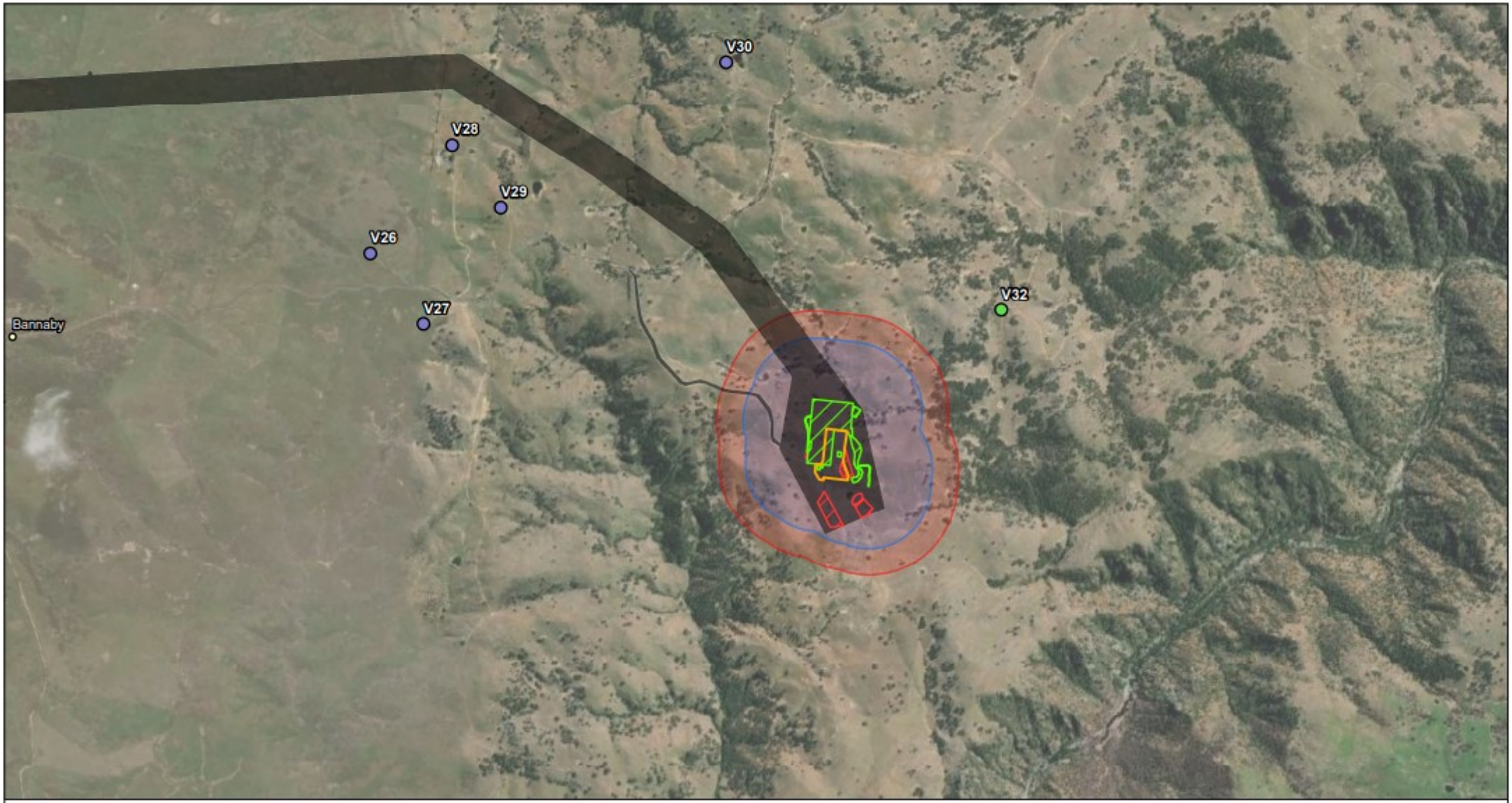
WAGGA 330 KV SUBSTATION AND WAGGA 330 KV SUBSTATION COMPOUND (C01) - SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-8

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig Compounds V2.mxd



0 250 500 1,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:30,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

SLR

- Population centre
- Dwelling
- Possible dwelling
- Substation – modification
- Substation - existing fenceline
- Construction compound
- Project footprint
- 350 m buffer
- 500 m buffer

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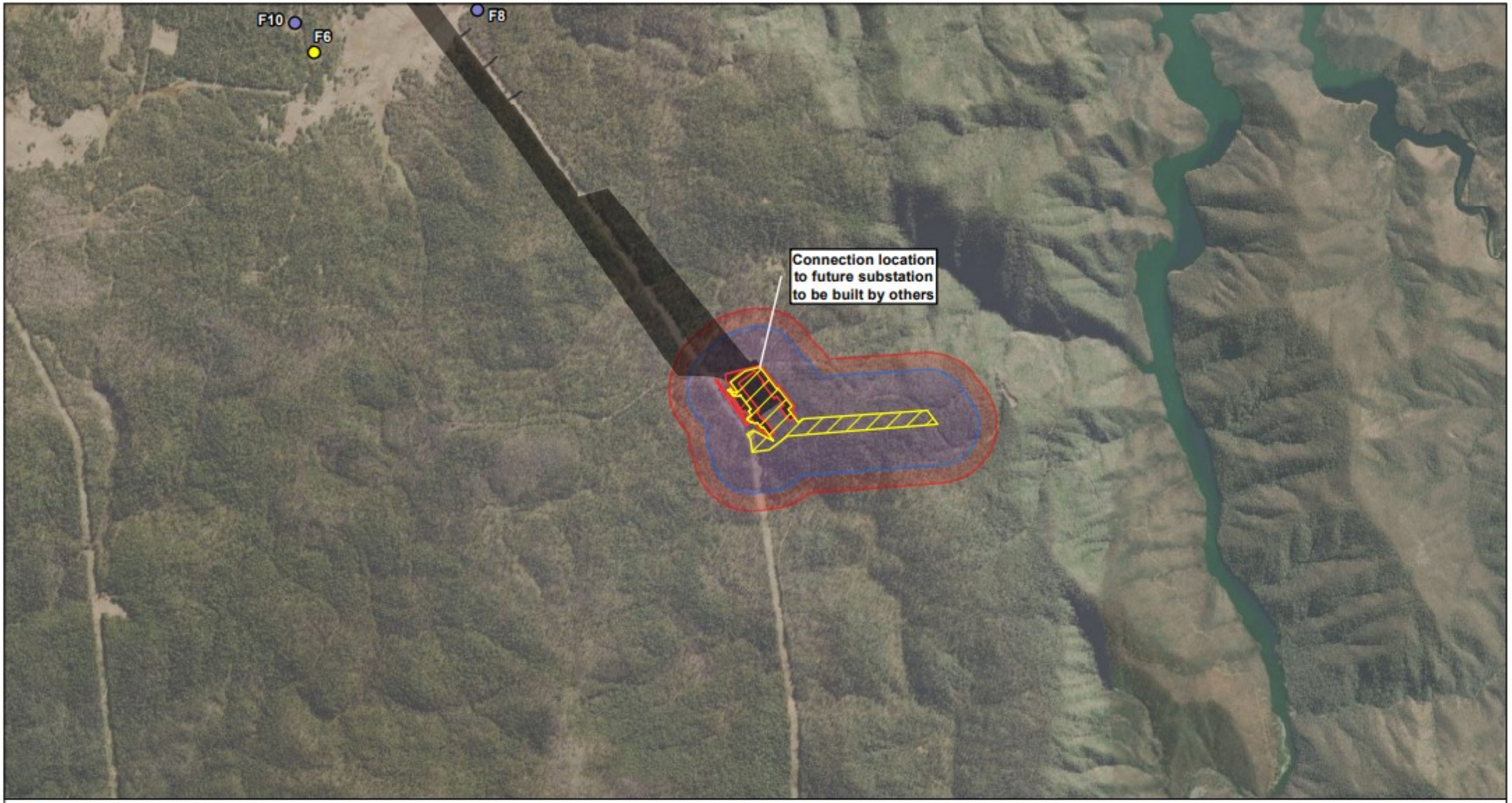
AIR QUALITY IMPACT ASSESSMENT

BANNABY 500 KV SUBSTATION LAYOUT AND BANNABY 500 KV SUBSTATION COMPOUND (C12) - SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-9

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig Compounds V2.mxd

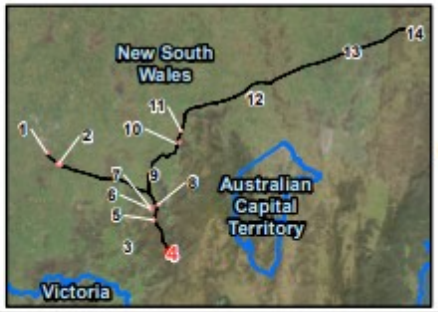


0 250 500 1,000 1,500 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:45,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

SLR

- Dwelling
- Other
- Substation
- Construction compound
- Project footprint
- 350 m buffer
- 500 m buffer



HUMELINK
AIR QUALITY IMPACT ASSESSMENT

FUTURE MARAGLE 500 KV SUBSTATION LAYOUT AND MARAGLE 500 KV SUBSTATION COMPOUND (C05) - SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-10

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig Compounds V2.mxd

7.1.1.3 Construction compounds

As shown on **Figure 1-2**, in addition to the construction of the transmission line and the proposed substation work, the project includes a number of construction compounds and a worker accommodation facility. This section presents the screening assessment for each of these locations. The site location numbers are the same as those shown on **Figure 1-2**.

During the screening assessment, consideration has also been given to the potential for dust emissions from helipads, concrete batching facilities, crushing and screening activities, blasting and access tracks (including access to the compounds).

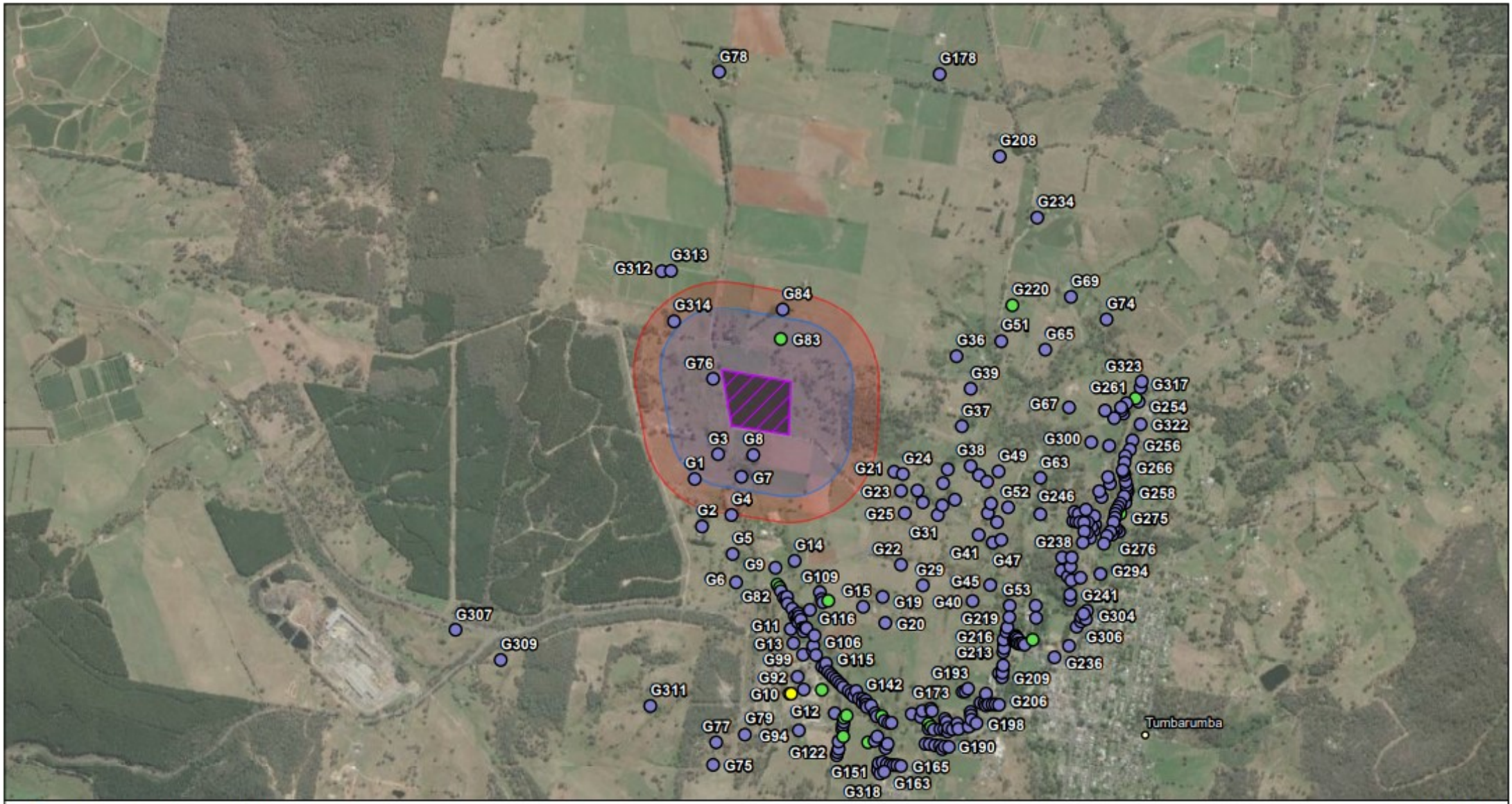
Table 7-3 lists the sensitive receptors identified within the 350 metre and 500 metre screening distances from the project footprint at each location and identifies if further assessment is needed. It also identifies the reference to zoomed in images of each construction compound with the IAQM screening distances and identified sensitive receptors overlaid. For the four construction compounds located at substations, the figures presented in **Section 7.1.1.2** are referred to in order to avoid repetition.

Table 7-3 Step 1: Screening assessment – construction compounds and worker accommodation facility

Location ID	Sensitive receptors within 350 m	Sensitive receptors within 350 m to 500 m	Receptor type	Further assessment needed?	Notes
Wagga 330 kV substation compound (C01) (**Figure 7-8**)	A51	None	Uninhabited Residence	Yes	There is one receptor (A51) located within the IAQM screening distances and there are several sensitive receptors just outside the 500 m screening distance that may be impacted by access to the site.
Gregadoo Road compound (C06) (**Figure 7-7**)	None	None	None	Yes	The closest sensitive receptor (B13) is located approximately 600 metres from the site boundary. As the indicative earthworks are the largest of the project it is considered that further assessment should be completed.
Tumbarumba accommodation facility (AC1) (**Figure 7-11**)	H2, H4, H9, H11, H16	H17, H292, H293	Residence	Yes	In addition to the residences located inside the IAQM screening distances, there are multiple receptors less than approximately 100 m from to the access to the accommodation facility.
Maragle 500 kV compound (C05) (**Figure 7-10**)	None	None	None	No	No dust generating activities associated with this project at this location.
Snubba Road compound (C16) (**Figure 7-12**)	None	None	None	No	Whilst a helipad may be constructed at this location, all sensitive receptors are at least 5 km from the project footprint and as such are considered unlikely to be impacted.
Bowmans Lane compound (C15) (**Figure 7-13**)	F41, F42, F43, F44, F46, F47	F40, F45, F48, F49	Residences	Yes	In addition to the residences located inside the IAQM screening distances, there are multiple receptors less than approximately 10 m from the access to the site and a helipad may be installed at this location.

Location ID	Sensitive receptors within 350 m	Sensitive receptors within 350 m to 500 m	Receptor type	Further assessment needed?	Notes
Memorial Avenue compound (C14) (**Figure 7-14**)	F140, F143, F145, F146, F147, F148, F149, F150, F151, F154, F156, F157, F161, F162, F163, F164, F168, F169, F170, F172, F173, F174, F180, F182, F184, F188, F190, F193, F194, F196, F199, F228, F236, F242, F245, F246, F253, F255, F267, F271, F281, F284, F285, F288, F289	F154, F156, F157, F161, F162, F163, F164, F168, F169, F170, F172, F173, F174, F180, F182, F184, F188, F190, F193, F194, F196, F199, F228, F236, F242, F245, F246, F253, F255, F267, F271, F281, F284, F285, F288, F289	Residences	Yes	In addition to the residences located inside the IAQM screening distances, there are multiple receptors close to the driveway entrance.
Snubba Road compound (C03) (**Figure 7-15**)	None	None	None	Yes	It is possible that a helipad may be constructed within the project footprint at this location. Since there are four sensitive receptors (E61, E62, E63 and E66) located adjacent to the access road to this site, it is considered that further assessment should be completed.
Snowy Mountains Highway compound (C02) (**Figure 7-16**)	None	I14, I15, I16	Residences	Yes	In addition to the residences located inside the IAQM screening distances, there are multiple receptors adjacent to the access to the site.
Honeysuckle Road compound (C07) **(Figure 7-17**)	None	None	None	No	Given the proximity of these two construction compounds to each other, they have conservatively been treated as a single location. It is possible that a helipad may be constructed within the Honeysuckle Road compound (C07) footprint, but since the closest sensitive receptors (N1 and N2) are located over 1 km away it is considered that no further assessment is needed.
Red Hill Road compound (C08) (**Figure 7-17)**	None	None	None	No	

Location ID	Sensitive receptors within 350 m	Sensitive receptors within 350 m to 500 m	Receptor type	Further assessment needed?	Notes
Adjungbilly Road compound (C09) (**Figure 7-18**)	None	None	None	Yes	It is possible that a helipad may be constructed within the project footprint at this location. Since there are five sensitive receptors (N3. N4, N5, N8 and N9) located within 1 km of the site, it is considered that further assessment should be completed.
Yass substation compound (C10) (**Figure 7-19**)	None	None	None	Yes	There are multiple sensitive receptors just outside the 500 m screening distance that may be impacted by traffic entering and leaving the site. It is therefore considered that further assessment should be completed.
Woodhouselee Road compound (C11) (**Figure 7-20**)	None	None	None	Yes	It is possible that a helipad may be constructed within the project footprint at this location. Since there are several sensitive receptors located adjacent to the access road to this site, it is considered that further assessment should be completed.
Bannaby 500 kV substation compound (C12) (**Figure 7-9**)	None	None	None	Yes	A concrete batching plant is proposed for this location, and it is possible that a helipad may be constructed within the project footprint at this location. There are also four sensitive receptors (S12, S13, S18, S36) located within approximately 1 km of the access road to this site. Therefore it is considered that further assessment should be completed.


G78
G178
G208
G234
G313
G312
G314
G84
G83
G76
G3
G8
G1
G7
G4
G2
G5
G14
G9
G6
G109
G82
G15
G19
G40
G307
G116
G20
G219
G11
G13
G106
G216
G309
G99
G115
G213
G92
G193
G209
G311
G10
G142
G173
G206
G12
G79
G77
G94
G198
G190
G122
G75
G151
G165
G318
G163
G220
G69
G74
G51
G65
G36
G39
G323
G261
G317
G67
G254
G37
G322
G300
G256
G38
G49
G63
G266
G21
G24
G23
G52
G246
G258
G25
G275
G31
G238
G276
G22
G41
G47
G29
G294
G45
G53
G241
G304
G306
G236
Tumbarumba
0
250
500
1,000
Metres
Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:30,000 at A4
Project Number: 610.30622
Date: 01-Mar-2023
Drawn by: AN
Population centre
Dwelling
Possible dwelling
Other
Worker accommodation facility
Project footprint
350 m buffer
500 m buffer
New South Wales
Australian Capital Territory
Victoria
SLR
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TUMBARUMBA ACCOMMODATION FACILITY (AC1) – SENSITIVE RECEPTOR LOCATIONS
FIGURE 7-11
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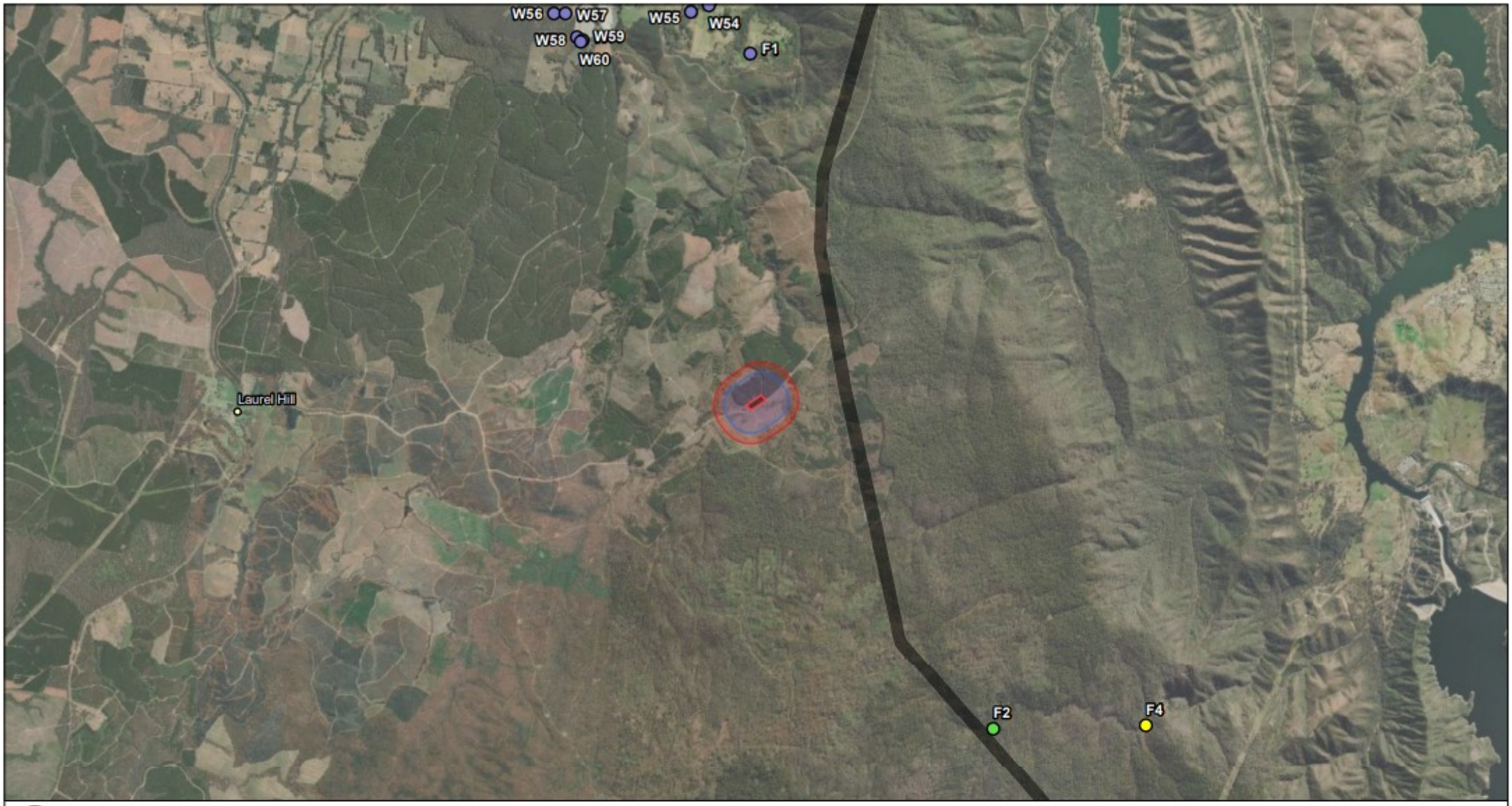

0 500 1,000 2,000 3,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:80,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

- Population centre
- Dwelling
- Possible dwelling
- Other
- Construction compound
- Project footprint
- 350 m buffer
- 500 m buffer

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SNUBBA ROAD COMPOUND (C16) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-12

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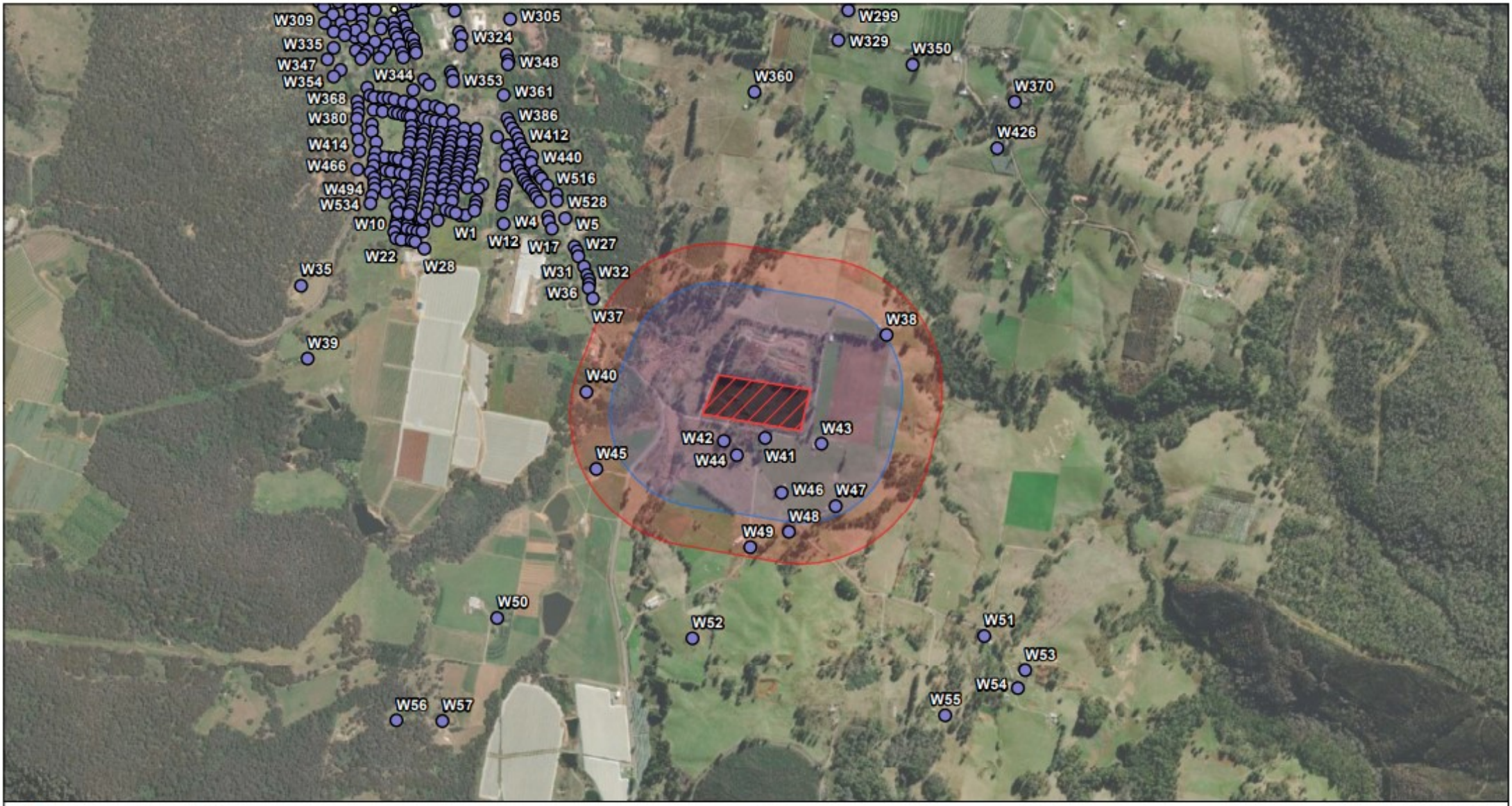

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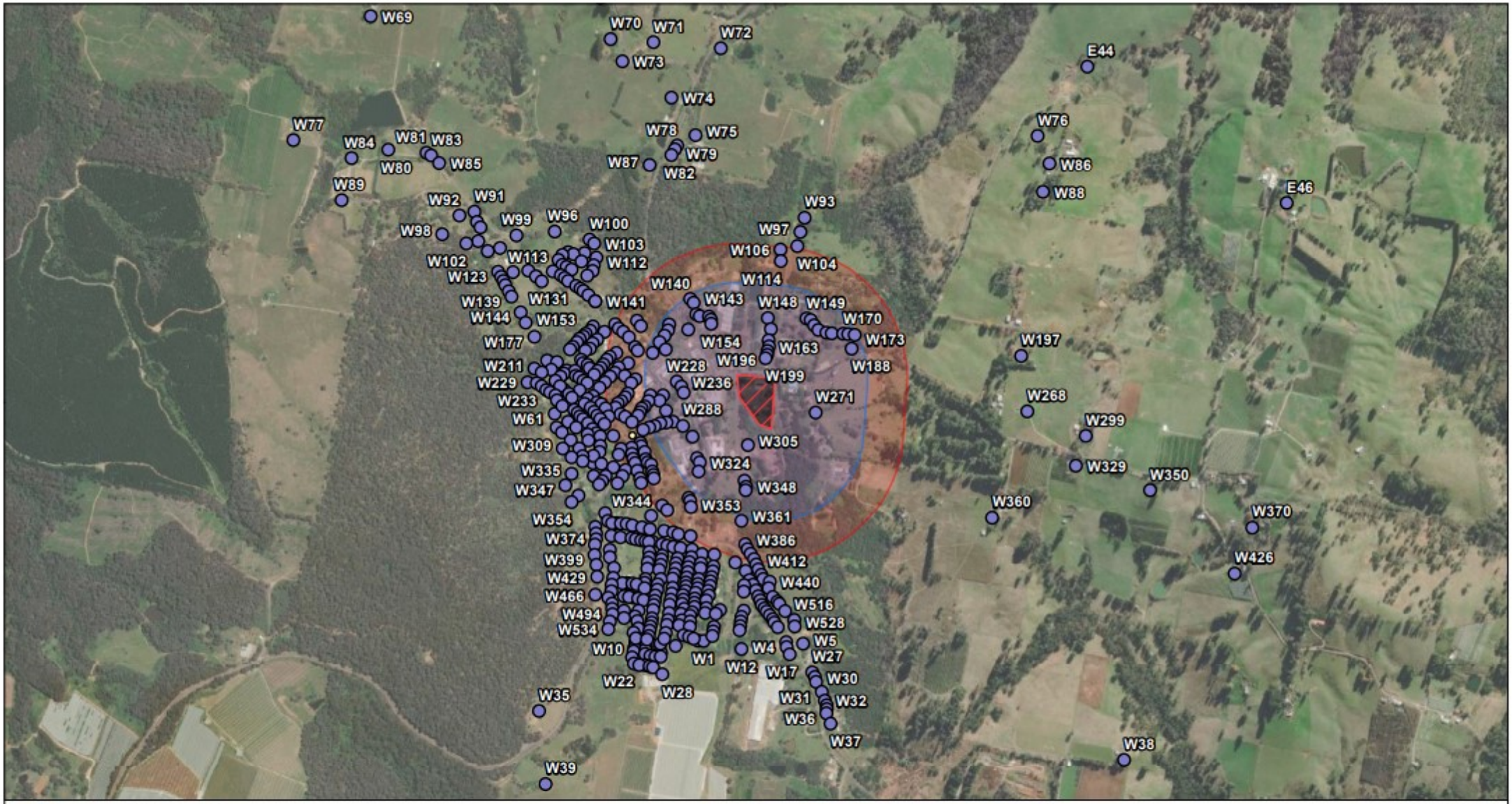
AIR QUALITY IMPACT ASSESSMENT

BOWMANS LANE COMPOUND (C15) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-13

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig Compounds V2.mxd



0 250 500 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

- Population centre
- Dwelling
- Construction compound
- Project footprint
- 350 m buffer
- 500 m buffer

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MEMORIAL AVENUE COMPOUND (C14) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-14

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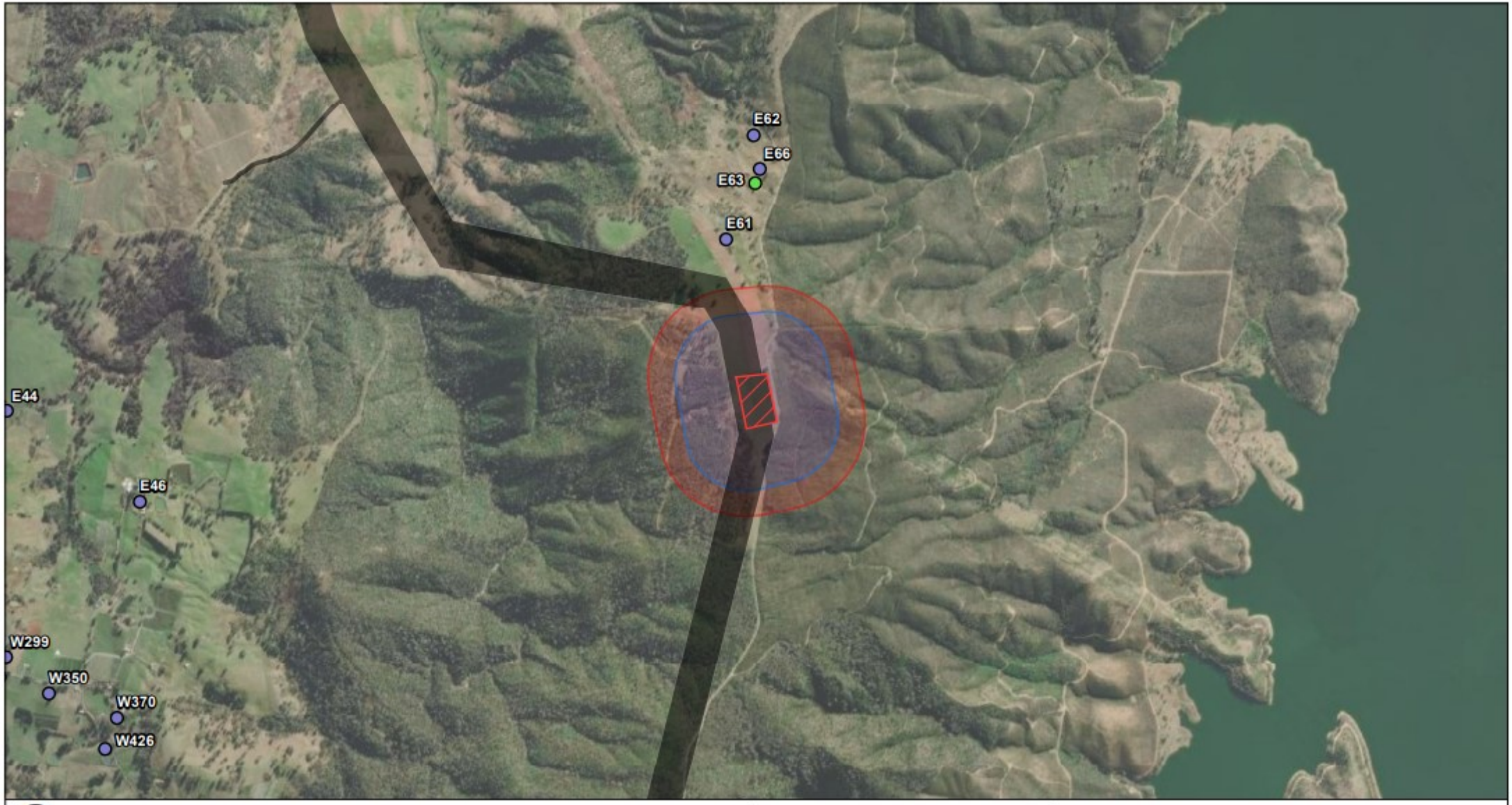

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:30,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

SLR

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SNUBBA ROAD COMPOUND (C03) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-15

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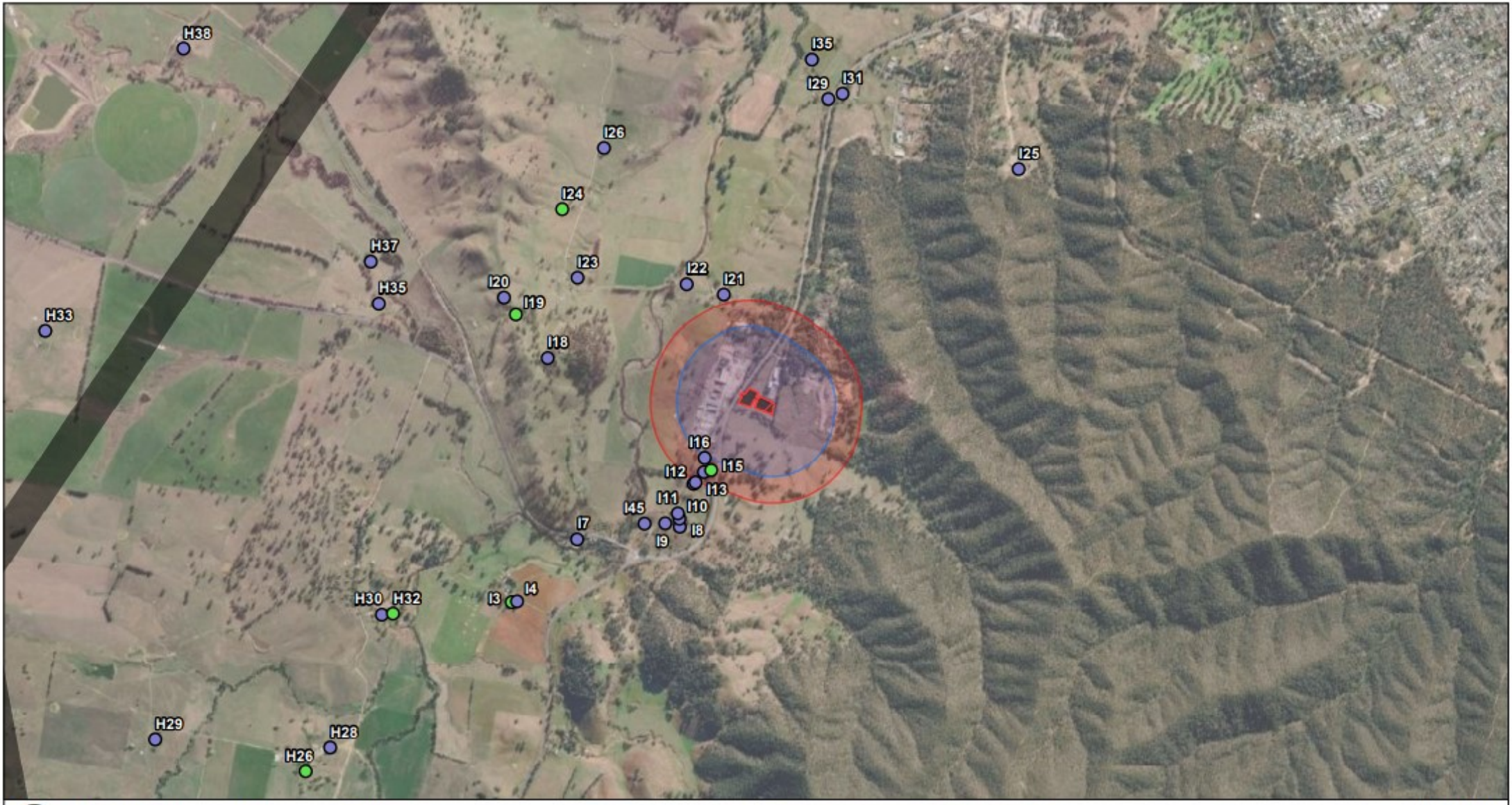

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:30,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

SLR

HUMELINK
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SNOWY MOUNTAINS HIGHWAY COMPOUND (C02) – SENSITIVE RECEPTOR LOCATIONS

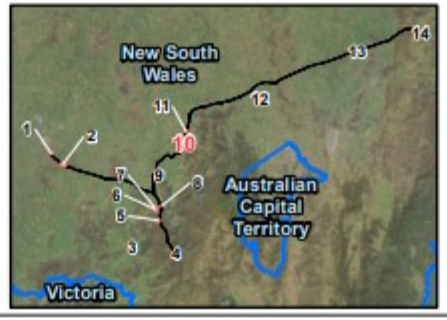
FIGURE 7-16

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig Compounds V2.mxd

0 250 500 1,000 1,500 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:60,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

Dwelling
Construction compound
Project footprint
350 m buffer
500 m buffer



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HONEYSUCKLE ROAD COMPOUND (C07) AND RED HILL ROAD COMPOUND (C08) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-17

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig Compounds V2.mxd

0 250 500 1,000 1,500 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:40,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

- Population centre
- Dwelling
- Construction compound
- Project footprint
- 350 m buffer
- 500 m buffer

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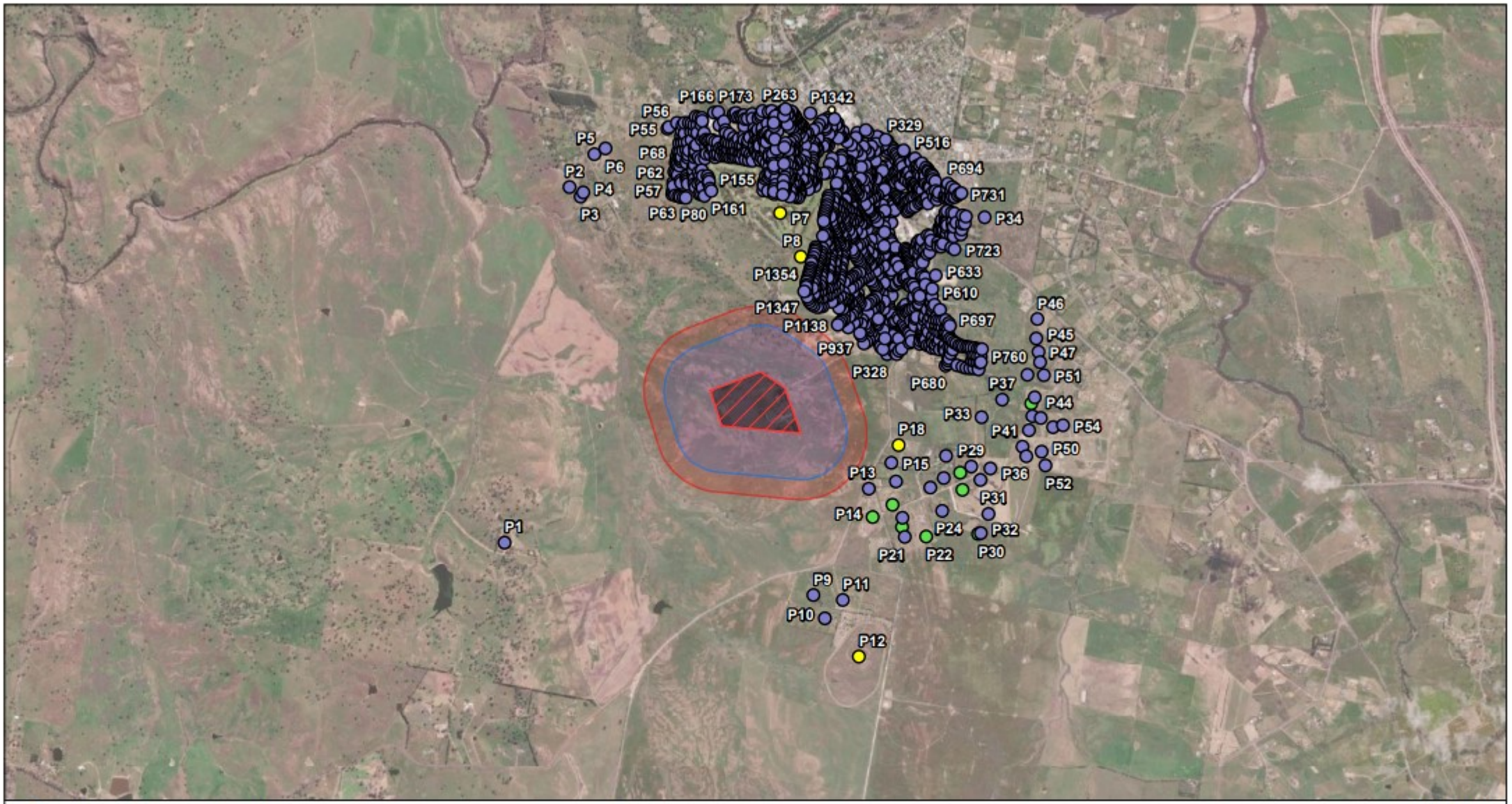
ADJUNGBILLY ROAD COMPOUND (C09) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-18

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610306222 AQ Fig Compounds V2.mxd



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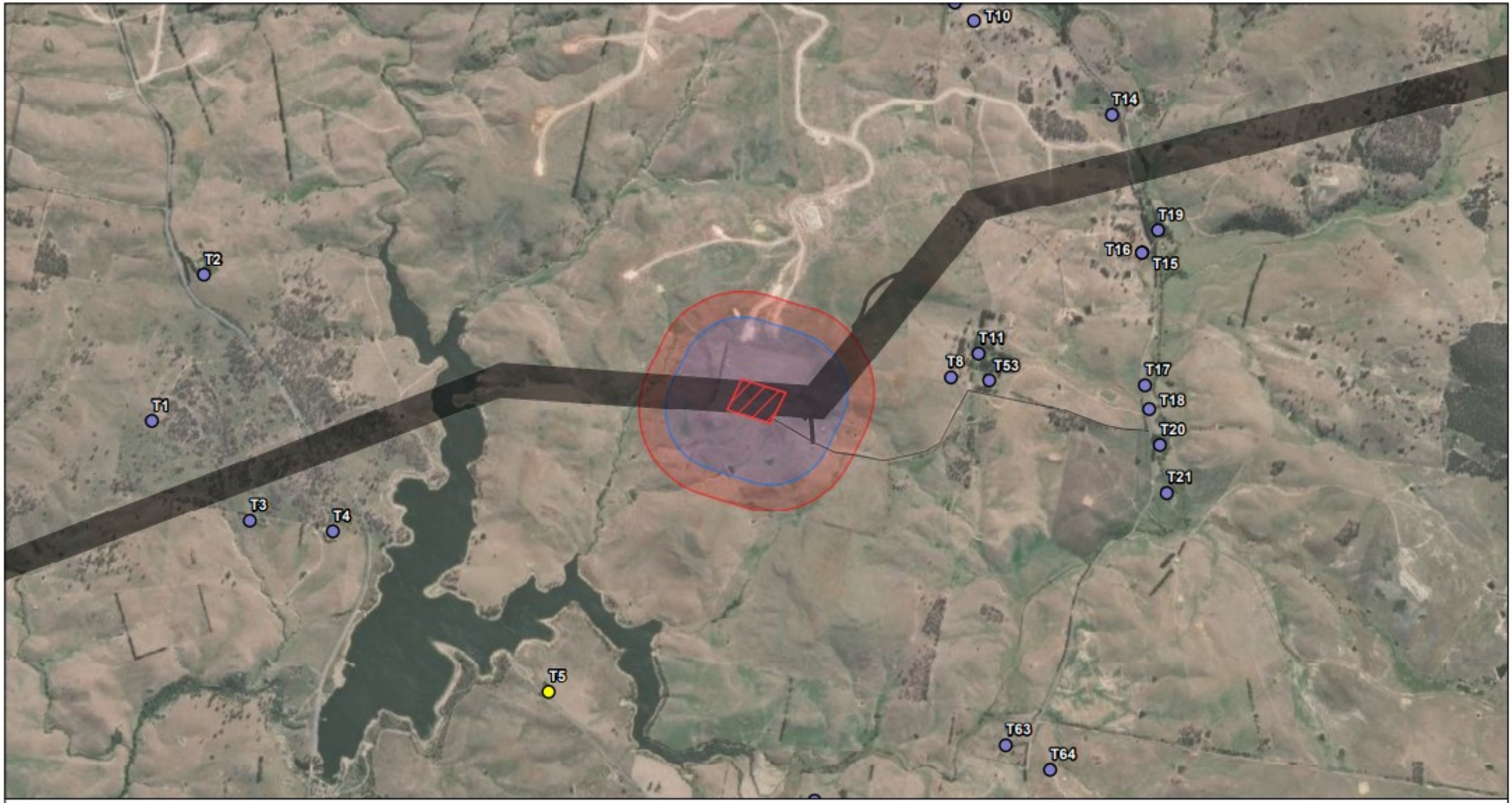
HUMELINK
AIR QUALITY IMPACT ASSESSMENT

YASS SUBSTATION COMPOUND (C10) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-19

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\610l030622 AQ Fig Compounds V2.mxd



0 250 500 1,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:30,000 at A4
Project Number:	610.30622
Date:	01-Mar-2023
Drawn by:	AN

Dwelling
Other
Construction compound
Project footprint
350 m buffer
500 m buffer

SLR

HUMELINK
AIR QUALITY IMPACT ASSESSMENT

WOODHOUSELEE ROAD COMPOUND (C11) – SENSITIVE RECEPTOR LOCATIONS

FIGURE 7-20

H:\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\61030622 AQ Fig Compounds V2.mxd

7.1.2 IAQM Guidance Step 2 – assessment of the risk of dust impacts

7.1.2.1 IAQM Guidance Step 2a – assessment of scale and nature of the works

The screening assessment presented in **Section 7.1.1** concluded that the following locations require further assessment:

- construction of the transmission line
- Wagga 330 kV substation modification and Wagga 330 kV substation compound (C01)
- Gugaa 500 kV substation construction and Gregadoo Road compound (C06)
- Tumbarumba accommodation facility (AC1)
- Bowmans Lane compound (C15)
- Memorial Avenue compound (C14)
- Snubba Road compound (C03)
- Snowy Mountains Highway compound (C02)
- Adjungbilly Road compound (C09)
- Yass substation compound (C10)
- Woodhouselee Road compound (C11)
- Bannaby 500 kV substation modification and Bannaby 500 kV substation compound (C12).

Step 2a of the IAQM Guidance provides "dust emissions magnitudes" for each of the following four dust generating activities:

- demolition
- earthworks
- construction
- track-out (the movement of site material onto public roads by vehicles).

Based on the IAQM definitions presented in **Table 5-1**, the dust emission magnitudes for the construction works are presented in **Table 7-4, Table 7-5** and **Table 7-6** for the transmission line, substations, construction compounds and the accommodation facility respectively.

Table 7-4 IAQM Step 2a: Categorisation of dust emission magnitudes – transmission line

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Demolition - Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time	Transmission line section 1	Medium	At the time of preparing the EIS it was not known exactly what buildings may (or may not) require demolition as it would depend on the final transmission line route and associated easement. Therefore a conservative estimate of *medium* has been applied.
	Transmission line section 2	Medium	
	Transmission line section 3	Medium	
	Transmission line section 4	Medium	
	Transmission line section 5	Medium	
	Transmission line section 6	Large	At the time of preparing the EIS it was not known exactly what buildings may (or may not) require demolition. As section 6 also includes demolition and relocation of Line 51, a conservative estimate of *large* has been applied.

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Earthworks - Covers the processes of soil-stripping, ground-levelling, excavation and landscaping	Transmission line section 1	Large	As shown in **Table 2-2**, the construction of the transmission line (including access tracks) would require total cut and fill volumes of approximately 400,000 cubic metres. Assuming an average material density of 1.5 tonnes per cubic metre[6], this equates to approximately 600,000 tonnes. Based on an indicative concept design, land clearing for transmission line structures would require a total of 406.62 ha and 1977.76 ha for the transmission line easement. Conservatively assuming the land clearing is equal in all six sections assessed, the risk associated is classified as *large*. It is noted that earthworks would only take place where structures are required and would not take place concurrently along the length of the transmission line.
	Transmission line section 2	Large	
	Transmission line section 3	Large	
	Transmission line section 4	Large	
	Transmission line section 5	Large	
	Transmission line section 6	Large	
Construction - Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential Residence, office building, retail outlet, road, etc	Transmission line section 1	N/A	No structures other than transmission line structures, which would have very limited potential for dust generation, are to be constructed
	Transmission line section 2		
	Transmission line section 3		
	Transmission line section 4		
	Transmission line section 5		
	Transmission line section 6		

[6] https://www.soilquality.org.au/au/nsw/examine/state/bulk-density-10-20 (accessed 15 September 2022)

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Track-out - The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network	Transmission line section 1	Large	At the time of preparing the EIS there was a degree of uncertainty about the exact location of the access tracks and proximity to sensitive receptors, and therefore conservative estimate of *large* has been applied.
	Transmission line section 2	Large	
	Transmission line section 3	Large	
	Transmission line section 4	Large	
	Transmission line section 5	Large	
	Transmission line section 6	Large	

Table 7-5 IAQM Step 2a: Categorisation of dust emission magnitudes – substations

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Demolition - Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time	Gugaa 500 kV substation	N/A	• No demolition
	Wagga 330 kV substation	Small	• Demolition and removal of redundant electrical equipment, fencing and cabling
	Bannaby 500 kV substation	Small	• Demolition of redundant fencing including footings and kerbs
Earthworks - Covers the processes of soil-stripping, ground-levelling, excavation and landscaping	Gugaa 500 kV substation	Large	• The proposed Gugaa 500 kV substation is expected to occupy an area of approximately 22 ha (refer to **Table 2-2**) • Bulk earthworks are required to form the substation bench, access roads, drainage, and oil containment structures
	Wagga 330 kV substation	Small	• Less than 10,000 tonnes of material would be required for cut and fill purposes • The disturbance would be limited due to working within an existing substation
	Bannaby 500 kV substation	Large	• Bulk earthworks are required to form the extended substation bench, new access road, modified stormwater drainage, modified oil containment and modified sediment control structures

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Construction - Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure would include a residential residence, office building, retail outlet, road, etc	Gugaa 500 kV substation	Medium	• Installation of concrete foundations, bund walls, fire walls, noise walls and kerbs including excavation • Installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures • Installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment works and associated concrete pits, pipes and tanks including excavation • Installation of new ancillary and equipment control buildings • Erection of galvanised steel structures to support electrical equipment • Installation of electrical equipment on foundations and/or steel support structures • Installation of conductors, cabling, wiring, electrical panels and electrical equipment • Erection of the substation site boundary security fencing, including site access gates connection of the proposed transmission lines to the substation.
	Wagga 330 kV substation	Medium	• Installation of concrete foundations and kerbs including excavation • Installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures • Erection of galvanised steel structures to support electrical equipment • Installation of electrical equipment on foundations and/or steel support structures • Installation of electrical conduits, electrical trenches, and modified site stormwater drainage including excavation • Installation of conductors, cabling, wiring, electrical panels and electrical equipment • Installation of fencing, lighting and other security features connection of the proposed transmission lines to the substation.

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
	Bannaby 500 kV substation	Medium	• Installation of concrete foundations, retaining walls, bund walls, fire walls and kerbs including excavation • Installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures • Erection of galvanised steel structures to support electrical equipment • Installation of electrical equipment on foundations and/or steel support structures • Installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment works and associated concrete pits, pipes and tanks including excavation • Installation of conductors, cabling, wiring, electrical panels and electrical equipment • Installation of fencing, lighting and other security features The activities at this location are anticipated to be medium for approximately six months, and small for an additional six months. The classification of medium has conservatively been applied to assess the first six months.
Track-out The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network	Wagga 330 kV substation	Medium	• Heavy vehicle movements would be a maximum of 92 per day but use of unsealed roads would be limited
	Gugaa 500 kV substation	Large	• Heavy vehicle movements would be a maximum of 102 per day on unsealed roads
	Bannaby 500 kV substation	Large	• Heavy vehicle movements would be maximum of 39 per day on unsealed roads

Table 7-6 IAQM Step 2a: Categorisation of dust emission magnitudes – construction compounds and accommodation facility

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Demolition - Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time	Wagga 330 kV substation compound (C01)	N/A	No demolition required
	Gregadoo Road compound (C06)	N/A	
	Tumbarumba accommodation facility (AC1)	N/A	
	Bowmans Lane compound (C15)	N/A	
	Memorial Avenue compound (C14)	N/A	
	Snubba Road compound (C03)	N/A	
	Snowy Mountains Highway compound (C02)	N/A	
	Honeysuckle Road compound (C07)	N/A	
	Red Hill Road compound (C08)	N/A	
	Adjungbilly Road compound (C09)	N/A	
	Yass substation compound (C10)	N/A	
	Woodhouselee Road compound (C11)	N/A	
	Bannaby 500 kV substation compound (C12)	N/A	

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Earthworks - Covers the processes of soil-stripping, ground-levelling, excavation and landscaping	Wagga 330 kV substation compound (C01)	Small	
	Gregadoo Road compound (C06)	Medium	
	Tumbarumba accommodation facility (AC1)	Medium	
	Bowmans Lane compound (C15)	Small	
	Memorial Avenue compound (C14)	Small	
	Snubba Road compound (C03)	Medium	
	Snowy Mountains Highway compound (C02)	Medium	
	Honeysuckle Road compound (C07)	Medium	
	Red Hill Road compound (C08)		
	Adjungbilly Road compound (C09)	Medium	
	Yass substation compound (C10)	Small	
	Woodhouselee Road compound (C11)	Medium	
	Bannaby 500 kV substation compound (C12)	Small	

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Construction - Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure would include a residential residence, office building, retail outlet, road, etc	Wagga 330 kV substation compound (C01)	Small	Structures would be limited to prefabricated demountable site offices and fencing etc requiring minimal construction. All structures would be temporary for the duration of compound / accommodation facility use during construction.
	Gregadoo Road compound (C06)	Small	
	Tumbarumba accommodation facility (AC1)	Medium	
	Bowmans Lane compound (C15)	Small	
	Memorial Avenue compound (C14)	Small	
	Snubba Road compound (C03)	Small	
	Snowy Mountains Highway compound (C02)	Small	
	Honeysuckle Road compound (C07)	Small	
	Red Hill Road compound (C08)		
	Adjungbilly Road compound (C09)	Small	
	Yass substation compound (C10)	Small	
	Woodhouselee Road compound (C11)	Small	
	Bannaby 500 kV substation compound (C12)	Small	

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
Track-out - The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network	Wagga 330 kV substation compound (C01)	Medium	Anticipated to have a dust emission magnitude of *medium* for approximately six months and then a dust emission magnitude of *small* for approximately six months.
	Gregadoo Road compound (C06)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.
	Tumbarumba accommodation facility (AC1)	Small	Access via closest existing public roads.
	Bowmans Lane compound (C15)	Medium	Access is likely to be via sealed roads with 50 peak daily heavy vehicle movements. However, as access may be via a short, unsealed road, a conservate dust emission magnitude of *medium* has been applied.
	Memorial Avenue compound (C14)	Small	Access is via sealed roads with a maximum of 90 movements per day.
	Snubba Road compound (C03)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.
	Snowy Mountains Highway compound (C02)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.
	Honeysuckle Road compound (C07)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.

Activity and IAQM Definition	Location	Dust emission magnitude (refer to Table 5-1)	Notes
	Red Hill Road compound (C08)		Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.
	Adjungbilly Road compound (C09)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.
	Yass substation compound (C10)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.
	Woodhouselee Road compound (C11)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.
	Bannaby 500 kV substation compound (C12)	Medium	Peak activity anticipated to have a dust emission magnitude of *medium* for approximately six months. Average activity anticipated to have a dust emission magnitude of *small*.

7.1.2.2 IAQM Guidance Step 2b – sensitivity to dust deposition and health impacts

Step 2b of the IAQM Guidance requires the sensitivity of the area to dust deposition and health impacts to be defined as detailed in **Section 5.4.2**.

Receptor sensitivity

Based on the criteria listed in **Table 5-2**, the sensitivity of the identified receptors in this study is concluded to be *high* for health impacts and *high* for dust deposition. Receptors are residential locations where people may be reasonably expected to be present continuously as part of the normal pattern of land use.

Sensitivity of an area to dust deposition effects

Based on the classifications shown in **Section 5.4.2**, the sensitivity of each area to dust deposition effects (refer to **Table 5-3**) is based on the receptor sensitivity (determined to be high) and the number of sensitive receptors within 20 metres, 50 metres, 100 metres and 350 metres of the project footprint.

With respect to the number of sensitive receptors, the IAQM Guidance states that exact counting of the number of people is not required with a residential property classed as one receptor. For receptors that are not residential properties, professional judgement should be used to estimate the number of sensitive receptors present, for example, a school would be treated as being in the 'greater than 100 persons' category.

Table 7-7 (transmission line) and **Table 7-8** (substation, construction compounds and workers accommodation facility) show the number of sensitive receptors identified at Step 1, and the determined sensitivity to dust deposition.

In line with the IAQM Guidance, only the *highest level* of area sensitivity from **Table 5-3** needs to be considered. For example, if there are seven high sensitivity receptors less than 20 metres from the source and 95 high sensitivity receptors between 20 and 50 metres, then the total of number of receptors greater than 50 metres is 102. The sensitivity of the area in this case would be high.

Table 7-7 IAQM Step 2b: Categorisation of sensitivity of area to dust deposition effects – transmission line

Location	Distance from project footprint (metres)	Number of sensitive receptors	Sensitivity of area to dust deposition effects (refer to Table 5-3) based on high receptor sensitivity
Transmission line section 1	< 20	4	Medium
	< 50	5	
	< 100	5	
	< 350	19	
Transmission line section 2	< 20	--	Low
	< 50	-	
	< 100	8	
	< 350	64	
Transmission line section 3	< 20	-	Low
	< 50	1	
	< 100	1	
	< 350	9	
Transmission line section 4	< 20	2	Medium
	< 50	3	
	< 100	3	
	< 350	11	
Transmission line section 5	< 20	7	High
	< 50	9	
	< 100	13	
	< 350	41	
Transmission line section 6	< 20	1	Medium
	< 50	2	
	< 100	2	
	< 350	12	

Table 7-8 IAQM Step 2b: Categorisation of sensitivity of area to dust deposition effects – substations

Location	Distance from project footprint (metres)	Number of sensitive receptors	Sensitivity of area to dust deposition effects (refer to Table 5-3) based on high receptor sensitivity
Gugaa 500 kV substation	< 20	-	Low[(a)]
	< 50	-	
	< 100	-	
	< 350	-	
Bannaby 500 kV substation	< 20	-	Low[(b)]
	< 50	-	
	< 100	-	
	< 350	-	
Wagga 330 kV substation	< 20	-	Low
	< 50	-	
	< 100	-	
	< 350	1	

Notes:

(a) Given the scale of activities proposed at Gugaa 500 kV substation, professional judgment has been applied to increase the sensitivity of the area to dust deposition effect from *negligible* to *low*.

(b) Given the potential impact due to the location of access tracks, the potential helipad at adjacent Bannaby 500 kV substation compound (C12) at Bannaby 500 kV substation, professional judgment has been applied to increase the sensitivity of the area to dust deposition effect from *negligible* to *low*.

Table 7-9 IAQM Step 2b: Categorisation of sensitivity of area to dust deposition effects – construction compounds and workers accommodation

Location	Distance from project footprint (m)	Number of sensitive receptors	Sensitivity of area to dust deposition effects (refer to Table 5-3) based on high receptor sensitivity
Wagga 330 kV substation compound (C01)	< 20	-	Low
	< 50	-	
	< 100	-	
	< 350	1	
Gregadoo Road compound (C06)	< 20	-	Low[(a)]
	< 50	-	
	< 100	-	
	< 350	-	
Tumbarumba accommodation facility (AC1)	< 20	-	Low
	< 50	-	
	< 100	1	
	< 350	5	
	< 50	-	
	< 100	-	
	< 350	-	
Bowmans Lane compound (C15)	< 20	-	Low
	< 50	-	
	< 100	3	
	< 350	6	
Memorial Avenue compound (C14)	< 20	-	Low
	< 50	-	
	< 100	4	
	< 350	53	
Snubba Road compound (C03)	< 20	-	Low[(b)]
	< 50	-	
	< 100	-	
	< 350	-	
Snowy Mountains Highway compound (C02)	< 20	-	Low[(b)]
	< 50	-	
	< 100	-	
	< 350	-	

Location	Distance from project footprint (m)	Number of sensitive receptors	Sensitivity of area to dust deposition effects (refer to Table 5-3) based on high receptor sensitivity
Adjungbilly Road compound (C09)	< 20	-	Low[(b)]
	< 50	-	
	< 100	-	
	< 350	-	
Yass substation compound (C10)	< 20	-	Low[(b)]
	< 50	-	
	< 100	-	
	< 350	-	
Woodhouselee Road compound (C11)	< 20	-	Low[(b)]
	< 50	-	
	< 100	-	
	< 350	-	
Bannaby 500 kV substation compound (C12)	< 20	-	Low[(b)]
	< 50	-	
	< 100	-	
	< 350	-	

Notes:

(a) Given the scale of activities proposed at Gregadoo Road compound (C06), professional judgment has been applied to increase the sensitivity of the area to dust deposition effect from *negligible* to *low*.

(b) Given the potential impact due to the location of access tracks/access to the site, and/or the potential helipads, professional judgment has been applied to increase the sensitivity of the area to dust deposition effect from *negligible* to *low*.

Sensitivity of an area to health effects

Based on the classifications shown in **Section 5.4.2**, the sensitivity of each area to health effects (refer to **Table 5-4**) have been classified based on the receptor sensitivity (determined to be high), the 5-year mean background PM_{10} concentration data collected at the closest air quality monitoring station (refer to **Section 6.3.2.4**), and the number of sensitive receptors within 20 metres, 50 metres, 100 metres, 200 metres and 350 metres of the project footprint.

Table 7-3 shows the estimated number of sensitive receptors identified at Step 1 at each distance, and the determined sensitivity to health effects.

Note that only the *highest level* of area sensitivity from **Table 5-4** needs to be considered. For example, if there are seven high sensitivity receptors less than 20 metres from the source and 95 high sensitivity receptors between 20 and 50 metres, then the total of number of receptors greater than 50 metres is 102. The sensitivity of the area in this case would be high.

Table 7-10 IAQM Step 2b: Categorisation of sensitivity of area to health effects – transmission line

Location	Annual average background PM_{10} concentration ($\mu g/m^3$)	Distance from project footprint (metres)	Number of sensitive receptors	Sensitivity of area to health effects (refer to Table 5-4) based on high receptor sensitivity
Transmission line section 1	22.7	< 20	4	High
		<50	5	
		<100	5	
		<200	9	
		< 350	19	
Transmission line section 2	22.7	< 20	-	Low
		<50	-	
		<100	8	
		<200	14	
		< 350	64	
Transmission line section 3	22.7	< 20	-	Medium
		<50	1	
		<100	1	
		<200	2	
		< 350	9	
Transmission line section 4	22.7	< 20	2	High
		<50	3	
		<100	3	
		<200	6	
		< 350	11	
Transmission line section 5	10.0	< 20	7	High
		<50	9	
		<100	13	
		<200	23	
		< 350	41	
Transmission line section 6	14.3	< 20	1	Low
		<50	2	
		<100	2	
		<200	7	
		< 350	12	

Table 7-11 IAQM Step 2b: Categorisation of sensitivity of area to health effects – substations

Location	Annual average background PM_{10} concentration ($\mu g/m^3$)	Distance from project footprint (metres)	Number of sensitive receptors	Sensitivity of area to health effects (refer to Table 5-4) based on high receptor sensitivity
Gugaa 500 kV substation	22.7	< 20	-	Low[(a)]
		<50	-	
		<100	-	
		<200	-	
		< 350	-	
Bannaby 500 kV substation	14.3	< 20	-	Low[(b)]
		<50	-	
		<100	-	
		<200	-	
		< 350	-	
Wagga 330 kV substation	22.7	< 20	-	Low
		<50	-	
		<100	-	
		<200	-	
		< 350	1	
		<50	-	
		<100	-	
		<200	-	
		< 350	-	

Notes:

(a) Given the scale of activities proposed at Gugaa 500 kV substation, professional judgment has been applied to increase the sensitivity of the area to health effects from *negligible* to *low*.

(b) Given the potential impacts due to the location of access tracks/access to the site, and the potential helipad at the adjacent Bannaby 500 kV substation (12) to Bannaby 500 kV substation kV, professional judgment has been applied to increase the sensitivity of the area to health effects from *negligible* to *low*.

Table 7-12 IAQM Step 2b: Categorisation of sensitivity of area to health effects – construction compounds and workers accommodation

Location	Annual average PM_{10} concentration ($\mu g/m^3$)	Distance from project footprint (m)	Number of sensitive receptors[a]	Sensitivity of area to health effects (refer to Table 5-4) based on high receptor sensitivity
Wagga 330 kV substation compound (C01)	22.7	< 20	-	Low
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	1	
Gregadoo Road compound (C06)	22.7	< 20	-	Low[a]
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	
Tumbarumba accommodation facility (AC1)	22.7	< 20	-	Low
		< 50	-	
		< 100	-	
		< 200	3	
		< 350	5	
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	
Bowmans Lane compound (C15)	22.7	< 20	-	Low
		< 50	-	
		< 100	3	
		< 200	4	
		< 350	6	
Memorial Avenue compound (C14)	22.7	< 20	-	Low
		< 50	-	
		< 100	4	
		< 200	8	
		< 350	53	

Location	Annual average PM_{10} concentration ($\mu g/m^3$)	Distance from project footprint (m)	Number of sensitive receptors[a]	Sensitivity of area to health effects (refer to Table 5-4) based on high receptor sensitivity
Snubba Road compound (C03)	22.7	< 20	-	Low[b]
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	
Snowy Mountains Highway compound (C02)	22.7	< 20	-	Low[b]
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	
		< 350	-	
Adjungbilly Road compound (C09)	22.7	< 20	-	Low[b]
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	
Yass substation compound (C10)	10.0	< 20	-	Low[b]
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	
Woodhouselee Road compound (C11)	10.0	< 20	-	Low[b]
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	
Bannaby 500 kV substation compound (C12)	14.3	< 20	-	Low[b]
		< 50	-	
		< 100	-	
		< 200	-	
		< 350	-	

Notes:

(a) Given the scale of activities proposed at Gregadoo Road compound (C06), professional judgment has been applied to increase the sensitivity of the area to health effects from *negligible* to *low*.

(b) Given the potential impact related to the location of access tracks/access to the site, and/or the potential helipads, professional judgment has been applied to increase the sensitivity of the area to health effects from *negligible* to *low*.

7.1.2.3 IAQM Guidance - risk assessment

Based on the dust emission magnitudes determined for the various construction activities (as per Step 2a in **Section 7.1.2.1**) and the sensitivity of the surrounding area for dust deposition and for health effects (as per Step 2b in **Section 7.1.2.2**), the resulting risk of air quality impacts **with no mitigation applied** are determined based on the risk categories provided in **Table 5-5** to **Table 5-7.**

Application of the IAQM Guidance to the construction of the transmission line shown in **Table 7-13** indicates that for the majority of the project footprint there is a *medium to high risk* of adverse dust deposition and human health impacts. These impacts would occur at sensitive receptor locations during construction **if no mitigation measures** are applied to control emissions during the demolition, earthworks, and track-out works.

The results for the substations shown in **Table 7-14** indicate that there is a *negligible to low risk* of adverse dust deposition and human health impacts occurring at the sensitive receptor locations **if no mitigation measures** are applied to control emissions during the earthworks, construction and track out works.

The results for the construction compounds and workers accommodation shown in **Table 7-15** indicate that there is a *low risk* of adverse dust deposition and human health impacts occurring at the sensitive receptor locations **if no mitigation measures** are applied to control emissions during earthworks, construction and track out.

Site specific mitigation is discussed further at **Section 7.1.3** (Step 3 of the IAQM Guidance).

Table 7-13 Preliminary risk of air quality impacts from construction activities – transmission line

Air quality impact	Sensitivity of area	Dust emission magnitude				Preliminary risk with no mitigation				
		Demolition	Earthworks	Construction	Track-out	Demolition	Earthworks	Construction	Track-out	Maximum
Transmission Line section 1										
Dust Deposition	Medium	Medium	Large	None	Large	Medium	Medium	N/A	Medium	High
Human Health	High					Medium	High	N/A	High	
Transmission Line section 2										
Dust Deposition	Low	Medium	Large	None	Large	Low	Low	N/A	Low	Low
Human Health	Low					Low	Low	N/A	Low	
Transmission Line section 3										
Dust Deposition	Low	Medium	Large	None	Large	Low	Low	N/A	Low	Medium
Human Health	Medium					Medium	Medium	N/A	Medium	
Transmission Line section 4										
Dust Deposition	Medium	Medium	Large	None	Large	Medium	Medium	N/A	Medium	High
Human Health	High					Medium	High	N/A	High	
Transmission Line section 5										
Dust Deposition	High	Medium	Large	None	Large	Medium	High	N/A	High	High
Human Health	High					Low	Low	N/A	High	
Transmission Line section 6										
Dust Deposition	Medium	Large	Large	None	Large	High	Medium	N/A	Medium	Medium
Human Health	Low					Medium	Low	N/A	Low	

Table 7-14 Preliminary risk of air quality impacts from construction activities – substations

Air quality impact	Sensitivity of area	Dust emission magnitude				Preliminary risk with no mitigation				
		Demolition	Earthworks	Construction	Track-out	Demolition	Earthworks	Construction	Track-out	Maximum
Gugaa 500 kV substation										
Dust Deposition	Low	None	Large	Medium	Large	N/A	Low	Low	Low	Low
Human Health	Low					N/A	Low	Low	Low	
Bannaby 500 kV substation										
Dust Deposition	Low	Small	Large	Medium	Large	Negligible	Low	Low	Low	Low
Human Health	Low					Negligible	Low	Low	Low	
Wagga 330 kV substation										
Dust Deposition	Low	Small	Small	Medium	Medium	Negligible	Negligible	Low	Low	Low
Human Health	Low					Negligible	Negligible	Low	Low	

Table 7-15 Preliminary risk of air quality impacts from construction activities – construction compounds and workers accommodation

Air quality impact	Sensitivity of area	Dust emission magnitude				Preliminary risk with no mitigation				
		Demolition	Earthworks	Construction	Track-out	Demolition	Earthworks	Construction	Track-out	Maximum
Wagga 330 kV substation compound (C01)										
Dust Deposition	Low	None	Small	Small	Medium	N/A	Negligible	Negligible	Low	**Low**
Human Health	Low					N/A	Negligible	Negligible	Low	
Gregadoo Road compound (CO6)										
Dust Deposition	Low	None	Medium	Small	Medium	N/A	Negligible	Low	Low	**Low**
Human Health	Low					N/A	Negligible	Low	Low	
Tumbarumba accommodation facility (AC1)										
Dust Deposition	Low	None	Medium	Medium	Small	N/A	Low	Low	Negligible	**Low**
Human Health	Low					N/A	Low	Low	Negligible	
Bowmans Lane compound (C15)										
Dust Deposition	Low	None	Small	Small	Medium	N/A	Negligible	Negligible	Low	**Low**
Human Health	Low					N/A	Negligible	Negligible	Low	
Memorial Avenue compound (C14)										
Dust Deposition	Medium	None	Small	Small	Small	N/A	Low	Low	Low	**Low**
Human Health	Medium					N/A	Low	Low	Low	
Snubba Road compound (C03)										
Dust Deposition	Low	None	Medium	Small	Medium	None	Low	Negligible	Low	**Low**
Human Health	Low					None	Low	Negligible	Low	
Snowy Mountains Highway compound (C02)										
Dust Deposition	Low	None	Medium	Small	Medium	N/A	Low	Negligible	Low	**Low**
Human Health	Low					N/A	Low	Negligible	Low	

Air quality impact	Sensitivity of area	Dust emission magnitude				Preliminary risk with no mitigation				
		Demolition	Earthworks	Construction	Track-out	Demolition	Earthworks	Construction	Track-out	Maximum
Adjungbilly Road compound (C09)										
Dust Deposition	Low	None	Medium	Small	Medium	N/A	Low	Negligible	Low	**Low**
Human Health	Low					N/A	Low	Negligible	Low	
Yass substation compound (C10)										
Dust Deposition	Medium	None	Small	Small	Medium	N/A	Low	Low	Low	**Low**
Human Health	Low					N/A	Negligible	Negligible	Low	
Woodhouselee Road compound (C11)										
Dust Deposition	Low	None	Medium	Small	Medium	N/A	Low	Negligible	Low	**Low**
Human Health	Low					N/A	Low	Negligible	Low	
Bannaby 500 kV substation compound (C12)										
Dust Deposition	Low	None	Small	Small	Medium	N/A	Negligible	Negligible	Low	**Low**
Human Health	Low					N/A	Negligible	Negligible	Low	

7.1.3 IAQM Guidance Step 3 – site-specific mitigation measures

The IAQM Guidance describes risks (with no mitigation applied) in terms of them being negligible, low, medium or high. Where there are low, medium or high risks, then site-specific mitigation would be required.

The recommended mitigation measures provided in the IAQM Guidance have been reviewed and in tandem with Transgrid's experience in managing projects such as this, proposed mitigation measures are presented in **Chapter 10**.

7.1.4 IAQM Guidance Step 4 – determination of significance of residual impacts

For almost all construction activities, the aim is to prevent significant effects on sensitive receptors through the use of effective mitigation which, according to the IAQM Guidance, is typically possible.

Therefore, with the implementation of mitigation measures detailed in **Chapter 10**, the residual dust impacts are anticipated to be managed to acceptable levels ie such that there is negligible risk of adverse air quality effects at the sensitive receptors.

7.2 Products of combustion

Emissions due to products of combustion (including particulate matter) during construction and operation of the project predominantly relate the use of trucks and other vehicles, including where relevant, helicopters accessing and idling the within the project footprint. During construction, diesel-powered construction equipment such as cranes and excavators will also emit combustion products. During operation, the emissions would be of a similar nature to existing emissions from traffic on roads in the vicinity. Whilst there would be traffic generated during operation, emissions would be substantially lower than during construction.

As detailed in **Section 5.6**, a risk-based assessment of potential air quality impacts due to products of combustion during construction was undertaken. As described in **Section 5.5**, the assessment method considers three impact descriptors – nature of impact, receptor sensitivity and magnitude of impact.

With respect to the products of combustion anticipated during construction:

- **nature of impact**: does the impact result in an adverse, neutral or beneficial environment?
  - If released at sufficient magnitude, the nature of the emissions could cause an impact on the receiving environment and is therefore categorised as *adverse.*
- **receptor sensitivity**: how sensitive is the receiving environment to the anticipated impacts?
  - Based on the categories presented in **Table 5-8**, the identified sensitive receptors are predominantly residences, and as such, the sensitivity is categorised as *high.*
- **magnitude**: what is the anticipated scale of the impact?
  - Air pollutant emissions due to consumption of diesel and petrol were estimated based on the activity assumptions in **Table 5-11** and the emission factors shown in **Table 5-12** and **Table 5-13**.
  - The resultant total emissions calculated are shown in **Table 7-16** together with the annual emissions for NSW as reported to the NPI for the 2020/21 reporting period.
  - As shown in **Table 7-16**, the total emissions due to combustion during construction represent less than one per cent of the annual NPI emissions for NSW.
  - Whilst some of the emissions would be localised (for example, use of generators at the construction compounds), the majority would occur intermittently over large areas. As such, the magnitude of the impact is anticipated to be *negligible.* It is also recommended that if the generators are to be located within 500 metres of sensitive receptors, a more detailed dispersion modelling assessment may need to be completed based on the size of the equipment, separation distance and local meteorology.

Table 7-16 Estimated emissions due to products of combustion during construction

Activity	CO	Formaldehyde	NO_x	$PM_{2.5}$	PM_{10}	PAHs	SO_2	VOC
	Emissions from diesel usage (t)							
Transmission line land clearing and construction, including transport of construction materials	61	2.7	147	11	12	0.01	0.08	13
Bannaby 500 kV substation modification	77	3.4	186	14	15	0.01	0.10	17
Gugaa 500 kV substation construction	152	6.7	366	27	30	0.01	0.20	33
Wagga 330 kV substation modification	64	2.8	153	11	13	0.01	0.08	14
Construction compounds (per compound)	4	0.2	9	1	1	0.0003	0.005	1
Light vehicle use for survey works, supervision, engineering and management support	11	-	5	1	1	0.0001	0.0091	0.2
Activity	**Emissions from unleaded petrol usage (t)**							
Bannaby 500 kV substation modification	106	0.2	5	0.3	0.3	0.000002	0.10	4
Gugaa 500 kV substation construction	206	0.4	9	0.5	0.5	0.000004	0.20	8
Wagga 330 kV substation modification	95	0.2	4	0.2	0.2	0.000002	0.09	4
Total	**776**	**16**	**884**	**67**	**73**	**0.03**	**0.86**	**94**
NSW NPI 2020/21[7]	***740,000***	***3,300***	***710,000***	***29,000***	***1,200,000***	***18***	***970,000***	***100,000***
Project percentage of NSW NPI 2020/21	***0.1***	***0.5***	***0.1***	***0.2***	***<0.1%***	***0.2***	***<0.1%***	***0.1***

[7] https://www.npi.gov.au/npidata/action/load/advance-search (accessed 13 September 2022)

Based on the estimated combustion emissions in **Table 7-16**, the potential impacts on the local sensitive receptors due to products of combustion is concluded to be ***neutral*** for all receptors, as shown in **Table 7-17**.

Table 7-17 Impact significance of products of combustion

Receptor Sensitivity[(a)]	Impact magnitude[(b)]			
	Substantial	Moderate	Slight	Negligible
Very High	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	**Neutral Significance**
Medium	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Notes:

(a) Receptor sensitivity is defined by Table 5-8

(b) Impact magnitude is defined by Table 5-9

8 Operational impacts

8.1 Dust emissions

As detailed in **Section 5.5**, the risk-based assessment of wheel-generated dust from unpaved roads during routine maintenance activities and emergencies considers three impact descriptors – nature of impact, receptor sensitivity and magnitude of impact.

With respect to the dust emissions anticipated during operation:

- **Nature of Impact**: does the impact result in an adverse, neutral or beneficial environment?
  - If released at sufficient magnitude, the nature of the emissions could cause an impact on the receiving environment and is therefore categorised as *adverse.*
- **Receptor Sensitivity**: how sensitive is the receiving environment to the anticipated impacts?
  - In terms of the categories presented in **Table 5-8**, the identified sensitive receptors are predominantly residences and as such the sensitivity is categorised as *high.*
- **Magnitude**: what is the anticipated scale of the impact?
  - Based on the definitions in **Table 5-9**, the impacts are not predicted to cause any significant consequences and are considered *negligible.*

Given the above considerations, the potential impact of the dust on the local sensitive receptors is concluded to be ***neutral*** for all receptors (see **Table 8-1**).

Table 8-1 Impact significance of products of combustion

Receptor Sensitivity[a]	Impact magnitude[b]			
	Substantial	Moderate	Slight	Negligible
Very High	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	**Neutral Significance**
Medium	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Notes:

(a) Receptor sensitivity is defined by Table 5-8

(b) Impact magnitude is defined by Table 5-9

8.2 Products of combustion

As detailed in **Section 5.6**, a risk-based assessment of potential air quality impacts due to products of combustion during operations was undertaken. As described in **Section 5.5**, the assessment method considers three impact descriptors – nature of impact, receptor sensitivity and magnitude of impact.

With respect to the products of combustion anticipated during operation:

- **Nature of Impact**: does the impact result in an adverse, neutral or beneficial environment?
  - If released at sufficient magnitude, the nature of the emissions could cause an impact on the receiving environment and is therefore categorised as *adverse.*
- **Receptor Sensitivity**: how sensitive is the receiving environment to the anticipated impacts?
  - In terms of the categories presented in **Table 5-8**, the identified sensitive receptors are predominantly residences and as such the sensitivity is categorised as *high.*
- **Magnitude**: what is the anticipated scale of the impact?
  - Emissions due to consumption of diesel and petrol were estimated based on the activity assumptions in **Table 5-14** and the emission factors shown in **Table 5-12**.
  - The resultant total emissions calculated are shown in **Table 8-2** together with the annual emissions for NSW as reporting to the NPI for the 2020/21 reporting period.
  - It can be seen from **Table 5-14** that the total emissions due to combustion during operation represent less than 0.1 per cent of the annual NPI emissions for NSW.
  - During operation, the emissions from products of combustion majority would occur over large areas for relatively short periods of time, and as such, the magnitude of the impact is anticipated to be *negligible*.

Table 8-2 Estimated emissions of products of combustion during operation

Activity	CO	Formaldehyde	NO_x	$PM_{2.5}$	PM_{10}	PAHs	SO_2	VOC
	Emissions from diesel usage (t/year)							
Bannaby 500 kV substation	0.09	0.004	0.22	0.02	0.02	0.000008	0.00012	0.02
Gugaa 500 kV substation	0.21	0.009	0.52	0.04	0.04	0.000019	0.00028	0.05
Wagga 330 kV substation	0.09	0.004	0.22	0.02	0.02	0.000008	0.00012	0.02
Transmission line/tracks	0.03	0.001	0.06	0.005	0.01	0.000002	0.00003	0.01
Activity	**Emissions from unleaded petrol usage (t/year)**							
Bannaby 500 kV substation	0.77	0.001	0.03	0.002	0.002	0.00000001	0.0007	0.03
Gugaa 500 kV substation	1.74	0.003	0.08	0.004	0.004	0.00000003	0.0016	0.07
Wagga 330 kV substation	0.77	0.001	0.03	0.002	0.002	0.00000001	0.0007	0.03
Total	**3.70**	**0.02**	**1.16**	**0.08**	**0.09**	**0.00004**	**0.004**	**0.22**
NSW NPI 2020/21[8]	***740,000***	***3,300***	***710,000***	***29,000***	***1,200,000***	***18***	***970,000***	***100,000***
Project percentage of NSW NPI 2020/21	***<0.001%***	***<0.001%***	***<0.001%***	***<0.001%***	***<0.001%***	***<0.001%***	***<0.001%***	***<0.001%***

[8] https://www.npi.gov.au/npidata/action/load/advance-search (accessed 13 September 2022)

Given the above considerations, the potential impact of the products of combustion on the local sensitive receptors is concluded to be ***neutral*** for all receptors (see **Table 8-3**).

Table 8-3 Impact significance of products of combustion

Receptor Sensitivity[(a)]	Impact magnitude[(b)]			
	Substantial	Moderate	Slight	Negligible
Very High	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	**Neutral Significance**
Medium	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Notes:

(a) Receptor sensitivity is defined by **Table 5-8**

(b) Impact magnitude is defined by **Table 5-9**

9 Cumulative impacts

Assessing cumulative impacts involves the consideration of the proposed impact in the context of air quality. The assessment of cumulative impacts also considers projects that are currently under development, or at the planning state that may also influence the assessment of this project's potential impacts. Cumulative impacts can potentially arise from the interaction of the construction and operation activities of the project and other future projects nearby.

The cumulative impact assessment was prepared in accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2022). Projects with the potential for cumulative impacts with the project were identified through a review of publicly available information and environmental impact assessments from the following databases in March 2023:

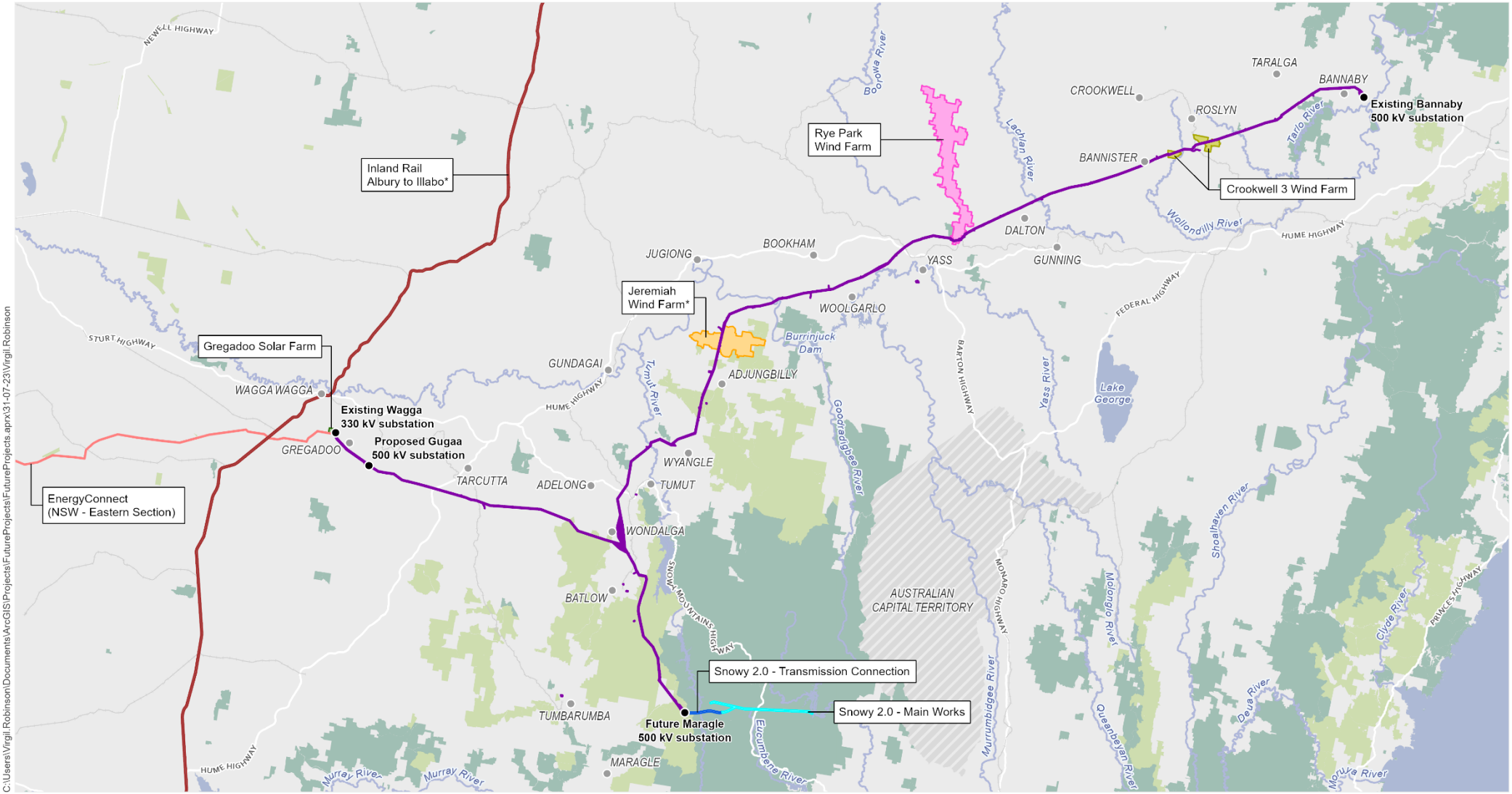
- DPE's Major Projects register
- NSW Government's Southern Regional Planning Panel project register
- NSW Independent Planning Commission project register
- EPBC Act Public Portal
- Transport for NSW Projects Map.

Searches were limited to the LGAs of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional, Upper Lachlan Shire, Goulburn-Mulwaree, and Hilltops.

Based on the above searches, the following projects are to be considered in the cumulative impact assessment for each of the key matters:

- EnergyConnect (NSW - Eastern Section)
- Victoria to NSW Interconnector West (VNI West)
- Gregadoo Solar Farm
- Snowy 2.0 - Main Works
- Snowy 2.0 - Transmission Connection
- Jeremiah Wind Farm
- Rye Park Wind Farm
- Crookwell 3 Wind Farm
- Inland Rail – Albury to Illabo.

Figure 9-1 shows the location of relevant future projects with respect to HumeLink's project footprint. Further detail on each project and the potential for cumulative air quality impacts with the project is provided in **Table 9-1**.



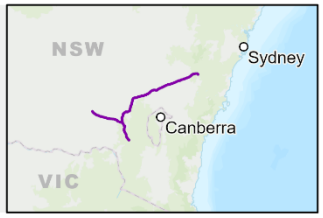
C:\Users\Virgil.Robinson\Documents\ArcGIS\Projects\FutureProjects\FutureProjects.aprx\31-07-23\Virgil.Robinson

Project footprint
National park and reserve
State forest
Waterbody
Waterway
Major road
Railway
Substation

Relevant future projects

Crookwell 3 Wind Farm
EnergyConnect (NSW - Eastern Section)
Gregadoo Solar Farm
Inland Rail Albury to Illabo*
Jeremiah Wind Farm*
Rye Park Wind Farm
Snowy 2.0 - Main Works
Snowy 2.0 - Transmission Connection

*Note: Subject to approval



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000
0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink **Air Quality**

FIGURE 9-1: Relevant future projects

Table 9-1 Summary of cumulative impacts identified

Project reference and status at September 2022	Project details	Relationship to HumeLink project footprint	Cumulative impacts
SSI-9172452 EnergyConnect (NSW - Eastern Section) *Approved September 2022*	The project includes a new transmission line connecting the existing Buronga substation and existing Wagga 330 kV substation, and construction of the new Dinawan substation (170 km west of Wagga Wagga). The new transmission line comprises: • 375 kilometres of new 330 kV double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan substation • 162 kilometres of new 500 kV double circuit transmission line (operated at 330 kV) and associated infrastructure between the proposed Dinawan substation and the existing Wagga 330 kV substation The project also involves associated infrastructure (optical repeater structures), new and/or upgrade of access tracks as required and ancillary works to support construction.	Both EnergyConnect and HumeLink require upgrades of the existing Wagga 330 kV substation.	The construction programs of EnergyConnect and HumeLink are likely to overlap and potentially increase the risk of cumulative dust impacts and cumulative impacts due to emissions from construction vehicles and plant. Any dust impacts will be managed in accordance with an AQMP. Minimal (if any) cumulative impacts anticipated during operation as neither project is a significant source of emissions to air.

Project reference and status at September 2022	Project details	Relationship to HumeLink project footprint	Cumulative impacts
Victoria to NSW Interconnector West *Scoping phase*	The project includes electricity transmission work to better connect NSW and Victoria, with connections proposed to the existing Wagga 330 kV substation.	The project may require connection at the existing Wagga 330 kV substation (depending on preferred option)	As the corridor for the Victoria to NSW Interconnector West project is yet to be defined, the potential impacts are currently unknown. However, it is probable that aside from the connection to the Wagga 330 kV substation, the majority of the footprint will be some distance from the project and therefore cumulative impacts are likely to be minimal.
SSD-9687 Gregadoo Solar Farm *Approved*	47 megawatt solar farm, substation and associated infrastructure.	Immediately west of Wagga 330 kV substation.	The construction programs of Gregadoo Solar Farm and HumeLink are likely to overlap. However, the solar farm project area is small (96 ha) and dust impacts are likely to be minor and temporary during construction only. Minimal (if any) cumulative impacts anticipated during operation.
SSI-9687 Snowy 2.0 - Main Works *Approved*	The project includes an underground pumped hydro power station and ancillary infrastructure.	Nearest point located approximately six kilometres east of the project footprint, measured from the Maragle 500 kV substation.	Most of the works associated with this project would be underground, reducing the potential for cumulative air impacts with the project. Additionally, the works are situated some distance from the project footprint.

Project reference and status at September 2022	Project details	Relationship to HumeLink project footprint	Cumulative impacts
SSI-9717 Snowy 2.0 - Transmission Connection *Approved*	Transmission connection between the proposed Snowy 2.0 Main Works project (above) and existing high voltage transmission network.	The proposed Snowy 2.0 project would terminate adjacent to the Maragle 500 kV substation compound (C05) and construct the future Maragle 500 kV substation.	Since the future Maragle 500 kV substation needs to be constructed by Snowy 2.0 - Transmission Connection project, there is likely to be consecutive construction programs which would potentially increase the risk of adverse dust impacts. However, as the closest sensitive receptor (F6) is over 3 km from the project they are unlikely to be adversely impacted.
SSD-22472709 Jeremiah Wind Farm *Preparing EIS*	65 turbine wind farm battery energy storage system and associated ancillary infrastructure	The project footprint traverses the subject site area, north of Adjungbilly, approximately nine km north-east of Adjungbilly Road compound (C09). Some proposed wind turbine locations are within 500 m of the project footprint.	This project would contribute to cumulative construction impacts and an increase in dust impacts as the project areas overlap. The magnitude of these potential cumulative impacts is reduced through the area of overlap being minimal and the wind farm projects having relatively small operational footprints. Cumulative impacts anticipated during operation are minimal (if any).
SSD-6693 Rye Park Wind Farm *Under construction*	77 turbine wind farm and ancillary access tracks and electricity transmission lines.	Project footprint intersects the proposed Rye Park Wind Farm site area one kilometre south-east of Bango Nature Reserve. The nearest proposed wind turbine is approximately 250 m from the project footprint. The project would also directly connect to a substation constructed as part of the Rye Park Wind Farm.	Whilst the project areas overlap, the Rye Wind Farm project is likely to be operational prior to the commencement of the project construction. Should construction periods overlap, this would contribute to cumulative construction impacts in the vicinity that need consideration. Cumulative impacts anticipated during operation are minimal.

Project reference and status at September 2022	Project details	Relationship to HumeLink project footprint	Cumulative impacts
SSD-6695 Crookwell 3 Wind Farm *Approved*	16 turbine wind farm and associated infrastructure.	The project footprint intersects the site area for the proposed development, which is located adjacent to the Crookwell 2 Wind Farm, approximately 18.5 km south-east of Crookwell. The nearest wind turbine would be approximately 200 m from the project footprint.	This project would contribute to cumulative construction impacts as the project areas overlap. Cumulative impacts anticipated during operation are minimal (if any).
SSI-10055 Inland Rail – Albury to Illabo *Responding to submissions*	Upgrade of 185 km of rail track from Albury to Illabo, which passes through Wagga Wagga.	The rail track upgrade is roughly nine km north-west of the nearest part of the project footprint at the existing Wagga 330 kV substation.	This project would be unlikely contribute to cumulative construction impacts as the project areas do not overlap.

10 Management of impacts

10.1 Overview of approach

The recommended mitigation measures provided in the IAQM Guidance have been reviewed and those relevant to the project are detailed in **Section 10.3**.

With respect to dust emissions during construction of the project, in tandem with outcomes of this assessment, Transgrid would draw on their extensive experience in the management of dust emissions for similar projects and the management of dust emissions and air quality management would be implemented through an Air Quality Management Plan (AQMP), which would include the following measures:

- potential sources of air pollution
- air quality management objectives consistent with any relevant published EPA and/or DPE guidelines
- mitigation and suppression measures to be implemented
- methods to manage work during strong winds or other adverse weather conditions;
- a progressive rehabilitation strategy for exposed surfaces
- monitoring of air quality within the project footprint (if needed)
- methods for dealing with complaints.

10.2 Avoidance and minimisation of impacts

In order to avoid and minimise impacts from air emissions during construction, as far as practicable, construction equipment should be located away from sensitive receptors. In particular, the location of generators, crushing and screening, and concrete batching plants in relation to sensitive receptors should be carefully considered.

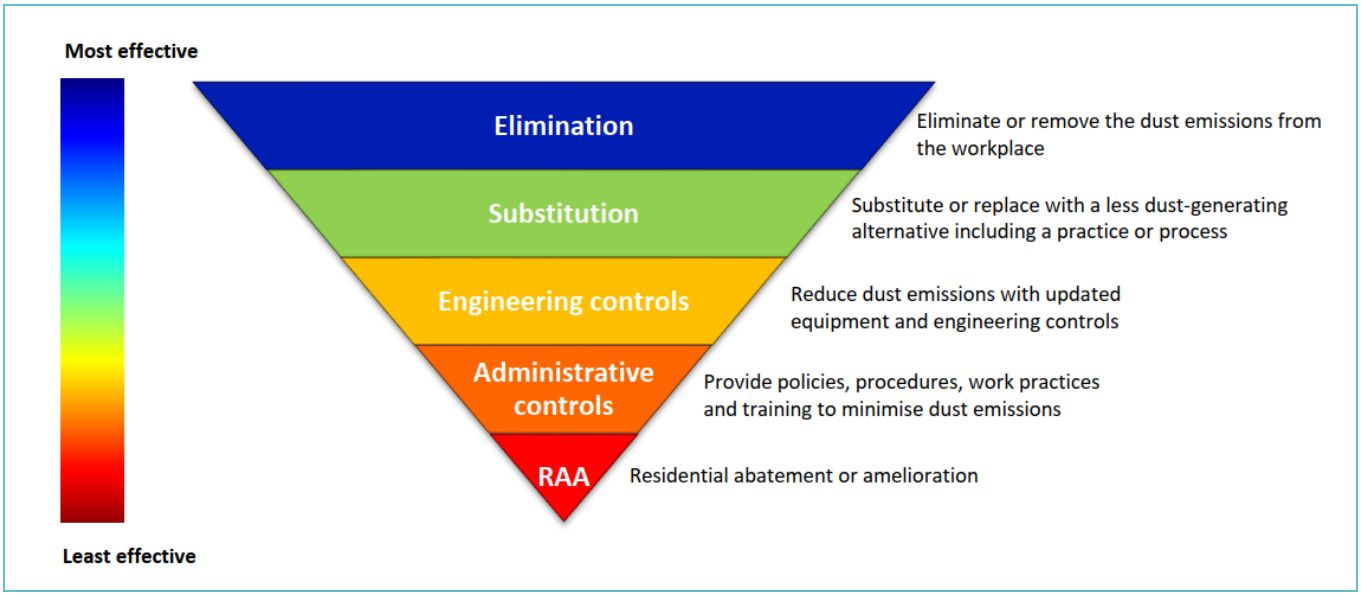
10.3 Summary of mitigation measures

Efforts at controlling emissions of any type should follow the engineering hierarchy of controls that was developed as a system for *controlling* risks and hazards in the workplace, for example the use of protective personal equipment (PPE) is specific to workers on site. Therefore, the hierarchy of controls has been adapted for the purpose of this assessment to the hierarchy of dust control to address the aim of reducing dust emissions to protect public health and the environment.

Figure 10-1 presents the hierarchy of dust control that ranks *controls* from the highest level of dust emission reduction through to the lowest, as follows:

- Wherever possible, focus controls at the top of the hierarchy by eliminating the emissions.
- If this is not possible, the next step is to consider substituting the process that creates the emissions with one that is less dusty.
- If this is not feasible, or the desired level of effectiveness cannot be achieved from substitution, engineering controls should be applied at source to manage the emissions.

- Control at the receptor should be considered only when these previous options are not possible. In the original hierarchy of controls, the lowest level of control is to reduce the risk through the use of protective personal equipment (PPE). However, since the use of PPE is not considered practicable (or appropriate) for use by sensitive receptors in proximity to the project, it has been replaced with the term Residential Abatement or Amelioration (RAA) to capture measures that could be implemented to minimise exposure of the residents.



Source: Adapted from Figure 1.7 (NIOSH, 2019)

Figure 10-1 Hierarchy of dust controls

Mitigation measures to minimise air quality impacts associated with the project are presented in **Table 10-1**.

Table 10-1 Mitigation Measures – Air Quality

Reference	Impact	Mitigation measure	Timing	Relevant locations
Air quality				
AQ1	Dust emissions	The following measures will be considered and implemented where practicable and appropriate to manage dust: • use water sprays or surfactants as required for dust suppression • provide adequate water supply on site for dust suppression • locate dust generating activities away from receptors • protect stockpiled materials from wind erosion to minimise dust generation and position stockpiles as far as practicable away from any nearby receptors • implement measures to minimise the tracking of dust generating material onto paved roads • cover the loads of potential dust producing materials • minimise the extent of ground disturbance as far as practicable • stabilise disturbed areas as soon as practicable • plan and schedule vegetation clearance and grubbing activities to minimise areas of open and exposed soil. The effectiveness of the installed controls will be monitored, and additional controls implemented as required to address any performance issues identified.	Construction	All locations
AQ2	Vehicles and machinery emissions	All vehicles and machinery will be maintained in accordance with manufacturer's specifications.	Construction	All locations
AQ3	Vehicle movements	Dust generation from project-related traffic movements on unsealed roads and access tracks (routes) in proximity to sensitive receivers will be visually monitored. Where dust from project-related traffic movements is impacting or has the potential to impact the sensitive receivers, measures to minimise dust emissions and potential associated amenity impacts will be implemented where practicable and appropriate.	Construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant locations
AQ4	Operation of concrete batching plant(s)	Measures will be implemented at concrete batching plants to minimise emissions to air as far as possible and will be regularly inspected with additional controls implemented as required. Measures to minimise emissions to air may include: • all aggregate and sand will be stored appropriately in storage bins or bays to minimise dust generation, and material will not exceed the height of the bay • cement silos and hoppers will be fitted with dust filters • all inspection points and hatches will be fully sealed • all dry raw materials to be transferred into the bowl of an agitator via front end loaders by maintaining adequate moisture levels and/or an enclosed conveyor • the cement silo will be fitted with emergency pressure alert and automatic cut off overfill protection • transfer of cement from storage to batching will occur via sealed steel augers • regularly inspect monitoring of dust emissions and apply additional controls as required.	Construction	Concrete batching plant(s)
AQ5	Crushing/screening activities	To minimise dust emissions during crushing/screening activities, the following measures (as a minimum) will be considered and implemented where practicable and appropriate: • fit screen covers will be fitted to the crushing/screening equipment • control dust emissions from screening activities using water sprinklers, where required and appropriate • inspect the water sprinklers on a regular basis and maintain as required to ensure operational efficiency • where practicable, install wind breaks in appropriate locations adjacent to the dust generating equipment and processes • prior to screening, dampen the rocks during dry weather conditions. The effectiveness of the implemented controls will be monitored, and additional controls implemented as required to address any performance issues identified.	Construction	Crushing/screening plant(s)

11 Conclusion

Potential emissions to air from construction and operation of the project have been qualitatively assessed to determine the risk of adverse air quality effects and identify appropriate mitigation measures.

Dust emissions during construction were assessed by applying the IAQM Guidance using project-specific information. The **risk** of adverse effects occurring at sensitive receptor locations **if no mitigation measures** were applied to control emissions were concluded to be as shown in **Table 11-1**.

A range of mitigation measures have been recommended. Implementation of the recommended mitigation measures is required such that the residual dust impacts from the short-term and temporary construction can be appropriately managed to prevent adverse air quality effects at the sensitive receptor locations.

Table 11-1 Summary of dust risk without and with mitigation measures

Activity	Dust risk		Location
	No mitigation	With mitigation	

Construction of the transmission line	Low to High	Negligible	Referring to **Table ES-1** the following transmission line sections:
			- High:
			  ○ Section 1: Wagga 330 kV substation to Wondalga
			  ○ Section 4: Adjungbilly to Yass
			  ○ Section 5: Yass to Roslyn
			- Medium:
			  ○ Section 3: Wondalga to Adjungbilly
			  ○ Section 6: Roslyn to Bannaby
			- Low:
			  ○ Section 2: Wondalga to future Maragle 500 kV substation

Substations	Low	Negligible	All
Construction compounds and Tumbarumba accommodation facility (AC1)	Negligible	N/A	Snubba Road compound (C16) Honeysuckle Road compound (C07) Red Hill Road compound (C08) Maragle 500 kV compound (C05)
	Low	Negligible	All - with the exception of Snubba Road compound (C16), Honeysuckle Road compound (C07), Red Hill Road compound (C08) and Maragle 500 kV Compound (C05)

Emissions due to dust emissions from operations, and products of combustion from vehicles and plant for both construction and operation were assessed using a qualitative risk-based assessment and shown to pose a negligible risk of adverse impacts to air quality.

Concrete batching plants should be located at least 100 metres from sensitive receptor(s) and crushing and screening activities should be located at least 500 metres from sensitive receptor(s). Where diesel-fuelled generators are proposed for use at the construction compounds, a minimum separation distance of 500 metres to the nearest sensitive receptor(s) is recommended.

12 References

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Attachment A: Climate Plots

Moss Vale

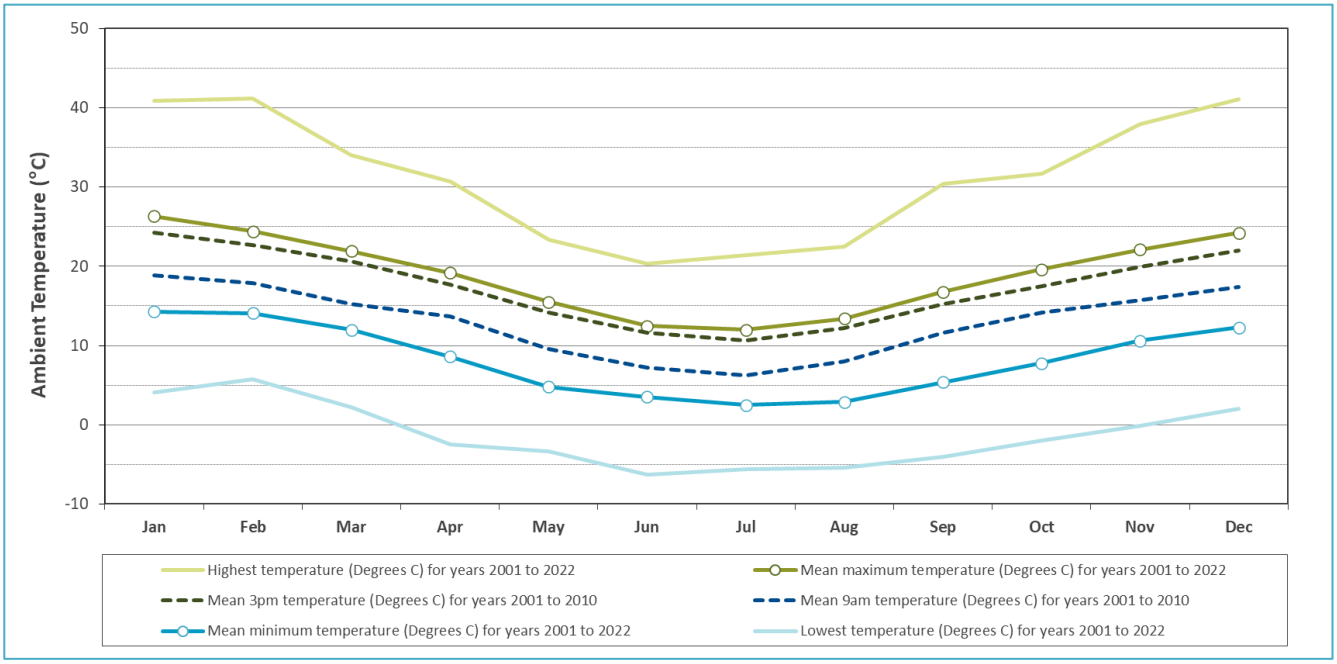

Figure A-1 Moss Vale – Temperature

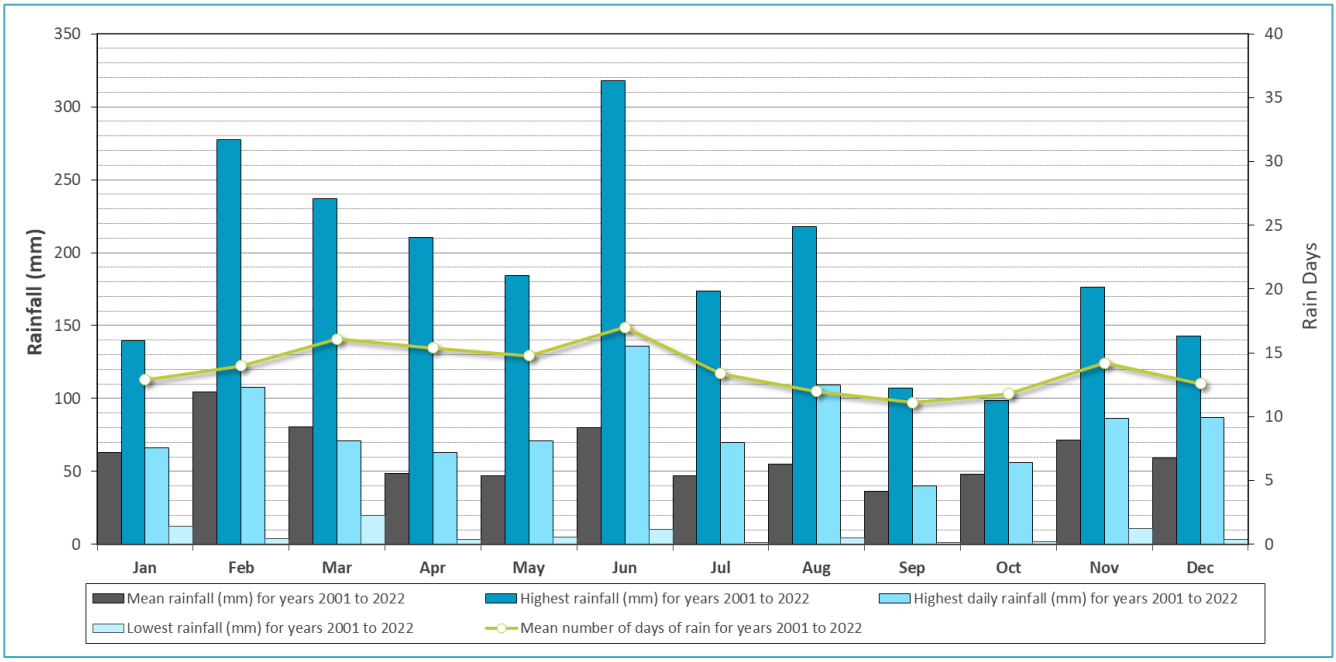

Figure A-2 Moss Vale – Rainfall

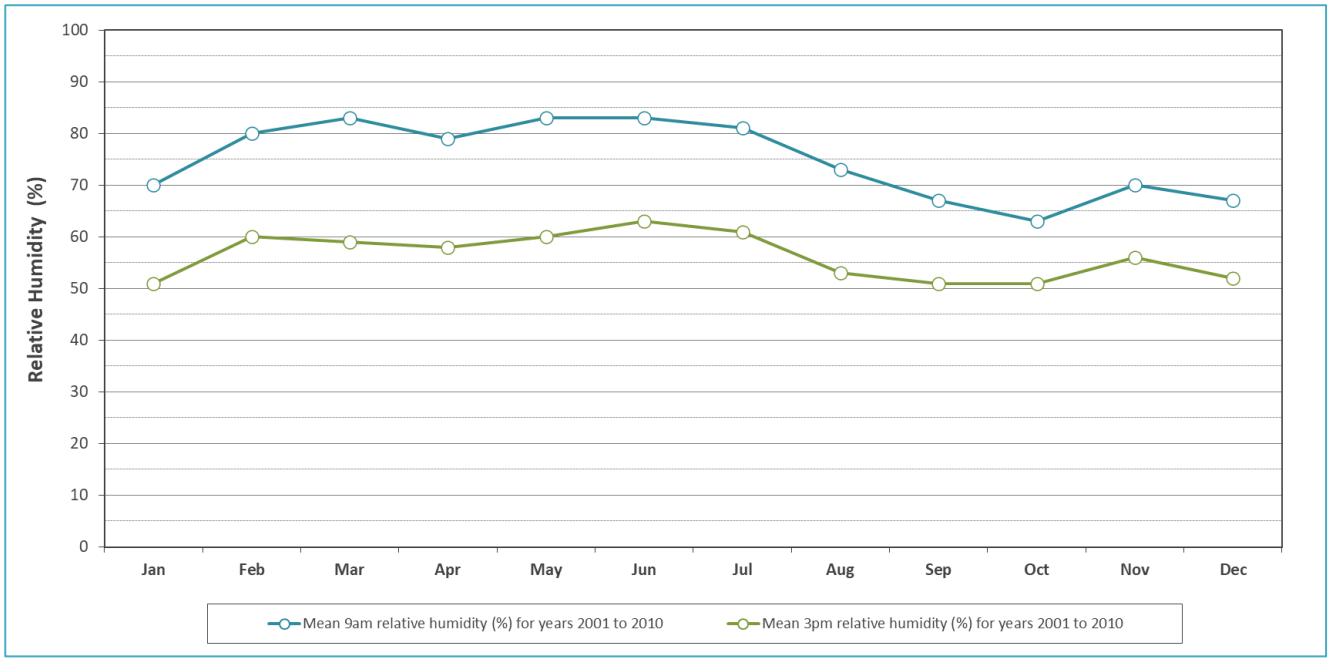

Figure A-3 Moss Vale – Relative Humidity

Cabramurra

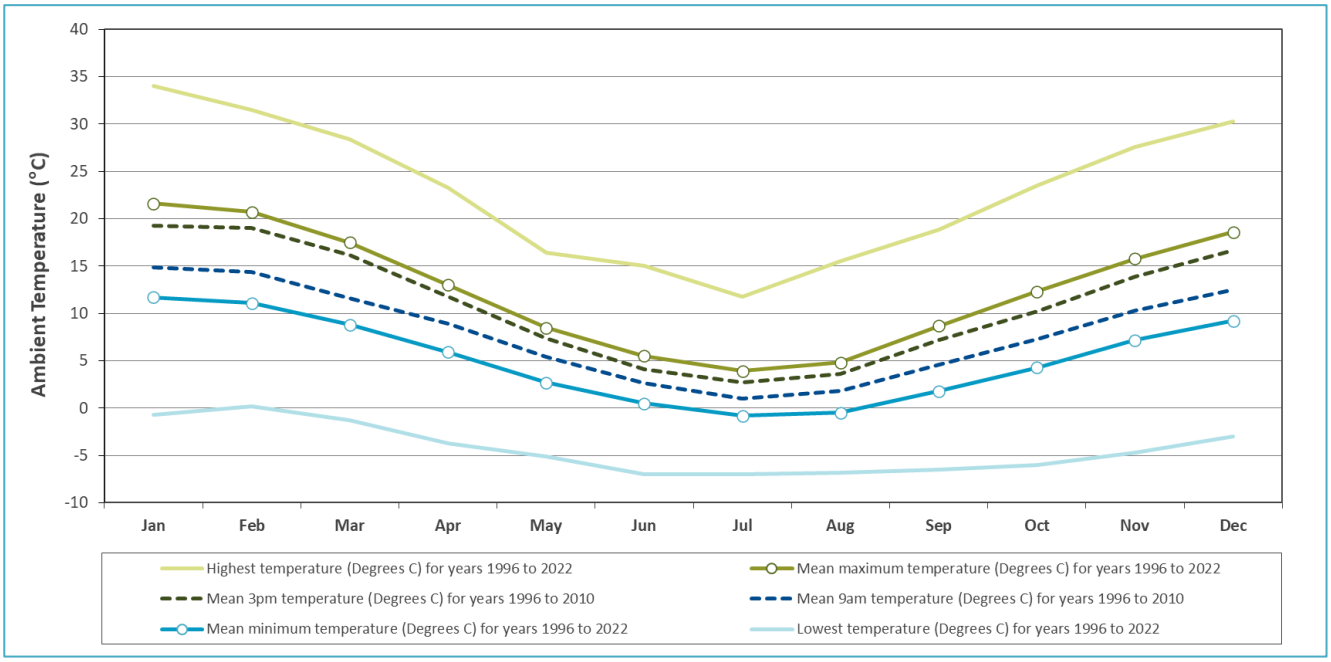

Figure A-4 Cabramurra – Temperature

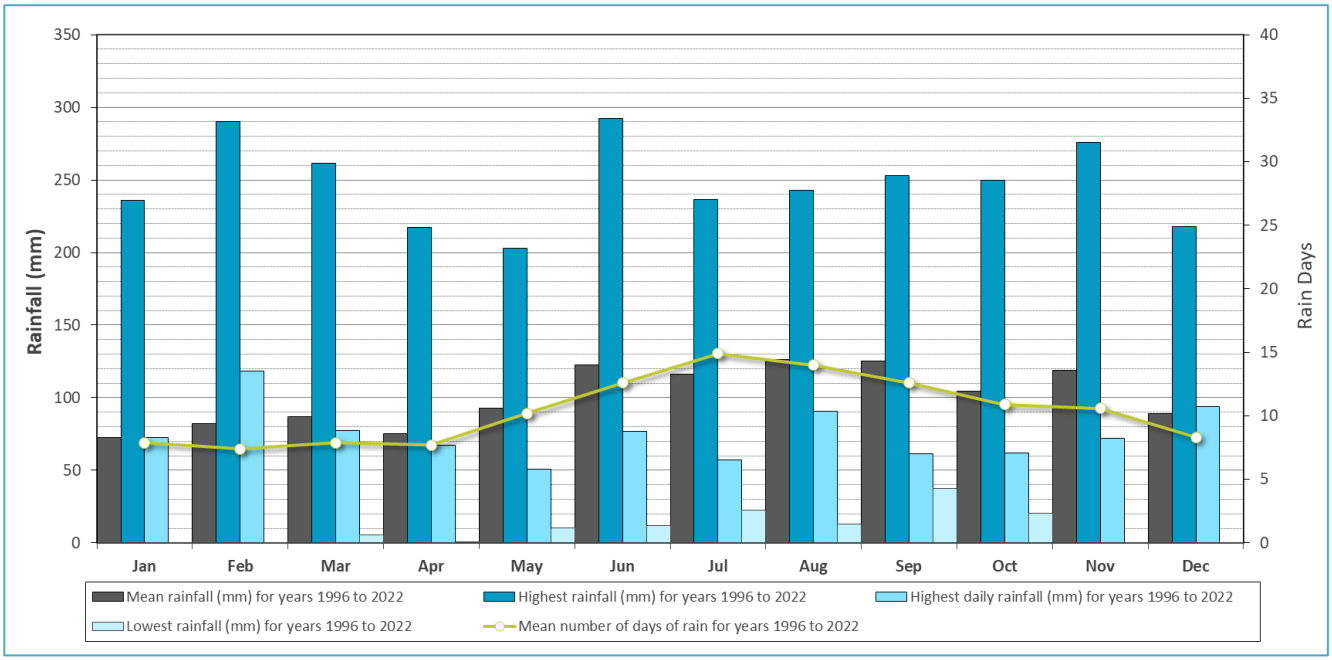

Figure A-5 Cabramurra – Rainfall

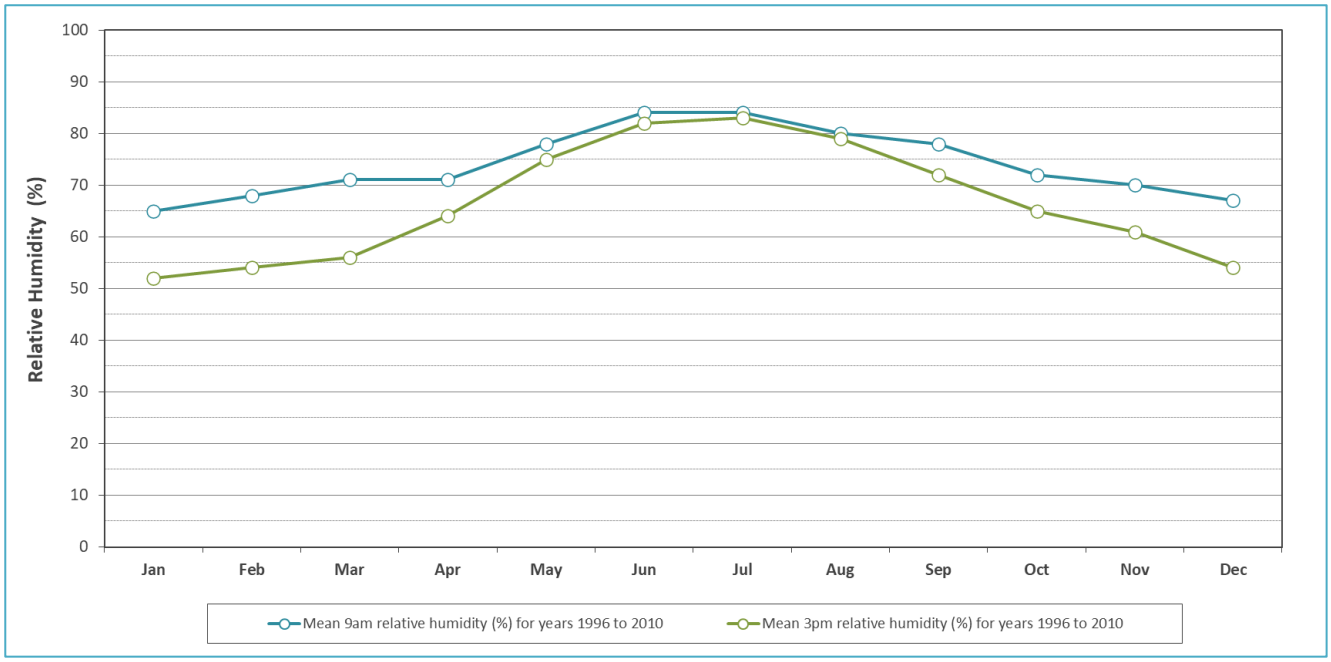

Figure A-6 Cabramurra – Relative Humidity

Wagga Wagga

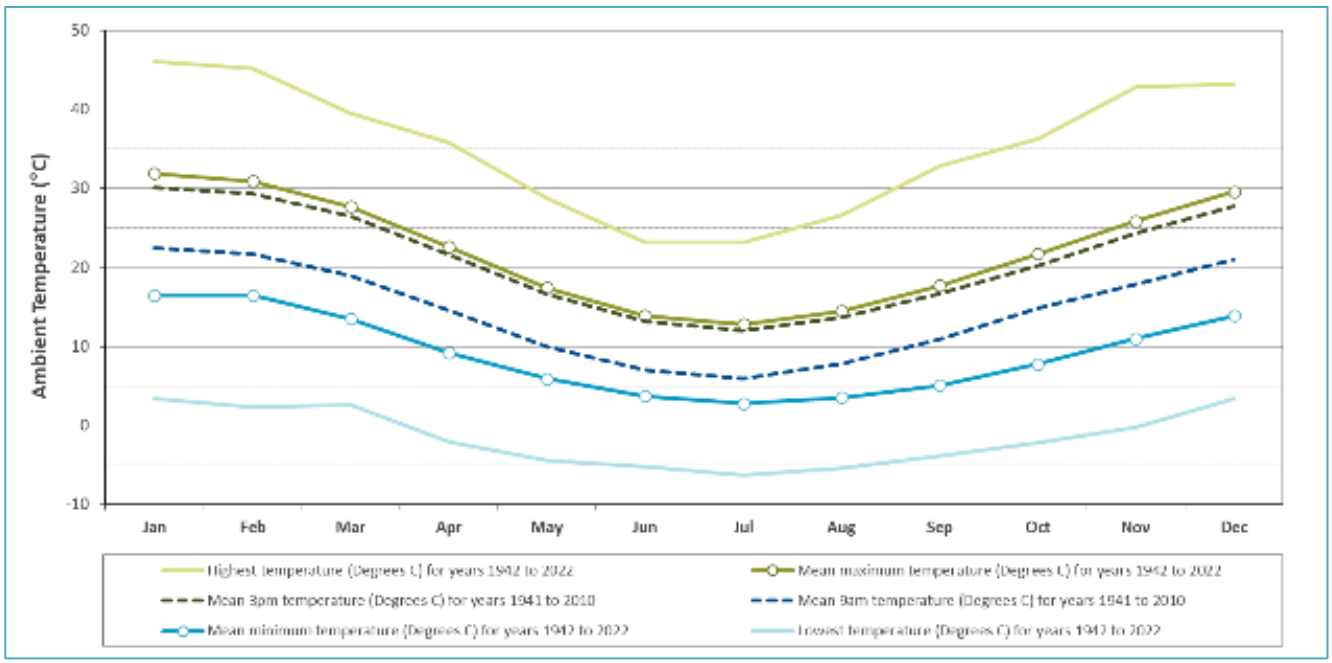

Figure A-7 Wagga Wagga – Temperature

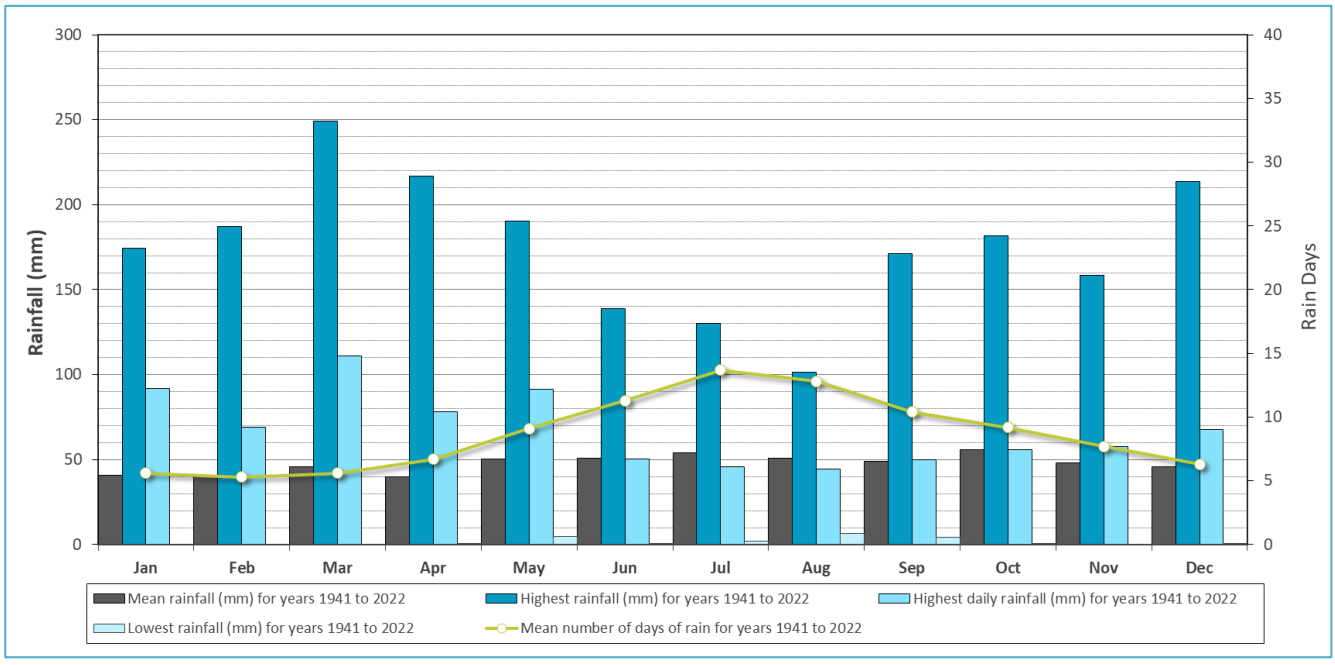

Figure A-8 Wagga Wagga – Rainfall

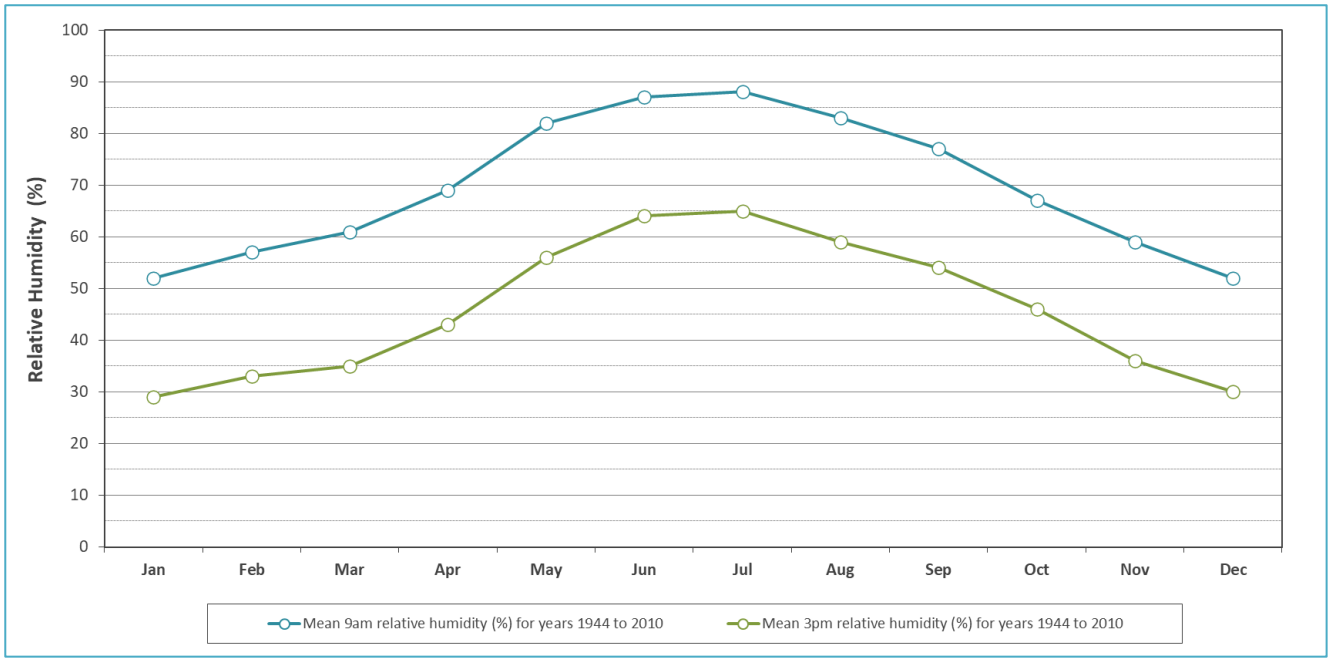

Figure A-9 Wagga Wagga – Relative Humidity

Goulburn

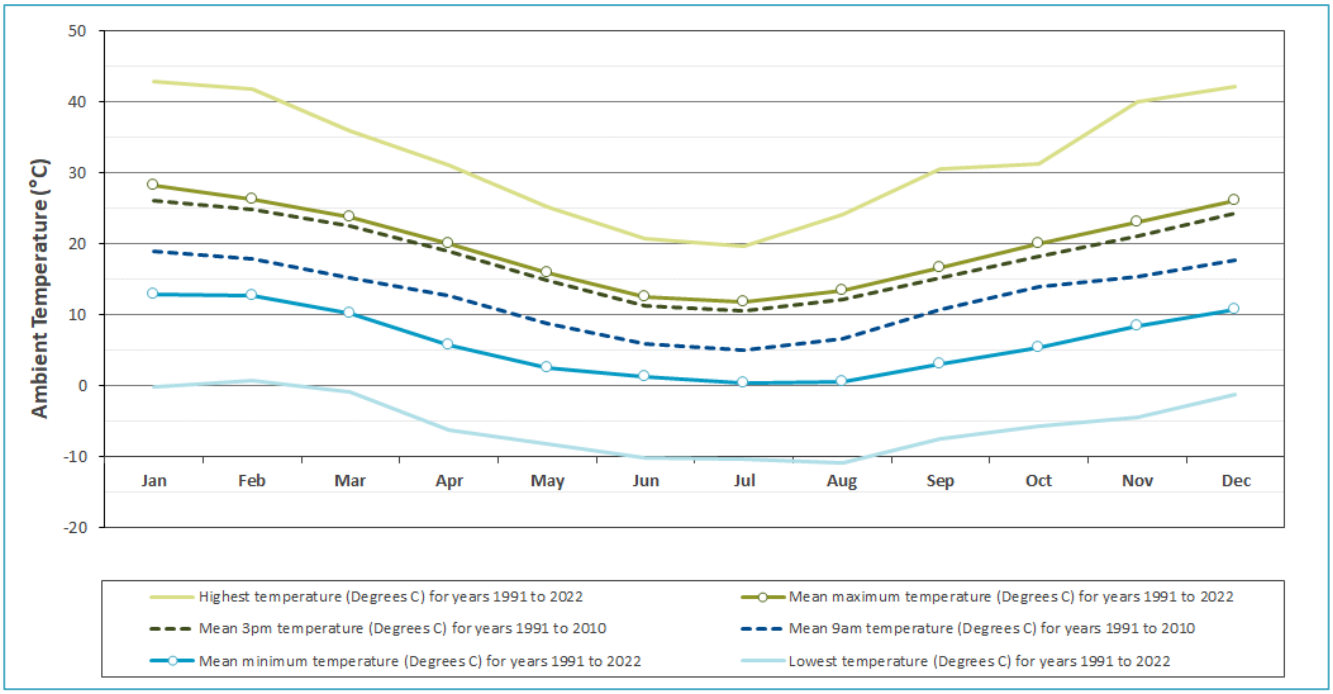

Figure A-10 Goulburn – Temperature

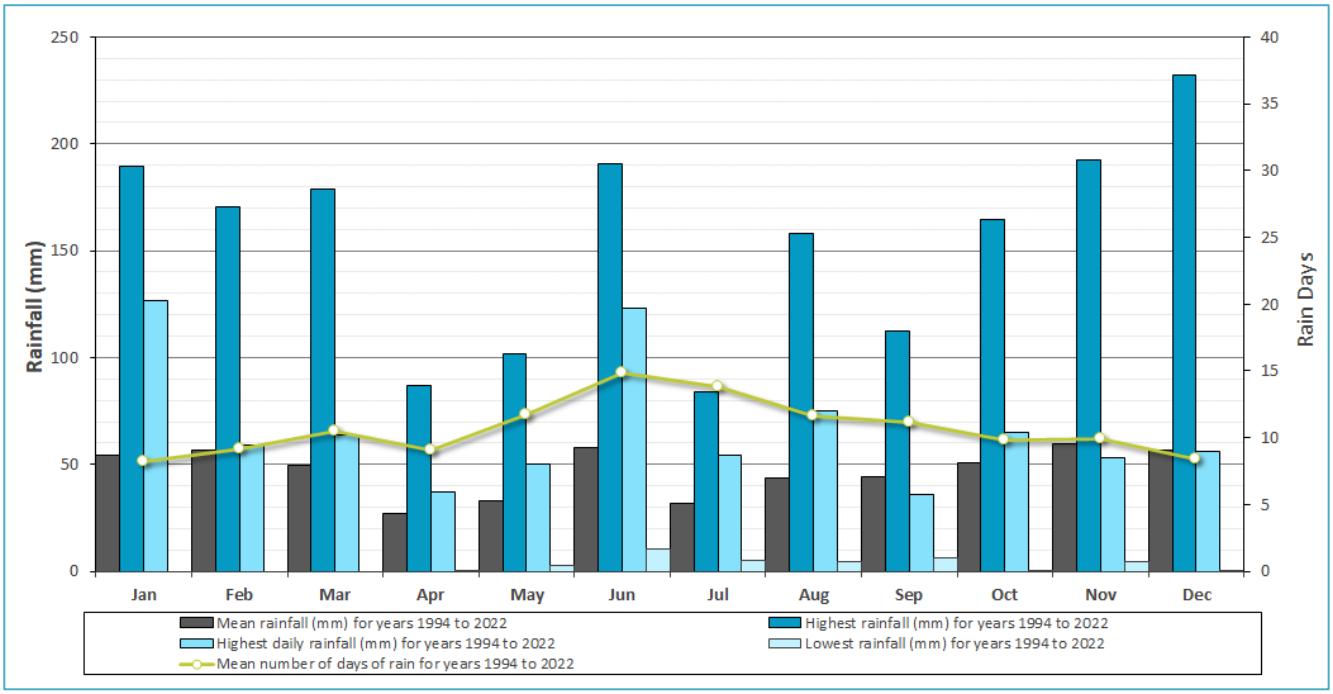

Figure A-11 Goulburn – Rainfall

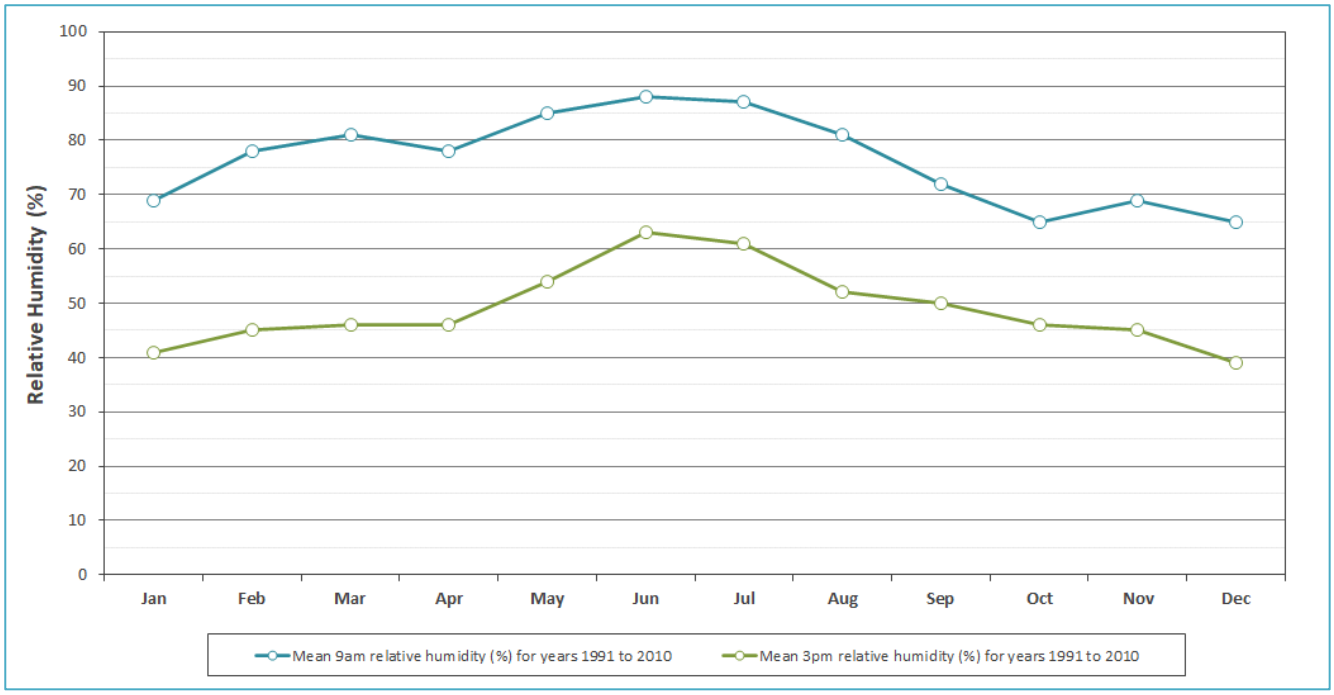

Figure A-12 Goulburn – Relative Humidity

ASIA PACIFIC OFFICES

ADELAIDE
60 Halifax Street
Adelaide SA 5000
Australia
T: +61 431 516 449

BRISBANE
Level 16, 175 Eagle Street
Brisbane QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CAIRNS
Level 1, Suite 1.06
Boland's Centre
14 Spence Street
Cairns QLD 4870
Australia
T: +61 7 4722 8090

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST
Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
1/25 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE CBD
Suite 2B, 125 Bull Street
Newcastle West NSW 2302
Australia
T: +61 2 4940 0442

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Level 1, 500 Hay Street
Subiaco WA 6008
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY
Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE
12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG
Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 2 4249 1000

AUCKLAND
201 Victoria Street West
Auckland 1010
New Zealand
T: 0800 757 695

NELSON
6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628

WELLINGTON
12A Waterloo Quay
Wellington 6011
New Zealand
T: +64 2181 7186

SINGAPORE
39b Craig Road
Singapore 089677
T: +65 6822 2203