EIS Volume 2 Appendix K

Air Quality Impact Assessment and Greenhouse Gas Assessment

JBS&G

project energy connect

This document has been prepared for **Resonate Consultants Pty Ltd** on behalf of **JBS&G**:

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Project EnergyConnect Revision – South Australia

Air Quality Impact Assessment & Greenhouse Gas Assessment

Addressee(s):	Resonate Consultants Pty Ltd; JBS&G
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Quality Control

Study	Status	Prepared by	Checked by	Authorised by
INTRODUCTION	Final	Northstar Air Quality	MD, GCG	MD
THE PROJECT	Final	Northstar Air Quality	MD, GCG	MD
LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar Air Quality	MD, GCG	MD
EXISTING CONDITIONS	Final	Northstar Air Quality	MD, GCG	MD
AIR QUALITY IMPACT ASSESSMENT	Final	Northstar Air Quality	MD, GCG	MD
GREENHOUSE GAS ASSESSMENT	Final	Northstar Air Quality	MD, GCG	MD
CONCLUSION	Final	Northstar Air Quality	MD, GCG	MD

Report Status

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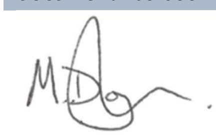
19	1065	F	R2	V1
Based upon the above, the specific reference for this version of the report is:				**19.1065.FR2V1**

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.



Martin Doyle **9th March 2021**

Non-Technical Summary

Resonate Consultants Pty Ltd (Resonate) has engaged Northstar Air Quality Pty Ltd (Northstar) on behalf of JBS&G and ElectraNet Pty Ltd (ElectraNet) to perform an air quality impact assessment and greenhouse gas assessment for the proposed development of a substation and energy interconnector transmission line, located between Robertstown and the South Australia/ New South Wales (NSW) border north of Murtho, SA (the Project).

This Air Quality Impact Assessment forms part of the Environmental Impact Statement prepared to accompany the development application for the Project under the *Development Act* 1993 and the *Environmental Protection and Biodiversity Conservation Act* 1999.

The air quality impact assessment presents an evaluation of the impacts of the proposed construction activities associated with the Project. The consequence of impacts associated with air quality have been assessed in addition to mitigation measures to manage these consequences. It is concluded that a range of mitigation measures should be applied, depending on the proximity of construction activities or access roads to sensitive receptor locations. Should these measures be appropriately implemented, the Project can be constructed with minimal impacts at those receptor locations.

A greenhouse gas assessment has been performed to examine the potential impacts of the construction of the Project relating to emissions of greenhouse gas. A quantitative assessment of greenhouse gas emissions has been performed with direct emissions compared with total national and SA emissions for context.

Direct greenhouse gas emissions associated with the Project are anticipated to represent <0.0001% of Australian and <0.0031 % of SA Greenhouse Gas emissions totals for the year 2018. Opportunities for the reduction of GHG emissions are provided in relation to direct and indirect emissions associated with the Project.

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1. INTRODUCTION

JBS&G Australia Pty Ltd (JBS&G and ElectraNet Pty Ltd (ElectraNet) has engaged Northstar Air Quality Pty Ltd (Northstar) to perform an air quality impact assessment (AQIA) and greenhouse gas assessment (GHGA) for the South Australian portion of Project EnergyConnect.

Project EnergyConnect is a proposed high voltage electricity transmission interconnector to be constructed between Robertstown in South Australia (SA) and Wagga Wagga in New South Wales (NSW), with an added connection from Buronga in NSW to Red Cliffs in north-west Victoria.

The owner and operator of the South Australian transmission network, ElectraNet, has partnered with TransGrid, the manager and operator of the high voltage electricity transmission network in NSW, to deliver Project EnergyConnect which will ultimately be built, owned, operated and maintained by ElectraNet and TransGrid.

ElectraNet would be responsible for constructing and operating the SA portion of Project EnergyConnect from Robertstown to the SA / NSW Border (the Project). This AQIA and GHGA addresses the South Australian portion only.

The AQIA presents an assessment of the potential impacts of the Project, associated with both the construction phase and operational phase of the development. Regarding potential construction and operational impacts, this has been assessed using a methodology prescribed by JBS&G, and appropriate control measures proposed to manage the consequence and risk from the Project.

A corresponding GHGA is provided, which quantifies the potential emissions of greenhouse gases associated with the construction and operation of the Project.

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2. THE PROJECT

The following provides a description of the Project and the potential air emissions associated with the construction and operational phases of the development.

2.1 Project Overview

The Project consists of a new electricity substation at Bundey and high-capacity interconnector transmission line between Robertstown in SA and the NSW border north of Murtho, SA.

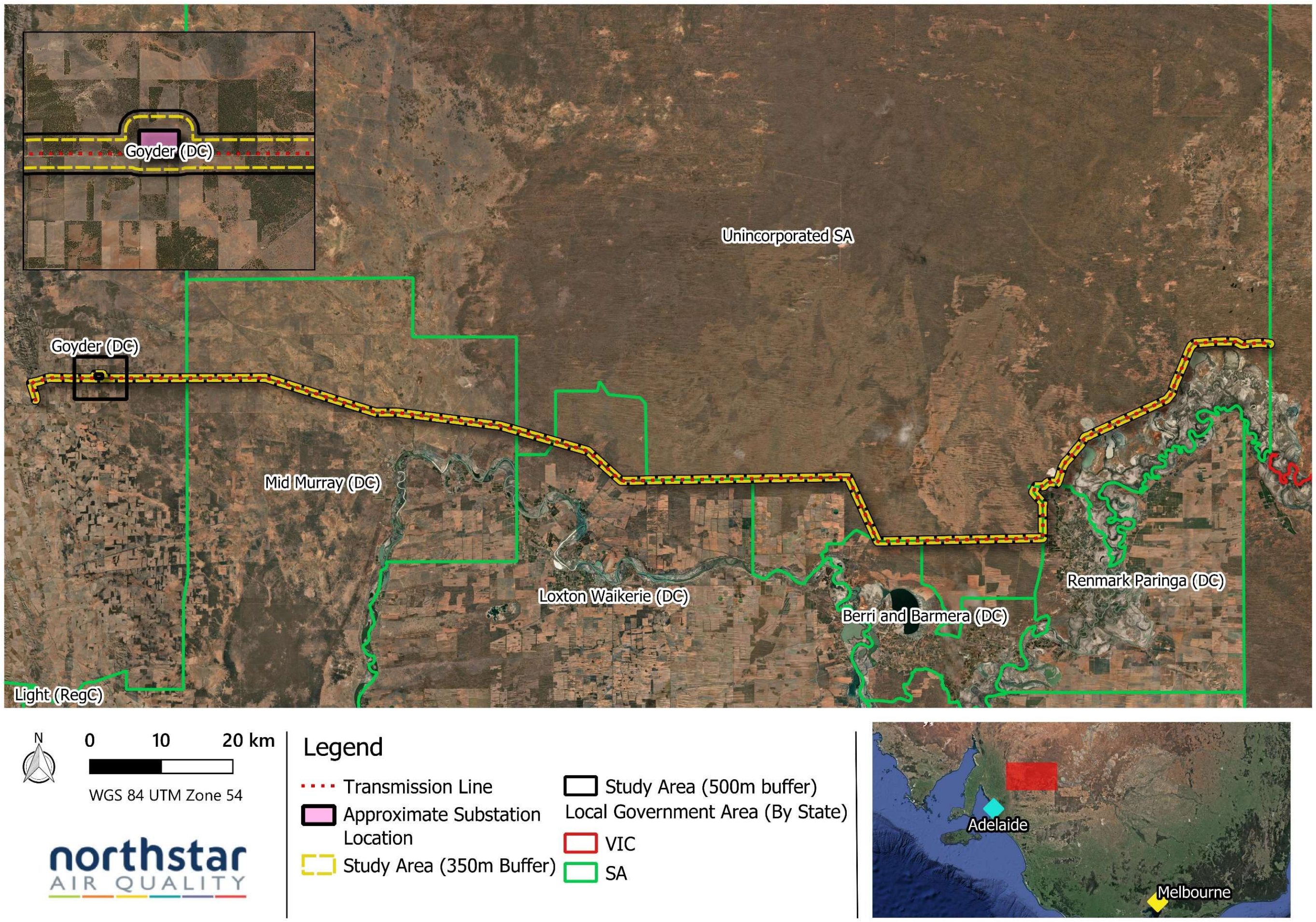
The Project area encompasses the area within a 500 metre (m) buffer around the transmission line alignment and a 1 km^2 clearance area at the site of the proposed substation.

For the purposes of this study the Study Area covers a 350 m buffer around the transmission line and substation. A 350 m buffer distance has been selected because it is the maximum screening distance determined by the Institute of Air Quality Management (IAQM) (Institute of Air Quality Management, 2016) for construction dust assessments. This is further discussed in **Section 4.1**. Receptors within the 500 m Project area have been identified and included within the assessment.

2.2 Environmental Setting

The location of the Project is illustrated in **Figure 1**.

Figure 1 Project location

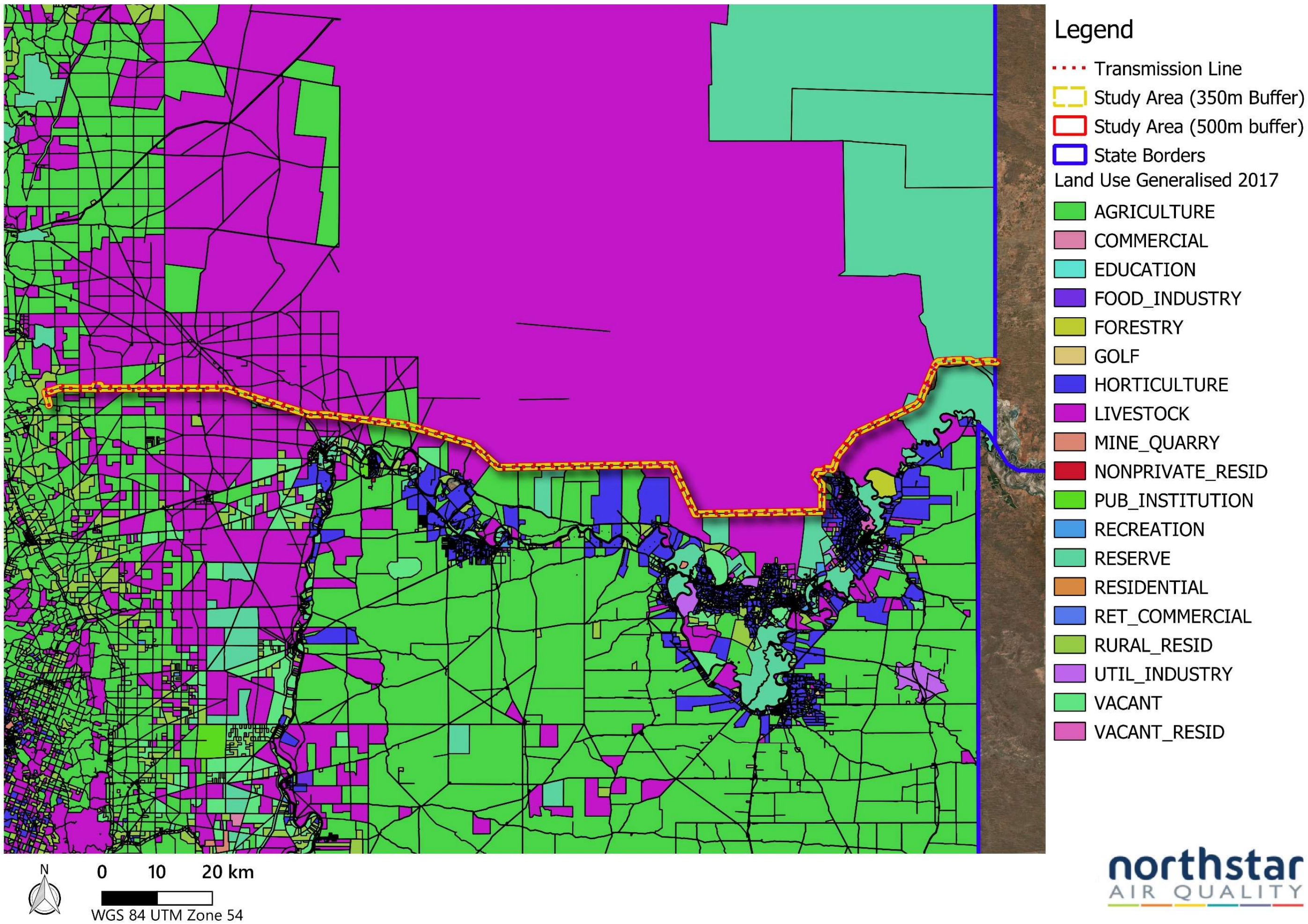


Source: Northstar Air Quality

It is understood that an extensive route selection process was undertaken for the Project and the proposed alignment is located largely within areas adjacent to existing transmission lines, roads and areas previously cleared. These areas are largely clear of vegetation, however additional vegetation clearance will be required for the establishment of access tracks and tower pads for construction.

The Project area encompasses land zoned as predominantly livestock, but also includes agriculture, utilities/industry), rural residential, reserve, mining/quarrying and horticulture, as illustrated in **Figure 2**. The nearest land zoned as residential is located over 10 km to the south of the Project area in the town of Renmark.

Figure 2 Land use surrounding the Project



Source: Northstar Air Quality

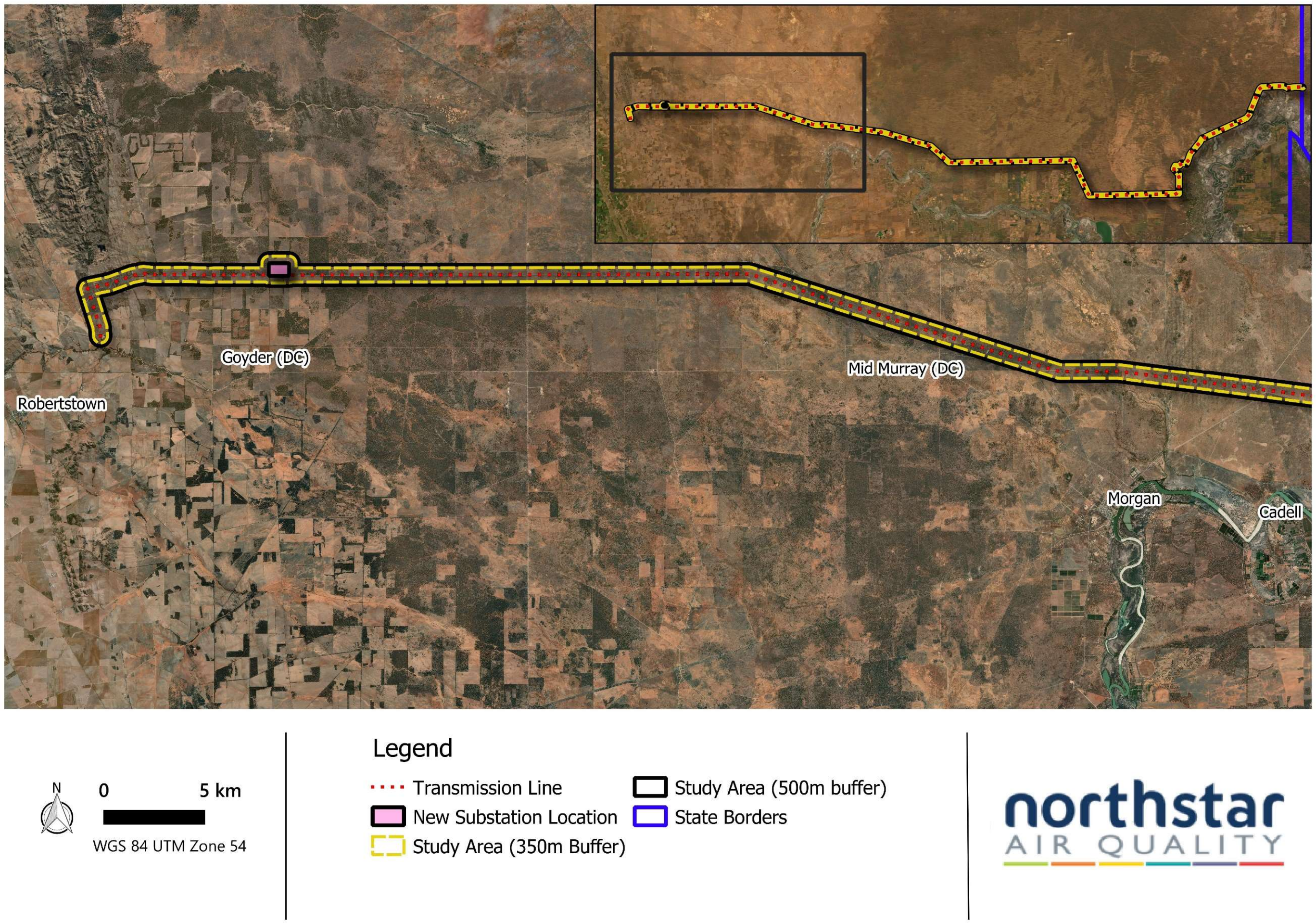
2.3 Specific Construction Details

2.3.1 Construction Details

Construction of the Bundey substation (refer **Figure 3**) is expected to commence in Q4 2021 and will take approximately 18 months. The construction of the transmission line from the SA-NSW border to Robertstown, SA (refer **Figure 1**) would take approximately 16-18 months.

Construction of the transmission line would typically occur in a linear manner along the proposed alignment, likely from the SA/NSW border in a westerly direction towards Robertstown, subject to access, weather conditions etc. This means construction activities at each transmission line structure location would be intermittent. It is anticipated that construction activities would progress between 8 km to 12 km per month. There may be up to three work fronts running simultaneously on different sections of the proposed alignment.

Figure 3 Substation location



Source: Northstar Air Quality

During construction, land clearance would be required for the substation covering an area of 9 hectares (ha) (approximately 400 m × 250 m) of the 80 ha site. This will allow space for future expansion if required.

Land clearance at the site of the Bundey substation will be required prior to localised excavation and establishment of a concrete hardstand. The construction of the Bundey substation would then require the installation of plant such as gantries, switch gear, 275/330 kilovolt (kV) transformers, control building, and lighting / flood lighting masts. The substation will be surrounded by palisade perimeter fence at a height of approximately 3 m.

Land clearance of approximately 50 m × 50 m would also be required along the proposed transmission line alignment at each tower location, which will be spaced approximately 450 m – 600 m apart.

For access, existing tracks will be used where possible, however where new access tracks are required a 5-6 m wide clearance will be required.

It is not yet determined whether the Project intends to utilise a twin-engine helicopter (such as a Kamov Ka-32A11BC, or equivalent) to transport and erect the towers onsite. Based on the assumption that a helicopter is used for this purpose, towers would be preassembled at staging sites, such as Hawks Nest Station, prior to being flown to tower locations. Additional helipads and refuelling sites would also be developed adjacent to temporary construction camps. One of the primary benefits of using a helicopter for tower transport and erection is the reduced need to clear vegetation at sensitive areas with difficult access.

A single engine helicopter (such as a Eurocopter AS350 Squirrel, or equivalent) may also be employed for conductor stringing to reduce the construction timeframe and minimise vegetation disturbance. However, this has also not yet been determined.

It is estimated that various vehicle movements will be required during the construction process as outlined in **Table 1**.

Table 1 Traffic movement estimates for Project construction

Item	Vehicle type	Total number of loads	Comments
Towers	Semi-trailer or helicopter[1]	450	1 load per tower
Conductors, insulators and hardware	Semi-trailer	500	3 cable/OPGW drums per load
Concrete	Concrete truck	2 780 (based on a total of 450 towers, 6 trucks per tower and 80 trucks for the Bundey substation)	16 (assuming all footings are constructed within the first 12 month which equates to 8 deliveries per day)

Item	Vehicle type	Total number of loads	Comments
Construction equipment	Cranes, dozers, graders, excavators etc	10-20	Generally remain on alignment
Substation plant	Semi-trailer	50	Will use existing roads
Substation civil works	Semitrailer, Concrete truck, cranes, dozers, graders, excavators etc	Several per day	Will use existing roads
Light vehicles	4x4 vehicles, light trucks	20-40	Various during different stages of construction
Other (including water, borrow material, camp supplies)	Truck (various)	Several per day	

Source: JBS&G, 2020

Note: 1 – Vehicle type for the delivery of towers is not yet determined, but is anticipated to be a semi-trailer and a helicopter for sections through Taylorville, Hawks Nest and Calperum Stations.

2.3.2 Identified Potential Emissions to Air

Construction of the Project would involve the movement of vehicles to and from the site, clearance of existing vegetation, excavation and the installation of new structures and services.

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

- Cranes;
- Earth moving vehicles;
- Light vehicles;
- Heavy vehicles;
- Helicopters;
- Pneumatic hand or power tools;
- Commercial vans;
- Cherry pickers / scissor lifts; and,
- Mobile concrete batching plants.

The methodology used in the construction phase air quality assessment is discussed in **Section 5.1**, and the assessment of the potential impacts upon local air quality resulting from construction activities is presented in **Section 6.1**.

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

Three (3) mobile concrete batching plants are proposed to be operated during the construction of the interconnector transmission line. SA EPA (SA EPA, 2016) have determined a maximum screening distance of 100 m associated with dust emissions resulting from mobile concrete batching. For the purposes of this study, it is assumed that the mobile concrete batching will be performed within 250 m of the interconnector transmission line, along all sections. This would allow dust emissions associated with mobile concrete batching to fall within the 350 m screening distance for construction activities (the Study Area).

Should helicopters be used for tower delivery and stringing, they will be operated in accordance with the *Civil Aviation Act* (CAA) (1998), the *Civil Aviation Regulations* (CAR) (1998) and the *Civil Aviation Safety Regulations* (CASR) (1998). Helicopter take-off and landing, and staging sites may be outside of the Project area and may result in the generation of particulate matter through rotor downwash and material handling activities. Care will be taken to locate helicopter take-off and landing, and staging sites as far from any sensitive receptor locations as possible, and at a minimum of 350 m from those locations. This is anticipated to provide a suitable buffer for anticipated short-term (<1 hr) particulate matter emissions and to ensure that the short - term (24 hr) particulate matter criteria are achieved. Emissions from helicopter activities have been assessed in the GHGA.

Localised engine exhaust emissions from construction machinery and vehicles are expected. Given the scale of the proposed works, it is considered that fugitive construction dust emissions would have the greatest potential to give rise to downwind air quality impacts. Construction phase vehicle emissions are therefore not considered further in this AQIA. It is noted however that the construction mitigation recommendations (see **Section 6.1.3**) includes measures to minimise and manage these potential impacts.

2.4 Specific Operational Details

2.4.1 Operating Hours

Given the nature of the Project, normal operational-phase emissions to air will be negligible.

Operational maintenance is planned to be approximately two visual inspections per year with annual helicopter-based inspections. Insulators will be replaced every 25 years, and the design life of the transmission line is approximately 100 years. Maintenance work will be scheduled in consultation with landholders and will occur with standard working hours, as outlined in **Table 2**.

Table 2 Proposed operational maintenance hours

Operation	Operational hours
Operational hours for maintenance (staffed)	7 am to 6 pm, Monday to Friday 8 am to 1 pm Saturday

2.4.2 Operational Details

During operation, the primary activity that may potentially lead to air quality impacts is the periodic maintenance of the transmission line and towers. Maintenance activities that may give rise to air emissions will generally be limited to vehicles exhaust emissions from the inspection vehicles.

2.4.3 Identified Potential Emissions to Air

The operational processes, which may result in the emission of pollutants to air are the movement of light vehicles around the Project area on paved and un-paved road surfaces, and emissions from vehicle and plant exhausts.

Given the nature and scale of operational-phase maintenance activities, the potential risk to air quality is very small. Additionally, the operational frequency is so low that the emissions to air from all the processes stated above are considered negligible.

Due to this frequency and type of processes performed as part of the Project operation, the operational phase has not been assessed further.

3. LEGISLATION, REGULATION AND GUIDANCE

3.1 Federal Air Quality Standards

3.1.1 National Environment Protection (Ambient Air Quality) Measure

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

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

The Ambient Air Quality NEPM was varied in July 2003 to include advisory reporting standards for fine particulate matter with an aerodynamic equivalent diameter of 2.5 microns (µm) or less ($PM_{2.5}$) and in February 2016 (NEPC, 2016), introducing varied standards for PM_{10} and $PM_{2.5}$. The air quality standards and goals as set out in the (revised) Ambient Air Quality NEPM for the pollutants considered within this assessment are presented in **Table 3**.

Table 3 National Environment Protection (Ambient Air Quality) Measure standards and goals

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

3.1.2 National Clean Air Agreement

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

Regarding air quality standards with relevance to this report, the Initial Work Plan set an objective to vary the Ambient Air Quality NEPM regarding PM_{10} and $PM_{2.5}$ standards (now in force).

Of relevance to the standards adopted as the relevant benchmarks for the performance of the Project, the previous standards were augmented by an annual average PM_{10} concentration standard of 25 µg·m^{-3}, and the advisory reporting standards for $PM_{2.5}$ considered as standards. It is further likely that the 24-hour average PM_{10} concentration standard will be made more stringent from the current value of 50 µg·m^{-3} in time, although it is currently not possible to determine the revised standard for that metric.

3.2 South Australian Air Quality Standards – Ambient Air Quality

State air quality guidelines adopted by the South Australia (SA) EPA are published in the *Environment Protection (Air Quality) Policy* 2016 (Air EPP) under section 28 of the *Environment Protection Act* (1993). Where relevant to the expected potential scope of emissions to air from the construction activities of the Project, the ground level concentration standards are reproduced from Schedule 2 of the Air EPP in **Table 4** below:

Table 4 Air EPP ambient air standards

Pollutant	Classification	Averaging time	Maximum concentration (mg·m^{-3})
Particles (as PM_{10})	Toxicity	24 hours	0.05
Particles (as $PM_{2.5}$)	Toxicity	24 hours	0.025
		12 months	0.008

The air quality standards presented in **Table 4** represent the standards to be achieved for the Project in this AQIA.

3.3 Greenhouse Gas Legislation and Guidance

The Australian Government Clean Energy Regulator administers schemes legislated by the Australian Government for measuring, managing, reducing or offsetting Australia's carbon emissions.

Schemes administered by the Clean Energy Regulator include:

- National Greenhouse and Energy Reporting Scheme, under the *National Greenhouse and Energy Reporting Act* (2007).
- Emissions Reduction Fund, under the *Carbon Credits (Carbon Farming Initiative) Act* (2011).
- Renewable Energy Target, under the *Renewable Energy (Electricity) Act* (2000).
- Australian National Registry of Emissions Units, under the *Australian National Registry of Emissions Units Act* (2011).

3.3.1 National Greenhouse and Energy Reporting Scheme

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

The objectives of the NGER scheme are to:

- inform government policy.
- inform the Australian public.
- help meet Australia's international reporting obligations.
- assist Commonwealth, state and territory government programs and activities.
- avoid duplication of similar reporting requirements in the states and territories.

Further information on the NGER scheme, specifically the definitions of various scopes and types of GHG emissions which have also been adopted for the purposes of this assessment, is provided in **Section 5.2**.

3.3.2 Relevant SA Legislation

There is no specific GHG legislation administered within SA. However, SA does implement the *Climate Change and Greenhouse Emissions Reduction Act* 2007, that provides emission reduction targets for the state. These targets are by 31 December 2050 to reduce the greenhouse gas emissions by at least 60 % within SA to an amount equal to or less than 40 % of 1990 levels as part of a national and international response to climate change. The NGER scheme (and other identified Federal schemes in **Section 3.3.1**) is the applicable legislation within SA.

3.3.3 Guidance

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

- Australian Government Department of the Environment, Australian National Greenhouse Accounts, National Greenhouse Accounts Factors, October 2020 (DISER, 2020).
- The World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) GHG Protocol: A Corporate Accounting and Report Standard (WRI, 2004).
- ISO 14064-1:2006 (Greenhouse Gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of GHG emissions and removal.
- ISO 14064-2:2006 (Greenhouse Gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of GHG emission reductions or removal enhancements).

- ISO 14064-3:2006 (Greenhouse Gases – Part 3: Specification with guidance for the validation and verification of GHG assertions) guidelines (internationally accepted best practice).
- Government of South Australia, Department for Infrastructure and Transport, Sustainability Manual, December 2020 (DIT, 2020).
- Government of South Australia, Department for Infrastructure and Transport, Climate Change and Adaptation Guideline, February 2021 (DIT, 2021).

4. EXISTING CONDITIONS

4.1 Surrounding Land Sensitivity

Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed. Typically, these locations are identified as residential properties although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations.

It is important to note that the selection of discrete receptor locations is not intended to represent a fully inclusive selection of all sensitive receptors across the study area. The location selected should be considered to be representative of its location and may be reasonably assumed to be representative of the immediate environs. In some instances, several viable receptor locations may be identified in a small area, for example a school neighbouring a medical centre. In this instance, the receptor closest to the potential sources to be modelled would generally be selected and would be used to assess the risk to other sensitive land uses in the area. It is further noted that the accidental non-inclusion of a location sensitive to changes in air quality does not render the AQIA invalid, or otherwise incapable of assessing those potential risks.

For this assessment sensitive receptors have been assessed within a 350 m buffer around the Project (the Study Area). The coverage of the Study Area has been determined through review of the screening distances as outlined within Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* 2016. This distance is considered to be a conservative representation of the distance over which particulate impacts may be experienced from construction projects. This guidance document also forms part of the construction phase air quality assessment.

Access roads will be required and the locations of these are not currently known. It is likely that these roads would be at a distance of greater than 350 m from sensitive receptors, although should this separation distance not be possible, mitigation measures outlined in **Section 6.1** should be employed.

Population density data has been examined to ensure that the selection of discrete receptors for the AQIA are reflective of the locations in which the population of the area surrounding the Project reside. Population density data based on the 2016 census have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km^2) grid, covering mainland Australia (ABS, 2017). Using a Geographical Information System (GIS), the locations of sensitive receptor locations have been confirmed with reference to their population densities.

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

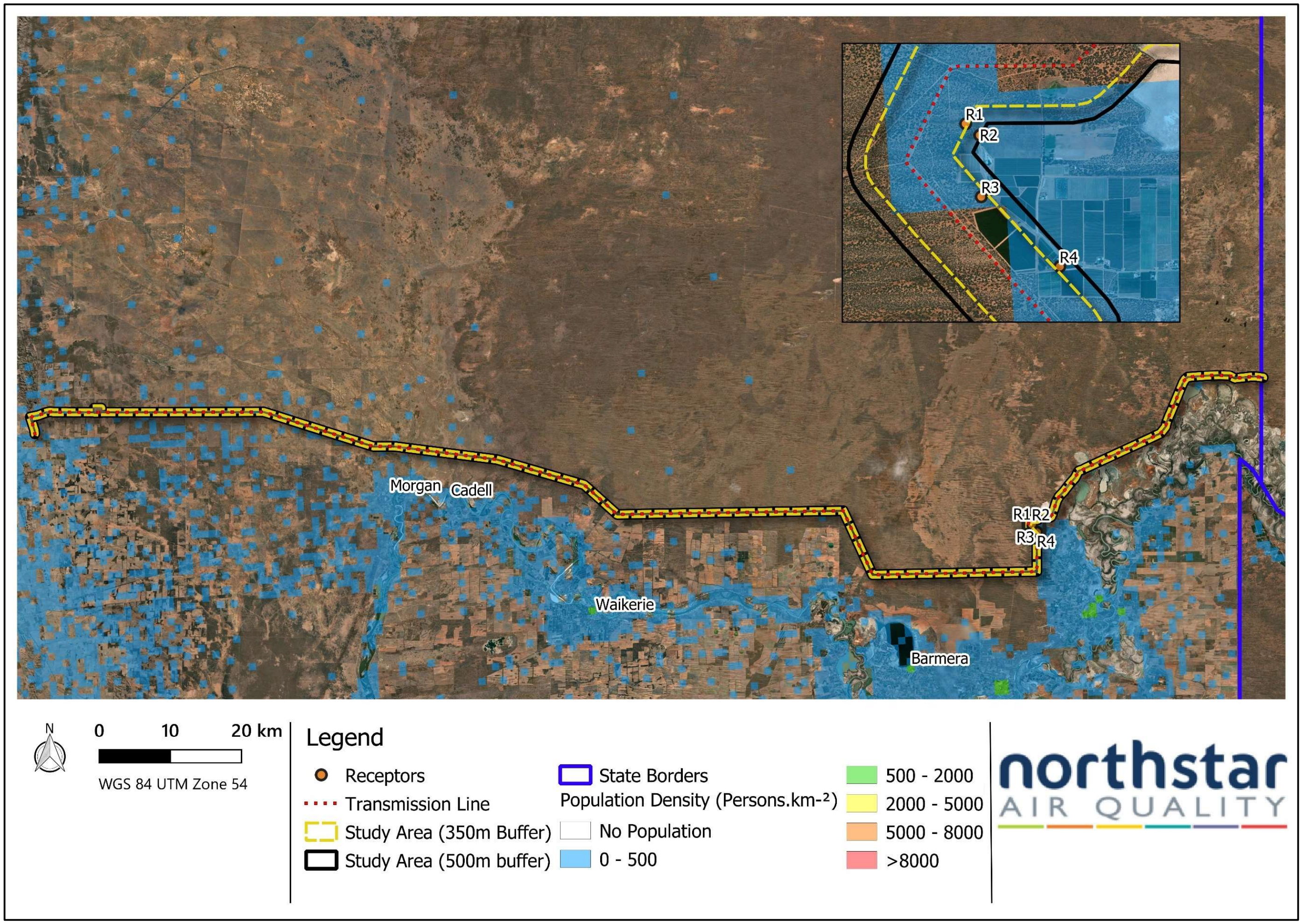
- Very high >8,000

- High >5,000
- Medium >2,000
- Low >500
- Very low <500
- No population 0

Using ABS data in a GIS, the population density of the area surrounding the Project are presented in **Figure 4**. The Project is located in areas of no population (0 persons·km^{-2}) to very low population density (<500 persons·km^{-2}). Areas with no colour in **Figure 4** represent areas with no population.

A number of residential locations surrounding the Project have been identified within the Study Area and these receptors have been adopted for use within this AQIA as presented in **Table 5**.

Figure 4 Population density and sensitive receptors surrounding the Project



Note: Areas with no colour represents a 1 km^2 grid cell with zero population

Table 5 represents the discrete receptor locations that have been identified as part of this study (see **Figure 4**). The table is not intended to represent a definitive list of sensitive land uses, but a cross section of available locations that are used to characterise larger areas, or selected as they represent more sensitive locations, which may represent people who are more susceptible to changes in air quality than the general population.

Table 5 Discrete sensitive receptor locations used in the study

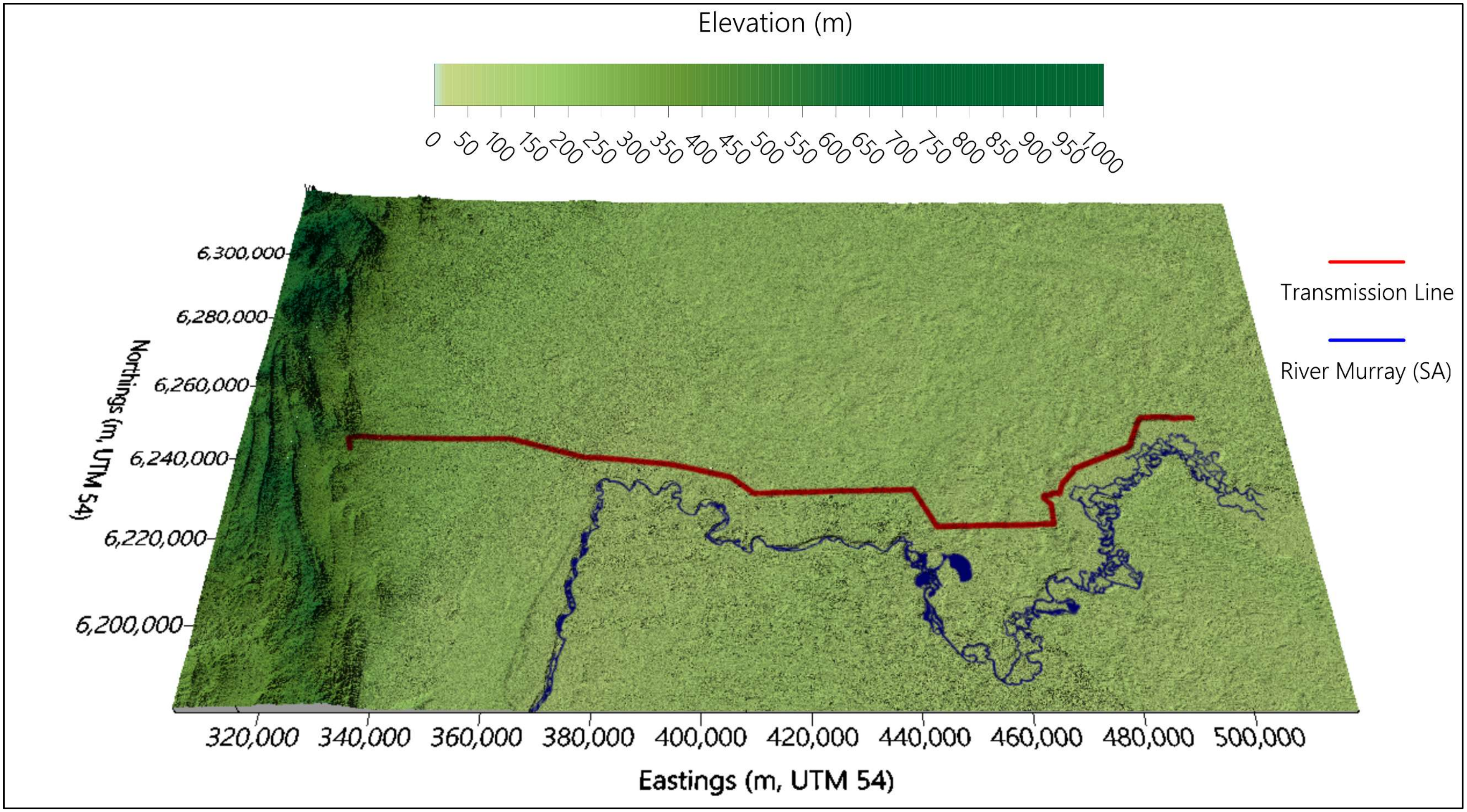
Receptor ID	Address	Receptor type	Generalised land use	Location (m, UTM 54)		Distance to Project (m)
				Eastings	Northings	
R1	615 Cooltong Av, Cooltong, SA	Residential	Rural residential	467 500	6 230 232	330
R2	606 Cooltong Av, Cooltong, SA	Residential	Rural residential	467 681	6 229 552	487
R3	555 Cooltong Av, Cooltong, SA	Residential	Horticulture	467 686	6 229 565	298
R4	31 Boase Rd, Coolton,g SA	Residential	Horticulture	468 253	6 228 921	393

4.2 Topography

The elevation of the Study Area ranges between approximately 20 m to 370 m Australian Height Datum (AHD) over the 204 km transmission line route, and there are no significant topographical features present between the Project and the nearest sensitive receptor locations.

There are significant topographical features to the west as shown in **Figure 5**, although these would not impact significantly upon the transport and dispersion of pollutants between the Project and receptors.

Figure 5 3-dimensional representation of topography surrounding the Project



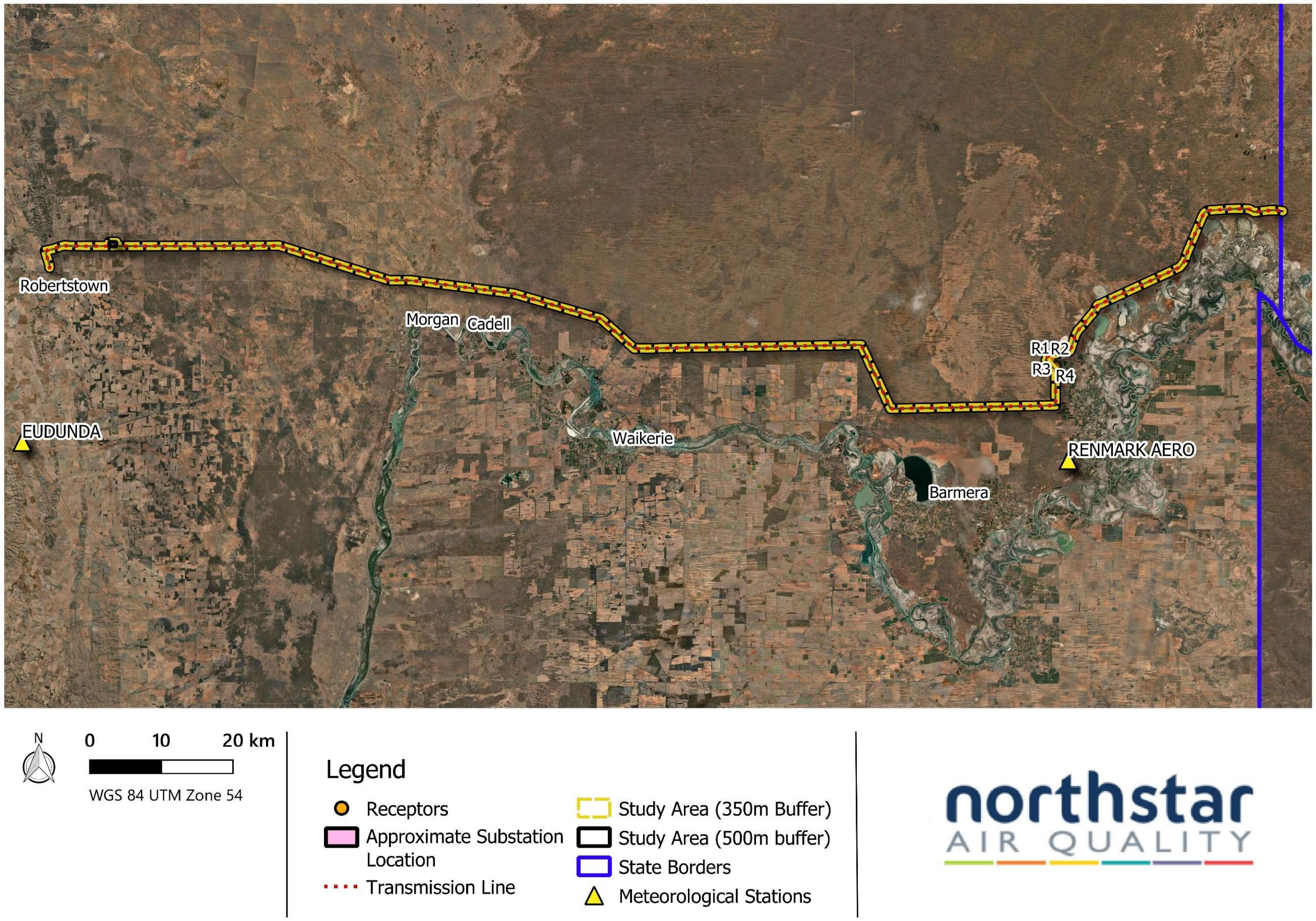
Source: Northstar Air Quality

4.3 Meteorology

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

As the Project spans such a large area, meteorology has been obtained from measurements taken at Eudunda AWS (station # 24511) and Renmark Aero AWS (station # 24048) to characterise the potential change in meteorology that may be experienced as operations take place along the transmission line corridor. The locations of the AWS in comparison to the Project are presented in **Figure 6.**

Figure 6 Meteorological station locations surrounding the Project

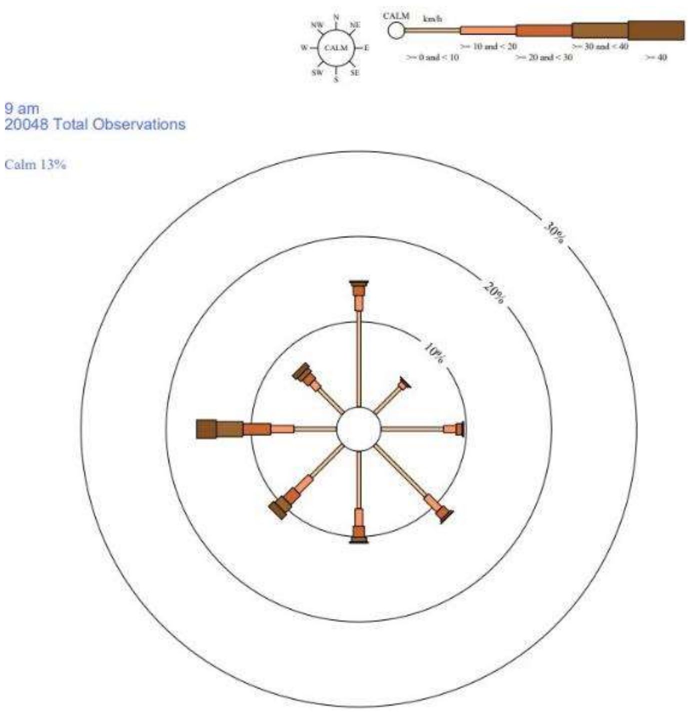


Source: Northstar Air Quality

Annual wind roses have been obtained for 9 am and 3 pm readings for both stations to show the variation in wind speed and direction over the day. The wind rose for the Eudunda AWS contains annual average data collected between 1965 and 2019 as illustrated in **Figure 7** and **Figure 8**. The wind rose for the Renmark Aero AWS contains annual average data collected between 1995 and 2019 as illustrated in **Figure 9** and **Figure 10**.

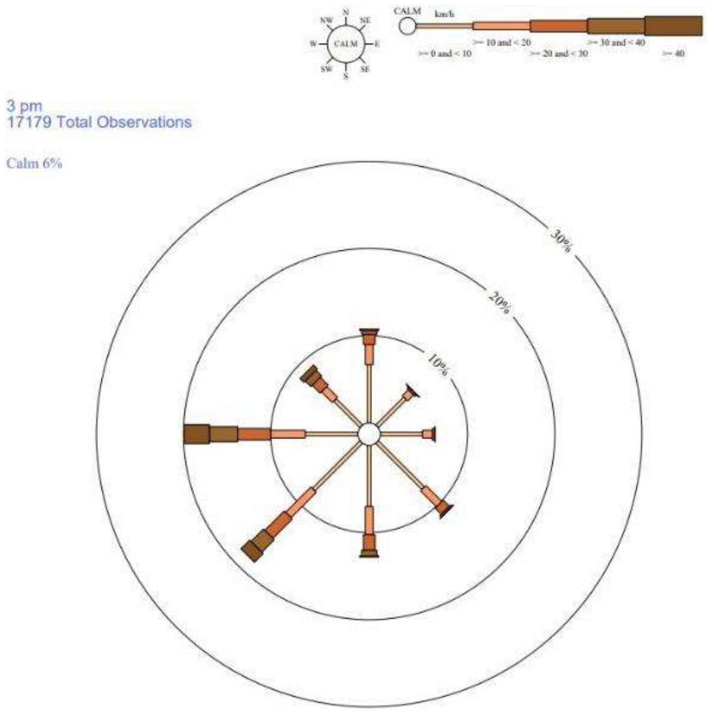
These wind roses are taken to be representative of the westerly and easterly extremities of the Project area. Both sets of wind roses indicate that winds from the south western quadrant are more likely to dominate, with these conditions more pronounced during the afternoon periods. Given the locations of the identified receptors to the east of the Project alignment, this may act to result in the transport of any generated air pollutants towards those receptors more often.

Figure 7 Wind rose – Eudunda 9am annual average



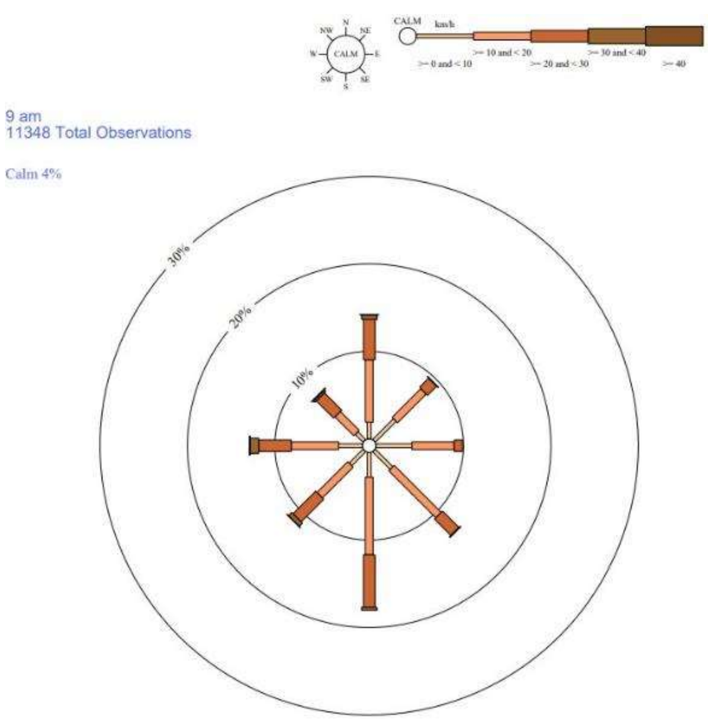
Source: http://www.bom.gov.au/clim_data/cdio/tables/pdf/windrose/IDCJCM0021.024511.9am.pdf

Figure 8 Wind rose – Eudunda 3pm annual average



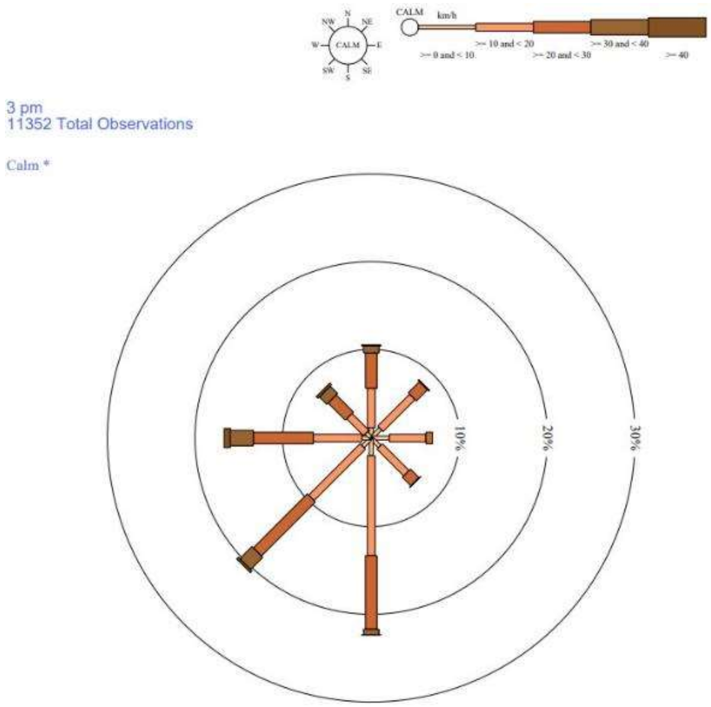
Source: http://www.bom.gov.au/clim_data/cdio/tables/pdf/windrose/IDCJCM0021.024511.3pm.pdf

Figure 9 Wind rose – Renmark Aero 9am annual average



Source: http://www.bom.gov.au/clim_data/cdio/tables/pdf/windrose/IDCJCM0021.024048.9am.pdf

Figure 10 Wind rose – Renmark Aero 3pm annual average



Source: http://www.bom.gov.au/clim_data/cdio/tables/pdf/windrose/IDCJCM0021.024048.3pm.pdf

4.4 Air Quality

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

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

Due to the rural nature of the Project area, there are no proximate air quality monitoring stations (AQMS) from which data can be collected to quantify the background air quality. The closest AQMS in SA to Robertstown (representing the western-most extent of the Project area) is located at Elizabeth Downs, Northern Adelaide, located approximately 90 km to the south south-west. NSW Department of Planning, Industry & Environment (NSW DPIE) operate a monitoring station at Lake Victoria as part of the NSW Community DustWatch network. This location is approximately 5 km east of the SA/NSW border, and may be generally representative of the eastern extent of the Project area. The AQMS records 1-hour average TSP concentrations for the purpose of monitoring dust storm events although data is not available at the current time in a format suitable for use within this assessment.

As described in **Section 2.2** the primary land uses along the transmission line corridor are agriculture and livestock. It can be assumed that the primary contribution from these land uses to local air quality are:

- Particulates (as dust) from cultivating and harvesting activities;
- Dust from livestock movement;
- Pesticides and fertilizers from aerial crop spraying; and
- Vehicle emissions from agricultural machinery.

Along the transmission line there are also some proximate built-up areas toward the town of Renmark. It would be expected that the marginally higher frequency of vehicle movements and commercial activities within those built-up areas would contribute to background air quality conditions.

Due to the distance the Project covers, the air quality conditions will vary as it moves through various land uses and closer to more urbanised areas. However, as the transmission line is still a considerable distance from these urban areas the local background air quality levels are expected to be low, except during episodic events such as dust storms or bush fires.

The methodology adopted here does not incorporate background air quality conditions and focuses on the management of emissions from construction activities. The existing air quality at locations along the transmission route are likely to be dominated by natural sources and the addition of managed construction dust emissions should not result in significant elevations above background. This is discussed further in **Section 6**.

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5. METHODOLOGY

5.1 Air Quality Impact Assessment

5.1.1 Construction Phase Impact Assessment

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

Subsequently for this assessment, Northstar has used the *ElectraNet: Project EnergyConnect Impact Assessment Methodology* provided by JBS&G as reported in **Section 5.1.2** to determine the consequence and certainty of air quality impacts upon surrounding sensitive receptors.

5.1.2 Impact Assessment

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

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

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

- impact consequence; and
- impact certainty

to assess the impact.

These terms are defined and discussed in the following subsections.

5.1.3 Impact Consequence

Impact consequence is a descriptor for the predicted scale of change to the air quality environment that may be attributed to the construction of the Project, and is evaluated on a scale from 'catastrophic' to 'negligible' (see **Table 6**).

The consequence scale adopted for this assessment has been derived from the JBS&G categorisation of impact consequence and with reference to the UK IAQM construction dust guidance (Institute of Air Quality Management, 2016), which identifies threshold screening distances from construction sites. Consequently, the levels of consequence have been evaluated by the distance from the Project alignment, whereby a receptor outside of the threshold screening distance (Study Area) of 350 m is considered to have a negligible risk of impact from construction activities. Although the locations of access roads are not currently known, a threshold distance of 350 m would also be applicable. These definitions are considered to be reasonable given the typically larger particle size associated with construction-phase activities, and the rate at which those larger particles are transported and deposited from activities being performed at construction sites.

In terms of the assessed consequence from emissions from construction-phase activities, it is reasonable to assume that no effects from fugitive emissions would result in a 'catastrophic' consequence at off-site locations. It is feasible that uncontrolled emissions from certain activities (for example rock breaking) may potentially have a catastrophic consequence resulting in '*debilitating chronic health impacts*' at on-site locations, however these on-site occupational risks would be addressed through appropriate work practices and use of appropriate personal protective equipment (PPE) by workers.

Subsequently, the consequence category of 'catastrophic' is considered to be only applicable to on-site construction workers and would represent an occupational exposure risk, and not appropriate at off-site locations. The highest appropriate level of consequence within this report is considered to be 'major', which is a potential risk of short-term and uncontrolled construction dust plumes from activities at nearby locations. Again, the potential risk of this can be effectively managed through employment of good construction practices. It is expected that a range of control measures will be employed at the Project as required.

The criteria and definitions used to categorise potential impact consequence in this assessment are defined in **Table 6**.

Table 6 Methodology - impact consequence and acceptability of impacts

Category	Distance from Project area	Impact consequence	Acceptability of impact
Catastrophic	Not applicable On-site occupational exposure impacts only	Public exposed to a major exceedance of air quality standards that results in severely debilitating chronic health impacts or life-threatening hazards.	Impacts are unacceptable. Review project design and control measures to ensure impacts are no higher than 'moderate'. Further review to ensure impacts are as low as reasonably practicable.
Major	<50 m with no implementation of dust controls	Widespread major short-term exceedance of air quality standards resulting in hospitalisation of members of the public.	Impacts are unacceptable. Review Project design and control measures to ensure impacts are no higher than 'moderate'. Further review to ensure impacts are as low as reasonably practicable.
Moderate	<50 m	Local minor ongoing exceedance of air quality standards. Widespread minor short-term exceedance of air quality standard. Ongoing impacts on wellbeing and air quality complaints.	Review to determine if impacts are as low as reasonably practicable and, if not, modify control measures or consider Project design changes to lessen impacts.
Minor	50-350 m	Isolated and localised exceedance of air quality standards. Short-term impacts of wellbeing. Complaints received about air quality that are resolved within days.	Review to determine if impacts are as low as reasonably practicable and, if not, modify control measures or consider Project design changes to lessen impacts.
Negligible	>350 m	Air quality standards met at all times	Impacts are considered to be as low as reasonably practicable and no further control measures are required.

5.1.4 Impact Certainty

In this assessment 'certainty' is evaluated on a scale from 'high' to 'low'. The scale is derived from the quality of site-specific data, reliability of any modelling that is undertaken and the effectiveness of design and management measures. The certainty for each potential impact that the assessment identifies will be specified a value derived from **Table 7**. It is noted that certainty related to 'modelling' outlined in **Table 7** is not relevant to this study.

Table 7 Methodology – rating level of certainty

Level of certainty	Quality of data	Extent to which modelling has been validated	Effectiveness of design measures	Effectiveness of management measures
High	Comprehensive data. Further studies are unlikely to generate additional information that would change the conclusions reached in the impact assessment.	Excellent baseline data available. Model has been run and provides accurate predictions over different seasons. Model has been extensively used and is regarded by discipline experts as leading practice and/or the impact assessment does not rely to any significant extent on the use of a model.	Widely used and demonstrated to be effective at a range of infrastructure sites including sites with similar topographical/climatic conditions. Requires minimal checking and failure risk has been shown to be low.	Management measures are considered routine and used effectively throughout industry. Reduction in the level of impact from an unmitigated level does not rely primarily on the management measures.
Medium	Some site-specific information available to provide ground-truthing of regional desktop information. Further studies could change some of the conclusions reached in the impact assessment.	Some baseline data available. Model shows a reasonable approximation of real conditions but relies on a number of assumptions and sufficient data not available to demonstrate the model accurately portrays seasonal conditions.	Has been used at sites with similar conditions but requires regular checking or maintenance to ensure performance. Has only been used at limited sites. OR Effectiveness has not been established in the long term or at sites similar to the Project area.	Management measures have been effectively used at a limited number of sites and have not been demonstrated at similar sites or in the long term and/or reduction in the level of impact from an unmitigated level relies primarily on the management measures.
Low	Minimal site-specific data available. Reliance on regional desktop studies that may not accurately reflect site conditions. Low level of confidence in the impact assessment.	Minimal baseline data. Model is unable to be validated with current data.	Measures are novel and have not been demonstrated in the field.	Management measures are novel and/or heavily reliant on specialised technical expertise.

Source: JBS&G, 2020

5.2 Greenhouse Gas Assessment Methodology

The purpose of the GHG assessment is to examine the potential impacts of the construction of the Project relating to emissions of GHG. A quantitative assessment of emissions is performed with direct emissions compared with total national and SA GHG emissions for context.

The scope of the GHG assessment is to provide a quantification of GHG emissions arising from the construction of the Project. This assessment does not provide a definitive quantification of GHG emissions arising from the Project but provides the general context of the likely quantum of emissions.

Opportunities for reduction of GHG emissions are discussed.

Note that emissions of GHG are anticipated to be minimal during operations and have not been considered further within this assessment.

5.2.1 Emission Types

The Australian Government Department of the Environment (DoE) document, "National Greenhouse Accounts Factors" Workbook (NGA Factors) (DISER, 2020) defines two types of GHG emissions (see **Table 8**), namely 'direct' and 'indirect'. This assessment considers both direct emissions and indirect emissions resulting from the construction of the Project.

Table 8 Greenhouse gas emission types

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

Note: Adapted from NGA Factors Workbook (DISER, 2020)

5.2.2 Emission Scopes

The NGA Factors (DISER, 2020) identifies two 'scopes' of emissions for GHG accounting and reporting purposes as shown in **Table 9**.

Table 9 Greenhouse gas emission scopes

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

Note: Adapted from NGA Factors Workbook (DISER, 2020)

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

> *"Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services."*

Given the remote and temporary nature of individual worksites which would continue to be relocated, electricity is unlikely to be available (apart from via diesel generation). Electricity consumption has been assumed to be negligible and therefore Scope 2 emissions have not been considered further within this assessment.

As required by the DIT Sustainability Manual (DIT, 2020), Scope 3 emissions related to the embodied emissions of purchased materials (concrete and steel), extraction, production, and transport of purchased fuels, transportation of purchased materials are considered in this assessment. Emissions of GHG resulting from the use of fuels in employee transport have also been considered.

5.2.3 Source Identification and Boundary Definition

The geographical boundary set for the GHG assessment covers the Project area. Transport of materials to and from the transmission line is considered within the boundary of the Project area.

For the purposes of this assessment, it has been assumed that construction employees will be residing in camps along the transmission line route. Therefore, emissions resulting from the transport of construction employees along the alignment has been considered to be negligible and not considered further.

All Scope 1 and Scope 3 emissions within the defined boundary have been identified and reported as far as possible (as noted above, electricity [a Scope 2 emission] is likely to represent a negligible contribution to total energy consumed as part of the Project).

5.2.4 Emission Source Identification

The GHG emission sources associated with the construction of the Project have been identified through review of the activities as described in **Section 2.3**.

The activities/operations being performed as part of the construction of the Project, which have the potential to result in emissions of GHG are presented in **Table 10**.

Table 10 Greenhouse gas emission sources

Project Component	Scope	Emission Source Description
Consumption of diesel fuel in equipment at the Project	1,3	Emissions from combustion of fuel
Land clearing	1	Loss of stored carbon into the atmosphere
Consumption of diesel fuel / unleaded fuel / aviation fuel for material transport purposes	3	Emissions associated with the extraction and processing of fuels
Use of purchased materials (concrete and steel)	3	Embodied emissions

5.2.5 Emissions Estimation

Emissions of GHG from each of the sources identified in **Table 10** have been calculated using activity data for each source per annum (e.g. ha, kL diesel fuel) and the relevant emission factor for each source.

The assumptions used in the calculation of activity data for each emissions source are presented below. Emission factors are presented in the following section.

Information relating to the quantities of diesel and unleaded fuel used as part of the Project have been estimated from details supplied by the Applicant. In the calculation of certain values, assumptions have been made based on the levels of activity at the Project. The equipment activity rates adopted for the assessment have been sourced from the Transport Authorities Greenhouse Group (Transport Authorities Greenhouse Group, 2013). These activity rates have been converted to an hourly activity rate as presented in **Table 11**.

For the purposes of this assessment, the helicopter usage for both tower delivery and stringing have been assumed to operate for four (4) hours a day, five (5) days a week. Fuel consumption rates have been assumed to be 800 $L \cdot hour^{-1}$ of aviation fuel for each helicopter (Shahid, 2005).

The data and assumptions adopted in the calculation of activity rates associated with the Project are outlined in **Table 12**.

Table 11 Activity rates for equipment

Equipment type	Activity rate per equipment unit	
	kL·month^{-1} (A)	kL·hour^{-1} (B)
Concrete truck	11.9	0.040
Crane	7.9	0.026
Dozer	5.7	0.019
Grader	5.1	0.017
Excavator	5.1	0.017
Semi-trailer	7.9	0.026
Helicopter	64(C)	0.8

Notes: (A) Sourced from (Transport Authorities Greenhouse Group, 2013) and based on 300 hours per month
(B) Assuming 4 weeks per month, 5.5 working days per week and 8 hours per full working day.
(C) Assuming 4 weeks per month, 5 working days per week and 4 hours per working day

Estimates of embodied emissions (Scope 3) have been made using the Infrastructure Sustainability Council of Australia (ISCA) Material Calculator, as required by (DIT, 2020). The most recent version available at the time of writing (version 1.2) was used.

Table 12 Calculated activity data

Emission Scope	Project component	Equipment	Assumptions					
			Fuel type	Units·day^{-1} (a)	hrs·year^{-1}·unit^{-1} (a)	L·hour^{-1}·unit^{-1} (as per Table 11)	Total activity (kL·annum^{-1})	Cumulative activity rate
Scope 1 & 3	Consumption of diesel fuel in mobile plant and equipment at the Project	Concrete truck	Diesel	8	264	40	83.8	279.1 kL·annum^{-1}
		Crane	Diesel	2	1 584	26	83.4	
		Dozer	Diesel	2	1 056	19	40.1	
		Grader	Diesel	2	1 056	17	35.9	
		Excavator	Diesel	2	1 056	17	35.9	
Scope 3	Consumption of diesel and aviation fuel for material transport purposes	Semi-trailer	Diesel	2	528	26	27.8	1 563.8 kL·annum^{-1}
		Helicopter	Aviation	2	960	800	1536.8	
Emission Scope	**Project component**	**Vegetation type (b)(c)**		**Vegetation clearance area (c)**	**Clearance·annum^{-1}**		**Units**	**Usage**
Scope 1	Land Clearing	Eucalyptus woodland vegetation		204	102		ha	102 ha·annum^{-1}

Emission Scope	Project component	Equipment	Fuel type	Units·day^{-1} (a)	m·day^{-1}·unit^{-1}(d)	kL·km^{-1} factor(b)	kL·day^{-1}·unit^{-1}	Total activity (kL·annum^{-1})	Units	Cumulative activity rate
Scope 3	Consumption of diesel fuel / unleaded fuel for employee transport purposes	4×4 vehicles and light trucks	Unleaded	15	700	0.136×10^{-3}	0.952×10^{-4}	0.027	kL·annum^{-1}	0.027 kL·annum^{-1}
			Diesel	15	700	0.122×10^{-3}	0.854×10^{-4}	0.024	kL·annum^{-1}	0.024 kL·annum^{-1}

Emission Scope	Project component	Material type	Material quantity(e)	Units
Scope 3 (embodied emissions)	Transmission line construction	Steel	11 681.9	t
		Concrete	31 540	m^3
	Substation construction	Steel	900	t
		Concrete	4 000	m^3

Note: (a) – Calculated from "Project Detail Specialists" by JBS&G over a 2 year construction period
(b) - Source (Transport Authorities Greenhouse Group, 2013)
(c) – Assumed for the Project for a 10 m wide clearance area along the transmission line
(d) – Assumed daily transportation along the transmission line of 700 m per day per unit
(e) – Information provided by ElectraNet

5.2.6 Emission Factors

Land Clearing

Vegetation such as trees metabolise carbon dioxide and store the carbon containing carbohydrates for use as food and for growth. When vegetation is cleared this stored carbon is generally lost to the atmosphere in the form of CO_2 and small amounts of carbon monoxide (CO) and methane (CH_4).

Emissions of GHG associated with vegetation clearance have been calculated using the methodology prescribed in the Transport Authorities Greenhouse Group *Greenhouse Gas Assessment Workbook for Road Projects* (Transport Authorities Greenhouse Group, 2013). This takes into account the maximum potential biomass for the area in which the Project is located and takes into account the vegetation type for the Project area.

The Project is located in an area of predominantly Eucalypt woodland (Class D) as described by the Department for Environment and Water, South Australia. The local maximum biomass is considered Class 1 (0-50 tonnes dry matter·ha^{-1}).

The Transport Authorities Greenhouse Group (Transport Authorities Greenhouse Group, 2013) state that for vegetation that is either reused or left to decompose naturally on site, the GHGs are emitted very slowly and can be considered to be negligible. However, if the vegetation is disposed of at a landfill or combusted the rate of emission release is much higher and is to be assessed.

Given that the temporary areas of disturbance are being rehabilitated, it is assumed that that they do not form part of this assessment. It is also assumed that all remaining vegetation that is cleared will be left to decompose naturally at the site of clearance. Therefore, all vegetative clearance emissions are considered negligible and are not considered further in this assessment.

Combustion of Fuel in Vehicles

Emissions factors used for the assessment of GHG emissions associated with the construction of the Project have been sourced from the NGA Factors (DISER, 2020) (refer to **Table 13**).

Table 13 Greenhouse Gas Emission Factors – Combustion of Fuel

Emission Scope	Emission Source	Emission Factor	Energy Content Factor
Scope 1	Diesel fuel for mobile plant and equipment	70.4 kg CO_2-e·GJ^{-1}	38.6 GJ·kL^{-1}
Scope 3	Diesel fuel for mobile plant and equipment	3.6 kg CO_2-e·GJ^{-1}	38.6 GJ·kL^{-1}
	Unleaded fuel for employee transport	3.6 kg CO_2-e·GJ^{-1}	34.2 GJ·kL^{-1}
	Diesel fuel for material transport	3.6 kg CO_2-e·GJ^{-1}	38.6 GJ·kL^{-1}
	Aviation fuel (Avgas) for helicopter	3.6 kg CO_2-e·GJ^{-1}	33.1 GJ·kL^{-1}

Source: Table 3 and Table 4 of (DISER, 2020)

Embodied Emissions in Materials

Emissions factors used for the assessment of Scope 3 GHG emissions associated with the use of materials in the construction of the Project have been sourced from the ISCA Material Calculator (v1.2) as discussed in **Section 5.2.5** (refer to **Table 14**).

Table 14 Greenhouse Gas Emission Factors – Embodied Emissions

Emission Scope	Material Type	Embodied Emissions
Scope 3	Steel plate	2.32 t CO_2-e·t^{-1}
	Pre-mixed concrete (40 MPa)	0.5 t CO_2-e·m^{-3}

Source: ISCA Materials Calculator V1.2

6. AIR QUALITY IMPACT ASSESSMENT

The following represents the impact assessment that is used to identify the consequences and certainties associated with construction without any supplementary mitigation and identify the type and nature of controls that are required to be applied to avoid unreasonable emissions of particulates.

6.1 Construction Phase Impact Assessment

6.1.1 Identification of Receptors

Based on information provided by JBS&G, a total of two (2) verified noise sensitive receptors have been identified within the study area. In line with the ElectraNet: Project EnergyConnect Impact Assessment Methodology, all of the identified properties are considered as air quality sensitive as a precautionary measure. The receptors are located at the eastern end at Cooltong. The nearest potential air quality sensitive receptor is located approximately 298 m from the transmission line alignment. It is noted that the majority of the identified potential receptors are greater than 1 km from the transmission line, outside of the air quality study area.

Table 15 Identification of receptors

Receptor ID	Address	Receptor type	Generalised land use	Distance to Project (m)
R1	615 Cooltong Av, Cooltong, SA	Residential	Rural residential	330
R2	606 Cooltong Av, Cooltong, SA	Residential	Rural residential	487
R3	555 Cooltong Av, Cooltong, SA	Residential	Horticulture	298
R4	31 Boase Rd, Cooltong, SA	Residential	Horticulture	393

6.1.2 Pre-Mitigated Impact Consequence

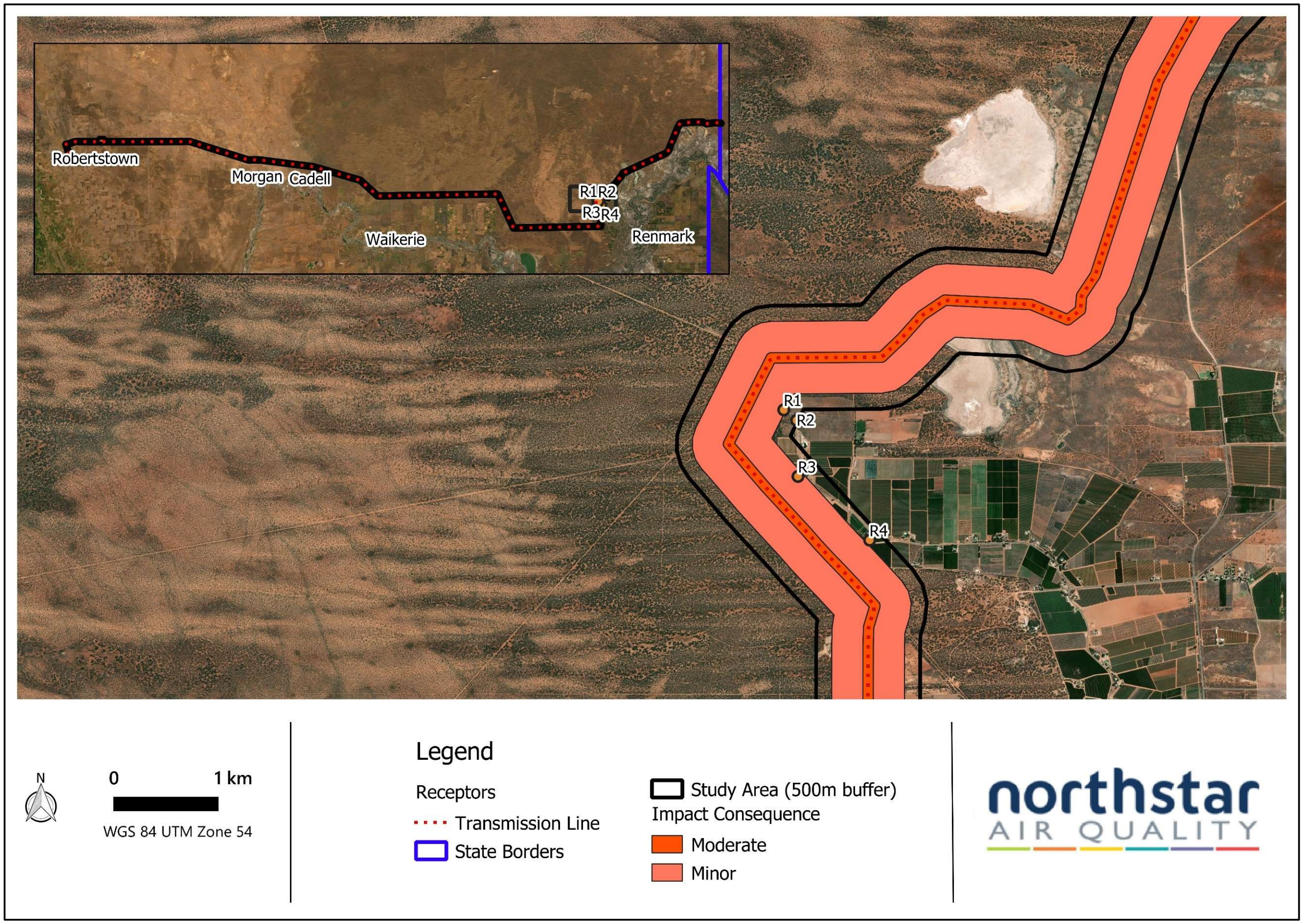
The impact consequence relates to the definitions presented **Section 5.1.3** and **Table 6**. The key considerations in the assessment of potential impact consequence are:

- Assessing the potential dust emissions from activities which may give rise to off-site impacts;
- Assessing the scale, frequency and duration of those process emissions.

Based upon the processes, and our experience in assessing and managing air quality from construction activities, the following is considered to represent the potential for dust to be generated from the process. Given the proximity of current land uses, the assessment has been performed on the assumption that air quality must be controlled to not give rise to unacceptable dust at those sensitive receptor locations. **Figure 11** illustrates the impact consequence upon the receptors (note, no shading – negligible impact consequence (>350 m)). For clarity, minor dust impacts may be experienced at up to 350 m from the Project, with moderate impacts likely to be experienced up to 50 m from the Project. These distances can also be applied to access roads, once the location is known.

It is noted that the method does not allow the quantification of impacts and therefore the achievement or exceedance of a criterion value cannot be stated. The method does however present a risk of exceedance, or elevated concentration due the activities performed and allows targeted implementation of measures to reduce that impact/risk.

Figure 11 Receptor 1, 2, 3, 4 impact consequence



Note: No colour shading = negligible impact consequence (<500m)

Based upon the above, the pre-mitigated consequence may be determined as presented in **Table 16**.

Table 16 Risk (unmitigated)

Location	Impact Consequence	
	Distance from activity (m)	Assessment
R1	330	Minor
R2	487	Negligible
R3	298	Minor
R4	393	Negligible

Based upon the above, dust consequences associated with emissions from construction activities at the Project are determined to be ***minor*** at receptors 1 and 3, and ***negligible*** at receptors 2 and 4.

As such, the consequence of dust impacts in the neighbouring environment is considered to be manageable through the implementation of good practice, rather than requiring additional air pollution control technology.

Potential minor impacts within Cooltong would be temporary and transient, and the identified mitigation measures (refer **Section 6.1.3**) would be focussed on this community.

6.1.3 Dust Control and Management

It is recommended that for the construction activities, mitigation measures established in the IAQM be adopted to control and manage the offsite impacts of dust. Mitigation measures that should be given consideration are described in **Table 17**. An increased number of mitigation measures should be employed when construction activities are located close to receptors (including those close to access roads).

Once again, it is noted that the method does not allow the quantification of impacts and therefore the likelihood of achievement or exceedance of a criterion value cannot be stated.

Table 17 Site-Specific Management Measures

Identified Mitigation	
1	Communications
1.1	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
1.2	Develop and implement a Air Quality Management Plan, which may include measures to control other emissions, approved by the relevant regulatory bodies.
2	Site Management
2.1	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
2.2	Make the complaints log available to the local authority when asked.
2.3	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
3	Monitoring
3.1	Carry out regular site inspections to monitor compliance with the dust management plan / CEMP as required,.
4	Preparing and Maintaining the Site
4.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
4.2	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below
4.3	Stabilise disturbed areas as soon as practicable, including new access routes
4.4	Adjust the intensity of activities based on observed dust levels and weather forecasts
5	Operating Vehicle/Machinery
5.1	Ensure all vehicles and machinery comply with relevant vehicle emission standards and fitted with appropriate emission control equipment and maintained in a proper and efficient manner
6	Measures Specific to Concrete Batching Plants
6.1	Ensure sand and other aggregates are stored in storage bins or bunded bays and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place

Identified Mitigation	
6.2	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
6.3	Cement silos and hoppers will be fitted with dust filters
6.4	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust
6.5	All inspection points and hatches will be fully sealed
6.6	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
6.7	the cement silo will be fitted with fitted with emergency pressure alert and automatic cut off overfill protection
6.8	transfer of cement from storage to batching will occur via sealed steel augers
6.9	regularly inspect dust emissions and apply additional controls as required
7	**Specific Measures to Construction Traffic**
7.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable
7.2	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
7.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
7.4	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
7.5	Record all inspections of haul routes and any subsequent action in a site log book.
7.6	Application of water sprays or dust suppression surfactants on on-site and access roads if required
7.7	Vehicle movements to be strictly limited to designated entry/exit routes and parking areas, and measures to minimise the tracking of material onto paved roads

6.1.4 Residual Consequence

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

Given the size of the Project area, the distance to sensitive receptors and of the activities to be performed, residual risks associated with fugitive dust emissions from the Project post-mitigation are anticipated to be 'negligible'.

It is also considered that the amount of time that construction activities are performed within the 350 m distance to any receptor is expected to be minor (i.e. a number of days).

6.1.5 Impact Certainty

The level of certainty relates to the definitions presented **Section 5.1.4**, and is described on a scale from '*low*' to '*high*'. The key considerations in this assessment of potential impact certainty are:

- Effectiveness of Design Measures; and,
- Effectiveness of Management Measures

Based upon the processes to be performed, and our experience in assessing and managing air quality from construction activities, the summary presented in **Table 18** is considered to represent certainty of the potential impact as an outcome, post-mitigation.

Table 18 Impact Assessment Summary

Sensitivity of receptors	Impact magnitude		Level of certainty (mitigated)
Location	Distance from activity	Impact Consequence	
R1	330	Minor	Medium
R2	487	Negligible	
R3	298	Minor	
R4	393	Negligible	

The level of certainty has been applied given that the level of impact relies upon the implementation of the controls as provided, rather than their effective use at a limited number of sites. The control measures proposed are used regularly in construction projects.

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7. GREENHOUSE GAS ASSESSMENT

The following presents the results of the greenhouse gas assessment.

7.1 Calculation of GHG Emissions

Based on the activity data and emissions factors outlined in **Section 5.2**, **Table 19** presents the calculated Scope 1 and 3 GHG emissions associated with the Project. Note that no Scope 2 emissions have been calculated as no electricity is being purchased and consumed from an organisation on site.

Table 19 Greenhouse gas emissions

Emission Scope	Emission Source	Emission Factor	Energy Content Factor	Activity Rate	Emissions (t CO_2-e ·yr^{-1})
Scope 1	Diesel fuel for mobile plant and equipment	70.4 kg CO_2-e GJ^{-1}	38.6 GJ·kL^{-1}	279.1 kL·$annum^{-1}$	758.5
			Total Scope 1		**758.5**
Scope 3	Diesel fuel for mobile plant and equipment	3.6 kg CO_2-e GJ^{-1}	38.6 GJ·kL^{-1}	279.1 kL·$annum^{-1}$	38.8
	Diesel fuel for material transport	3.6 kg CO_2-e GJ^{-1}	38.6 GJ·kL^{-1}	27.8 kL·$annum^{-1}$	3.9
	Unleaded fuel for employee transport	3.6 kg CO_2-e GJ^{-1}	34.2 GJ·kL^{-1}	0.027 kL·$annum^{-1}$	0.003
	Diesel fuel for employee transport	3.6 kg CO_2-e GJ^{-1}	38.6 GJ·kL^{-1}	0.024 kL·$annum^{-1}$	0.003
	Aviation fuel (Avgas) for helicopter	3.6 kg CO_2-e GJ^{-1}	33.1 GJ·kL^{-1}	1 536 kL·$annum^{-1}$	183.0
	Steel used in construction (embodied emissions)	2.32 t CO_2-e·t^{-1}	-	12 581.9 t	29 190
	Concrete used in construction (embodied emissions)	0.5 t CO_2-e·m^{-3}	-	35 540 m^3	17 770
			Total Scope 3		**47 185.7**

7.2 Comparison with National Totals

A comparison of the calculated GHG emissions associated with the Project and SA and Australia total emissions in 2018 is presented in **Table 20**.

Table 20 Greenhouse gas emissions in context

Project total (t CO_2-e·yr^{-1}) Scope 1 (Direct)	Emissions (Mt CO_2-e·yr^{-1})	
	Australia (2018) (excluding LUCF) 516.8 Mt	SA (2018) 24.2 Mt
758.5	0.0001 %	0.0031 %

Note: LUCF = Land Use Change and Forestry

These data indicate that the construction of the Project at maximum capacity would contribute up to 0.0001 % of Australian total GHG emissions in 2018 and up to 0.0031 % of SA Total GHG emissions.

7.3 Opportunities for GHG Reduction

The above assessment indicates that direct (Scope 1) GHG emissions associated with the Project are anticipated to be small, although emissions could be further reduced through the application of a number of measures:

- All vehicles/plant and machinery should be turned off when not in use and regularly serviced to ensure efficient operation, including the optimisation of tyre pressures;
- Truck routes and loading capacity should be designed to reduce the distance and effort required by the vehicles;
- Maintenance of roads in good condition to avoid meandering of vehicles;
- Reducing gradients around the Project area where feasible; and
- Where possible, B5 fuel should be used in plant and equipment.

Calculation of Scope 3 (indirect) emissions indicates that embodied emissions associated with the use of steel and concrete may result in potentially significant emissions of GHG. These emissions may be reduced by:

- Using concrete with a lower embodied energy, through the use of for example recycled aggregates, fly ash cement or calcined clay as binders, or granulated blast furnace slag. All vehicles/plant and machinery should be turned off when not in use and regularly serviced to ensure efficient operation, including the optimisation of tyre pressures;

- Investigation into using a proportion 'Green Steel' for tower construction (where iron ore is reduced using synthesis gas, rather than coal).

8. CONCLUSION

8.1 Air Quality

The AQIA presents an assessment of the impacts of the proposed construction activities associated with the Project. The consequence of impacts associated with air quality have been assessed in addition to mitigation measures to manage these consequences. It is concluded that a range of mitigation measures should be applied, depending on the proximity of construction activities or access roads to sensitive receptor locations. Should these measures be appropriately implemented, the Project can be constructed with minimal impacts at those receptor locations.

8.2 Greenhouse Gas

A greenhouse gas (GHG) assessment has been performed to examine the potential impacts of the construction of the Project relating to emissions of GHG. A quantitative assessment of GHG emissions has been performed with GHG emissions compared with total national and SA GHG emissions for context.

Direct (Scope 1) GHG emissions associated with the Project are anticipated to represent 0.0001 % of Australian and <0.0031 % of SA GHG emissions totals for the year 2018.

Opportunities are considered for the reduction of GHG emissions associated with the Project.

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APPENDIX A

Report Units and Common Abbreviations

Units Used in the Report

All units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units. In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol. For example:

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

Common Abbreviations

Abbreviation	Term
ABS	Australian Bureau of Statistics
AHD	Australian height datum
AQIA	air quality impact assessment
AQMS	air quality monitoring station
AWS	automated weather station
BoM	Bureau of Meteorology
°C	degrees Celsius
CAA	Civil Aviation Act
CAR	Civil Aviation Regulations
CASR	Civil Aviation Safety Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCP	Development Control Plan
DPIE	NSW Department of Planning, Industry and Environment
EETM	emission estimation technique manual
EPA	Environmental Protection Authority
GDA	Geocentric Datum of Australia
GHG	Greenhouse gas
GHGA	Greenhouse gas assessment
GIS	geographical information system
ha	hectare
J	Joule

Abbreviation	Term
kV	kilovolt
L	litre
MGA	Map Grid of Australia
$mg \cdot m^{-3}$	milligram per cubic metre of air
$\mu g \cdot m^{-3}$	microgram per cubic metre of air
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
NGER	National Greenhouse and Energy Reporting scheme
NO	nitric oxide
NO_X	oxides of nitrogen
NO_2	nitrogen dioxide
O_3	ozone
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 µm or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 µm or less
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEE	Statement of Environmental Effects
STP	standard temperature and pressure (273.15 K, 101.3 kPa)
TAPM	The Air Pollution Model
TPM	total particulate matter
TSP	total suspended particulates
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VKT	vehicle kilometres travelled