TECHNICAL PAPER 15

Air Quality Assessment

ILLABO TO STOCKINBINGAL ENVIRONMENTAL IMPACT STATEMENT

Technical and Approvals Consultancy Services: Illabo to Stockinbingal

Technical Paper 15 – Air Quality Assessment

August 2022

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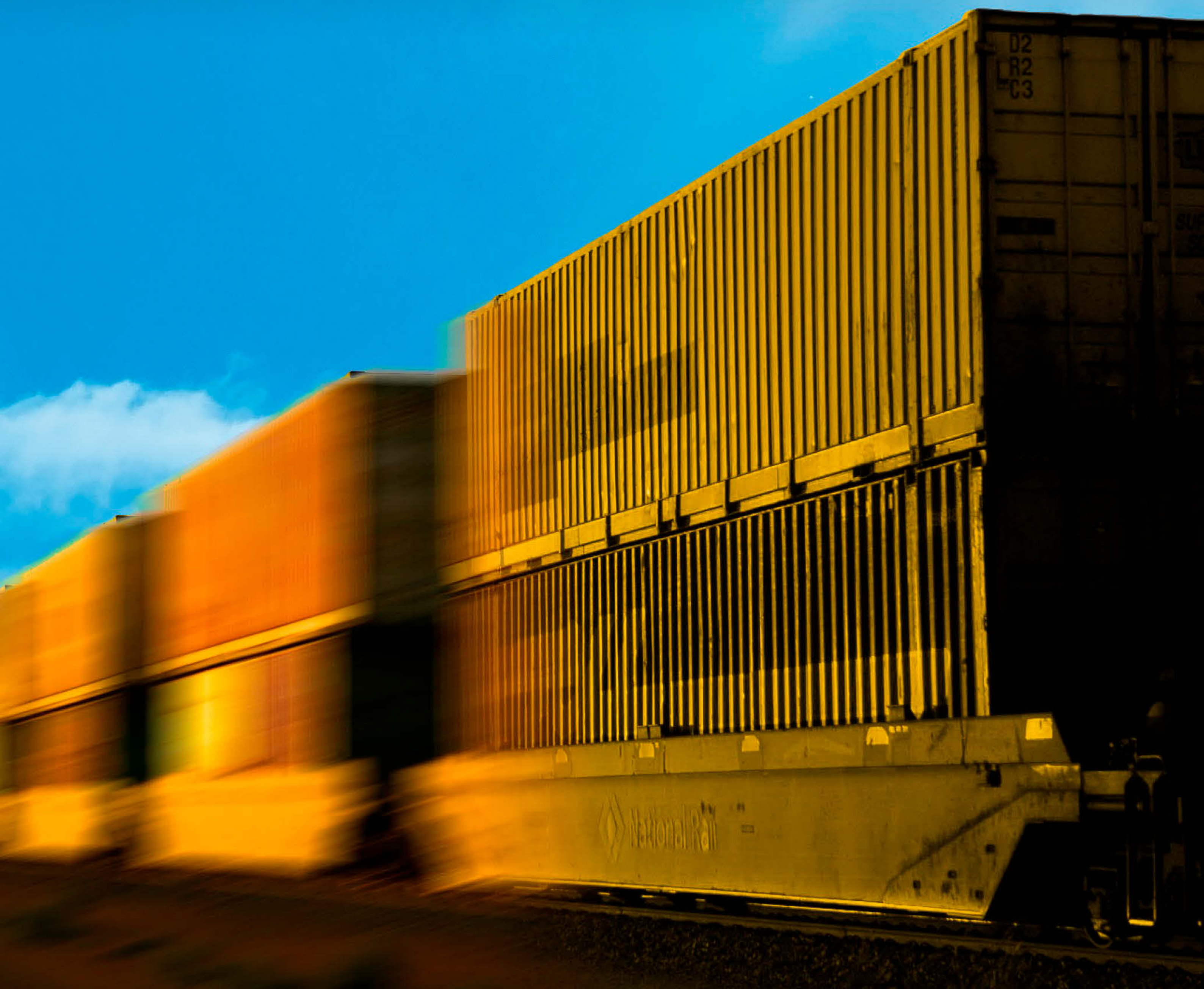

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Glossary and abbreviations

AAQMS	Ambient air quality monitoring station
ACT	Australian Capital Territory
AHD	Australian height datum
Air NEPM	*National Environment Protection (Ambient Air Quality) Measure*
Air Toxics NEPM	*National Environment Protection (Air Toxics) Measure*
AQIA	Air Quality Impact Assessment
AQMP	Air Quality Management Plan
ARTC	Australian Rail Track Corporation
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
BRD	Botany Rail Duplication Project
CoA	Conditions of Approval
CBD	Central business district
CEMP	Construction Environmental Management Plan
CO	Carbon monoxide
DPE	NSW Department of Planning and Environment, formerly Department of Planning, Industry and Environment
DPIE	NSW Department of Planning, Industry and Environment
Dust deposition	The removal of particles by dry deposition through gravity, impaction and diffusion or wet deposition in or below clouds.
EIS	Environmental Impact Statement
EMF	Environmental management framework
EMP	Environmental management plan
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
GLC	Ground level concentrations
HDVs	Heavy duty vehicles
IAC	Impact assessment criteria
I2S	Illabo to Stockinbingal
LGA	Local government area
N2N	Narromine to Narrabri Project
N2NS	Narrabri to North Star Project
NEPC	National Environment Protection Council

NEPM	National Environment Protection Measure
NO_x	Oxides of nitrogen
NO_2	Nitrogen dioxide
NPI	National Pollutant Inventory
NSFC	Northern Sydney Freight Corridor Strathfield Rail Underpass Project
NSW	New South Wales
PAHs	Polycyclic Aromatic Hydrocarbons
PM	Particulate matter
PM_{10}	Particulate Matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate Matter less than 2.5 microns in aerodynamic diameter
POEO Act	*Protection of the Environment Operations Act 1997*
Proposal site	The area that would be directly affected by construction and operation of the proposal. It includes the location of proposal infrastructure, the area that would be directly disturbed by the movement of construction plant and machinery, and the location of the storage areas/compounds sites etc., that would be used to construct that infrastructure. It is also referred to as the 'construction footprint'.
RH	Relative humidity
SEARs	Secretary's Environmental Assessment Requirements
SO_2	Sulphur dioxide
SVOCs	Semi-volatile organic compounds
TSP	Total suspended particulates are particles of less than 100 micrometres
VOCs	Volatile Organic Compounds
WSP	WSP Australia Proprietary Limited
Units	
°C	Degrees Celsius
km	Kilometre
km/hr	Kilometres per hour
m	Metre
mm	Millimetre
m^3	Cubic metres
mg/m^3	Milligrams per cubic metre
ng/m^3	Nanograms per cubic metre
pphm	Parts per hundred million
ppm	Parts per million
$\mu g/m^3$	Micrograms per cubic metre
ng/m^3	Nanograms per cubic metre
%	Per cent

Executive summary

Inland Rail Design Joint Venture (IRDJV) was engaged by the Australian Rail Track Corporation (ARTC) to undertake a qualitative construction and operational air quality assessment to support the Environment Impact Statement (EIS) for the Illabo to Stockinbingal (I2S) proposal.

The existing air quality along the proposal was characterised using the following publicly available information:

- Junee ambient air quality monitoring station (AAQMS) [Total Suspended Particulates (TSP)]
- Wagga Wagga North AAQMS (PM_{10} and $PM_{2.5}$]
- Florey AAQMS (nitrogen dioxide (NO_2) and carbon monoxide [CO])
- Bargo AAQMS (sulphur dioxide [SO_2]).

Given its rural location, air quality along the proposal is likely to be cleaner in general than the air quality measured at the above listed AAQMS.

The meteorology of the local area was considered using data collected at the Bureau of Meteorology (BoM) stations at Cootamundra Airport Automatic Weather Station (AWS) and Temora Airport AWS. The following parameters were analysed and reported: wind speed and direction, temperature, relative humidity, and precipitation.

108 sensitive receptors within 350 metres (m) of the construction footprint were identified, among which 19 are also located within 50m of haulage roads up to 500m from site access points. Five receptors are located within 100m of the proposal and are all located in the township of Stockinbingal.

Construction

Dust impacts associated with construction of the proposal was conducted in accordance with the risk-based approach detailed in the *Guidance on the assessment of dust from demolition and construction 2014* published by the Institute of Air Quality Management (IAQM guidance).

Gaseous and odour emissions from construction works and any dust related construction works '*screened out*' by the IAQM guidance criteria were assessed qualitatively.

The risk of dust impacts prior to mitigation measures are as follows (refer to section 5.2.1.1 for detail):

- Earthworks: high risk around site 5, low risk around sites 1 to 4 and sites 6 to 7
- Construction: high risk around site 5, negligible to low around sites 1 to 4 and 6 to 7
- Track out[1]: medium risk from routes 1 and 2 and high risk from route 3.

With further site-specific mitigation measures in place, the residual dust impacts are not expected to be of significance.

Dust impacts around all other parts of the construction footprint are not significant due to the absence of sensitive receptors within 350m of construction works and 50m from haulage routes up to 500m from the site access.

Gaseous and odour emissions generated during the construction phase would be minimised with mitigation measures in place and air quality impacts would not be significant.

Road diversions will occur during construction of level crossings and overbridges at four locations along the proposal. Except for Hibernia Street, the proposed diversion routes for all other roads are through rural areas with few sensitive receptors likely to be affected by increased traffic. The increase in air emissions from construction traffic on these diversion routes is not expected to be of significance.

1 Track out is dirt, mud or other materials tracked onto a paved public roadway by a vehicle leaving a construction site.

The Burley Griffin Way overbridge construction will take approximately 11 months to complete and 1 minute of additional travel time during this period, Sensitive receptors on Troy Street may potentially be impacted by an increase in vehicular traffic (including construction) during the diversion. While an increase in vehicular emissions is expected to occur on Troy Street, potential impacts will be minor, of short duration and temporary.

Additionally, potential changes in air quality due to road modifications, including Burley Griffin Way and Ironbong Road, are not considered to be of significance.

There is the potential for dust to be deposited onto the foliage of vegetation in proximity to the proposal site activities. However, deposition on dust foliage is likely to be highly localised, intermittent, and temporary and not considered to impact significantly on the proposal. Consequently, ecological receptors were not considered in the dust risk assessment.

Operation

During operations, particulate matter (of varying size fractions) and combustion emissions (e.g. NO_2, CO, SO_2, volatile organic compounds [VOCs] and semi-volatile organic compounds [SVOCs]) would be generated.

Considering the low frequency of projected train movements, remoteness of the proposal location and the low number of sensitive receptors in the vicinity of the proposal, air dispersion modelling for operational emissions was not conducted. Consequently, air quality impacts of potential emissions from the operational phase were assessed qualitatively by comparing the project to similar rail projects in New South Wales (NSW). The projects comprised:

- Northern Sydney Freight Corridor Strathfield (NSFC) Rail Underpass Project
- Botany Rail Duplication (BRD) Project
- Narrabri to North Star (N2NS) Project
- Narromine to Narrabri (N2N) Project
- North Star to NSW/Queensland Border (NS2B) Project.

The proposal would be trafficked by an average of 6 trains per day (both directions) from commencement of operations in late 2026, increasing to about 11 trains per day (both directions) in 2040.

The potential impacts associated with the operation of the proposal are expected to be lower than that from the reference projects. Air dispersion modelling conducted for both the NSFC Project and the BRD Project demonstrated compliance with the relevant IAC for all assessed pollutants.

The reference projects discussed in section 6.1.3 demonstrate that air emissions in idle mode are much lower than that in the operating mode. The dispersion modelling conducted for the NS2B Project demonstrated compliance with the assessment criteria while taking into consideration of idling emissions.

Most of the proposal traverses a rural area with only five sensitive receptors located within 100m of the proposal and all are located in Stockinbingal. There are no receptors located within 100m of other parts of the proposal. The potential air quality impacts on sensitive receptors in Stockinbingal are expected to be low, and the impacts at other parts of the proposal are anticipated to be not of significance.

Air quality impacts during operations can be managed at source through diesel fuel standards, locomotive maintenance, and emissions testing. Other management measures include minimising train idling near sensitive receptors.

In summary, air quality impacts during construction are not expected to be of significance with management measures in place.

Air quality impacts during operation are expected to be low at the nearest sensitive receptors due to the projected frequency of trains using the proposal for the opening year 2026 and future year 2040.

1 Introduction

1.1 Overview

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor between Melbourne and Brisbane. Inland Rail involves the design and construction of a new inland rail connection, about 1,700 kilometre (km) long, between Melbourne and Brisbane. Inland Rail is a major national proposal that will enhance Australia's existing national rail network and serve the interstate freight market.

Australian Rail Track Corporation Ltd (ARTC) is seeking approval to construct and operate the Illabo to Stockinbingal section of Inland Rail ('the proposal'), which has a total extent of about 42.5km, and consists of about 39km of new, greenfield single track standard gauge railway and associated infrastructure between Illabo and Stockinbingal.

The proposal requires approval from the NSW Minister for Planning under Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal is also a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and requires approval from the Australian Government Minister for the Environment.

This report has been prepared by (Inland Rail Design Joint Venture (WSP/Mott Macdonald) as part of the environmental impact statement (EIS) for the proposal. The EIS has been prepared to accompany the application for approval of the proposal and addresses the Secretary's Environmental Assessment Requirements (SEARs) from the Secretary of the Department of (then) NSW Planning, Industry and Environment (now the Department of Planning and Environment (DPE)), issued on 30 April 2021.

1.2 The proposal

The proposal is located between Illabo and Stockinbingal within the Riverina region of NSW. The location of the proposal is shown in Figure 1.1.

1.2.1 Key features

The key features of the proposal (which would be confirmed during detailed design) are shown in Figure 1.2 and includes:

- a total extent of about 42.5km, including about 39km of new, greenfield single track standard gauge railway between Illabo and Stockinbingal, including:
  - a combination of track vertical alignments on existing ground level, on embankments and in cuttings
  - 8 new bridges at watercourses, two road overbridges and one grade separated (road over rail) at Burley Griffin Way
  - one crossing loop and associated maintenance siding
  - construction of new level crossings and alterations of existing level crossings (at public roads and private accesses)
  - stock underpasses and other vehicular crossings on private land to allow for the movement of livestock and vehicles across the rail line
  - installation and upgrade of about 88 new and existing cross drainage culverts below the rail formation and 27 longitudinal drainage culverts below level crossings
  - removal of redundant sections of track along the existing Stockinbingal to Parkes line and Lake Cargelligo line at Stockinbingal
- upgrades of about three kilometres of existing track for the tie-in works to the existing Main South rail line at Illabo, and tie ins to the Stockinbingal to Parkes rail line at Stockinbingal

- construction of about 1.7km of new track to maintain the existing connection of the Lake Cargelligo rail line either side of the proposal
- realignment of a 1.4km section of the Burley Griffin Way to provide a road over rail bridge at Stockinbingal
- realignment of Ironbong Road to allow for safe sight lines at the new active level crossing.

Associated infrastructure would include signalling and communications, signage, fencing and services and utilities. The construction of the proposal would also require the following works:

- construction access roads and access tracks
- watercourse crossings
- temporary changes to the road network
- construction compounds.

1.2.2 Timing and operation

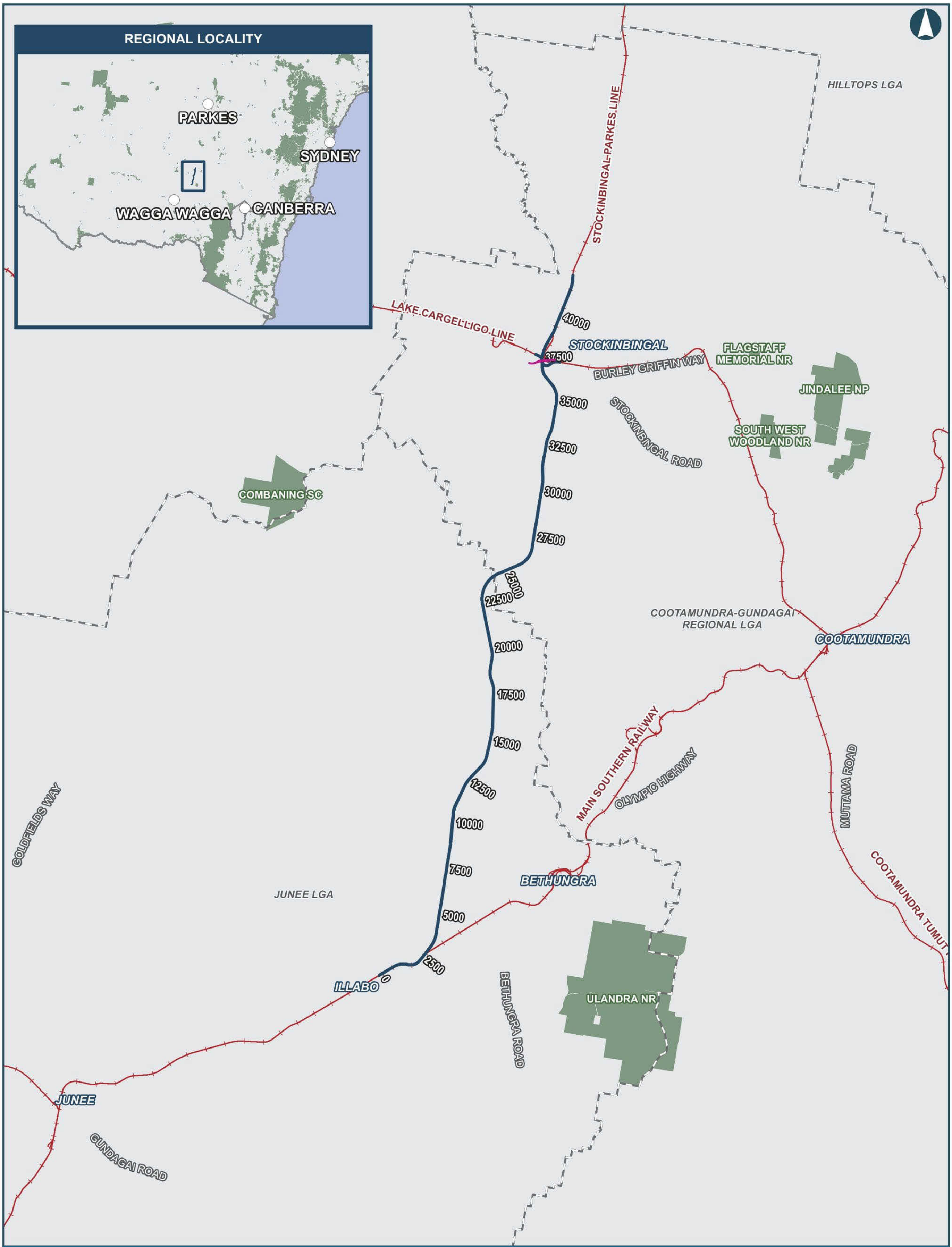
Subject to approval of the proposal, construction of the proposal is planned to start in mid-2024 and is expected to be completed mid-2026.

The proposal would form part of the rail network managed and maintained by ARTC. Train services would be provided by a variety of operators. It is estimated the Illabo to Stockinbingal section of Inland Rail would be trafficked by an average of 6 trains per day (both directions) from commencement of operations in late 2026, increasing to about 11 trains per day (both directions) in 2040.

The new rail line will be a faster, more efficient route that bypasses the Sydney rail network and will enable the use of double stacked trains (up to 6.5 metres high) along its entire length.

The trains would be diesel powered, and would be a mix of grain, intermodal (freight), and other general transport trains up to 1,800 metres in length.

The proposal is expected to be operational, as part of Inland Rail as a whole, once all 13 sections are complete, which is estimated to be in 2027. Prior to that, regional rail movements may occur on the Illabo to Stockinbingal section once complete.



ILLABO TO STOCKINBINGAL 1.1 Location of the proposal

0 2 4 6 km

Coordinate System: GDA 1994 MGA Zone 55

Date: 7/23/2021 Paper: A3
Author: IRDJV Scale: 1:200,000
Data Sources: ARTC, NSWSS, ESRI

Key features of proposal

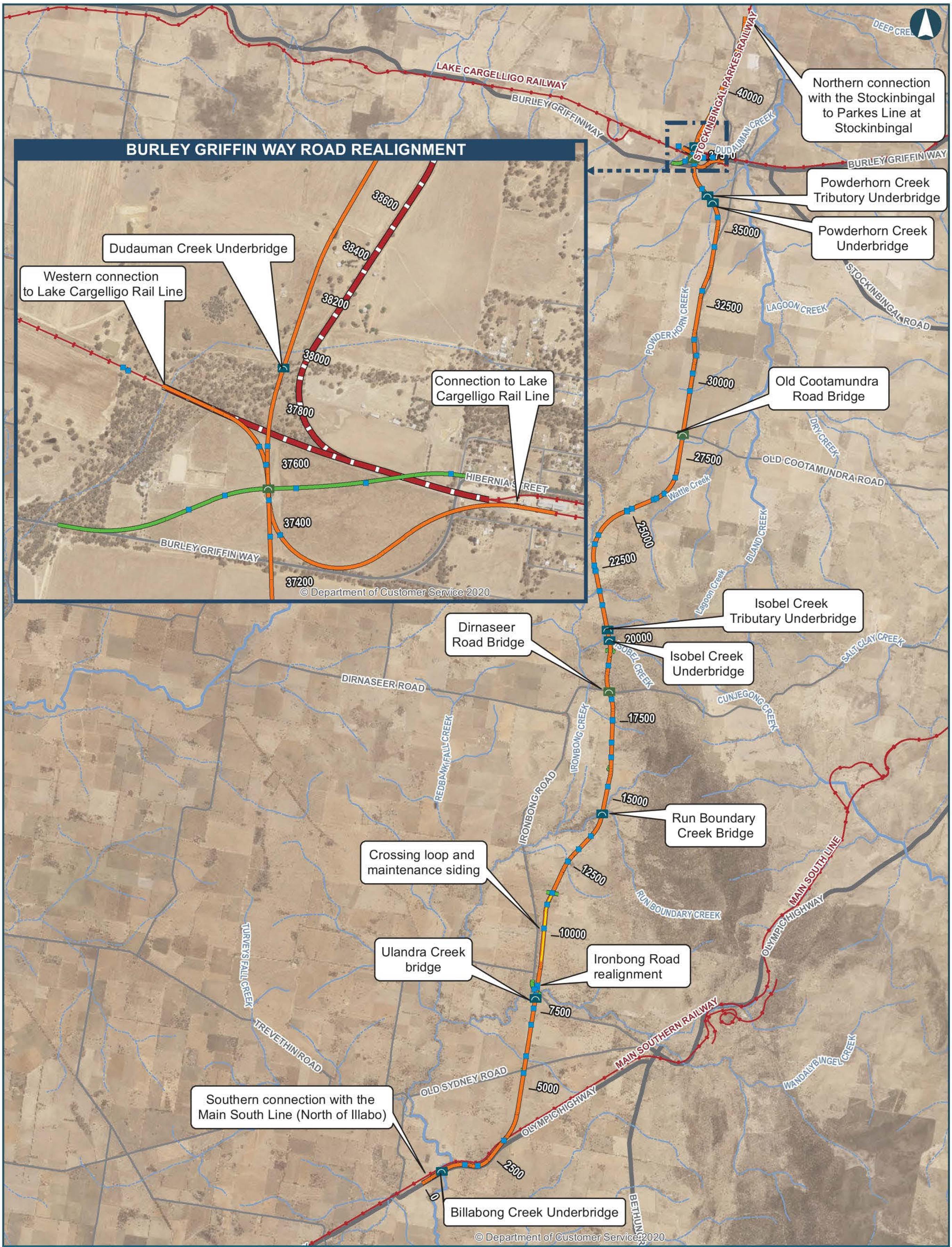
- Key features of proposal
- 40950 Chainage (distance in metres from southern limit of the proposal)
- Burley Griffin Way realignment

Existing features

- Local Government area boundary
- Existing rail
- Parks and reserves
- Sub-arterial road
- Arterial road

INLAND RAIL ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.



ILLABO TO STOCKINBINGAL 1.2 Key features of the proposal

0 1 2 3 km

Coordinate System: GDA 1994 MGA Zone 55

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Date: 7/23/2021 Paper: A3
Author: IRDJV Scale: 1:120,000
Data Sources: ARTC, NSWSS, ESRI

Key features of proposal

- New track/track upgrade
- 40950 Chainage (distance in metres from southern limit of the proposal)
- Crossing Loop & Maintenance Siding
- Burley Griffin Way Road realignment
- Culvert
- Bridge (road crossing)
- Bridge (water crossing)

Existing features

- Sub-arterial road
- Arterial road
- Existing Rail
- Major Watercourse
- Minor Watercourse
- Redundant sections of rail to be decommissioned

INLAND RAIL ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

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1.3 Scope and purpose of the report

The purpose and scope of works of the report are provided in this section.

1.3.1 Purpose of the report

Although no SEARs directly relevant to the assessment of air quality are specified, potential air quality impacts associated with the proposal construction and operation were assessed in consideration of relevant legislation and guidelines to minimise potential impacts on the existing environment and to protect beneficial land uses.

1.3.2 Scope of works

The scope of works is as follows:

- confirm the proposal description including proposal and train volumes
- identify and map the existing sensitive receptor locations to the proposal
- characterise the local air quality using publicly available information (e.g. ambient air monitoring data collected and managed by the Environment Protection Authority [EPA] which sits within the NSW Environment, Energy and Science Group within DPE)
- characterise the local meteorology for the proposal using publicly available information (e.g. data collected at the Bureau of Meteorology [BoM])
- review legislative framework for the proposal as it relates to air quality
- identify the main sources of air emissions during construction and operation
- conduct a qualitative assessment of potential air quality impacts during construction and operation
- propose management and mitigation measures to minimise emissions to air for the construction and operational phases of the proposal; and
- prepare a qualitative air quality impact assessment report.

The methodology for the assessment is described further in Chapter 3.

1.4 Pollutants of interest

Key air pollutants expected to be emitted during construction and operation of the Proposal, and therefore considered in the assessment are:

- total suspended particulates (TSP)
- particulate matter with an equivalent aerodynamic diameter less than 10 micrometres (PM_{10})
- particulate matter with an equivalent aerodynamic diameter less than 2.5 micrometres ($PM_{2.5}$)
- oxides of nitrogen (NO_X) comprising of nitrogen dioxide (NO_2) and nitrogen monoxide (NO)
- carbon monoxide (CO)
- sulphur dioxide (SO_2)
- volatile organic compounds (VOCs) [e.g. benzene]
- semi-volatile organic compounds (SVOCs) (e.g. polycyclic aromatic hydrocarbons (PAHs) as benzo(a)pyrene equivalents).

National and State legislation that set objectives and standards to protect the ambient air environment is described further in Chapter 2.

1.5 Structure of this report

The structure and content of this report is outlined below:

- **Chapter 1 – Introduction** – outlines the background and need for the proposal, and the purpose of this report.
- **Chapter 2 – Legislation and policy context** – provides an outline of the key legislative requirements and policy guidelines relating to the proposal.
- **Chapter 3 – Methodology** – provides an outline of the methodology used for the preparation of this AQIA.
- **Chapter 4 – Existing environment** – describes the local setting, sensitive receptors, topography, local meteorology and ambient air quality.
- **Chapter 5 – Construction impacts** – describes the potential construction impacts associated with the proposal.
- **Chapter 6 – Operational impacts** – describes the potential operational impacts associated with the proposal.
- **Chapter 7 – Mitigation and management measures** – outlines the proposed mitigation measures for the proposal.
- **Chapter 8 – Conclusion** – provides a conclusion of the potential impacts of the proposal on air quality impacts.
- **Chapter 9 – References** – identifies the key reports and documents used to generate this report.

In addition, the report comprises Appendix A – Location of identified sensitive receptors.

2 Legislation and policy context

The relevant legislative considerations and advisory documents for the proposal are detailed below.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The objective of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is to protect and manage prescribed Matters of National Environmental Significance (MNES). Under the EPBC Act, proposed 'actions' that have the potential to significantly impact on MNES, the environment of Commonwealth land, or that are being carried out by a Federal Government agency, must be referred to the Federal Minister for the Environment for assessment.

As a result of the potential for impacts on protected matters, the proposal was referred to the (then) Australian Government Minister for the Environment in June 2018 (EPBC Referral No 2018/8233). On 6 August 2018, the (then) Australian Government Department of the Environment and Energy notified that the proposal is a controlled action, with the controlling provisions being 'listed threatened species and communities' (under section 18 & 18A of the EPBC Act).

2.1.2 Environment Planning and Assessment Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) and Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) establish a framework for the assessment and approval of developments in NSW. They also provide for the making of environmental planning instruments, including state environmental planning policies (SEPPs) and local environmental plans (LEPs), which determine the permissibility and approval pathway for development proposals and form a part of the environmental assessment process. In accordance with the provisions of the EP&A Act, the proposal is State Significant Infrastructure),

SSI may also be declared to be critical State significant infrastructure (CSSI) in accordance with section 5.13 of the EP&A Act, if it is of a category that, in the opinion of the NSW Minister for Planning, is essential for the State for economic, environmental, or social reasons. The proposal was declared as CSSI in 2021.

Under section 5.14 of the EP&A Act, the approval of the NSW Minister for Planning is required for State significant infrastructure (including CSSI), and an EIS has been prepared under Division 5.2 of the EP&A Act.

2.1.3 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 particular aspects of the environment e.g. air quality.

The NEPMs relevant to air quality are the:

- *National Environment Protection (Ambient Air Quality) Measure 2021* (Air NEPM)
- *National Environment Protection (Air Toxics) Measure 2011* (Air Toxics NEPM).

Key pollutants commonly found in ambient air are nationally regulated under these NEPMs and are discussed in further detail in the following sections.

2.1.3.1 National Environment Protection (Ambient Air Quality) Measure 2021

The Air NEPM outlines standards and goals for key pollutants that are required to be achieved nationwide, with due regard to population exposure. The national environment protection standards of this measure are outlined in Table 2.1. Changes in concentration standards (NO_2 and SO_2 only) and maximum allowable exceedances for NO_2, SO_2 and CO came into law on 15 April 2021 and are presented in Table 2.1 together with standards applicable up to this date. There were no changes to concentration standards for PM_{10} and $PM_{2.5}$.

It is noted that these standards are not relevant to air emissions from individual sources, specific industries or roadside locations. Air NEPM standards are intended to be applied at performance monitoring locations that represent air quality for a region or sub-region of 25,000 people or more. These performance monitoring stations are operated by the relevant environmental regulatory authority in each State and Territory.

Table 2.1 Air NEPM standards and goals

Pollutant	Averaging period	Air quality standard [1, 2]	Maximum allowable exceedances
PM_{10}	1 day	$50\mu g/m^3$ [3]	None
	1 year	$25\mu g/m^3$	None
$PM_{2.5}$	1 day	$25\mu g/m^3$	None
		$20\mu g/m^3$ (2025)	None
	1 year	$8\mu g/m^3$	None
		$7\mu g/m^3$ (2025)	None
CO	8 hours	9.0ppm[4] (up to 15 April 2021)	1 day a year
		9.0ppm (from 15 April 2021)	None
NO_2	1 hour	0.12ppm (up to 15 April 2021)	1 day a year
		0.08ppm (from 15 April 2021)	None
	1 year	0.03ppm (up to 15 April 2021)	None
		0.015ppm (from 15 April 2021)	None
SO_2	1 hour	0.20ppm (up to 15 April 2021)	1 day a year
		0.10ppm (from 15 April 2021)	None
	1 day	0.08ppm (up to 15 April 2021)	1 day a year
		0.02ppm (from 15 April 2021)	None
	1 year	0.02ppm (up to 15 April 2021)	None
		No standard (from 15 April 2021)	

(1) Defined as a standard that consists of quantifiable characteristics of the environment against which environmental quality can be assessed
(2) 100^{th} percentile
(3) $\mu g/m^3$: micrograms per cubic metre
(4) ppm: parts per million

In addition, Commonwealth, State and Territory Environment Ministers have flagged an objective to move to a $PM_{2.5}$ standard of $20\mu g/m^3$ (1-day average) and $7\mu g/m^3$ (1-year average) by 2025.

2.1.3.2 National Environment Protection (Air Toxics) Measure 2011

The objective of the Air Toxics NEPM is to improve knowledge regarding ambient air toxic pollutants within areas containing sensitive receptors that are likely to be impacted by elevated concentrations to facilitate development of standards that will allow for the protection of human health and well-being. Table 2.2 presents these standards for air toxics.

Table 2.2 Air toxics NEPM standards and goals

Pollutant	Averaging period	Air quality standard
Benzene	1 year	0.003ppm
PAHs (as benzo(a)pyrene)	1 year	0.3ng/m^3 [1]
Formaldehyde	1 day	0.04ppm
Toluene	1 day	1ppm
	1 year	0.1ppm
Xylene isomers	1 day	0.25ppm
	1 year	0.2ppm

(1) ng/m^3: nanograms per cubic metre

2.2 NSW legislation

2.2.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the legislative framework for the protection and enhancement of air quality in NSW. Its primary objectives are to reduce risks to harmless levels through pollution prevention, cleaner production, application of waste management hierarchy, continual environmental improvement, and environmental monitoring. Sections 124 to 126 and 128 of the POEO Act refer to air pollution related activities.

'Railway Activities'

Under Schedule 1 of the POEO Act, Scheduled activities, Part 1 Premises-based activities, Clause 33, 33A and 33B, '*railway activities*', is taken to be an activity for which a licence is required. Clause 33, 33A and 33B apply to the following activities respectively:

- railway infrastructure construction
- railway infrastructure operations
- rolling stock operations.

Environment protection licence's (EPLs) for licensed railway activities currently include conditions that all plant and equipment used on licensed premises must be operated properly and efficiently.

2.2.2 Protection of the Environment Operations (Clean Air) Regulation 2021

The Protection of the Environment Operations (Clean Air) Regulation 2021 ([POEO (Clean Air) Regulation] provides measures for the control of air emissions from sources including industry, motor vehicles, fuels, wood heaters and open burning. Under Schedule 4, concentration standards for specific pollutants are prescribed for scheduled activities for general activities and plant.

The POEO ACT together with the POEO (Clean Air) Regulation provides a comprehensive framework for regulating activities to minimise their impact on air quality.

2.3 Relevant guidelines

2.3.1 Approved Methods for the Modelling and Assessment of Air Quality in NSW (2016)

Pursuant to the POEO Act, the Approved Methods for Modelling and Assessment of Air Quality in NSW 2016 (Approved Methods) prescribes the statutory methods for modelling and assessing air emission sources in NSW.

The Approved Methods lists impact assessment criteria (IAC) for a range of pollutants against which emissions from a licensed activity are to be assessed. The IAC for relevant pollutants is presented in Table 2.3.

Table 2.3 NSW impact assessment criteria

Pollutant	Averaging period	Air quality standard	Source
TSP	Annual	90µg/m^3	Approved Methods
PM_{10}	24 hours	50µg/m^3	Approved Methods
	Annual	20µg/m^3	
$PM_{2.5}$	24 hours	25µg/m^3	Approved Methods
		20µg/m^3 (2025)	
	Annual	8µg/m^3	
		7µg/m^3 (2025)	
CO	15 minutes	100mg/m^3	Approved Methods
	1 hour	30mg/m^3	
	8 hours	10mg/m^3	
NO_2	1 hour	246µg/m^3	Approved Methods
	Annual	62µg/m^3	
SO_2	10 minutes	712µg/m^3	Approved Methods
	1 hour	570µg/m^3	
	24 hours	228µg/m^3	
	Annual	60µg/m^3	
Benzene	1 hour	29µg/m^3	Approved Methods
	Annual	9.7µg/m^3	Air Toxics NEPM
PAHs (as benzo(a)pyrene equivalents	1 hour	0.0004ng/m^3	Approved Methods
	Annual	0.3ng/m^3	Air Toxics NEPM

2.3.2 Guidance on the assessment of dust from demolition and construction

The UK Institute of Air Quality Management (IAQM) developed the *Guidance on the assessment of dust from demolition and construction 2014* (the IAQM guidance), which provides an approach for assessing the potential dust impacts during construction, taking into consideration the emission magnitude of different construction activities and the sensitivity of the local environment. Further details of the IAQM guidance methodology is presented in section 3.1, and it is applied to the proposal in section 5.2.

3 Methodology

This chapter describes the methods used to assess the potential impacts of the proposal. As the nature of activities during the construction and operation phases vary, the assessment methodology used for the two phases were discussed separately.

3.1 Study area

For construction works, the study area considers potential air quality impacts within 350m from construction footprint and 50m of the route(s) used by construction vehicles on public roads up to 500m from the site access points. Sensitive receptors including a dwelling, school, hospital, office, or public recreational area within this distance were identified and presented in section 4.2.

The proposal was broken down into separate sites based on the presence of sensitive receptors, which is independent to the six sections defined for the proposal, for construction impact assessment. Detailed definition for the sites is presented in section 5.2.1.1.

For operations, the study area considers potential air quality impacts within 100m of the rail track. Beyond 100m from the track, emissions from freight trains are not expected to impact on the receiving environment. Sensitive receptors affected by operational emissions are measured from the rail track rather than the proposal site.

A review of the National Pollutant Inventory (NPI) database for the 2019/2020 reporting year was conducted to identify existing industrial and diffuse (e.g. motor vehicles, railway operations) emission sources within local government areas (LGA's) relevant to the study area.

3.2 Construction

The dust emissions associated with the construction of the proposal were assessed in accordance with the *Guidance on the assessment of dust from demolition and construction* published by the Institute of Air Quality Management (IAQM) in 2014 (the IAQM guidance). Gaseous emissions from the construction works and any construction works 'screened out' by the IAQM guidance was assessed qualitatively.

The assessment methodology adopted was as follows:

- Conduct a risk-based assessment in accordance with the IAQM guidance for potential dust impacts associated with the proposal construction:
  - Step 1: Screening to establish the requirement for a more detailed assessment.
  - Step 2: Assess the risk of dust impacts. This is done separately for each type of activity including demolition, earthworks, construction and track out.
    - Step 2A: Determine the potential dust emission magnitude
    - Step 2B: Determine the sensitivity of the area (Table 3.1 and Table 3.2)
    - Step 2C: Assess the risk by combining the factors in Step 2A and Step 2B (Table 3.3 and Table 3.4).
  - Step 3: Determine the site-specific mitigation.
  - Step 4: Examine the residual effects and determine whether these are significant.
- For construction works screened out for a detailed risk assessment (in Step 1), the IAQM guidance indicates that it can be concluded that the level of risk is "negligible" and any effects would not be of significance. To minimise the impacts on the environment from the proposal construction activities and implement best practices, the potential emissions from these construction site activities were qualitatively assessed.
- Qualitatively address gaseous and odour emissions generated during proposal construction.
- Develop site-specific mitigation measures during construction proposal.
- Assess the residual impacts after the implementation of mitigation measures.

Table 3.1 Sensitivity of the area to dust soiling

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

Note: As only high and medium sensitivity types are involved in this proposal, the assessment matrices for these two types are provided in the table.

Table 3.2 Sensitivity of the area to human health impacts

Receptor sensitivity	Annual mean PM_{10} concentration[1]	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High[2]	>25 µg/m^3	>100	High	High	High	Medium	Low
		10–100	High	High	Medium	Low	Low
		1–10	High	Medium	Low	Low	Low
Medium[2]	>25 µg/m^3	>10	High	Medium	Low	Low	Low
		1–10	Medium	Low	Low	Low	Low

(1) The annual mean PM_{10} concentration ranges were adjusted in accordance with the annual mean Air NEPM standard of 25 µg/m^3.

(2) As only high and medium sensitivity types are involved in this proposal, the assessment matrices for these two types only are provided in the table.

Table 3.3 Risk of dust impacts for earthworks and construction

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 3.4 Risk of dust impacts for track out

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

3.3 Operation

Given the low frequency of train movements and rural setting of the proposal, air dispersion modelling for operational emissions was not conducted.

Air quality impact assessment reports for three rail projects in NSW were reviewed. The number of train movements, train speed, distance to sensitive receptors and locality setting for reference projects were compared with the proposal to demonstrate the potential air quality impacts of the proposal. The projects are:

- Northern Sydney Freight Corridor (NSFC) Strathfield Rail Underpass Project
- Botany Rail Duplication (BRD) Project
- Narrabri to North Star (N2NS) Project
- Narromine to Narrabri (N2N) Project
- North Star to NSW/Queensland Border (NS2B) Project.

4 Existing environment

4.1 Local and regional setting

The proposal crosses two local government areas (LGAs). The southern section is located in the Junee LGA and the northern section in the Cootamundra-Gundagai Regional LGA. Both LGAs comprise predominantly rural land used for agriculture and grazing, as well as major road and rail infrastructure. The Illabo and Stockinbingal townships are situated to the south and north of the proposal respectively.

Illabo is a small town located at the southern end of the proposal, 16km north-east of Junee and 32km south-west of Cootamundra. The town is located on the Olympic Highway between Junee and Bethungra.

Stockinbingal, at the northern end of the proposal within the Cootamundra-Gundagai Regional LGA. The town is located on Burley Griffin Way between Temora and Harden, 19km north-west of Cootamundra.

The nearest major towns to the proposal are Wagga Wagga, approximately 50km to the south, Young approximately 40km to the north-east and Cootamundra approximately 15km to the east.

4.2 Sensitive receptors

Air emissions associated with the construction and operation of the proposal have the potential to cause adverse impacts on the beneficial use of surrounding environment. The Approved Methods describes a sensitive receptor as:

'*A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of any known or likely future sensitive receptor*.'

Sensitive receptors along the proposal have been identified and discussed separately for construction and operation of the proposal in the following sections.

There is the potential for dust to be deposited onto the foliage of vegetation in proximity to the proposal site activities. However, deposition on dust foliage is likely to be highly localised, intermittent, and temporary and not considered to impact significantly on the proposal. Consequently, ecological receptors were not considered in the dust risk assessment.

4.2.1 Sensitive receptors relevant to construction of the proposal

This air quality impact assessment has addressed impacts during construction based on a risk-based approach. The sensitive receptors potentially impacted during construction are discussed below.

Sensitive receptors within the following distances were identified in accordance with the *Guidance on the assessment of dust from demolition and construction* published by the Institute of Air Quality Management (IAQM) in 2014 (the IAQM guidance):

- 350m of the construction footprint
- 50m of the routes used by construction vehicles on the public highway, up to 500m from access points.

These sensitive receptors are summarised in Table 4.1 and Table 4.2 and illustrated in the sensitive receptor figure in Appendix A. It is noted that R226696, R226828 and R226929 identified in the figure in Appendix A are located within the proposal site and were therefore not assessed in this report. They are not considered sensitive receptors.

A total of 108 sensitive receptors were identified within 350m of construction footprint among which 19 receptors are also located within 50m of haulage routes up to 500m from site access points. Most receptors are located in Stockinbingal, immediately east of the construction footprint, in low-density residential dwellings. South of Stockinbingal, residential receptors are typically sparsely distributed as rural dwellings within agricultural properties.

Table 4.1 Sensitive receptors within 350m of construction footprint boundary

Receptor ID	Chainage (m)	Type	Distance to construction footprint (m)
R226614	1400	Residential	160
R226610	2100	Residential	298
R226616	2100	Residential	327
R226702	10400	Residential	331
R226777	18500	Residential	220
Multiple (101 receptors)	37250-38200	75 residential receptors 15 commercial receptors 8 educational receptors 2 recreational receptors	<20: 9 receptors <50: 20 receptors <100: 44 receptors <350: 101 receptors
R321487	39200	Residential	347
R226994	40600	Residential	110

Note: R226696, R226828 and R226929 are located within the proposal site and were therefore not assessed in this report.

Table 4.2 Sensitive receptors within 50m of haulage routes up to 500m from access points

Receptor ID	Access point	Chainage (m)	Type	Distance to haulage road (m)
R226777	Dirnaseer Road	18500	Residential	40
R226926	Burley Griffin Way (west)	37300	Residential	48
R320746	Hibernia Street	37750	Residential	18
R320032			Residential	41
R321056			Residential	16
R319535			Residential	40
R320859			Residential	15
R319701			Residential	17
R319343			Commercial	17
R900005			Park	17
R320776			Commercial	13
R321120			Commercial	9
R319721			Residential	15
R319490			Residential	18
R320838			Commercial	16
R321010			Commercial	16
R321126			Residential	8
R320761			Commercial	8
R320758			Residential	20

4.2.2 Sensitive receptors relevant to operation of the proposal

Sensitive receptors affected by operational emissions are measured from the proposal rather than construction footprint. Consequently, receptors identified in Table 4.1 have a longer distance to the proposal.

There are five receptors located within 100m of the proposal and are presented in Table 4.3.

Table 4.3 Sensitive receptors within 100m of the proposal

Receptor ID	Chainage (m)	Type	Distance to proposal alignment (m)
R320746	37600	Residential	92
R320859		Residential	88
R319076		Residential	88
R320739		Residential	78
R318977		Residential	89

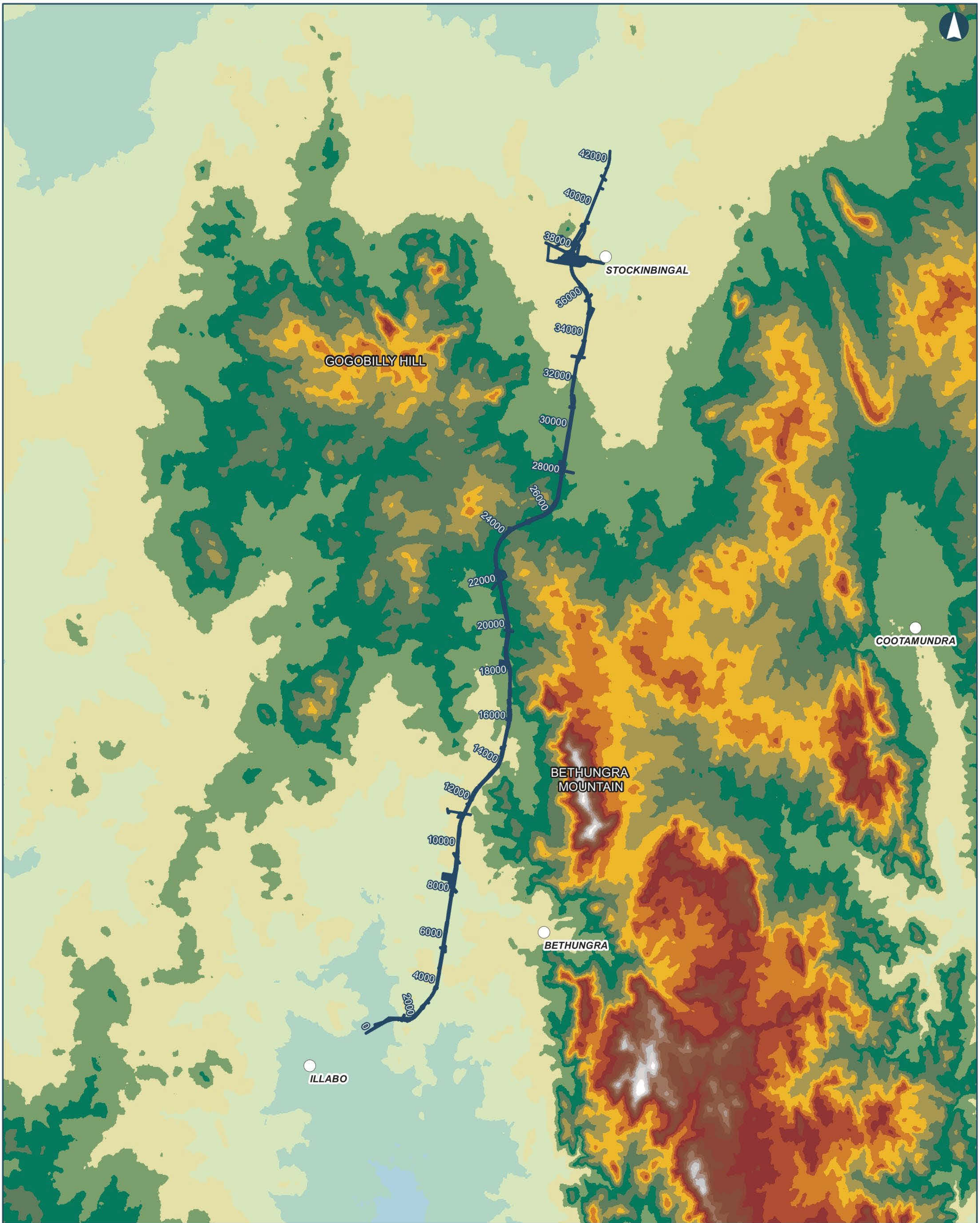
4.3 Topography

The topography of the land surrounding the proposal is illustrated in Figure 4.1. Terrain along the proposal is comprised of gently to moderate undulating topography. The town of Stockinbingal has an elevation of 295m Australian Height Datum (AHD)[2] and the southern end of the route near Illabo has an elevation of 280m. The proposal passes through areas of higher terrain between 400m and 480m.

Approximately 800m to the east lies the Bethungra Range with a highest elevation of 709m (Bethungra Mountain) above sea level. Approximately 6km to the south-west of the proposal lies another mountain range with Gogobilly Hill being the highest pointy at 524m.

Undulating topography is capable of steering and channelling the wind such that the spatial distribution of wind patterns across a region can be localised. The Bethungra Mountain Range and Gogobilly Hill plays a role in not only steering and channelling the prevailing wind direction but also influencing night-time drainage flow regimes. Night-time drainage flows, or katabatic drift, occur at night when air at the top of the mountain cools and becomes heavier and is forced by gravity to move downslope. The steeper the slope, the faster these winds move. Inversions are also often associated with such conditions, where cold dense air pools form in the bottom of valleys under calm conditions and are strongest in the early hours of the morning just before dawn. When assessing the potential impact from a ground level air pollutant source, it is important to consider these local drainage flows. For the proposal, given the distance to the higher topographical areas, pollutants from diesel locomotives are expected to adequately disperse and the dispersion is not anticipated to be affected by the Bethungra Mountain Range and Gogobilly Hill.

[2] All elevations in this report are in Australian Height Datum.



ILLABO TO STOCKINBINGAL Figure 4.1 Site topography

0 1 2 3 4 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 8/18/2021 Paper: A3
Author: IRDJV Scale: 1:150,000
Data Sources: ARTC, NSWSS, ESRI

Proposal site

Elevation (mAHD)

- 220 - 250
- 251 - 275
- 276 - 300
- 301 - 325
- 326 - 350
- 351 - 375
- 376 - 400
- 401 - 425
- 426 - 450
- 451 - 475
- 476 - 500
- 501 - 525
- 526 - 550
- 551 - 575
- 576 - 600
- 601 - 625
- 626 - 650
- 651 - 675
- 676 - 700
- 701 - 725

INLAND RAIL ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

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4.4 Local meteorology

Meteorological conditions are important for determining the direction and rate at which emissions from a source would disperse. The key meteorological requirements for an air quality impact assessment are typically hourly records of wind speed, wind direction, temperature, rainfall, and relative humidity. The following section discusses meteorological conditions in the vicinity of the proposal.

The Bureau of Meteorology (BoM) collects meteorological data at automatic weather stations (AWS) across Australia and can be used for determining climate statistics over standard periods, such as 30 years, known as climate normals.

There are two AWS located near to the proposal that characterises the local meteorology using the most recent long-term dataset available. These are:

- Cootamundra Airport AWS (Site Number: 073142), located approximately 17km east of the proposal. It is situated at an elevation of 335m on flat plains. This AWS commenced operation in 1995.
- Temora Airport AWS (Site Number: 073151), approximately 34km west of the proposal. It is situated at an elevation of 281m on flat plains. This AWS commenced operation in 2005.

Cootamundra Airport AWS, being the closest meteorological station to the proposal and given the relatively flat terrain, it is considered to be most representative of the local meteorology. Data for Temora Airport AWS was included to provide a broader picture of meteorological conditions for the proposal. It is noted that Temora Airport AWS is the nearest station that collects 1 minute average wind data and is further discussed in section 4.4.1.

Climate statistics data collected at Cootamundra Airport AWS include wind speed and direction, temperature, rainfall, and relative humidity, while only temperature and rainfall were collected at Temora Airport AWS. Table 4.4 presents a summary of the climate statistic data at the Cootamundra Airport AWS and Temora Airport AWS.

The local climate around Cootamundra Airport AWS is characterised by:

- average maximum temperature of 32.3ºC in January
- average minimum temperature of 1.1ºC in July
- annual average rainfall of 583.3 millimetres and average rainy days (rain ≥ 1 millimetres) of 72.3
- average maximum 9am relative humidity of 91 per cent in June and July
- average minimum 3pm relative humidity of 33 per cent in January.

The local climate around Temora Airport AWS is characterised by:

- average maximum temperature of 34.3ºC in January
- average minimum temperature of 2.2ºC in July
- annual average rainfall of 471.5 millimetres and average rainy days (rain ≥ 1 millimetre) of 58.6.

Table 4.4 Climate data for Cootamundra Airport AWS and Temora Airport AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Cootamundra Airport AWS													
Mean maximum temperature (°C)[1]	32.3	30.6	27.3	22.7	17.6	14	13	14.5	18.3	22.5	26.4	29.5	22.4
Mean minimum temperature (°C)[1]	16.2	15.7	12.3	7.5	3.4	2.1	1.1	1.4	3.4	6.2	10.5	13.1	7.7
Mean rainfall (mm)[2]	45.7	54.7	52.9	34.1	36	59.3	57.4	55.1	50.6	45.3	58.6	52.8	583.3
Mean number of days of rain ≥ 1mm[2]	4.9	4.2	5	4	5.2	7.9	9	8	6.7	5.9	6.1	5.4	72.3
Mean 9am temperature (°C)[3]	22.1	20.9	17.2	14.7	9.4	6.6	5.1	7.5	11.3	15.2	17.7	20.6	14
Mean 9am relative humidity (%)[3]	59	67	72	73	84	91	91	86	77	68	64	60	74
Mean 9am wind speed (km/h)[3]	14.5	8.2	10	5.6	7.6	4.6	7.1	5.8	11	7.7	13.2	7.6	8.6
Mean 3pm temperature (°C)[3]	30.3	29.3	26.3	22	17	13.4	12.1	13.9	17.2	21	24.8	27.9	21.3
Mean 3pm relative humidity (%)[3]	33	38	38	43	53	66	65	61	53	46	39	36	48
Mean 3pm wind speed (km/h)[3]	16.5	9.4	14.9	7	11.7	6.1	13.1	8	15.8	9.1	16.7	10	11.5
Temora Airport AWS													
Mean maximum temperature (°C)[4]	34.3	31.7	28.6	23.9	18.6	14.8	13.8	15.3	19.5	24.7	28.6	31.1	23.7
Mean minimum temperature (°C)[4]	17.5	16.5	13.6	8.7	4.3	3.1	2.2	1.9	3.5	7.2	11.9	14.2	8.7
Mean rainfall (mm)[5]	41	47.9	34.3	27.2	28.9	51.3	37.9	36.2	39.3	35.4	50.6	42.8	471.5
Mean number of days of rain ≥ 1mm[5]	4.4	4.3	3.9	3.8	4.1	6.3	6.4	6.2	4.5	5	5.3	4.4	58.6

(1) Data recorded for the period 1995 to 2020.
(2) Data recorded for the period 1995 to 2021.
(3) Data recorded for the period 1995 to 2010.
(4) Data recorded for the period 2005 to 2020.
(5) Data recorded for the period 2005 to 2021.

4.4.1 Wind speed and direction

1 minute average wind speed and direction were recorded at Temora Airport AWS while only 9am and 3pm wind data were collected at Cootamundra Airport AWS. Detailed wind data is more appropriate to indicate local wind conditions therefore the data collected at the Temora Airport AWS was analysed in this section.

Figure 4.2 presents seasonal and annual wind roses showing the frequency of strength and direction of winds for the past five years (2016 to 2020 inclusive) at Temora Airport AWS.

The wind roses indicate that the typical winds at Temora Airport AWS are:

- most frequently ranging from south southwest to west southwest and rarely from south-easterly directions during spring with an average wind speed of 3.8m/s
- most frequently from the east and moderately from southwest during summer and autumn with an average wind speed of 4.2m/s and 3.2m/s respectively
- most frequently from the south to south-southwest during winter with an average wind speed of 2.9m/s
- most frequently from the east and south-westerly directions and rarely from southeast with an average wind speed of 3.6m/s and calm winds of 8.3 per cent across five years.

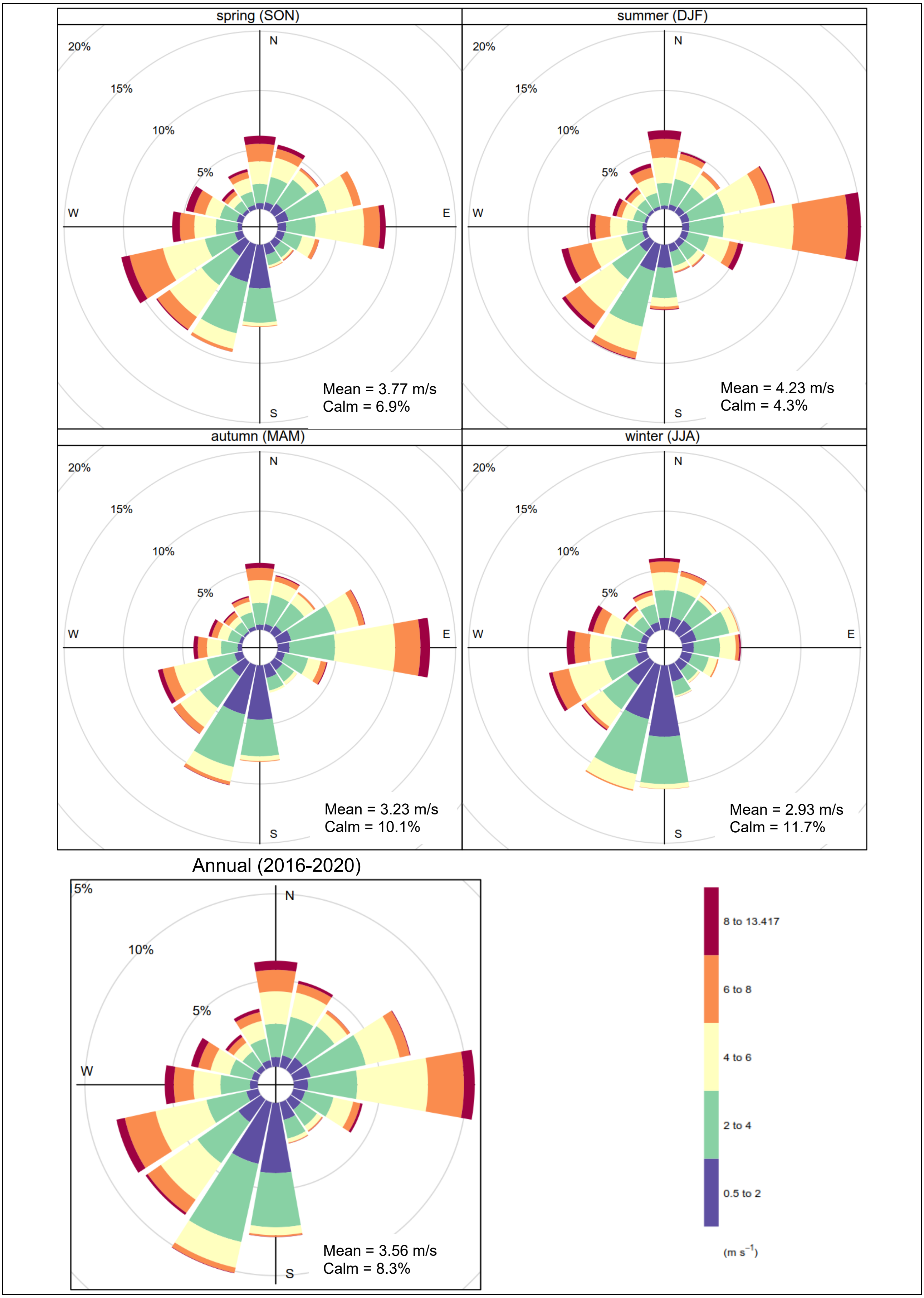

Figure 4.2 Temora Airport AWS seasonal and annual wind roses (2016–2020)

4.5 Existing air quality

This section characterises the local ambient air quality within the proposal and discusses the emission sources contributing to the local air shed.

4.5.1 Local air emission sources

The main industrial and non-industrial air emission sources contributing to the local air shed include:

- traffic using the local road networks
- railway operations on the existing rail line adjoining the proposal at its northern and southern extents
- fuel storage facilities
- gas metering stations
- domestic solid and liquid fuel burning
- dust from paved and unpaved roads
- residential activities e.g. and barbecues
- agricultural activities.

These sources give rise to emissions of pollutants relevant to the proposal including particulate matter fractions (TSP, PM_{10} and $PM_{2.5}$), NO_x (comprising NO_2 and NO), CO, SO_2, VOCs and SVOCs e.g. PAHs.

4.5.1.1 National Pollutant Inventory

Information regarding local air emission sources and collated by the National Pollutant Inventory (NPI). It is an online database that provides public information regarding estimated emissions of 93 substances in Australia, together with the sources and location of these emissions. The NPI also includes estimated emissions data for non-industrial (diffuse) sources such as motor vehicle exhausts, wood heaters, lawn mowers and barbecues.

A review of the National Pollutant Inventory (NPI) database for the 2019/2020 reporting year was conducted to identify and quantify industrial emissions in the following LGAs in which the proposal is located:

- Junee
- Cootamundra-Gundagai Regional.

There was no information provided for diffuse emission sources such as motor vehicles, agricultural activities, railway operations, unpaved roads.

Table 4.5 presents the industrial facilities that reported to the NPI database for 2019/2020. Emissions from these facilities will contribute to the local airshed.

Table 4.5 Industrial facilities reporting to the NPI database for the 2019/2020 period

Facility	Address	Main activity	Reported pollutant
Junee			
Burnt Creek Meter Station	Burnt Creek Lane, Junee, NSW 2663	Gas supply	VOCs
Illabo Meter Station	Brabins Road, Illabo, NSW 2590	Gas supply	VOCs
Junee Abattoir	Harefield Road, Junee, NSW 2663	Meat processing	PM_{10}, $PM_{2.5}$ NO_x, CO, SO_2 VOCs Polycyclic aromatic hydrocarbons (PAHs)

Facility	Address	Main activity	Reported pollutant
Cootamundra-Gundagai Regional Shire			
Cootamundra meter station	Hogans Lane, Cootamundra, NSW 2590	Gas supply	VOCs
Aero Refuellers Cootamundra	Airport Cootamundra, NSW 2590	Petroleum product wholesaling	VOCs
Mt Hercules Pastoral Company	Cherrygrove Lane Wallendbeen, NSW 2588	Sheep, beef cattle and grain farming	Ammonia PM_{10}
Pacific National Cootamundra	Victoria Parade, Cootamundra, NSW 2590	Rail freight transport	VOCs Xylene isomers Cumene
Cootamundra Depot	30 Hovell Street, Cootamundra, NSW 2590	Mineral, metal and chemical wholesaling	VOCs Lead & compounds

4.5.2 Overview of historical ambient air quality data

The NSW Government monitors air quality at 47 ambient air quality monitoring stations (AAQMS) in metropolitan and regional centres and 36 rural AAQMS. In addition, the Australian Capital Territory (ACT) Government also operates three AAQMS which were also reviewed due to the proximity to the proposal.

The two nearest AAQMS to the study area Junee AAQMS and Temora AAQMS, 14km and 34km to the proposal respectively, but only TSP was monitored at both sites. The next nearest station is Wagga Wagga North AAQMS. PM_{10} and $PM_{2.5}$ monitored at this station and were adopted in this assessment to represent the existing air quality along proposal.

Due to the remoteness of the study area, the nearest station that monitored NO_2 and CO is located at Florey AAQMS in the ACT, approximately 125km south east of the proposal, while the nearest station that monitored SO_2 is located at Bargo AAQMS in NSW, approximately 245km east of the proposal.

To provide an indicative NO_2, CO and SO_2 level, monitoring data at these two stations were presented in this assessment. It is noted that both Florey and Bargo AAQMS are located in more densely populated areas than the proposal. As such NO_2, CO and SO_2 concentrations are likely to be higher than the site location primarily due to higher vehicular traffic emissions.

There is no publicly available ambient air quality monitoring data for VOCs or SVOCs. Notwithstanding, background concentrations are likely to be low in the local area.

A summary of the relevant AAQMS is presented in Table 4.6.

Table 4.6 Summary of relevant EPA AAQMS

AAQMS ID	Location	Distance to proposal (km)	Direction from proposal	Pollutants monitored (2015–2019)	Adopted
Junee	34.825°S,147.510°E	14	South-west	TSP	TSP
Temora	34.428°S,147.512°E	34	West north-west	TSP	NA[1]
Wagga Wagga North	35.104°S,147.361°E	40	South-west	PM_{10}, $PM_{2.5}$, O_3	PM_{10}, $PM_{2.5}$
Florey (ACT)	35.221°S, 149.043°E	125	South-east	NO_2, CO	NO_2, CO
Bargo	34.306°S,150.581°E	245	East	NO_2, SO_2, O_3, PM_{10}, $PM_{2.5}$	SO_2

The latest five years (2016 to 2020 inclusive) of TSP data collected at Junee AAQMS, PM_{10} and $PM_{2.5}$ monitoring data collected at Wagga Wagga North AAQMS, CO and NO_2 data at Florey AAQMS and SO_2 data at Bargo AAQMS were analysed and are presented in Table 4.7. The monitoring results indicate that:

- annual average TSP data were below the assessment criterion as prescribed in the Approved Methods
- 24-hour and annual average PM_{10} and $PM_{2.5}$ concentrations exceeded the relevant Air NEPM standards in some of the five years
- SO_2 concentrations were compliant with the Air NEPM standards for all five years
- CO and NO_2 concentrations were compliant with relevant Air NEPM standards for 2016 to 2019 but exceeded the Air NEPM standards in 2020.

PM_{10} and $PM_{2.5}$ exceedances were mostly caused by dust storms and sometimes due to local dust events. PM concentrations at the study area are expected to be similar or lower than that at the Wagga Wagga North AAQMS, given its more remote location. Traffic on the local road network and domestic activities may also contribute to the elevated concentrations.

CO and NO_2 exceedances in 2020 were likely caused by the severe bushfires in early 2020.

A variation to the Air NEPM came into law on 15 April 2021 and introduced more stringent standards for NO_2 and SO_2 (section 2.1.3.1). The new standards are not retrospective, and the Air NEPM 2016 concentration standards are applicable for comparison to the ambient air quality monitoring data (Table 4.7) collected at all AAQMS for the years 2016 to 2020 inclusive.

Table 4.7 Summary of ambient air quality at the AAQMS

Pollutant	Averaging period	Unit	Maximum concentrations					NEPM standard[6]	Source
			2016	2017	2018	2019	2020		
TSP	Annual	µg/m³	13.7	12.8	12.5	26.9	30.0	90[1]	Junee AAQMS[2]
PM_{10}	24-hour	µg/m³	**114.7**	**171.6**	**127.2**	**420.0**	**259.4**	50	Wagga Wagga North AAQMS[3]
	Annual	µg/m³	20.6	20.6	**27.4**	21	21.9	25	
$PM_{2.5}$	24-hour	µg/m³	**28.1**	**32.5**	23.8	**386.5**	**559.5**	25	
	Annual	µg/m³	7.4	**8.1**	**8.4**	**12.2**	**12.9**	8	
CO	8-hour	ppm	1.9	1.8	1.5	8.6	**14.6**	9	Florey AAQMS[4]
NO_2	1-Hour	ppm	0.034	0.033	0.039	0.062	**0.17**	0.12[6]	
	Annual	ppm	0.004	0.005	0.005	0.005	0.004	0.03[6]	
SO_2	1-Hour	ppm	0.01	0.01	0.01	0.002	0.012	0.2[6]	Bargo AAQMS[5]
	24-hour	ppm	0.004	0.002	0.002	0.006	0.003	0.08[6]	
	Annual	ppm	0.0003	0.0003	0.0004	0.0004	0.0003	0.02[6]	
VOCs (e.g. benzene)	Annual	No background data available							
SVOCs (e.g. PAHs (as Benzo(a)pyrene))	Annual	No background data available							

(1) In the absence of a TSP ambient air quality standard in the Air NEPM, the impact assessment criterion prescribed in the NSW Approved Methods was adopted.
(2) Monitoring data at Junee AAQMS was provided by (then) NSW DPIE (https://www.environment.nsw.gov.au/topics/air/monitoring-air-quality/regional-and-rural-nsw/rural-monitoring-stations/junee)
(3) Monitoring data at Wagga Wagga North AAQMS for the period 2016 to 2018 were from *New South Wales Annual Compliance Report 2018 (*https://www.environment.nsw.gov.au/research-and-publications/publications-search/new-south-wales-annual-compliance-report-2018). Monitoring data for 2019 and 2020 was provided by (then) NSW DPIE.
(4) Monitoring data at Florey AAQMS were from *ACT Air Quality Report 2019* (https://www.accesscanberra.act.gov.au/ci/fattach/get/553912/1593570007/redirect/1/filename/ACT+Air+Quality+Report+2019.pdf). Monitoring data for 2020 were downloaded from https://www.accesscanberra.act.gov.au
(5) Monitoring data at Bargo AAQMS for the period 2016 to 2018 were from *New South Wales Annual Compliance Report 2018 (*https://www.environment.nsw.gov.au/research-and-publications/publications-search/new-south-wales-annual-compliance-report-2018). Monitoring data for 2019 and 2020 were downloaded from https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility.
(6) Concentration standards as prescribed in the Air NEPM Variation 2016

4.6 Soil type

The quantity of dust emitted from construction activities is related to a number of factors including the silt content of the soil (particles smaller than 75 micrometres). Some soil types such as clay are more prone to suspension during dry conditions due to the smaller particle and have a greater impact on dust soiling and human health impacts.

The soil types at each site were identified following a review of Technical Paper 14 – Contamination Assessment (WSP, 2021a). They are presented in Table 4.8.

Table 4.8 Soil type at each site

Site number	Chainage range	Soil type
Site 1	1,050–1,750	Clay
Site 2	1,750–2,200	Clay/gravelly
Site 3	10,280–10,520	Sandy
Site 4	18,200–18,450	Sandy/clay
Site 5	37,250–37,750	Sandy/Clay
Site 6	39,200–39,300	Silty/sandy
Site 7	40,350–41,000	Clay

5 Construction impacts

5.1 Construction scheduling

It is anticipated that construction would commence in mid-2024 and conclude in mid-2026.

Table 5.1 outlines the high-level staging and indicative construction timeframes. For emissions associated with construction activities, the duration of construction works and construction working hours indicate the period during which the emissions would be potentially generated. The construction methodology will be further developed and confirmed during detailed design.

Table 5.1 Construction schedule and timing

Indicative stages	Chainage/element	Indicative duration (work days)	Indicative timing of works
Enabling works	Across proposal site	40	Mid-2024 (approximately 2 months)
Site establishment	Across proposal site	70	Mid-2024–late 2024 (approximately 3 months)
Main construction works—Section 1	0–2900	108	Mid-2024–early 2025 (approximately 5 months)
Main construction works—Section 2	2901–8840	109	Late-2024–early 2025 (approximately 5 months)
Main construction works—Section 3	8841–18500	157	Late-2024–mid 2025 (approximately 7 months)
Main construction works—Section 4	18501–28300	196	Late-2024–mid-2025 (approximately 9 months)
Main construction works—Section 5	28301–37300	171	Late 2024–mid-2025 (approximately 8 months)
Main construction works—Section 6	37300–42600	331	Late 2024–early-2026 (approximately 16 months)
Signalling, testing and commissioning	Across proposal site	130	Late 2025—mid-2026 (approximately 7 months)
Finishing works	Across proposal site	50	Mid-2026 (approximately 2 months)

Air emissions during construction would mainly be generated during working hours, due to the operation of plant and equipment and active movement of spoil and other materials. Outside of the working hours, these activities would not occur, however wind erosion from stockpiles and other exposed areas may potentially occur. Proposed working hours during construction are as follows:

- Monday to Friday: 6.00am to 6.00pm
- Saturday: 6.00am to 6.00pm (concluding at 1.00pm every second weekend)
- Sundays and public holidays: 6.00am to 6.00pm (not occurring on every second Sunday).

Works that would also be undertaken outside of the above hours or during 24-hour rail possessions include:

- tie into the existing Main South Line at Illabo (Section 1)
- tie into the existing Lake Cargelligo Line (Section 6) and Stockinbingal to Parkes Line at Stockinbingal (Section 6)
- installation of precast bridge beams over existing public highways
- installation of level crossings where road closures are not approved during normal hours
- utility relocations that are required to be undertaken out of hours to avoid impact to local residents and businesses (across proposal site).

5.2 Dust emissions

Dust impacts depend on the quantity and drift potential of the particles in the atmosphere. Larger particles (the larger particle fractions of TSP) settle out closer to the source due to their larger mass. The deposition of the particles can cause nuisance and aesthetic impacts on the receiving environment. Finer particles (PM_{10} and $PM_{2.5}$) remain entrained longer and therefore dispersed at greater distances from the source. The fine nature of these particles also has the potential for human health impacts if not adequately controlled.

This section assesses the potential dust impacts associated with the proposal. For construction works that are ‘screened in’ for a detailed risk assessment are analysed in section 5.2.1 and for those activities ‘screened out’ are qualitatively assessed in section 5.2.2. The screening process is presented in section 5.2.1.1.

5.2.1 Risk assessment

5.2.1.1 Step 1 – Screening to establish the need for a detailed assessment

The IAQM guidance recommends that a risk assessment of potential dust impacts from construction activities is undertaken when sensitive receptors are located within the distance specified in section 4.2.1.

Where sensitive receptors are identified within that distance, construction works are ‘screened in’ for a detailed assessment. In cases where no sensitive receptors are identified within these locations, the need for a more detailed assessment is ‘screened out’. It can be concluded that the level of risk is negligible, and any impacts will not be of significance.

Due to the nature of the proposal, the proposal site is divided into separate sites based on the presence of sensitive receptors (see section 4.2 and Appendix A), which is independent to the six sections defined for the proposal. Where a sensitive receptor is located within 350m of the proposal site, the whole segment within a range of 350m of the receptor is considered to be a separate construction site. Burley Griffin Way Realignment construction is conservatively considered as one construction site although not all receptors would be affected equally by the construction works.

Seven construction sites and three haulage routes where sensitive receptors are located nearby were identified, as shown in Table 5.2 and Table 5.3. The chainage range of each site in the table indicates the extent of each identified site. A detailed risk assessment was triggered for the above construction works and these are discussed in section 5.2.1.2 to section 5.2.1.6.

Where there are gaps in chainages between construction sites 1 to 7 (see Table 4.1 and Table 4.2), this indicates there are no sensitive receptors within 350m of the construction footprint or within 50m of public haulage routes up to 500m from site access points.

These areas were ‘screened out’ for a detailed risk assessment and not assessed individually. However, to minimise the impacts on the environment from proposal construction activities, potential emissions sources from these areas were qualitatively addressed in section 5.2.2.

Table 5.2 Construction sites with sensitive receptors located within 350m of construction footprint

Site No.	Chainage range (m)	Receptor number	Distance to construction footprint boundary (m)	Site type
Site 1	1,050–1,750	R226614	160	Construction site and No.3 Construction compound
Site 2	1,750–2,200	R226610 and R226616	298 and 327	Construction site
Site 3	10,280–10,520	R226702	331	Construction site
Site 4	18,200–18,450	R226777	220	No.11 Construction compound
Site 5	37,250–37,750	101 receptors in total	<20: 9 receptors (2 commercial) <50: 20 receptors (4 commercial) <100: 44 receptors <200: 69 receptors <350: 101 receptors	Burley Griffin Way Construction site and No. 25-28 Construction compounds
Site 6	39,200–39,300	R321487	347	No.29 Construction compound
Site 7	40,350–41,000	R226994	110	Construction site

Table 5.3 Haulage routes with sensitive receptors located within 50m up to 500m from access points

Route No.	Chainage (m)	Access point	Receptor number	Distance to haulage road (m)
Route 1	18,500	Dirnaseer Road	R226777	40
Route 2	37,300	Burley Griffin Way (west)	R226926	48
Route 3	37,750	Hibernia Street	17 receptors (including 6 commercial and 1 park)	<50

5.2.1.2 Step 2A – Determine the potential dust emission magnitude

The potential dust emission magnitudes for earthworks, construction and vehicle track out activities were evaluated in this section.

It is noted that demolition is not assessed in this section as no major demolition works are expected to be involved in the proposal construction aside from some minor works including removal of a section of the Lake Cargelligo Line and Stockinbingal to Parkes Line located at the Burley Griffin Way Realignment site and potentially demolition of a number of buildings which would be further investigated during detailed design.

The IAQM guidance classifies potential large, medium, or small dust emission magnitude and provides examples as shown in Table 5.4.

Table 5.4 Example definitions for large, medium and small dust emission magnitude

Activities	Large	Medium	Small
Earthworks	• Total site area >10,000m² • Potential dust soil type (e.g. clay) • >10 heavy earth moving vehicles active at any one time • Formation of bounds >8m in height • Total material moved >100,000t.	• Total site area 2,500–10,000m² • Moderately dusty soil type (e.g. silt) • 5–10 heavy earth moving vehicles active at any one time • Formation of bounds 4–8m in height • Total material moved 20,000t–100,000t.	• Total site area <2,500m² • Soil type with large grain size (e.g. sand) • <5 heavy earth moving vehicles active at any one time • Formation of bounds <4m in height • Total material moved <20,000t • Earthworks during wetter months.
Construction	• Total building volume >100,000m³ • On-site concrete batching • Sandblasting.	• Total building volume 25,000–100,000m³ • On-site concrete batching • Potentially dusty construction material (e.g. concrete).	• Total building volume <25,000m³ • Construction material with low potential for dust release (e.g. metal cladding or timber).
Track out[1]	• >50 heavy duty vehicles (Heavy duty vehicles [HDV],>3.5 tonne) outward movements in any one day • Potential dusty surface material (e.g. high clay content) • Unpaved road length >100m.	• 10-50 HDV (>3.5 tonne) outward movements in any one day • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50–100m.	• <10 HDV (>3.5 tonne) outward movements in any one day • Surface material with low potential for dust release • Unpaved road length <50m.

(1) Track out is dirt, mud or other materials tracked onto a paved public roadway by a vehicle leaving a construction site.

Earthworks

Earthworks primarily involve excavating material, haulage, tipping and stockpiling (Institute of Air Quality Management, 2014). For this proposal, earthworks would be required to:

- create embankments and cuttings to minimise the extent of elevation gain along the proposal and maintain rail gradients in accordance with adopted design requirements
- construct the new crossing loop
- construct culverts and bridges
- construct the ancillary infrastructure and undertake the ancillary works associated with the proposal.

The dust emission magnitude from earthworks for each site was assessed separately based on the following parameters: site area, soil type, number of HDVs, the total material excavated and filled, and the likelihood of blasting occurring. These are summarised in Table 5.5.

For this assessment, the site area is the same as the construction footprint which includes earthworks, construction compounds and ancillary activities where relevant. Construction compounds would generally accommodate stockpiles, laydown area, site offices, a concrete batching plant and fuel storage. The location of construction compounds is shown in the figures in Appendix A. Site layout information would be further developed at the detailed design stage. This assessment has conservatively assumed earthworks would occur within the whole construction footprint and construction compounds.

Blasting is potentially required for hard rock excavation below two metres. Table 5.5 provides the likelihood of blasting occurring at Sites 1 to 7. Dust is anticipated to be generated during a blasting event. Although blasting is not one of the examples provided by the IAQM guidance as listed in Table 5.4, it is conservatively assumed to be an indicator for *Large* emission magnitude in this assessment.

Although the value of each determining parameter may fall into a different magnitude category as shown in Table 5.4, the dust emission magnitude from earthworks was assigned based on the highest category a site can fall into. In summary, dust emissions from earthworks on all seven sites are assigned a *Large* category.

Table 5.5 Earthworks emission magnitude summary for each site

Site Number	Chainage (m)	Site area (m^2)	Soil type	Number of HV[4]	Material handled[3]		Blasting likelihood	Emission magnitude
					(m^3)	(t)[1]		
Site 1[2]	1,050-1,750	**73,620**		<5	11,077	61,034	Low	Large
Site 2	1,750-2200	**46,200**		<5	31,150	**171,637**	Low	Large
Site 3	10,280-10,520	**22,835**		<5	9,136	50,339	Low	Large
Site 4[2]	18,200-18,450	**93,017**	Clay or sandy soil	<5	60,798	**334,997**	Low	Large
Site 5[2]	37,250-37,750	**678,310**		**≤36**	14,382	79,245	Low	Large
Site 6[2]	39,200-39,300	8,799		<5	586	3,229	Low	Large
Site 7	40,350-41,000	**21,712**		<5	2,766	15,241	Low	Large

(1) Assuming earth density of 5,510kg/m^3.

(2) Sites containing construction compounds

(3) Total volume of excavated and filled material.

(4) Number of heavy earth moving vehicles active at any one time

(5) Magnitude determining parameter is highlighted in bold.

Other construction activities

The key issues when determining the potential dust emission magnitude during the construction phase include the size of the infrastructure, method of construction, construction materials, and duration of build. Table 5.4 provides examples of large, medium, and small dust emission magnitudes.

A summary of construction information for each site and dust emission magnitude is presented in Table 5.6. It is noted that:

- concrete batching plants would be located in No.11 and No.25 construction compounds which would be within site 4 and 5 respectively
- mobile concrete batching plants may also be used during construction and would be wholly located within the proposal site
- the materials to be used during construction include ballast, concrete sleeper, steel rail, precast culverts and precast bridge girders are considered to have low potential for dust release
- due to the nature of proposal construction works, the term ‘building volume’ (i.e. the size of the building) is not a representative parameter for determining dust emission magnitude as most of the construction materials would be precast and assembled or welded on-site and has therefore not been included in determining the dust emission magnitude
- dust emission magnitude for construction was assigned based on the highest category a site can fall into by assessing against each determining parameter. In summary, emission magnitude from sites 4 and 5 are assigned as *Large* and the rest of the sites are *Small*.

Table 5.6 Construction emission magnitude summary for each site

Site number	Chainage (m)	Construction works	Construction material	On-site concrete batching	Sandblasting	Emission magnitude
Site 1[2]	1,050-1,750	Track upgrade, culvert	Ballast, concrete sleeper, steel rail and precast culverts	No	No	Small
Site 2	1,750-2,200	Track upgrade, culvert		No	No	Small
Site 3	10,280-10,520	New Track	Ballast, concrete sleeper, steel rail	No	No	Small
Site 4[2]	18,200-18,450	NA[1]	NA	**Yes**	No	Large
Site 5[2]	37,250-37,750	New Track, level crossing, bridge, culvert, road modification	Ballast, concrete sleeper, steel rail, precast culverts and precast bridge girders	**Yes**	No	Large
Site 6[2]	39,200-39,300	NA[1]	NA	No	No	Small
Site 7	40,350-41,000	New Track	Ballast, concrete sleeper, steel rail	No	No	Small

(1) No construction works would be conduct within construction compounds.

(2) Sites where construction compounds are included.

Track out from haulage routes

Track out is defined as 'the *transport of dust and dirt from the construction site onto the public road network. This arises when HDVs leave construction site with dusty materials which may spoil onto the road, and/or when HDVs transfer dust and dirt onto the road having travelling over muddy ground on site'* (Institute of Air Quality Management, 2014). Factors determining the dust emission magnitude include vehicle size, vehicle speed and vehicle numbers.

Heavy duty vehicles (HDVs) would arrive and depart construction sites and from/onto public roads via several site access points as shown in the sensitive receptor figure in Appendix A.

Sensitive receptors near three site access points have the potential to be affected by track out dust as shown in Table 5.3. Peak traffic movements per day for each section are as follows:

- 319 for HDVs including haulage and delivery trucks
- 18 for water tanks
- 80 for light vehicles (cars and utility vehicles).

The total length that HDVs could travel on unpaved roads before reaching access points is expected to be longer than 100m. The soil type at all the site access points is sandy/clay with a high potential for dust generation on public roads.

In consideration of the number of daily truck movements, the haulage route length and the type of soil at the construction sites, the dust emission magnitude for track out at all three routes is conservatively considered to be in the *Large* category.

5.2.1.3 Step 2B – Determine the sensitivity of the area

The sensitivity of the surrounding land uses takes account of a number of factors. These are:

- the specific sensitivities of receptors
- the number of receptors and their proximity to the site
- local background PM_{10} concentrations
- site-specific factors that may reduce the risk of wind-blown dust (e.g. trees).

The majority of sensitive receptors identified in this assessment are residential in nature, while a few are educational, commercial and recreational receptors. Residential and educational receptors are considered to be *high* sensitivity receptors to dust soiling and health effects. Commercial and recreational receptors are considered to be *medium* sensitivity receptors.

The PM_{10} annual average concentration monitored at Wagga Wagga North AAQMS was above Air NEPM standard of 25 µg/m^3 in 2018 while below the standard in other years (2016 to 2020). The background annual PM_{10} concentration was conservatively assumed to be above the standard for the purposes of this risk assessment.

The matrices for determining the sensitivity of the surrounding area to dust soiling and human health effects are presented in Table 3.1 and Table 3.2.

Based on the sensitivity assessment matrices in Table 3.1 and Table 3.2, and the sensitive receptors identified in Table 5.2 and Table 5.3, the sensitivity of the surrounding areas to dust soiling and human health effects is summarised in Table 5.7.

Table 5.7 Summary of sensitivity of the surrounding areas

Earthworks and construction			Trackout		
No.	Dust soiling	Human health	No.	Dust soiling	Human health
Site 1	Low	Low	Route 1	Low	Medium
Site 2	Low	Low	Route 2	Low	Medium
Site 3	Low	Low	Route 3	Medium	High
Site 4	Low	Low	Not relevant		
Site 5	Medium	High			
Site 6	Low	Low			
Site 7	Low	Low			

5.2.1.4 Step 2C – Define the risk of impacts

The dust emission magnitudes for earthworks, construction and track out were combined with the sensitivity of the area to determine the risk of dust impacts. The matrices for risk of dust impacts are presented in Table 3.3 and Table 3.4.

Based on the dust emission magnitudes determined in section 5.2.1.2, the sensitivity of the surrounding areas in Table 5.7 and determining matrices in Table 3.3 and Table 3.4, dust risks from earthworks, construction and track out activities associated with the proposal are summarised below and in Table 5.8:

Earthworks on:

- Site 5 would have medium risk of dust soiling and high risk of human health impacts.
- Site 1 to site 4 and site 6 to site 7 would have low risk of dust soiling and human health impacts.

Construction works on:

- Site 4 would have low risk of dust soiling and human health impacts.
- Site 5 would have medium risk of dust soiling and high risk of human health impacts.
- Sites 1, 2, 3, 6 and 7 would have negligible risk of dust soiling and human health impacts.

Track out activities on:

- Route 3 would have medium risk of dust soiling and high risk of human health impacts.
- Routes 1 and 2 would have low risk of dust soiling and medium risk of human health impacts.

Table 5.8 Summary of dust risks

Site location	Earthworks		Other construction activities		Site location	Track out	
	Dust soiling	Human health	Dust soiling	Human health		Dust soiling	Human health
Site 1	Low	Low	Negligible	Negligible	Route 1	Low	Medium
Site 2	Low	Low	Negligible	Negligible	Route 2	Low	Medium
Site 3	Low	Low	Negligible	Negligible	Route 3	Medium	High
Site 4	Low	Low	Low	Low	Not relevant		
Site 5	Medium	High	Medium	High			
Site 6	Low	Low	Negligible	Negligible			
Site 7	Low	Low	Negligible	Negligible			

5.2.1.5 Step 3 – Site-specific mitigation

As stated in section 5.2.1.4, risks are described in terms of a negligible, low, medium, or high risk. Where there are low, medium, or high risks of an impact, then site-specific mitigation is required based on the risk level. For cases where the risk category is negligible, no mitigation measures beyond those required by legislation is required. For general mitigation measures, the highest risk category was applied. To minimise the dust impacts associated with the proposal, site-specific mitigation measures are presented in Chapter 7.

5.2.1.6 Step 4 – Determine significance of residual impacts

For all construction activities, the aim is to prevent significant impacts on receptors through effective mitigation. As stated in the IAQM guidance, this is normally possible. Therefore, with the implementation of site-specific mitigation measures detailed in Chapter 7, residual dust impacts would not be of significance in terms of dust soiling and health effects.

5.2.2 Qualitative assessment

For areas i.e. gaps in chainage where between construction sites 1 to 7 (see Table 4.1 and Table 4.2) where no sensitive receptors are located within 350m of the construction footprint, and haulage routes where no receptors within 50m of haulage roads up to 500m from the access points, a detailed risk assessment of dust impacts was 'screened out'. The IAQM guidance indicates the level of risk to dust impacts would be negligible and any effects would not be of significance.

Nevertheless, potential dust emissions at these locations are addressed in this section to assist with developing site-specific mitigation measures.

The main dust impacts during construction of the proposal would be generated by:

- site clearance and construction site establishment
- vehicle movements on paved and unpaved roads
- handling, transfer, and storage of material
- handling, transfer and stockpiling of spoil material
- erosion of stockpiles and exposed areas
- bulk earthworks operations such as excavation and earth moving activities
- movement of on-site machinery
- re-contouring of land and soil exposure for reseeding
- operation of a mobile concrete batching plant
- demolition of existing roadways (e.g. Burley Griffin Way realignment)
- construction of surface roads, under bridges and culverts
- construction and installation of above ground infrastructure (e.g. crossing loops, new tracks)
- relocation of utility services.

Table 5.9 provides further detail of the main dust emission sources and associated activities for the proposal.

Due to the nature of the proposal, construction works would progress as per the construction schedule outlined in Table 5.1. Dust emissions from any part of the proposal site would be intermittent and would cease once construction works for that area is complete.

Furthermore, most of the dust emissions would likely to only occur during working hours as presented in section 5.1. Outside of these hours and under certain meteorological conditions (e.g. dry conditions and high winds) dust may be also generated from stockpiles and exposed surfaces.

With mitigation measures proposed in Chapter 7 in place, dust impacts during construction can be effectively minimised.

Table 5.9 Emission sources and construction activities

Stage of works	Activities which may generate dust
Site establishment and enabling works	• property access modifications along the proposal including relocation of existing facilities • demolition of buildings and other structures • establishing ancillary facilities and construction sites • vegetation removal • erecting temporary fencing • establishing site access roads where required • utility relocations as required • delivering and stockpiling materials including rail, sleepers, ballast, culverts and structural fill.
Earthworks and drainage	Earthworks: • tracks: excavation or blasting for the earth formation • culverts and underbridges: excavation to the required depth • crossing loops: excavation beside the new track for the length of the crossing loop • turnouts: construction of turnouts • level crossings: earthworks to the road to suit the new rail level height, road pavement construction • road modifications and new bridges: earthworks as required • new alignment areas: earthworks as required • embankment and cuttings; earthworks as required • construction of ancillary infrastructure: earthworks as required. Drainage: • excavation of earth material from the side of the existing track formation, and trim and compact base and sides of the drain • formation of spoil mounds.

Stage of works	Activities which may generate dust
Track works	The installation of: • tracks: trim formation, place ballast and concrete sleepers • culverts: place ballast, sleepers, and rails on top of the culvers • crossing loops: place and compact formation material, place ballast, sleepers and rails • turn outs: place ballast, sleepers, and rails • level crossings: installation of concrete or steel top level crossing, road pavement construction • new bridges construction.
Rail maintenance access road	• clearing of vegetation • placing gravel layer surfacing.
Road modifications	Road modifications will be conducted at Burley Griffin Way, Corby's Lane, Old Sydney Road, Ironbong Road, Dirnaseer Road, Old Cootamundra Road, and a number of unformed roads and private access tracks: • relocation of existing services • earthworks • installation of bridges, culverts and level crossings.
Finishing and landscaping	• demobilising site compounds and facilities • removing all materials, waste, and redundant structures from the works sites • forming, and stabilising of spoil mounds • removing of temporary fencing • establishment of permanent fencing • decommissioning of site access roads that are no longer required • restoration of disturbed areas as required, including revegetation where required.
Concrete batch plants	Two concrete batching plants at construction compounds 11 and 25 and proposed mobile concrete batching plants at other compounds will supplement supply from existing ready-mix plants to be used for construction drainage and bridges. Dust may generate from: • sand and aggregate unloading and transferring to elevated bins • fugitive emission from conveyers • weigh hopper loading and mixer loading • sand and aggregate spillage on the road and within the yard • wind erosion from stockpiles, bunkers, and other exposed surfaces.

5.3 Gaseous emissions

Gaseous emissions including PM_{10}, $PM_{2.5}$, CO, NO_x, SO_2, VOCs and PAHs would be generated from vehicles and fugitive sources during the construction phase.

5.3.1 Vehicle emissions

5.3.1.1 On-site plant and machinery

Diesel fuel combustion from vehicle movements and on-site plant and machinery operation would generate, CO, NO_x, SO_2 and trace amounts of non-combustible hydrocarbons (i.e. VOCs and PAHs) in addition to PM_{10} and $PM_{2.5}$ The emission rates and potential impact on surrounding areas would depend on the number and power output of the combustion engines, the quality of fuel used, the condition of the engines and the intensity of use.

During the construction phase, equipment, materials, and workers would be transported to the proposal construction site along the proposal and construction compounds on haulage roads and RMAR. Vehicle movements during construction are estimated to be as follows across the whole proposal site:

- Heavy vehicles:
  - haulage and delivery trucks: peak movements of 319 per day per section
  - water tankers: peak movements of 18 per day per section.
- Light vehicles:
  - cars and utility vehicles: peak movements of 80 per day per section.

The plant and machinery involved in the proposal construction include excavators, rollers, dozers, graders, compactors, rigid tippers, articulated dump trucks, water carts, road cranes, franna cranes, scrapers, front end loaders, hydrema dumpers, flashbutt Welders, piling rigs and concrete trucks.

Fuel combustion emissions from plant and equipment along the proposal would be intermittent and transient. Given the anticipated duration of works at any given location, the likely numbers of emission sources, and scheduling of activities (i.e. not all machinery would be operating at the same location simultaneously), gaseous emissions are not anticipated to significantly influence local air quality. Emissions would be adequately manageable through the implementation of mitigation measures (refer to Chapter 7).

5.3.1.2 Diversions and traffic flow

Table 5.10 presents the details of the proposed traffic diversions during construction for the proposal including the increased travel time and distance. Further details of the traffic diversions are presented in Technical Paper 3 – Traffic, Transport and Access Impact Assessment report (WSPa).

With the exception of Hibernia Street, the proposed diversion routes for all other roads are through rural areas with few sensitive receptors likely to be affected by increased traffic. For these roads, the report (WSP 2021b) '*only low volumes of traffic are expected to be generated on the diversion route as result of construction so the impact on the detour roads and intersections are likely to be negligible*'. Consequently, increased air emissions from construction traffic on these diversion routes is not expected to be of significance.

There will be 1 minute of additional travel time during construction of Burley Griffin Way overbridge. Sensitive receptors on Troy Street may potentially be impacted by an increase in vehicular traffic (including construction) during the diversion. While an increase in vehicular emissions is expected to occur on Troy Street, potential impacts will be minor, of short duration and temporary.

Table 5.10 Location of road closures and traffic diversions

Chainage	Road	Construction type	Increased travel time / distance
5,600	Old Sydney Road	Level crossing	3 minutes / 6km
8,150	Ironbong Road	Level crossing	17 minutes / 13.1km
18,490	Dirnaseer Road	Underbridge	12 minutes / 13.5km
28,280	Old Cootamundra Road	Underbridge	17 minutes / 14.9
37,550	Hibernia Street/Burley Griffin Way	Overbridge	1 minute / No change

5.3.2 Fugitive emissions

Diesel and petrol fuel would be stored at No.11, 18 and 25 construction compounds at volumes of 5 to 10,000 litres. Lubricating and hydraulic oils and greases, acids and disinfectant would also be stored at multiple compounds. Fuel, oils, and greases would be stored in a bunded area within drums, and refuelling would be conducted in the bunded area. Acids and disinfectant would be stored within immediate bulk containers within a bunded area.

Fuel storage, plant, machinery, and vehicles refuelling, chemicals storage and handling have the potential to generate fugitive emissions. These emissions are expected to be minor and readily dispersed under normal conditions. In an event of leaking or spilling, local air quality is likely to be adversely impacted for a short period. However, these events are rare or may never happen during construction if proper management (Chapter 7) and handling procedure are in place and strictly followed.

In summary, with appropriate handling and storage, air quality impacts from these fugitive sources are considered to be not of significance.

5.4 Odour emissions

Odour emissions have the potential to be generated during following works:

- excavation works if contaminated materials are found
- asphalt laying during road modification works.

A review of Technical Paper 14 – Contamination Assessment (WSPb) indicated there are no contaminated sites listed in the NSW EPA Contaminated Land Record Database within 1km of the proposal site. A site walkover also indicated no obvious signs of contamination were observed. The contamination assessment identified a number of areas of environmental concern (AECs), the majority of which were considered to pose a low to medium risk. If present, the contamination is likely to be localised and manageable through the implementation of mitigation measures during construction.

In an event that contaminated materials are encountered, work in the affected area would cease immediately and the unexpected finds protocol would be implemented. Odour emissions would be effectively controlled and not cause adverse impacts on sensitive receptors.

A number of road modifications have been identified at Old Sydney Road, Ironbong Road, Dirnaseer Road, Old Cootamundra Road, Corbys Lane, Burley Griffin Way and a number of unformed roads and private access tracks that the proposal interfaces with. Given the short length that each road needs to be modified and the transient nature of the odour emissions from asphalt road laying, odour impact from asphalt laying during road modification works is not of significance.

5.5 Ecological sensitivity

As part of the assessment of potential air quality impacts on the receiving environment, ecological receptors within the proposal were considered. An ecological receptor refers to any sensitive habitat affected by dust soiling.

A review of Technical Paper 1 – Biodiversity Development Assessment Report (WSPc) states '*elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the proposal site activities. This has the potential to reduce photosynthesis and transpiration and cause abrasion and heating of leaves resulting in reduced growth rates and decreases in overall health of the vegetation. Dust pollution is likely to be greatest during periods of substantial earthworks, vegetation clearing, vehicle movements for construction and decommissioning activities and during adverse weather conditions. However, deposition of dust on foliage is likely to be highly localised, intermittent and temporary and is therefore not considered to be a major impact of the proposal*'.

While no specific dust mitigation measures were included in Technical Paper 1 (WSPc, Chapter 9), several management measures will help to ensure dust impacts from construction works are minimised. These include:

- preparation of a soil management sub-plan
- construction areas to be located outside of tree protection zones i.e. compounds, stockpiles, fuel storage, laydown areas, staff parking
- topsoil stockpiles to be limited to 2.5m in height
- rehabilitation and reinstatement of disturbed area to be undertaken progressively.

6 Operational impacts

6.1 Rail

6.1.1 Operational sources and characteristics

The Inland Rail trains would include a mix of grain, bulk freight, and other general transport trains. No passenger services are planned to operate between Illabo and Stockinbingal. Train speeds would vary according to axle loads and range from 80 to 115km/h. Diesel locomotives traversing through the I2S proposal would generate the following air emissions:

- PM_{10} and $PM_{2.5}$
- NO_x, CO and SO_2
- VOCs and SVOCs (e.g. PAHs).

The proposal would be trafficked by an average of 6 trains per day (both directions) from commencement of operations in late 2026, increasing to about 11 trains per day (both directions) in 2040.

Given the greenfield setting of the I2S proposal, its operation would result in an increase of local air emissions from the diesel locomotives travelling along the proposal. However, considering the low frequency of train movements and remoteness of the proposal, air dispersion modelling for operational emissions was not considered to be required.

A review of potential air quality impacts from several rail projects in NSW was undertaken and discussed in the following sections to assess the potential impacts for the proposal.

6.1.2 Comparison of air quality for similar projects with the proposal for normal operations

6.1.2.1 Northern Sydney Freight Corridor – Strathfield Rail Underpass Project

The Air Quality Impact Assessment Report (Parsons Brinckerhoff, 2012) for the Northern Sydney Freight Corridor Strathfield Rail Underpass Project (NSFC project) was reviewed with respect to potential air quality impacts of operational freight trains on the receiving environment.

The assessment included modelling of emissions from three classes of diesel locomotives (81, 82 and 90) at 75km per hour for 31 movements per day in each direction in 2026. Modelling results showed that for all pollutants assessed (PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2 and benzene), predicted pollutant (incremental and cumulative) ground level concentrations (GLCs) for 2026 were below the relevant NSW impact assessment criteria (IAC) at a distance of 50m from the track.

A comparison between NSFC Project and the proposal is presented in Table 6.1. Maximum predicted incremental concentrations of the NSFC Project are presented in Table 6.2. The proposal would have much less train movements than the NSFC project. As such, air quality impact from the proposal is expected to be lower than that from the NSFC Project and sensitive receptors are not anticipated to be adversely impacted by the proposal.

Table 6.1 Comparison between NSFC project and I2S

Item	NSFC Project	The proposal
Train movements (per day)	31 in each direction	11 (2040)
Train speed (km/h)	75	80–115
Nearest receptor location	Adjacent to corridor	20m to proposal
Locality setting	Urban	Rural
Predicted impacts	Predicted incremental (refer to Table 6.2) and cumulative concentrations for all monitored pollutants were below relevant NSW IAC at all modelled distances (smallest distance was 50m).	Incremental concentrations expected to be lower than that presented in Table 6.2 and below IAC. Given some background data exceeded criteria, cumulative concentrations would be dominated by background concentrations with the contribution from the proposal expected to be low.
Impacts on receptors	Predicted cumulative concentration were below NSW IAC at all locations from contour plots in the report. Sensitive receptors would not be adversely impacted were concluded.	Not expected to be adversely impacted.

Table 6.2 Maximum predicted incremental concentrations at all modelled distances of the NSFC Project

Pollutants	Averaging period	Maximum at all distances and all modelled years ($\mu g/m^3$)[1]	Percentage of criteria	Criteria ($\mu g/m^3$)
NO_2	1 hour	217[1]	NA	246
	Annual	35[1]	NA	62
CO	15 minutes	27	0.03%	100,000
	1 hour	20	0.07%	30,000
	8 hours	19	0.19%	10,000
PM_{10}	24 hours	0.06	0.12%	50
	Annual	0.009	0.04%	25
$PM_{2.5}$	24 hours	2.0	8.0%	25
	Annual	0.3	3.8%	8
SO_2	10 minutes	28.4	4.0%	712
	1 hour	19.9	3.5%	570
	24 hours	10.0	4.4%	228
	Annual	1.6	2.7%	60
VOCs (as benzene)	1 hour	3.19	11.0%	29
	Annual	0.3	3.1%	9.7

(1) Only cumulative concentrations were provided in the NSFC Project report due to the application of the ozone limiting method conversion.

6.1.2.2 Botany Rail Duplication Project

The Botany Rail Duplication Project (BRD project) involves the construction and operation of a new second track within the existing Botany Line rail corridor between Mascot and Botany. Outcomes of the Air Quality Impact Assessment Report (WSP/GHD IR Joint Venture, 2019) with respect to the potential impacts of operational phase for the BRD project were reviewed.

A dispersion modelling assessment of air emissions (NO_2, CO, SO_2, benzene, PM_{10} and $PM_{2.5}$) from diesel freight trains (NR class locomotives (NR121) and 93 class locomotives (9317)) was undertaken for five scenarios (S1 to S5): the existing situation (2019) to the 10-year future build scenario (2034). Projected average daily locomotives travelling to and from Port Botany for the five scenarios ranged from 40 (2019 existing) to 112 (2034 future build) respectively.

The modelling indicated that for all pollutants modelled, predicted pollutant GLCs were below the relevant IAC at all sensitive receptors and for all averaging periods. As expected, the highest predicted concentrations occurred for Scenario 5, for which the maximum number of trains are projected to occur.

A comparison between the BRD Project and the proposal is presented in Table 6.3. Maximum predicted incremental concentrations of the BRD Project are presented in Table 6.4. The proposal is estimated to have much less train movements than the BRD project. As such, air quality impacts from the proposal are expected to be much lower than that from the BRD Project and sensitive receptors are not anticipated to be adversely impacted by the proposal.

Table 6.3 Comparison between Botany Rail Duplication Project and I2S

Item	Botany Rail Duplication Project	I2S
Peak train movements (per day)	40–112	11 (2040)
Train speed (km/h)	30–45	80–115
Nearest receptor location	adjacent to corridor	20m to proposal
Locality setting	Urban	Rural
Predicted impacts	Predicted incremental (refer to Table 6.4) and cumulative concentrations for all monitored pollutants were below relevant NSW IAC at all receptors.	Incremental concentrations expected to be lower than that presented in Table 6.4 and below IAC. Given some background data exceeded criteria, cumulative concentrations would be dominated by background concentrations and the contribution from the proposal is expected to be low.
Impacts on receptors	Sensitive receptors would not be adversely impacted.	Not expected to be adversely impacted.

Table 6.4 Maximum predicted incremental concentrations at all modelled receptors for all modelled scenarios of the BRD Project

Pollutants	Averaging period	Maximum at all modelled sensitive receptors for all modelled scenarios (µg/m^3)	Percentage of criteria	Criteria(µg/m^3)
NO_2	1 hour	163	66%	246
	Annual	25	40%	62
CO	15 minutes	128	0.1%	100,000
	1 hour	97	0.3%	30,000
	8 hours	25	0.3%	10,000
PM_{10}	24 hours	0.7	1.4%	50
	Annual	0.2	0.8%	25
$PM_{2.5}$	24 hours	0.7	3%	25
	Annual	0.2	3%	8
SO_2	10 minutes	125	18%	712
	1 hour	87	15%	570
	24 hours	5	2%	228
	Annual	2	3%	60
VOCs (as benzene)	1 hour	0.3	1%	29

6.1.2.3 Inland Rail – Narrabri to North Star Project

The Narrabri to North Star Project (N2NS project), a section of the Inland Rail Project, estimates between 10 and 12 trains per day travelling north and south of Moree respectively in 2025 and 19 and 21 trains per day travelling north and south of Moree respectively in 2040. These estimates are additional to the rail traffic using the existing N2NS rail line. Chapter 13 Air Quality of the EIS report (WSP/Mott McDonald, 2017) for this project was reviewed.

Modelling was not conducted for operational emissions for this project. The NSFC project was referenced to indicate the potential impacts Chapter 13 of the Narrabri to North Star Project EIS states '*as the levels of operational rail traffic along the proposal site would be much lower than for the Northern Sydney Freight Corridor, the operational emissions as a result of the proposal are expected to be much lower. The emissions from use of the existing rail corridor as a result of the proposal would increase as a result of the increase in the number of trains travelling along the corridor, however the emissions are still expected to be below the relevant impact assessment criteria*.'

Table 6.5 provides a comparison between the N2NS project and the proposal. The estimated maximum train movements for I2S are lower than that for the N2NS project. As such, it is considered reasonable to predict the operational impacts from the proposal would be lower than that from the N2NS project.

Table 6.5 Comparison between Narrabri to North Star Rail Track Project and I2S

Item	N2NS	I2S
Train movements (per day)	19 north of Moree and 21 South of Moree in addition to existing rail traffic	11 (2040)
Train speed (km/h)	80–115	80–115
Locality setting	Rural	Rural
Nearest receptor location	3 receptors within 20m of proposal site	20m to proposal
Predicted impacts	No modelling was conducted. Estimated to be below IAC by referring to Northern Sydney Freight Project.	Impacts from the I2S proposal expected to be lower than that from the N2NS project.

6.1.3 Comparison of air quality for similar projects with the proposal during train idling

Idling of trains is expected to occur at the crossing loop located at chainage 10,000m (north of Ironbong Road) with the potential to generate air emissions. A review of the following three NSW projects was undertaken in consideration of potential air quality impacts from train idling:

- Botany Rail Duplication
- Narromine to Narrabri
- North Star to NSW/Queensland Border.

These projects are discussed in further detail in the following sections.

There are five sensitive receptors within 100m of the proposal (Table 4.3). It is noted that receptors R226696, R226828 and R226929 are located within the proposal site and have not been assessed as a sensitive receptor.

6.1.3.1 Botany Rail Duplication project

The Project botany rail duplication project (BRD project) air quality assessment report (WSP/GHD IR Joint Venture, 2019) estimated emission rates for different operating notches including idling. The air emission rates for train in the idle mode are much lower than in operating mode as shown in Table 6.6. Although no specific modelling was conducted at the crossing loop for the BRD project, the total contributions from the project are expected to be close to the data presented in section 6.1.2.2, given the low emissions from idling trains.

As presented in section 6.1.2.2, the train movements from the proposal are estimated to be much lower than the BRD Project. The total emissions at the crossing loop of the proposal are anticipated to be low.

Table 6.6 Locomotive pollutant emission rates from BRD Project

Operating notch	NOx (g/hr)	CO (g/hr)	HC (as Benzene) (g/hr)	SO_2 (g/hr)	PM_{10} (g/hr)	$PM_{2.5}$ (g/hr)
Idle	317	42	0	7	6	6
1-8	3762-32,612	193-3146	2-11	221-3602	40-237	38-230

6.1.3.2 Inland Rail-Narromine to Narrabri Project

The Inland Rail-Narromine to Narrabri Project (N2N project) modelled emissions of locomotives idling at crossing loop. Chapter B10 Air Quality of the EIS report (Jacobs/GHD IR Joint Venture, 20219) indicates that based on the assumption of two adjacent locomotives at idle notch, the modelling predicted compliance with the 1 hour NO_2 criterion at a distance of approximately 25m from the emission source with a background concentration of 70µg/m^3.

Given the short duration of trains in the idling mode and the distance to sensitive receptors (the nearest receptor is 78m from the crossing loop and five receptors in total within 100m), air quality impacts from trains idling at the crossing loop are not anticipated to be significant.

6.1.3.3 Inland Rail-North Star to NSW/Queensland Border Project

The North Star to NSW/Queensland Border Project (NS2B project) Air Quality Technical Report (Future Freight, 2020) included modelling of emissions in consideration of idling. The assumptions for the modelling are:

- locomotive type and configuration
- an average of 17 trains per day
- 75 per cent of journey time to include travel time, and the remaining 25 per cent of journey time where trains are stationary and producing idling emissions.

The emission rates estimated in the report are presented in Table 6.7. The idling emission rates are less than 1 per cent of the total emissions.

The maximum predicted concentrations are presented in Table 6.8. The results demonstrate the compliance with the assessment criteria for the scenario modelled which take into consideration of idling emissions. With less train movements from the proposal, the potential impacts are expected to be lower.

Table 6.7 Modelled emission rates in the NS2B Project

Pollutant	Total NS2B emissions (g/s)	Total NS2B idling emissions (g/s)
NOx	5.366	0.03556
TSP	0.33	0.00089
PM_{10}	0.322	0.00087
$PM_{2.5}$	0.309	0.00083
CO	2.138	0.00621
Total VOC	0.654	0.00379
SO_2	0.0015	0.0000042

Table 6.8 Maximum predicted incremental concentrations at sensitive receptors of the NS2B Project

Pollutants	Averaging period	Maximum predicted concentrations(µg/m³)	Criteria(µg/m³)
NO_2	1 hour	168[1]	246
	Annual	28.2[1]	62
TSP	Annual average	0.5	90
PM_{10}	24 hours	48.1[1]	50
	Annual	17.0[1]	25
$PM_{2.5}$	24 hours	2.5	25
	Annual	0.4	8
VOCs (as benzene)	1 hour	1.2	29

(1) Assessment was completed as a cumulative contemporaneous assessment within the dispersion model, and only cumulative concentrations were presented.

6.1.4 Summary

Train movements projected for the proposal are lower than that for the three rail projects discussed in section 6.1.2 and the potential impacts associated with the operation of the proposal are expected to be lower than that from the reference projects. Air dispersion modelling conducted for both the NSFC Project and the BRD Project demonstrated compliance with the relevant IAC for all assessed pollutants.

There is also the potential for the generation of combustion emissions from idling diesel locomotives at the crossing loop (chainage 10,000m) The reference projects in section 6.1.3 demonstrate that air emissions in idle mode are much lower than that in the operating mode. The dispersion modelling conducted for the NS2B Project demonstrated compliance with the assessment criteria while taking into consideration idling emissions.

Most of the proposal traverses a rural area with only five permanent sensitive receptors located within 100m of the proposal, all of which are located in Stockinbingal and no other permanent sensitive receptors are located within 100m of other parts of the proposal. The potential air quality impacts on the nearest sensitive receptors are expected to be low, and the impacts at other parts of the proposal are anticipated to be not of significance.

In summary, air quality impacts from the proposed operation of the proposal are expected to be low at the nearest sensitive receptors.

6.2 Road

Potential changes in air quality due to road modifications, including Burley Griffin Way and Ironbong Road, are not considered to be of significance.

During operation of the proposal, it is anticipated there will be minor increases in road traffic due to maintenance activities and operational requirements including staff changeovers associated with additional rail services. These increases are expected to be in the range of one or two vehicles per day. Consequently, there will be a minimal increase in vehicular emissions from operational activities with no significant contribution to future background concentrations anticipated.

7 Mitigation and management

This section provides air quality management measures during construction and operation.

7.1 Approach to mitigation and management

Environmental management for the proposal would be carried out in accordance with the environmental management approach as detailed in Chapter 27 of the EIS (Approach to environmental management and mitigation).

An air quality management sub-plan would be prepared as part of the Construction Environmental Management Plan (CEMP) and implemented during construction to ensure that air quality impacts do not exceed relevant air quality criteria. The air quality management sub-plan would help ensure that dust and emissions are managed in an environmentally sound manner, and in accordance with statutory requirements.

During operation, air quality would be managed to achieve compliance with the operational environment protection licence.

7.2 Summary of mitigation and management measures

7.2.1 Approach to mitigation and management

Environmental management for the proposal would be carried out in accordance with the approach detailed in Chapter 27 (Approach to environmental management and mitigation) of the EIS.

This would include an air quality sub-plan, prepared as part of the CEMP and an operational environmental management framework (EMF).

7.2.2 Summary of mitigation measures

The mitigation measures to manage impacts to air quality from the proposal during detailed design / pre-construction, construction and operation phases are outlined in Table 7.1.

Table 7.1 Proposed specific mitigation measures for air quality

Issue/Impact	Mitigation and management measures	Project phase
General air quality management	An air quality management plan would be prepared and implemented as part of the Construction Environmental Management Plan. It would include measures to minimise the potential for air quality impacts on the local community and environment, and would address all aspects of construction, including: • spoil handling • machinery operating procedures • soil treatments • stockpile management • haulage dust suppression • monitoring.	Construction
Construction activities and earthworks that may cause dust impacts	Where sensitive receptors are located within the study area (350m from construction footprint and 50m of the route(s) used by construction vehicles on public roads, up to 500m from the site access points) for each key activity, or visible dust is generated from vehicles using unsealed access roads, road watering and/or other stabilising approaches would be implemented.	Construction
Blasting management	Blasting will not be undertaken if the prevailing wind conditions are likely to transport dust emissions towards the nearest sensitive receptors.	Construction

Issue/Impact	Mitigation and management measures	Project phase
Impacts on sensitive receptors (communications)	Where sensitive receptors are located in close proximity to construction sites, especially sites 4 and 6: • implement the Inland Rail Communications and Engagement Strategy which would include community engagement before work commences on site • display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary • display the head or regional office contact information.	Construction
Locomotive emissions	Locomotive emissions would be managed in accordance with the air quality management requirements specified in the rolling stock operator's environment protection licence.	Operation
Impacts during track maintenance	Maintenance service vehicles and equipment would be maintained and operated in accordance with the manufacturer's specifications.	Operation

7.3 Residual impacts

The management of any residual impacts is considered in Chapter 27 (Approach to environmental management and mitigation) of the EIS for both the construction and operation phase.

8 Conclusion

Dust impacts associated with construction of the proposal was conducted in accordance with the risk-based approach detailed in the IAQM guidance (Institute of Air Quality Management, 2014).

Gaseous and odour emissions from construction works and any dust related construction works 'screened out' by the IAQM guidance criteria was assessed qualitatively. Air quality impacts of potential emissions from the operation phase were assessed qualitatively by comparing train movements for three rail projects in NSW.

8.1 Construction

The risks of dust impacts prior to mitigation measures are as follows:

- Earthworks: high risk around site 5, low risk around sites 1 to 4 and sites 6 to 7
- Construction: high risk around site 5, negligible to low around sites 1 to 4 and 6 to 7
- Track out: medium risk from routes 1 and 2 and high risk from route 3.

With further site-specific mitigation measures in place, the residual dust impacts are not expected to be of significance.

Dust impacts around all other parts of construction footprint are not significant due to the absence of sensitive receptors within 350m and 50m of the route used by construction vehicles on the public highway up to 500m from the site access.

Gaseous and odour emissions generated during the construction phase would be minimised with mitigation measures in place and air quality impacts would not be significant.

Road diversions will occur during construction of level crossings and overbridges at four locations along the proposal. Except for Hibernia Street, the proposed diversion routes for all other roads are through rural areas with few sensitive receptors likely to be affected by increased traffic. The increase in air emissions from construction traffic on these diversion routes is not expected to be of significance.

There will be 1 minute of additional travel time during construction of Burley Griffin Way overbridge. Sensitive receptors on Troy Street may potentially be impacted by an increase in vehicular traffic (including construction) during the diversion. While an increase in vehicular emissions is expected to occur on Troy Street, potential impacts will be minor, of short duration and temporary.

There is the potential for dust to be deposited onto the foliage of vegetation in proximity to the proposal site activities. However, deposition on dust foliage is likely to be highly localised, intermittent and temporary and not considered to impact significantly on the proposal. Consequently, ecological receptors were not considered in the dust risk assessment.

8.2 Operation

During operations, particulate matter (of varying size fractions) and combustion emissions (e.g. NO_2, CO, SO_2, VOCs and SVOCs) would be generated. A literature review of the impact of freight trains on air quality for the following projects in NSW was conducted. The projects included:

- Northern Sydney Freight Corridor Strathfield Rail Underpass Project
- Botany Rail Duplication Project
- Narrabri to North Star Project
- Narromine to Narrabri Project
- North Star to NSW/Queensland Border Project.

The proposal would be trafficked by an average of 6 trains per day (both directions) from commencement of operations in late 2026, increasing to about 11 trains per day (both directions) in 2040.

The potential impacts associated with the operation of the proposal are expected to be lower than that from the reference projects. Air dispersion modelling conducted for both the NSFC Project and the BRD Project demonstrated compliance with the relevant IAC for all assessed pollutants.

The reference projects in section 6.1.3 demonstrate that air emissions in idle mode are much lower than that in the operating mode. The dispersion modelling conducted for the NS2B Project demonstrated compliance with the impact assessment criteria taking into consideration idling emissions.

Most of the proposal traverses a rural area with only five sensitive receptors located within 100m of the proposal in Stockinbingal and no receptors are located within 100m of other parts of the proposal. The potential air quality impacts on sensitive receptors in Stockinbingal are expected to be low, and the impacts at other parts of the are anticipated to be not of significance.

There is also the potential for the generation of combustion emissions from idling diesel locomotives at the crossing loop (chainage 10,000m) As air emissions generated during idle mode are much lower than that in the operating mode, potential air quality impacts on the receiving environment will also be lower. Consequently, potential air quality impacts from train idling emissions are not expected to be of significant.

Air quality impacts during operations can be managed at source through diesel fuel standards, locomotive maintenance, and emissions testing. Other management measures include minimising train idling near sensitive receptors.

Potential changes in air quality due to road modifications, including Burley Griffin Way and Ironbong Road, or operational traffic from the proposal are considered to be negligible.

In summary, air quality impacts during construction are not expected to be of significance with management measures in place. Air quality impacts during operation are expected to be low at the nearest sensitive receptors due to the projected frequency of trains using the proposal for the opening year in 2026 and future year 2040 together with the number of sensitive receptors likely to be affected.

9 References

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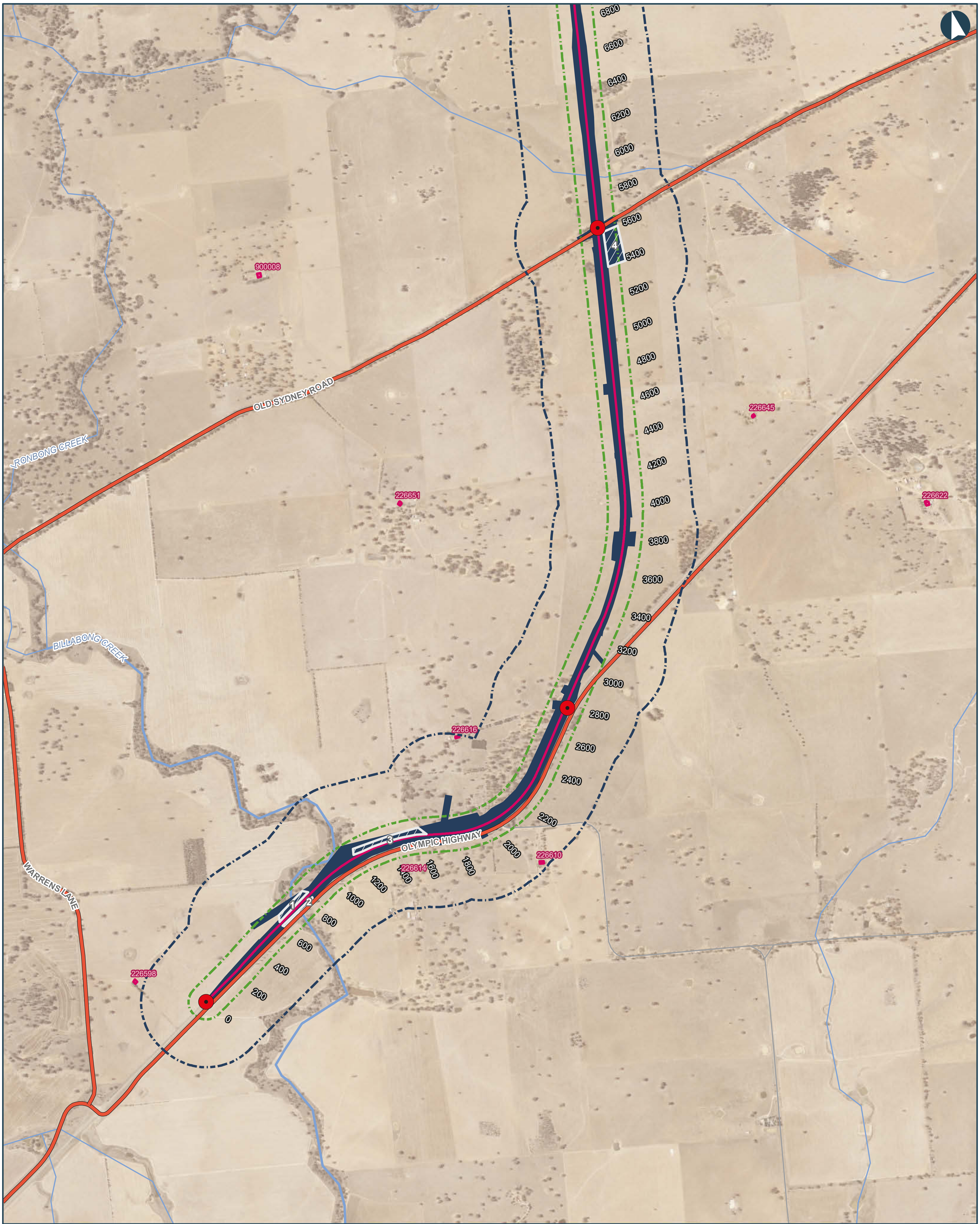
- WSPb, Technical Paper 14 – Contamination Assessment, 2022.
- WSPc, Technical Paper 1 – Biodiversity Development Assessment Report, 2022.

TECHNICAL PAPER 15

Air Quality Assessment

Appendix A Sensitive receptors

ILLABO TO STOCKINBINGAL ENVIRONMENTAL IMPACT STATEMENT



ILLABO TO STOCKINBINGAL Sensitive receptors

MAP 1 OF 7

0 0.25 0.5 0.75 1 Km

Coordinate System: GDA 1994 MGA Zone 55

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Date: 11/4/2021
Paper: A3
Author: IRDJV
Scale: 1:20,000
Data Sources: ARTC, NSWSS, ESRI

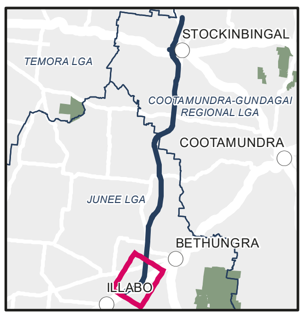
- Alignment of proposal
- Haulage Route
- Proposal site
- Within 350m of proposal site
- Within 100m of alignment
- Construction Compounds
- Construction site access point

Receptor Type

- Active Recreation
- Commercial
- Educational
- Place of worship
- Residential

Existing features

- Arterial road
- Sub-arterial road
- Local road
- Major Watercourse
- Minor Watercourse



INLAND RAIL
ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

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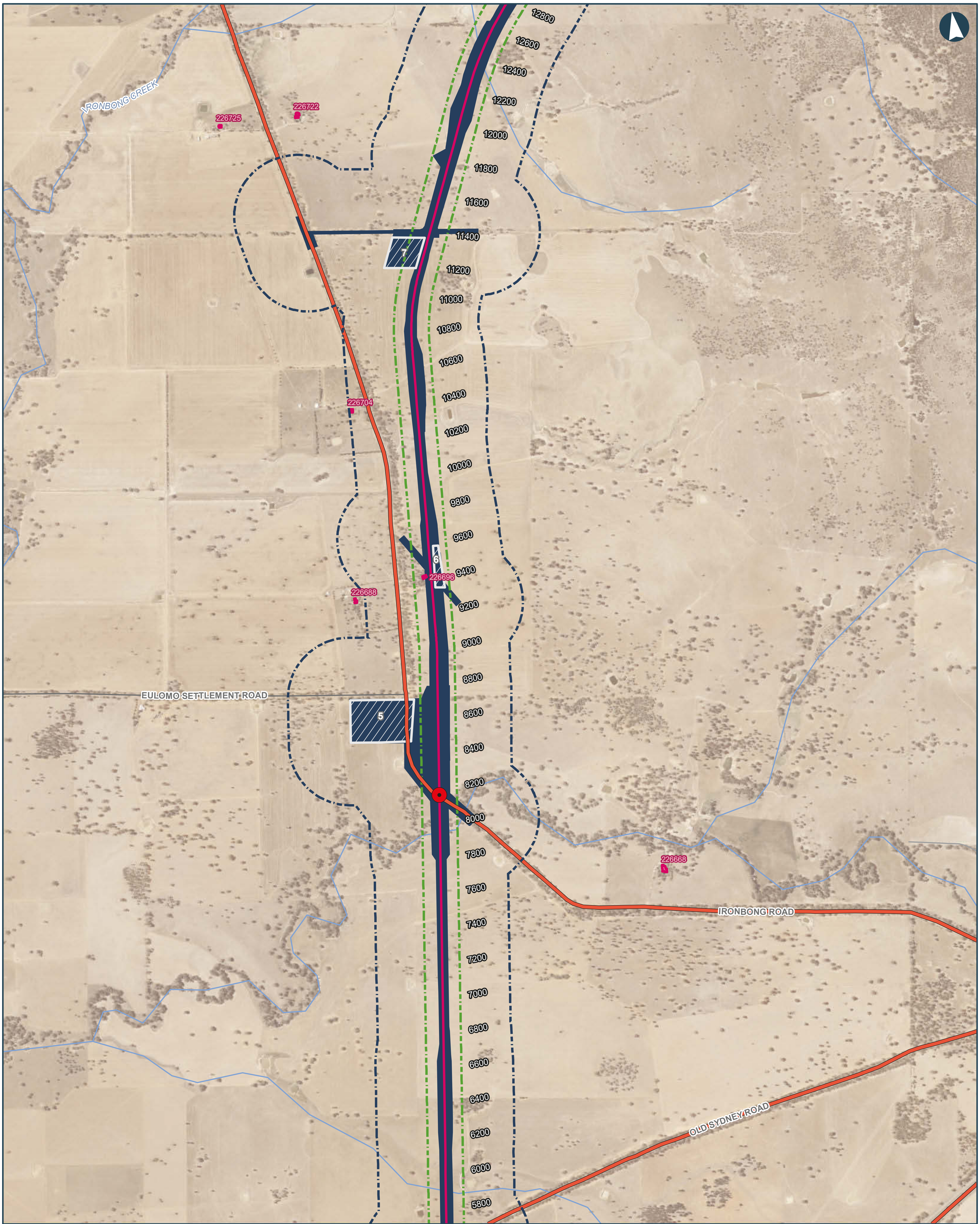

ILLABO TO STOCKINBINGAL Sensitive receptors

MAP 2 OF 7

0 0.25 0.5 0.75 1 Km

Coordinate System: GDA 1994 MGA Zone 55

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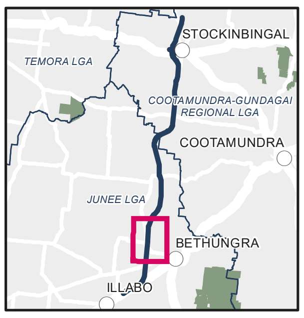
Date: 11/4/2021 Paper: A3
Author: IRDJV Scale: 1:20,000
Data Sources: ARTC, NSWSS, ESRI

- Alignment of proposal
- Haulage Route
- Proposal site
- Within 350m of proposal site
- Within 100m of alignment
- Construction Compounds
- Construction site access point

Receptor Type
- Active Recreation
- Commercial
- Educational
- Place of worship
- Residential

Existing features
- Arterial road
- Sub-arterial road
- Local road
- Minor Watercourse



INLAND RAIL ARTC

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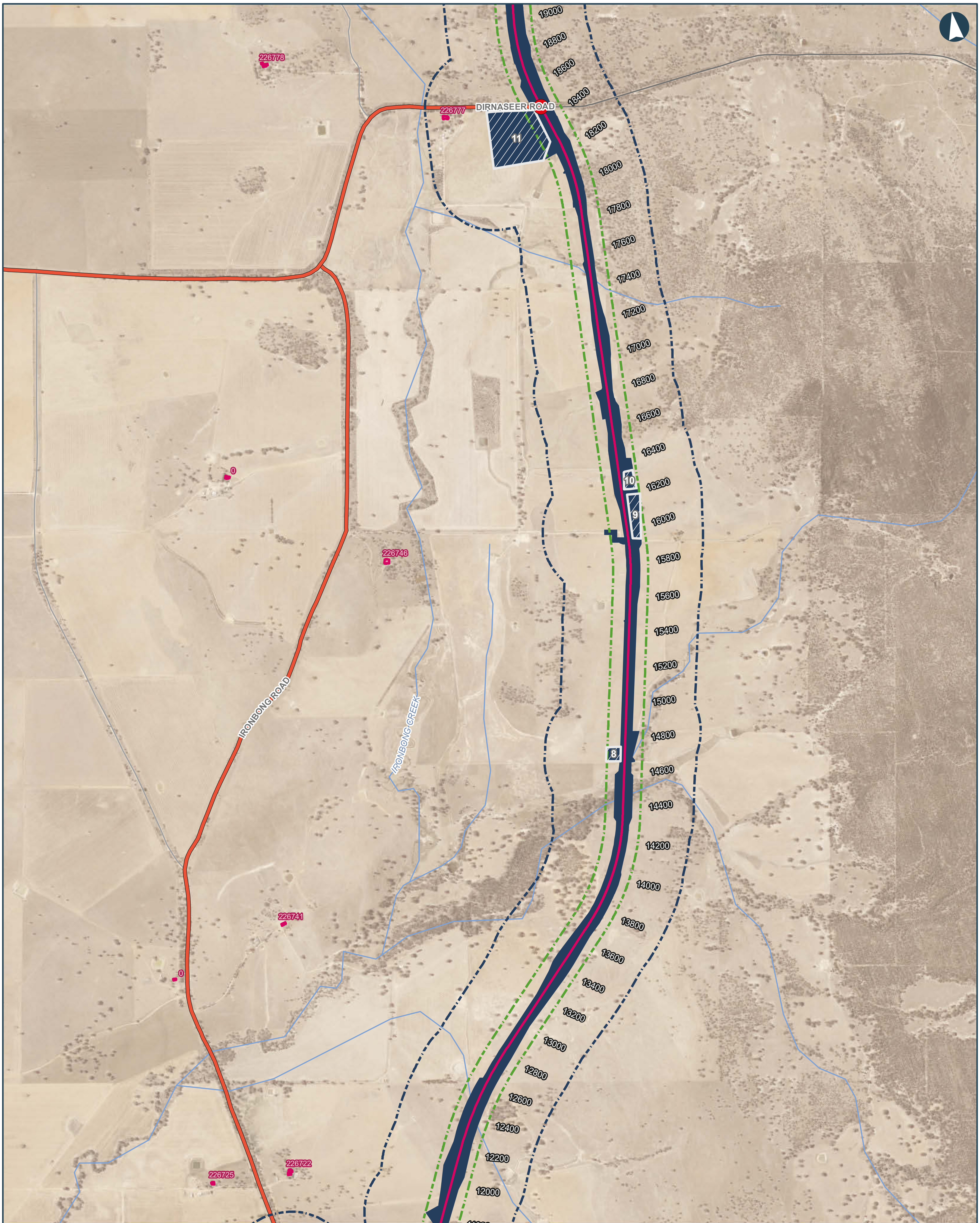


ILLABO TO STOCKINBINGAL Sensitive receptors

MAP 3 OF 7

0 0.25 0.5 0.75 1 Km

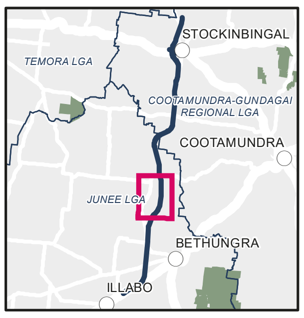
Coordinate System: GDA 1994 MGA Zone 55

Date: 11/4/2021
Author: IRDJV
Data Sources: ARTC, NSWSS, ESRI
Paper: A3
Scale: 1:20,000

- Alignment of proposal
- Haulage Route
- Proposal site
- Within 350m of proposal site
- Within 100m of alignment
- Construction Compounds
- Construction site access point

Receptor Type
- Active Recreation
- Commercial
- Educational
- Place of worship
- Residential

Existing features
- Sub-arterial road
- Local road
- Minor Watercourse



INLAND RAIL ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

ILLABO TO STOCKINBINGAL Sensitive receptors

MAP 4 OF 7

0 0.25 0.5 0.75 1 Km

Coordinate System: GDA 1994 MGA Zone 55

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Date: 11/4/2021 Paper: A3
Author: IRDJV Scale: 1:20,000
Data Sources: ARTC, NSWSS, ESRI

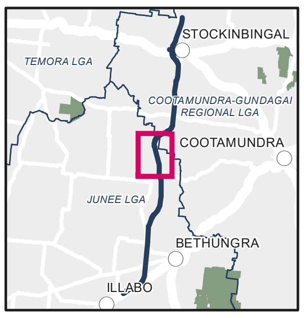
- Alignment of proposal
- Haulage Route
- Proposal site
- Within 350m of proposal site
- Within 100m of alignment
- Construction Compounds
- Construction site access point

Receptor Type

- Active Recreation
- Commercial
- Educational
- Place of worship
- Residential

Existing features

- Sub-arterial road
- Local road
- Minor Watercourse



INLAND RAIL ARTC

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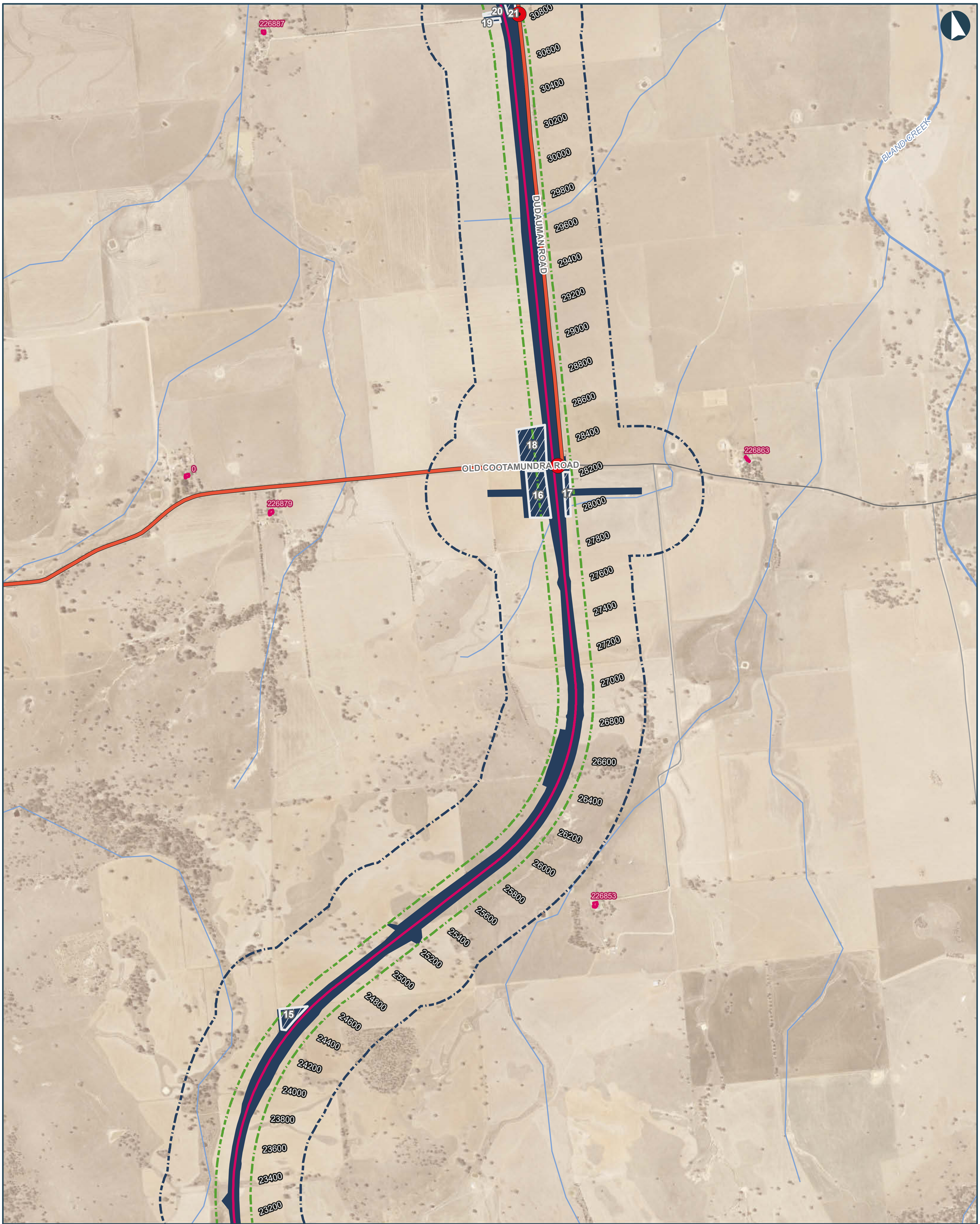


ILLABO TO STOCKINBINGAL Sensitive receptors

MAP 5 OF 7

0 0.25 0.5 0.75 1 Km

Coordinate System: GDA 1994 MGA Zone 55

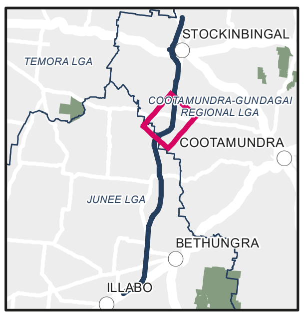
Date: 11/4/2021 Paper: A3
Author: IRDJV Scale: 1:20,000
Data Sources: ARTC, NSWSS, ESRI

Alignment of proposal
Haulage Route
Proposal site
Within 350m of proposal site
Within 100m of alignment
Construction Compounds

Construction site access point

Receptor Type
Active Recreation
Commercial
Educational
Place of worship
Residential

Existing features
Sub-arterial road
Local road
Major Watercourse
Minor Watercourse



INLAND RAIL
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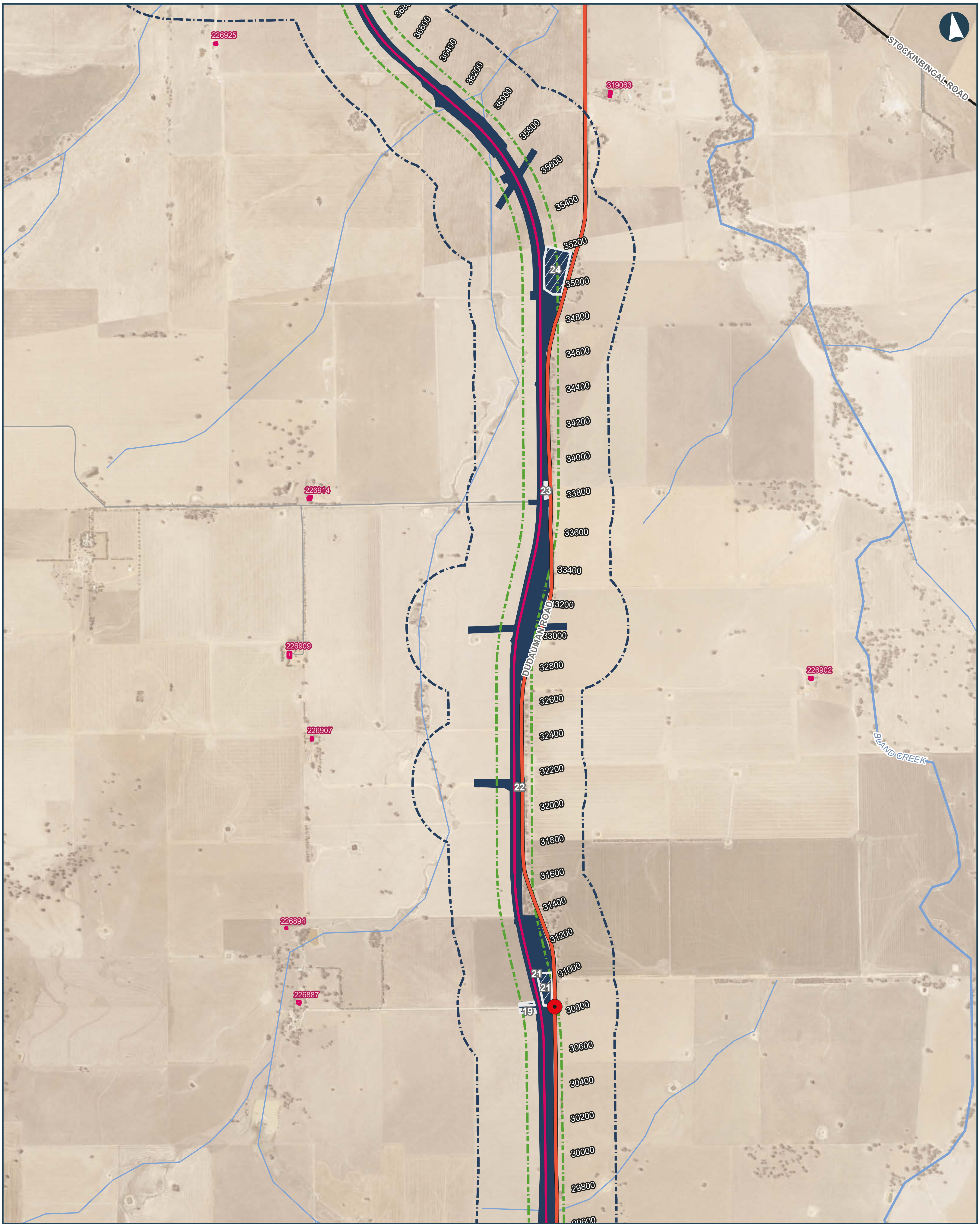

ILLABO TO STOCKINBINGAL Sensitive receptors

MAP 6 OF 7

0 0.25 0.5 0.75 1 Km

Coordinate System: GDA 1994 MGA Zone 55

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Date: 11/4/2021 Paper: A3
Author: IRDJV Scale: 1:20,000
Data Sources: ARTC, NSWSS, ESRI

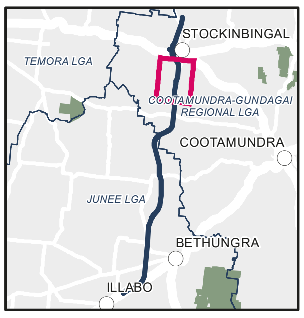
- Alignment of proposal
- Haulage Route
- Proposal site
- Within 350m of proposal site
- Within 100m of alignment
- Construction Compounds
- Construction site access point

Receptor Type

- Active Recreation
- Commercial
- Educational
- Place of worship
- Residential

Existing features

- Arterial road
- Sub-arterial road
- Local road
- Major Watercourse
- Minor Watercourse



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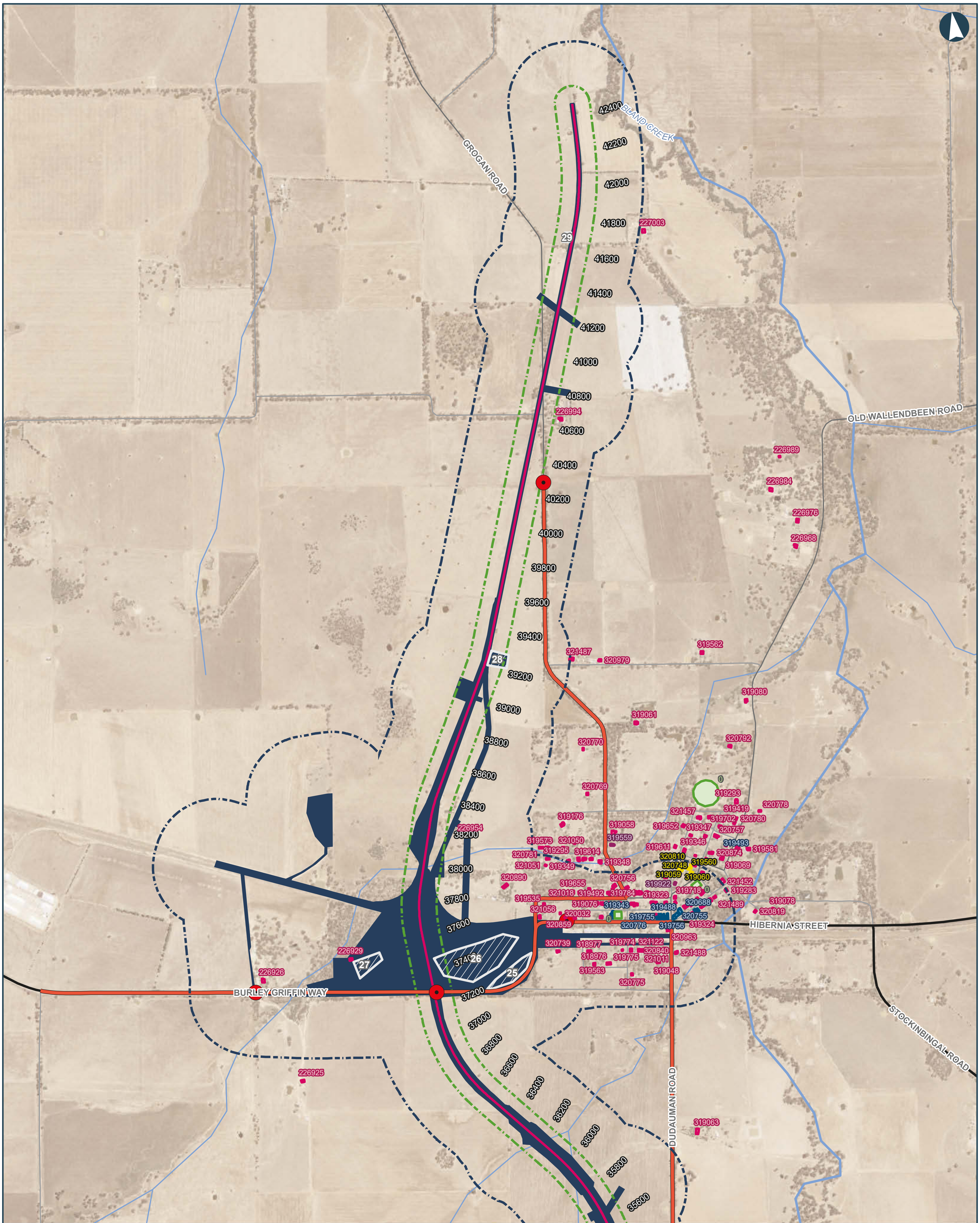


ILLABO TO STOCKINBINGAL Sensitive receptors

MAP 7 OF 7

0 0.25 0.5 0.75 1 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 11/4/2021
Paper: A3
Author: IRDJV
Scale: 1:20,000
Data Sources: ARTC, NSWSS, ESRI

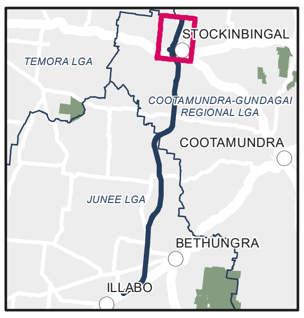
- Alignment of proposal
- Haulage Route
- Proposal site
- Within 350m of proposal site
- Within 100m of alignment
- Construction Compounds
- Construction site access point

Receptor Type

- Active Recreation
- Commercial
- Educational
- Place of worship
- Residential

Existing features

- Arterial road
- Sub-arterial road
- Local road
- Major Watercourse
- Minor Watercourse



INLAND RAIL

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