TECHNICAL REPORT

10

Traffic and Transport Assessment

NARROMINE TO NARRABRI ENVIRONMENTAL IMPACT STATEMENT

INLAND RAIL

ARTC

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

ARTC Inland Rail

Narromine to Narrabri Project

Traffic and Transport Assessment

Technical Report 10

2-0001-250-ITR-00-RP-0001

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Table of contents

Table index

Figure index

Appendices

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Executive summary

The proposal

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, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail is a major national program that will enhance Australia's existing national rail network and serve the interstate freight market.

The proposal consists of about 306 kilometres of new single-track standard gauge railway with crossing loops. The proposal also includes changes to some roads to facilitate construction and operation of the new section of railway, and ancillary infrastructure to support the proposal.

The proposal would link the Parkes to Narromine section of Inland Rail located in central western NSW, with the Narrabri to North Star section of Inland Rail located in north-west NSW.

Australian Rail Track Corporation Ltd (ARTC) ('the proponent') is seeking approval to construct and operate the Narromine to Narrabri section of Inland Rail ('the proposal').

The proposal is State significant infrastructure and is subject to approval by the NSW Minister for Planning and Public Spaces under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal is also determined to be a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and requires approval from the Australian Minister for the Environment.

This report

This Traffic and Transport Assessment has been prepared on behalf of ARTC for the proposal to support the environmental impact statement (EIS) for the proposal and responds to the Secretary's Environmental Assessment Requirements (SEARs) for traffic and transport.

This report provides a description of the existing conditions on the transport network, and an analysis of the existing and design condition of existing and future infrastructure within the proposal site. It presents a consideration of the impact of construction activities by determining the likely traffic generation, access and egress routes and parking requirements in the context of the surrounding road network. It also provides estimates of the delays (total closure time) at level crossings based on the expected train lengths, travel speeds and pre- and post-train closure times and includes an assessment of impacts and benefits on the wider transport network, including implications for access, cyclists, pedestrians, and public transport.

Recommended mitigation and management measures were identified in response to the impact assessment findings.

Existing environment

The proposal would be located within a new section of rail corridor between the towns of Narromine and Narrabri. The proposal would link the Parkes to Narromine section located in central west NSW, with the Narrabri to North Star section of Inland Rail located in north west NSW.

The road network within the study area generally comprises public local roads and private rural roads however there are some arterial and sub-arterial roads in operation near the proposal. These roads are Mitchell Highway, Newell Highway, Oxley Highway, Castlereagh Highway and Kamilaroi Highway.

Rail freight services run on two networks in NSW. These are the Country Regional Network and the NSW Interstate, Hunter Valley and Metropolitan Freight Network. Both of these networks operate within the study area. A number of passenger rail services are also in operation within the study area.

Impacts from the proposal during construction

Construction of the proposal would be separated into four construction areas (Narromine, Gilgandra, Baradine, and Narrabri). Each construction area would be constructed concurrently and the anticipated construction period is expected to last for up to 48 months. As such, traffic and transport impacts would be expected for the duration of the works within each construction area.

Construction of the proposal would result in a temporary increase in heavy and light vehicle movements on the public road network. The traffic would be distributed throughout the four construction areas. The main vehicle movements would be generated from the workforce, borrow pits, capping and ballast, and concrete. These four construction activities have been considered for network impacts as they would use the public road network to access the proposal site. There would be a minor increase in the overall traffic volumes on some haulage routes. However, this increase is expected to have a negligible impact on the road network.

Additional traffic generating construction activities would include the delivery of water, spoil, and plant and equipment. Movements associated with these activities would mainly travel via the construction haul road which would run along most of the proposal site with gated access to public roads. This haul road is intended to allow for heavy vehicle haulage, plant and equipment deliveries and personnel movement between work fronts and would reduce the amount of traffic on public roads. The reduction of heavy vehicle haulage on the public road network would also minimise road safety impacts through separation of public and project related traffic movements at these locations.

There would be the potential for temporary impacts on existing rail freight operations where connections to existing rail lines are proposed. There is also one formal timetabled passenger service which has the potential to be impacted during construction of the connection with the Narrabri to North Star line (currently the Mungindi Line). These works would generally be undertaken during programmed weekend rail possession periods.

There would be road realignments and road closures to local and low order roads as part of the proposal. Road realignment construction would mainly be done off-line with minor disruptions to tie into the existing road. Localised impacts are expected from temporary access restrictions.

Impacts from the proposal during operation

During operation of the proposal minimal traffic generation is expected. The key traffic impacts of the proposal relate to the added presence of level crossings along the rail alignment. Traffic activity at most of the proposed level crossings in the proposal site would be low, based on existing conditions, and the volume of traffic likely to be delayed by train activity is not substantial. There is capacity at each level crossing for delayed vehicles to queue clear of nearby intersections. In some locations, road realignments would be required to connect with a new level crossing to allow for safe road crossing access across the proposal.

It is anticipated that it would take a train less than two minutes to pass a single point (ie level crossing). This would occur up to 10 times daily when Inland Rail is fully operational in 2025, equating to about 18 minutes of total delay at crossing points daily.

A number of public roads and access tracks are proposed to be closed and/or realigned due to the alignment of the proposal. In most instances, alternate access is proposed either via access to a nearby level crossing, an alternate route being provided, or the existing road network around the proposal being used.

Recommended mitigation measures

During the design process, as well as the construction and operational phase, a number of mitigation measures have been identified to reduce the impact on the local road network and traffic movements. These measures are summarised below.

Detailed design phase

The following mitigation measures are proposed during the detailed design phase:

- The detailed design of the proposal would aim to minimise the potential for impacts on the surrounding road and transport network, and property accesses.
- Input would be sought from relevant stakeholders (including local councils and, Transport for NSW) prior to finalising the detailed design of those aspects of the proposal that impact on the operation of road and other transport infrastructure under the management of these stakeholders.
- Road safety audits would be carried out at level crossings and where changes to the road network are required, to ensure the safety of all road users is considered as part of the design process.
- Public level crossings would be designed in accordance with relevant guidelines and standards.

Construction phase

The following mitigation measures would be put in place during the construction phase:

- A traffic, transport and access management sub-plan would be prepared and implemented as part of the Construction Environmental Management Plan. It would include measures, processes and responsibilities to minimise the potential for impacts on the community and the operation of the surrounding road and transport network during construction.
- Consultation with relevant stakeholders would be undertaken regularly to facilitate the efficient delivery of the proposal and to minimise congestion and inconvenience to road users.
- A dilapidation survey would be undertaken of the formed public roads within the proposed haulage routes prior and post construction and provided to the relevant road authority.
- Emergency vehicle access routes which may be impacted by the proposal would be identified and appropriate control measures would be implemented in consultation with the relevant emergency services providers.

Operation phase

The following mitigation measures would be put in place during the operation phase:

- A review of the operation of all level crossings would be undertaken after the proposal commences operation.
- In accordance with National and State Rail Safety Law requirements, public road crossings would be subject to an Interface Agreement with the relevant road manager in order to ensure that safety risks are identified and minimised as far as practicable during operations.

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Glossary and abbreviations

Acronym/term	Definition
AADT	Annual average daily traffic
Active control (level crossings)	Where the movement of vehicular or pedestrian traffic across a railway crossing is controlled using devices such as flashing signals, gates or barriers (or a combination of these), with the device/s activated prior to, and during, the passage of a train through the crossing.
ADT	Average daily traffic
ALCAM	Australian Level Crossing Assessment Model
ARTC	Australian Rail Track Corporation
AS	Australian Standard
Ballast	Crushed rock, stone etc used to provide a foundation for a railway track. Ballast usually provides the bed on which railway sleepers are laid, transmits the load from train movements, and restrains the track from movement.
Bulk freight	Bulk freight generally involves large quantities of homogenous product, typically liquid or loose crushed solid material (such as cement, grains and ores), transported on mass without packaging.
CEMP	Construction Environmental Management Plan
Classified road	Roads classified under sections 46, 47, 50 or 51 of the NSW *Roads Act 1993* that have a legal class of highway, main road, secondary road or tourist road.
Construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials and/or construction site offices and worker facilities.
Crossing loop	A section of track off to the side of the main track/s that allows a train to move to the side so that another can pass.
Culvert	A structure that allows water to flow under a road, railway, track or similar obstruction.
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Existing rail corridor	The corridor within which existing rail infrastructure are located. The rail corridor is defined by ARTC to mean everywhere within 15 metres of the outermost rails; or within the boundary fence where boundary fences are provided and are closer than 15 metres; or if the property boundary is less than 15 metres, the property boundary; or a permanent structure such as a fence, wall or level crossing separating the operating rail corridor from other land.
Freight	Goods transported by truck, train, ship, or aircraft.
Freight task	The amount of freight transport, usually measured in tonnes or tonne-kilometres.

Acronym/term	Definition
Inland Rail program (Inland Rail)	The Inland Rail programme encompasses the design and construction of a new inland rail connection between Melbourne and Brisbane, via Wagga, Parkes, Moree, and Toowoomba. The route for Inland Rail is about 1,700 kilometres in length. Inland Rail will involve a combination of upgrades of existing rail track and the provision of new track.
Intermodal terminal	A facility used to facilitate the movement of freight between different modes of transport (such as between trucks and rail), usually without handling of the freight itself when changing modes.
LCIP	NSW Level Crossing Improvement Program
Level crossing	A place where rail lines and a road cross at the same elevation.
Level crossing protection	The level of control provided at level crossings, which is determined on a case by case basis, and depends on the particular characteristics of a crossing. It generally falls into two categories: passive protection (uses warning signage only) or active protection (uses either signage and flashing lights only, or signage/flashing lights with boom gates).
Level of service	Defined by Austroads as a measure for ranking operating road and intersection conditions, based on factors such as speed, travel time, freedom to manoeuvre, interruptions, comfort and convenience.
Local road	A road used mainly to access properties located along the road.
LOS	Level of service
m	metres
NSW	New South Wales
Passive control (level crossings)	Where the movement of vehicular or pedestrian traffic across a railway crossing is controlled using signs or devices that are not activated by the approach or passage of a train, relying on the road user to detect the approach or presence of a train by direct observation.
Peak hour	Hour of the day that has the highest recorded traffic volume.
The proposal	Defined as the construction and operation of the Narromine to Narrabri section of Inland Rail.
The proposal site	Defined as the area that would be directly affected by construction of the proposal (also known as the construction footprint). 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 compounds and laydown areas that would be used during construction.
PTSF	Per cent Time Spent Following. A service measure used when analysing levels of service for traffic routes.
Rail corridor	The corridor within which the rail tracks and associated infrastructure would be located.
RTA	(former) NSW Roads and Traffic Authority
SEARs	Secretary's Environmental Assessment Requirements
SFAIRP	So far as is reasonably practicable.
Spoil	Material generated by excavation during construction.
SSI	State Significant Infrastructure. Includes major NSW transport and services developments that have a wider significance and impact than just the local area.

Acronym/term	Definition
Study area	The study area is defined as the wider area including and surrounding the proposal site, with the potential to be directly or indirectly affected by the proposal (for example, by noise and vibration, visual or traffic impacts). The actual size and extent of the study area varies according the nature and requirements of each impact assessment technical report. The study area used in this report is defined in section 1.2.
Turnout	A junction point where a rail vehicle can leave a given track for a branching or parallel track.
TfNSW	Transport for New South Wales
VKT	Vehicle Kilometres Travelled
Work area	Individual areas within the proposal site that are subject to construction at any one time.

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1 Introduction

1.1 Overview

1.1.1 Inland Rail and the proposal

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, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail is a major national program that will enhance Australia's existing national rail network and serve the interstate freight market.

The Inland Rail route, which is about 1,700 kilometres long, involves:

- using the existing interstate rail line through Victoria and southern NSW
- upgrading about 400 kilometres of existing track, mainly in western NSW
- providing about 600 kilometres of new track in NSW and south-east Queensland.

The Inland Rail program has been divided into 13 sections, seven of which are located in NSW. Each of these projects can be delivered and operated independently with tie-in points on the existing railway.

Australian Rail Track Corporation Ltd (ARTC) ('the proponent') is seeking approval to construct and operate the Narromine to Narrabri section of Inland Rail ('the proposal').

1.1.2 Approval and assessment requirements

The proposal is State significant infrastructure and is subject to approval by the NSW Minister for Planning and Public Spaces under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal is also determined to be a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and requires approval from the Australian Minister for the Environment.

This report has been prepared by the JacobsGHD Joint Venture as part of the environmental impact statement (EIS) for the proposal. The EIS has been prepared to support the application for approval of the proposal, and address the environmental assessment requirements of the Secretary of the NSW Department of Planning, Industry and Environment (the SEARs), dated 9 September 2020.

1.2 The proposal

The proposal consists of about 306 kilometres of new single-track standard gauge railway with crossing loops. The proposal also includes changes to some roads to facilitate construction and operation of the new section of railway, and ancillary infrastructure to support the proposal.

The proposal would be constructed to accommodate double-stacked freight trains up to 1,800 metres long and 6.5 metres high. It would include infrastructure to accommodate possible future augmentation and upgrades of the track, including a possible future requirement for 3,600 metre long trains.

The land requirements for the proposal would include a new rail corridor with a minimum width of 40 metres, with some variation to accommodate particular infrastructure and to cater for local topography. The corridor would be of sufficient width to accommodate the infrastructure currently proposed for construction, as well as possible future expansion of crossing loops for 3,600 metre long trains. Clearing of the proposal site would occur to allow for construction and to maintain the safe operation of the railway.

1.2.1 Location

The proposal would be located between the towns of Narromine and Narrabri in NSW. The proposal would link the Parkes to Narromine section of Inland Rail located in central western NSW, with the Narrabri to North Star section of Inland Rail located in north-west NSW.

The location of the proposal is shown in Figure 1.1.

1.2.2 Key features

The key design features of the proposal include:

Rail infrastructure

- a new 306 kilometre long rail corridor between Narromine and Narrabri
- a single-track standard gauge railway and track formation within the new rail corridor
- seven crossing loops, at Burroway, Balladoran, Curban, Black Hollow/Quanda, Baradine, The Pilliga and Bohena Creek
- bridges over rivers and other watercourses (including the Macquarie River, Castlereagh River and the Namoi River/Narrabri Creek system), floodplains and roads
- level crossings
- new rail connections and possible future connections with existing ARTC and Country Regional Network rail lines, including a new 1.2 kilometre long rail junction between the Parkes to Narromine section of Inland Rail and the existing Narromine to Cobar Line (the Narromine West connection)

Road infrastructure

- road realignments at various locations, including realignment of the Pilliga Forest Way for a distance of 6.7 kilometres
- limited road closures.

The key features of the proposal are shown in Figure 1.2.

Ancillary infrastructure to support the proposal would include signalling and communications, drainage, signage and fencing, and services and utilities.

Further information on the proposal is provided in the EIS.

Figure 1.1 **Location of the proposal**

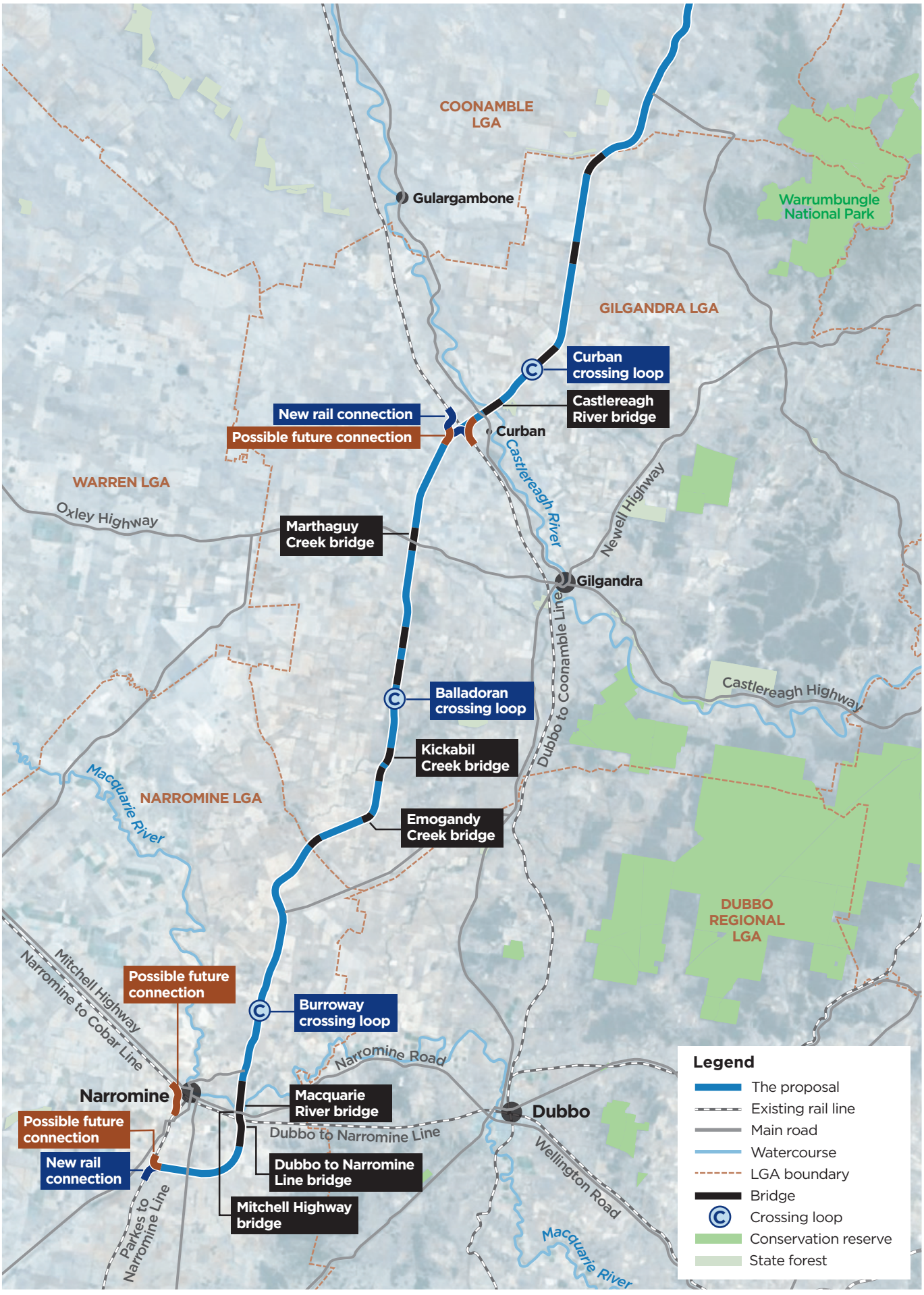

Figure 1.2a **Key features of the proposal**

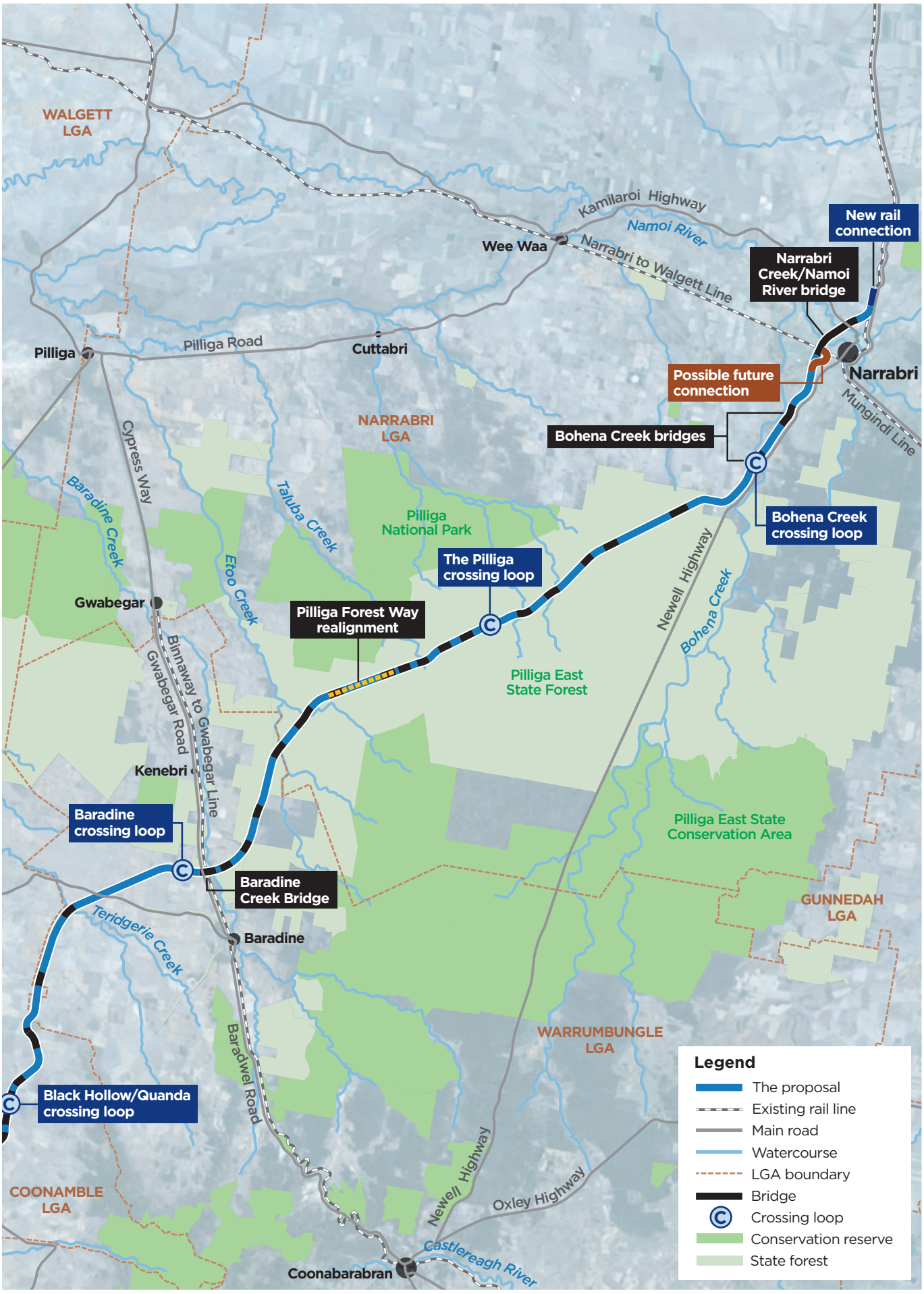

Figure 1.2b **Key features of the proposal**

1.2.3 Construction overview

An indicative construction strategy has been developed based on the current reference design to be used as a basis for the environmental assessment process. Detailed construction planning, including programming, work methodologies, staging and work sequencing would be undertaken once construction contractor(s) have been engaged and during detailed design.

Timing and work phases

Construction of the proposal would involve five main phases of work as outlined in Table 1.1. It is anticipated that the first phase would commence in late 2021, and construction would be completed in 2025.

Table 1.1 Main construction phases and indicative activities

Phase	Indicative construction activities
Pre-construction	• Establishment of areas to receive early material deliveries • Delivery of certain materials that need to be bought to site before the main construction work
Site establishment	• Establishment of key construction infrastructure, work areas and other construction facilities • Installing environmental controls, fencing and site services • Preliminary activities including clearing/trimming of vegetation
Main construction works	• Construction of the proposed rail and road infrastructure, including earthworks, track, bridge and road works
Testing and commissioning	• Testing and commissioning of the rail line and communications and signalling systems
Finishing and rehabilitation	• Demobilisation and decommissioning of construction compounds and other construction infrastructure • Restoration and rehabilitation of disturbed areas

Key construction infrastructure

The following key infrastructure is proposed to support construction of the proposal:

- borrow pits:
  - borrow pit A – Tantitha Road, Narromine
  - borrow pit B – Tomingley Road, Narromine
  - borrow pit C – Euromedah Road, Narromine
  - borrow pit D – Perimeter Road, Narrabri
- three main compounds, which would include a range of facilities to support construction ('multi-function compounds'), located at:
  - Narromine South
  - Curban
  - Narrabri West
- temporary workforce accommodation for the construction workforce:
  - within the Narromine South multi-function compound
  - Narromine North
  - Gilgandra
  - Baradine
  - within the Narrabri West multi-function compound.

The key construction infrastructure are shown in Figure 1.3.

Other construction infrastructure would include a number of smaller compounds of various sizes located along the proposal site, concrete batching plants, laydown areas, welding yards, a concrete pre-cast facility and groundwater bores for construction water supply.

1.2.4 Operation

The proposal would form part of the rail network managed and maintained by ARTC. Train services would be provided by a variety of operators. Inland Rail as a whole would be operational once all 13 sections are complete, which is estimated to be in 2025.

It is estimated that Inland Rail would be trafficked by an average of 10 trains per day (both directions) in 2025, increasing to about 14 trains per day (both directions) in 2040. This rail traffic would be in addition to the existing rail traffic using other lines that the proposal interacts with.

The trains would be a mix of grain, bulk freight, and other general transport trains. Total annual freight tonnages would be about 10 million tonnes in 2025, increasing to about 17.5 million tonnes in 2040.

Train speeds would vary according to axle loads, and range from 80 to 115 kilometres per hour.

1.3 Purpose and scope of this report

The purpose of this report is to assess the potential traffic and transport impacts from constructing and operating the proposal. The report:

- addresses the relevant SEARs listed in Table 1.2
- describes the existing environment with respect to traffic and transport
- assesses the impacts of constructing and operating the proposal on traffic and transport
- recommends measures to mitigate and manage the impacts identified.

The methodology for the assessment is described in section 3.

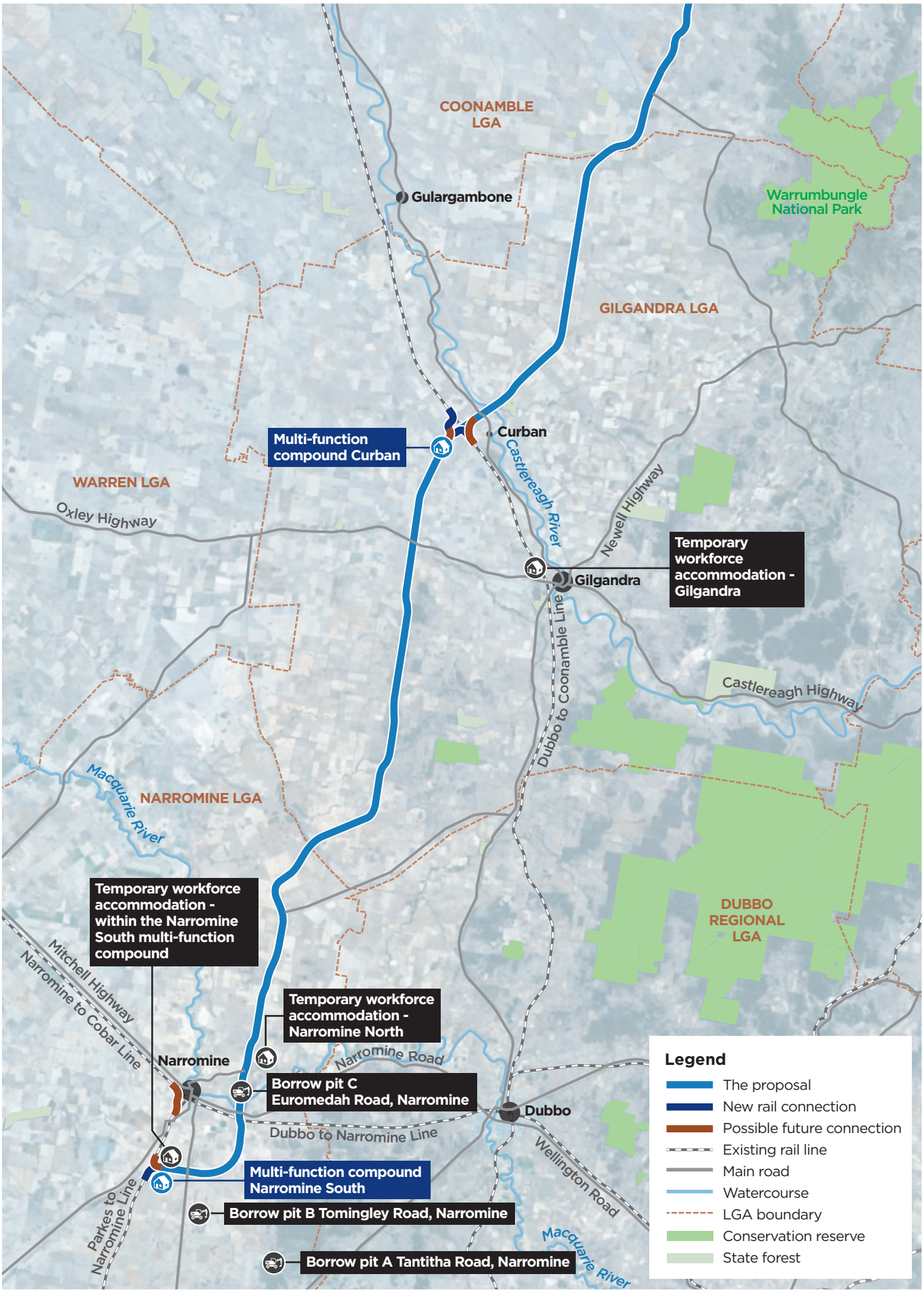

Figure 1.3a **Key construction infrastructure**

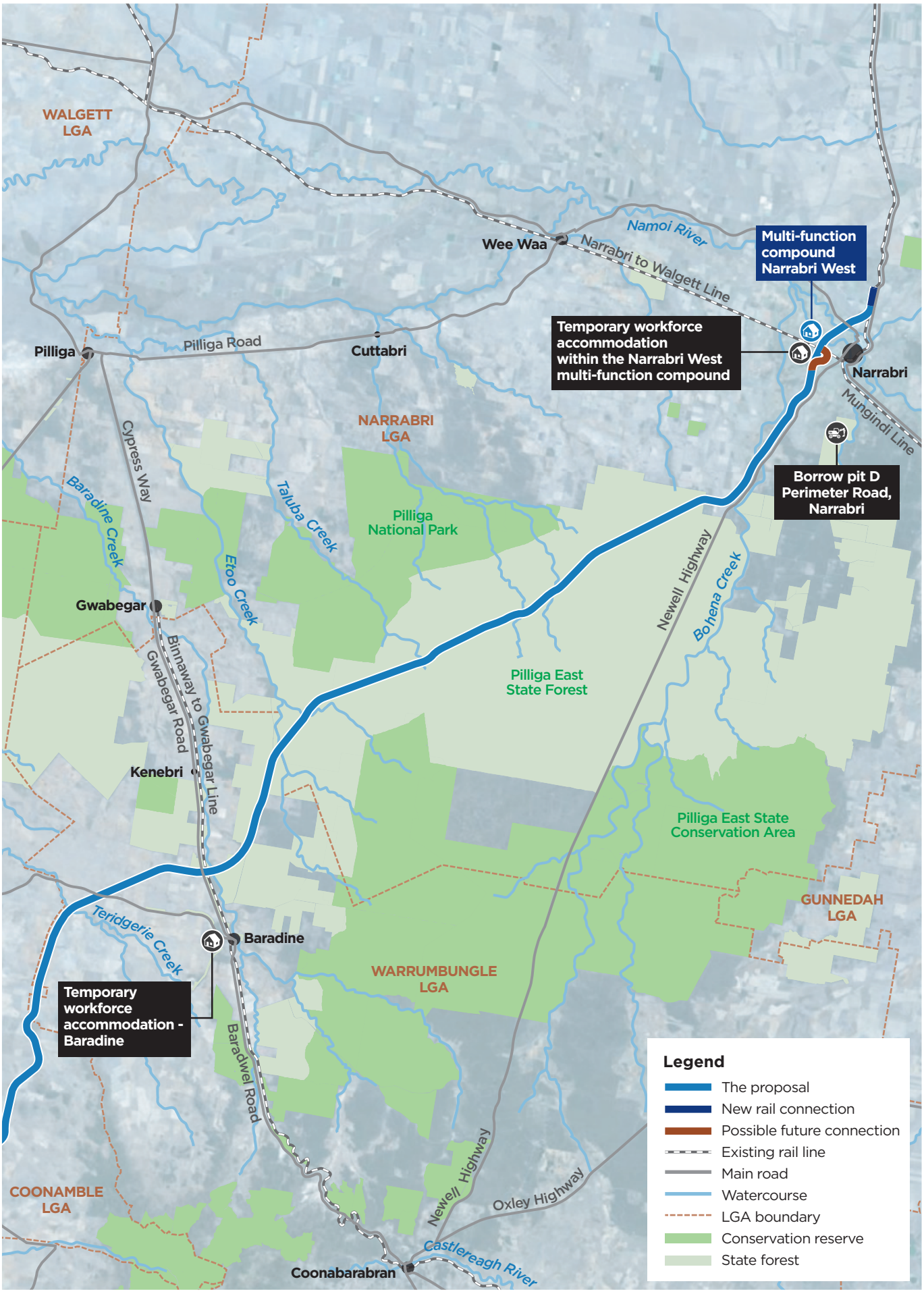

Figure 1.3b **Key construction infrastructure**

Table 1.2 SEARs relevant to this assessment

SEAR number	Requirements	Where addressed in this report
8.1	The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists, bus services, and train operations) impacts, including, but not necessarily limited to:	
	a. A considered approach to route alignment identification and scheduling of transport movements;	Section 5.2.4 sets out the approach of the construction haul roads and the route alignment to minimise the vehicle movements on the road network, where possible construction movements would use the haul road as soon as practically possible.
	b. The number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements and track machines), including those related to the establishment and operation of borrow sites and haulage to and from borrow sites;	Section 5.2.4 summarises the key information relating to the construction of the proposal, including the vehicle movements, borrow site operation and the haulage to/from borrow sites.
	c. The nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements) and assessment of traffic impacts on these routes including identifying traffic management measures to mitigate any impacts;	Section 6.1 and Table 6.1 describes the existing traffic volumes within the study area on the construction routes and assesses the potential impacts that construction traffic would have on these roads. Section 4.2.1 describes the existing traffic movements in the area including the composition of heavy vehicles.
	d. The closure, diversion or reconfiguration of elements of the road network associated with the construction of the project; and	Section 5.2.4 discusses the required changes to the road network associated with the construction phase of the proposal. Section 6.1 describes the changes to the road network and impacts as a result of the proposal.
	e. Safe access and egress to/from the classified road network.	Section 6.1.1 sets out the approach as to how construction vehicles would access the local road network in a safe manner.

SEAR number	Requirements	Where addressed in this report
8.2	The Proponent must assess (and model) the operational transport impacts of the project, including:	
	a. The performance of key level crossings and intersections;	Section 6.2.1 provides the assessment of the busiest road (Castlereagh Highway) that is proposed to have a level crossing once the project is operational, as well as discussing potential impacts on nearby intersection to the proposal.
	b. Wider transport interactions (local and regional roads, cycling, public and freight transport and the broader NSW rail network); and	Section 6.2.2 discusses the impact of the proposal on the local road network, public transport and cycling networks.
	c. Identification of traffic and transport measures, including grade separation of rail/road interfaces to mitigate any impacts.	Sections 5.1.1 and 5.1.2 provide detail on the road network measures included to mitigate traffic impacts. Section 6.2.2 provides a summary of measures used (ie grade separation) to mitigate the impacts on roads due to the proposal. Section 7.3 provides measures to mitigate operational impacts.
8.3	The Proponent must assess the feasibility of level crossings (existing and proposed) and justify the safety and operational impacts and/or benefits of the proposed crossing type, taking into account the classification of the road.	Section 5.1.1 provides a summary of the process that was taken to determine the feasibility of proposed level crossings and the associated impacts and benefits. Section 6.2.1 provides a worst case assessment of the operational impacts. No changes to existing level crossings are proposed.
8.4	In the assessment of level crossings, the EIS must take into account:	
	a. The NSW Government's Construction of New Level Crossings Policy;	Section 5.1.1 provides details as to how the New Level Crossing Policy was accounted for in the design process.
	b. Level crossing ALCAM assessments for public crossings and site- specific risk assessments. The Proponent must demonstrate how it has reduced risks identified So Far As Is Reasonably Practicable (SFAIRP);	Section 5.1.1 outlines that the ALCAM assessment and site-specific risk assessments have been undertaken by ARTC, separate to this assessment report and how this process reduced risks SFAIRP.
	c. Consistency with any Interface Agreements and related Safety Management Plans, including draft Interface Agreements and draft Safety Management Plans;	Section 5.1.1 sets out the approach that would be adopted to ensure consistency with any interface agreements and in accordance with National and State Rail Safety Law requirements.

SEAR number	Requirements	Where addressed in this report
	d. The practice of upgrading active public level crossings to boom gates and flashing lights as adopted by the NSW Level Crossing Improvement Program (LCIP);	There are no existing active level crossings within the proposal site. However, all proposed active level crossings would include boom gates and flashing lights as noted in section 5.1.1,
	e. The rationalisation of private and public level crossings in line with the NSW Government's Level Crossing Closures Policy;	There is proposed to be no changes to existing level crossings within the study area, therefore the rationalisation of level crossing closures is not considered within this report.
	f. The closure of public roads and the provision of alternative road routes, taking into consideration the existing and proposed traffic volumes and intersection performance, and the condition of the alternative roads, and any necessary road upgrades (including stormwater drainage systems) to accommodate increased traffic volumes; and	Section 5.1.2 outlines the proposed changes to public roads and the required alternate routes. Section 6.2.2 considers the impact on existing conditions from the changes introduced to the road network.
	g. Operation of level crossings with regard to road and rail travel speeds, vehicle types, train lengths, train numbers, road and rail traffic volumes, vehicle queuing and sight distance.	Section 6.2.1 provides the assessment of the busiest road (Castlereagh Highway) that is proposed to have a level crossing once the project is operational, as well as discussing the assumptions associated with the assessment process.

1.4 Structure of this report

The structure of the report is outlined below:

- Section 1 – provides an introduction to the report.
- Section 2 – provides an overview legislation, policies and guidelines application to this assessment.
- Section 3 – describes the methodology and approach for the assessment.
- Section 4 – describes the existing traffic and transport network of the proposal site.
- Section 5 – provides a description of the proposal including interfaces with the existing transport network.
- Section 6 – provides an assessment of traffic and transport impacts from the construction and operation.
- Section 7 – provide recommended mitigation and management measures.
- Section 8 – concludes the key findings and recommendations from the investigation.

2 Legislation, policy and relevant guidelines

2.1 Legislative requirements

2.1.1 NSW legislation

Environmental Planning and Assessment Act 1979

As noted in section 1.1.2, the proposal is State significant infrastructure (SSI) by operation of Division 5.2 of the EP&A Act, State Environmental Planning Policy (State and Regional Development) 2011 and State Environment Planning Policy (Infrastructure) 2007. As SSI, the proposal needs to be approved by the NSW Minister for Planning and Public Spaces, and the application for approval needs to be supported by an EIS. SEARs have been provided by the Department of Planning, Industry and Environment and those that are relevant to traffic and transport are summarised in Table 1.2.

Roads Act 1993

The *Roads Act 1993* provides guidance on the classification of public roads, the procedures for closure of a public road, and to regulate the carrying out of various activities on public roads. It is noted that a section 138 permit is required from the relevant road authority to carry out various works in, on or under a public road. If the road is a classified road under the Act, then the concurrence of Transport for NSW (TfNSW) (formerly Roads and Maritime Services) is also required before the roads authority can grant its consent. However, if the works are part of an SSI project which has been given planning approval, then the Section 138 consent cannot be refused and must be on terms which are not inconsistent with the planning approval.

2.1.2 Policy and strategic plans

Future Transport Strategy 2056

Future Transport 2056 (TfNSW, 2018a) provides an overarching, customer focused 40-year strategy that outlines a vision, strategic directions and customer outcomes for the state's transport system.

Future Transport includes a number of strategies to improve the movement of people and goods within the Greater Sydney area. In particular, Inland Rail is discussed as a major focus of Australian governments, to provide an efficient link to freight hubs and supporting intermodal hubs in regional NSW.

NSW Freight and Ports Plan 2018-2023

The *NSW Freight and Ports Plan 2018-2023* (TfNSW, 2018b) is a call to action for government and industry to collaborate on clear initiatives and targets to make the NSW freight task more efficient and safe.

Key objectives of the Plan are to increase economic growth, increased efficiency, connectivity and access, greater freight capacity, improved safety and enhanced sustainability. Investment in improving the east-west rail freight network with NSW ports will be critical to optimising the benefits of the Inland Rail project for NSW and the Plan details a number of measures recommended, such that to maximise the benefits of Inland Rail.

Newell Highway Corridor Strategy

The *Newell Highway Corridor Strategy* (Department of Infrastructure, Transport, Regional Development and Communication, 2019a) sets out the objectives, current performance, and issues in managing the Newell Highway corridor over the long term. It details a series of safety, asset and traffic actions to meet the current and future issues along the highway. The strategy notes that:

- The Newell Highway currently provides the major freight route between Queensland and Victoria, and connects numerous regional centres and communities along its 1,060 kilometre length.
- The Newell Highway serves as a key economic link to domestic and export markets for agricultural products from the Central West, and interstate road freight between Queensland and Victoria.
- Traffic volumes along the Newell Highway vary significantly, from around 1,200 to 4,000 vehicles per day in rural areas. Traffic volumes along the Newell Highway increase substantially within urban areas (including Narrabri), where average daily traffic volumes can exceed 20,000 vehicles a day.
- The Newell Highway experiences high levels of heavy vehicle use, with around 26 to 52 per cent of daily traffic made up of heavy vehicles, depending on the location. Relative use of heavy vehicles is highest to the north between Narrabri and Boggabilla, with up to 1,500 heavy vehicles per day near the Queensland border, and rural sections around Narrandera.
- A number of significant intermodal freight hubs are located along and around the Newell Highway, including major hubs at Tocumwal, Forbes, Parkes, Dubbo, Narrabri, and Moree. The NSW government aims to support these hubs by improving inland rail access, and supporting the road connections.

Relevant to Inland Rail and the proposal, the strategy notes the issues associated with moving significant volumes of freight along the road corridor. Consistent with the strategy, Inland Rail supports north–south freight movement between the communities of western and north-western NSW, along with interstate movements between Victoria, NSW and Queensland.

Road Safety Plan 2021

The *Road Safety Plan 2021* (TfNSW, 2018d) recognises the importance of reducing road trauma on NSW roads. The Plan aims to achieve this by focusing on three interconnected areas including safe vehicles and equipment, safe roads and speeds, and safe people. The proposal seeks to support the objectives of the plan by removing freight vehicles from the local road network, therefore reducing the risk of injury for road users in the area.

2.1.3 Guidelines

Guide to Traffic Management – Part 3 Traffic Studies and Analysis

Part 3 of Austroads' *Guide to Traffic Management* (Austroads, 2007) outlines the importance of traffic data and its analysis for the purpose of traffic management and traffic control within a network. It serves as a means to ensure some degree of consistency in conducting traffic studies and surveys. It provides guidance on the different types of traffic studies and surveys that can be undertaken, their use and application, and methods for traffic data collection and analysis.

The traffic assessment that was completed for the proposal was conducted with consideration of the requirements in this guide.

Australian Level Crossing Assessment Model: Level Crossing Assessment Handbook

The *Australian Level Crossing Assessment Model* (ALCAM) (National ALCAM Committee, 2017) is the only comprehensive level crossing assessment model in Australia. It is a tool used to identify key potential risks at level crossings and assess the overall effects of proposed treatments. It does not specify what treatment is warranted at level rail-road crossing sites nor attempt to define a 'safe' or acceptable level of risk. This is a decision for each Rail Infrastructure Manager.

ALCAM assessments have been undertaken for all public road level crossings proposed as part of the proposal.

Guide to Traffic Generating Developments, Version 2.2

The *Guide to Traffic Generating Developments* (Roads and Maritime Services, 2002) outlines the purpose for, and the process to complete traffic impact studies. It includes the traffic generation rates for various land uses and their impacts, as well as parking requirements, design and access.

As this guide is designed to assess the impacts of a development and the impacts it will have on the road network, it was not used in the assessment of the construction impacts in the immediate road network surrounding the proposal.

NSW Sustainable Design Guidelines Version 4.0

The *NSW Sustainable Design Guidelines* (TfNSW, 2017) seek to incorporate sustainable development practices into the design and construction of transport infrastructure projects. These guidelines form part of the Transport Projects Sustainability Framework. Key aims of the guidelines are to:

- ensure development, expansion and management of the transport network is sustainable and resilient to climate change
- minimise impacts of transport on the environment, encompassing transport operations, infrastructure delivery and maintenance and corporate activities
- enhance quality of life for transport customers by procuring, delivering and promoting sustainable transport options.

The guidelines dictate that an EIS must critically consider the Guidelines and facilitate their implementation in later stages of a project. An indicative compliance goal must be obtained and provided to the design team/contractor.

Through the assessments undertaken as part of the EIS which included climate change and sustainability assessment, the aims of this guideline have been considered in the delivery of the proposal as relevant.

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3 Assessment approach and methodology

3.1 Study area

The study area for the Traffic and Transport Assessment is comprised of one kilometre either side of the proposal site and includes transport routes and intersecting public roads.

3.2 Objective

The objective of this Traffic and Transport Assessment is to describe the current operation of the transport network in the study area, the expected operation of the transport network in the future with the proposal, and provides a comparison between the existing and future operations.

The assessment identifies the spatial extent of impacts on the road network arising from the proposal during construction and operation, detailing potential impacts on road and rail users. The assessment also includes mitigation strategies to minimise the impacts of the proposal, and to facilitate safe and efficient operation of the transport network.

Outputs from this study have informed the development of the proposal design, including the strategy for level crossings, and supported other specialist studies including the following:

- *ARTC Inland Rail Narromine to Narrabri Agriculture and Land Use Assessment* (JacobsGHD, 2020a)
- *ARTC Inland Rail Narromine to Narrabri Social Assessment* (JacobsGHD, 2020b)
- *ARTC Inland Rail Narromine to Narrabri Noise and Vibration Assessment – Construction and Other Operations* (JacobsGHD, 2020c)
- *ARTC Inland Rail Narromine to Narrabri Noise and Vibration Assessment - Operational Rail* (SLR, 2020).

3.3 Methodology

The methodology that has been used to develop this Traffic and Transport Assessment is outlined as follows:

- Review and report upon the **existing conditions** (section 4) of the transport network for traffic, public transport, crash history, land use and travelling stock reserves, within the study area that is assumed to be impacted by the construction or operation of the proposal. The study area for the assessment includes all local and state roads that would be affected by the proposal.

  The purpose of the existing environment assessment is to document the current operations within the study area as a point of reference for comparison to the construction and operational stages. Information gathered for the assessment includes:

  – traffic volumes and profiles by time of day, and time of year including surveys over a seven-day period on roads that are likely to be impacted by the proposal
  – historical growth rates, and potential future growth expectations
  – measures of existing performance, including level of service (LOS)
  – crash history, including identification of high-level trends and indices relevant to the assessment, and calculation of crash rates
  – road network function, including heavy vehicle routes
  – public transport, pedestrians and cyclist activity and facilities

  - travelling stock reserves
  - existing and future land use within the area surrounding the study area.

- Carry out a **construction** traffic impact assessment (section 6.1) as follows:
  - review traffic surveys undertaken in November 2018 and February 2019, capture traffic profiles over a normal week and provide an understanding of peak travel times, taking into consideration the seasonal variation of the traffic data
  - identify key construction activities expected to generate traffic and establish the construction access routes
  - review roads impacted by the proposed increase in traffic volumes from construction activities
  - quantify construction traffic activity, vehicle type, and timing
  - evaluate impacts of construction traffic activity on road corridor performance and comparing to base conditions (LOS assessment)
  - evaluate needs for works to provide safe and efficient access to site compounds or other construction activities
  - evaluate the safe access and egress to/from the public road network
  - evaluate impacts to existing road infrastructure and transport modes (parking, public transport, pedestrians, etc)
  - assess impacts on key road performance as a result of the peak construction activities using SIDRA analysis for identified roads.

  It is noted that there was only one road within the study area with incremental construction traffic volumes that required modelling using specialist software (for example SIDRA Intersection), as detailed in section 6.1.1. Notwithstanding, SIDRA analysis has been carried out on a further two key roads located near urban centres with high traffic volumes relative to the rest of the study area and is considered representative of the likely worst impacts.

- Carry out an **operational** traffic impact assessment (section 6.2) as follows:
  - assess the potential travel time impacts at level crossings based on the train speeds, train lengths and type of crossing
  - assess the potential impacts on the wider transport network, inclusive of public transport, cycling, pedestrians, travelling stock reserves
  - evaluate the potential impacts on the local road network, due to realignments, diversions and closures
  - Provide mitigation measures to manage the potential impacts on traffic, transport and access (section 7).

3.3.1 Cumulative impacts and benefits

In addition to assessment of the proposal impacts in isolation (as outlined above), it is important to consider the cumulative impacts of the Inland Rail as a collective as well as other projects within close proximity to the proposal site. A qualitative cumulative impact assessment was undertaken in section 6.3 according to the following methodology:

- review the relevant traffic and transport aspects of projects potentially impacting the proposal from an operational and construction perspective
- identify any locations, routes, time periods which are likely to impact the construction/ operation of the proposal
- determine cumulative impacts to the road and rail network, with respect to haulage routes, pavement conditions and operation of the wider road network.

3.3.2 Assumptions and limitations

This assessment is based on the following assumptions:

- This Traffic and Transport Assessment does not include the consideration of impacts to private roads including access impacts. Any impacts to private roads are addressed directly with the impacted landowners as part of the proposal's wider consultation process, including rail interfaces with private roads.
- Traffic surveys at a number of key locations within the study area were undertaken between 7 November and 13 November 2018, to determine the average daily volumes and the peak hour two-way traffic volumes. These traffic counts were undertaken and the assessment has been based on these traffic volumes as they are considered representative of a robust traffic scenario for the study area.
- Trip generation for construction vehicle movement, work hours, haulage routes and the number of workers has been estimated and is discussed in section 5. These estimates are based on assumed design, construction methodology and program as provided by the project team.
- Existing conditions traffic growth in the study area up to the opening of the proposal has been assumed to be one per cent based on observed growth rates in the area from various sources.

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4 Existing transport environment

4.1 Road network

The road network within the study area consists mainly of local and private rural roads. There are also some arterial and sub-arterial roads located near the proposal site. The road network is described below and shown in Figure 4.1.

This figure also shows heavy vehicle routes (19 metre B-double routes) within the study area.

4.1.1 Road hierarchy

Roads within NSW are categorised in the following two ways:

- by classification
- by the function that they perform.

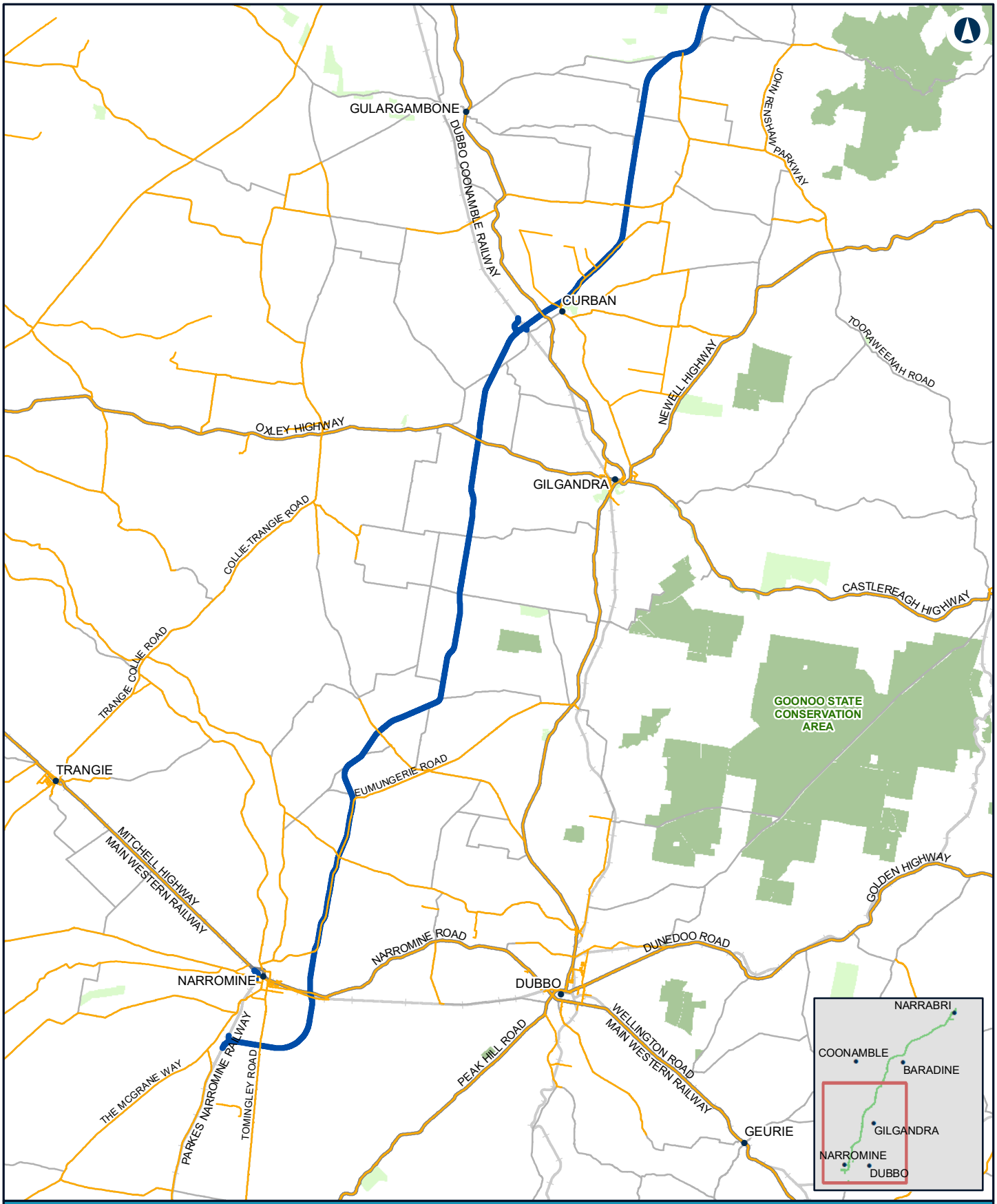
It is noted that a road's administrative classification may not necessarily be consistent with its function.

Road classification

Roads are classified in accordance with the *Roads Act 1993* based on their importance to the movement of people and goods within NSW. The classification of a road allows TfNSW to exercise authority of all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways and Transitways.

For management purposes, TfNSW has three administrative classes of roads that are not derived from the classification system in the *Roads Act 1993*. These are:

- **State Roads:** Major arterial links through NSW and within major urban areas. They are the principle traffic carrying roads and fully controlled by TfNSW with maintenance fully funded by TfNSW. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway.
- **Regional Roads:** Roads of secondary importance between State Roads and Local Roads which, with State Roads, provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though TfNSW funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under the delegations to local government from TfNSW. Regional Roads may be all or part of a Main Road, Secondary Road, Tourist Road or State Highway or other roads as determined by TfNSW.
- **Local Roads:** Local Roads are the responsibility of councils for maintenance funding. TfNSW may fund some maintenance and improvements based on specific programs (eg urban bus routes, road safety programs). Traffic management on Local Roads is controlled under the delegations to local government by TfNSW.



NARROMINE TO NARRABRI Arterial and sub-arterial roads in local area Figure 4.1a

0 8.5 17 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 3/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:600,000

Data Sources: Basemap layers: NSWSS; Alignment, project elements: GHDJACOBS; Heavy vehicle routes: TfNSW

LEGEND

- The proposal
- Road
- Arterial road
- 19m B-double Routes (over 50 tonnes)

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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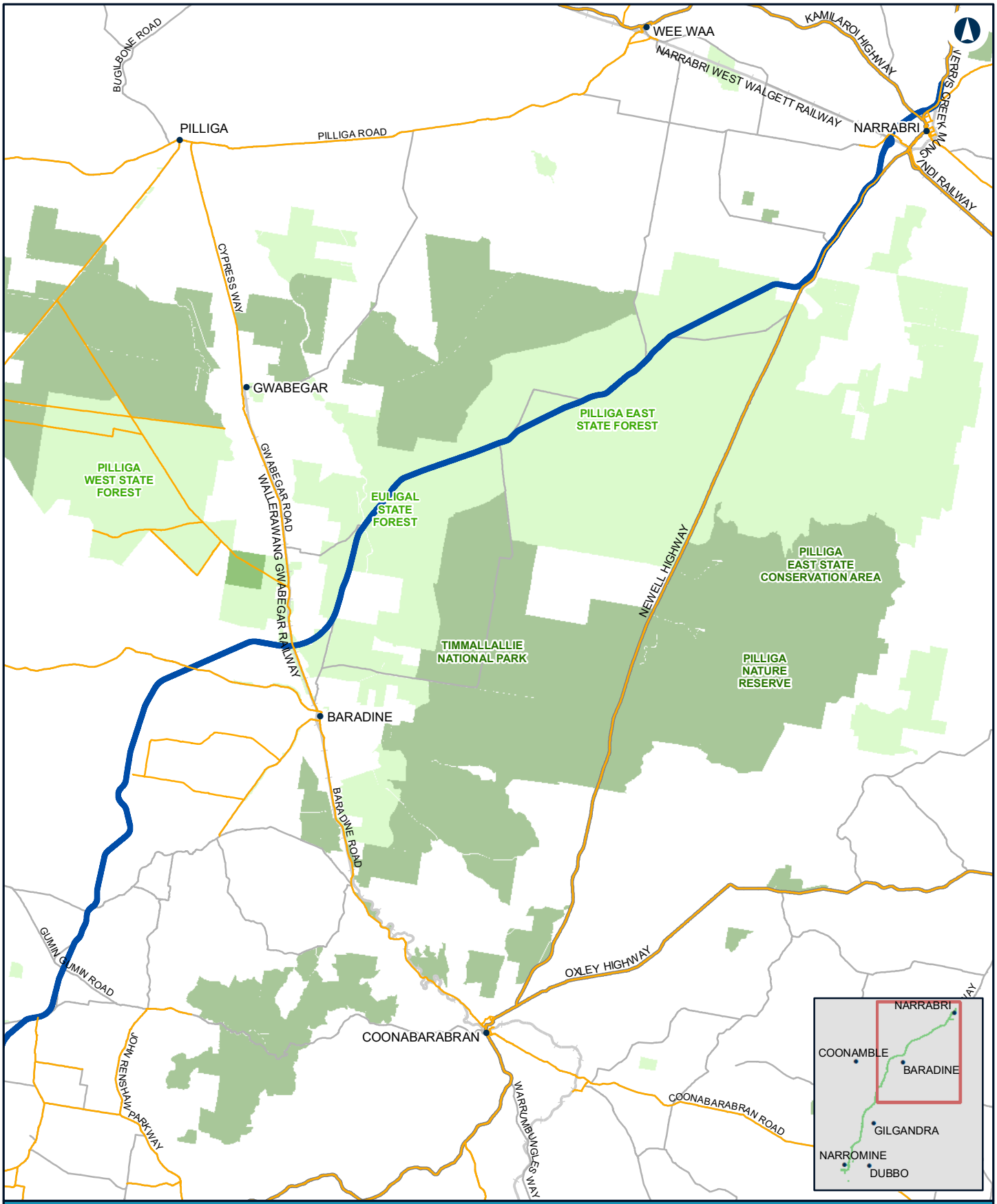

NARROMINE TO NARRABRI Arterial and sub-arterial roads in local area Figure 4.1b

0 8.5 17 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal
- Road
- Arterial road
- 19m B-double Routes (over 50 tonnes)

Date: 3/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:600,000

Data Sources: Basemap layers: NSWSS; Alignment, project elements: GHDJACOBS; Heavy vehicle routes: TfNSW

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Functional hierarchy

Functional road classification involves the relative balance of the mobility and access functions. TfNSW define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- Arterial Roads – designed to carry vehicles long distance between regional centres.
- Sub-Arterial Roads – designated to carry through traffic between specific areas in a sub region, or provide connectivity from arterial road routes (regional links).
- Collector Roads – provide connectivity between local roads and the-arterial road network.
- Local Roads – provide direct access to properties and the collector road system.

TfNSW's functional hierarchy is used within this report as the default road classification unless otherwise stated.

4.1.2 Roads passing through the study area

The study area consists mainly of local roads and private rural roads. Arterial and sub-arterial roads passing through the study area include:

- A32 Mitchell Highway
- A39 Newell Highway
- B56 Oxley Highway
- B55 Castlereagh Highway
- B51 Kamilaroi Highway.

The study area also includes lower order roads which have importance for movements between regional areas. These include:

- Tomingley Road
- Eumungerie Road
- Gwabegar Road
- Killarney Gap Road
- The McGrane Way.

Each of these are described in detail below with Figure 4.3 providing a map of these roads in the context of the study area.

Newell Highway

The Newell Highway runs generally north-south and connects the Goulburn Valley Highway near the Victoria/NSW border to the Leichardt Highway near the Queensland/NSW border. It forms part of the primary inland passenger vehicle and road freight route between Melbourne and Brisbane, via Narrandera, Parkes, Dubbo and Moree. Within the study area, the Newell Highway runs to the east of the proposal site. Outside of built-up areas, the Newell Highway has a posted speed limit of 110 kilometres per hour except for the 55 kilometre section between Tooraweenah and Coonabarabran which has a speed limit of 100 kilometres per hour. It generally comprises a single lane of travel in each direction on a single carriageway with sealed shoulders. Overtaking lanes are provided in some locations.

The proposal does not cross the Newell Highway within the study area.

Mitchell Highway

The Mitchell Highway runs generally north-south and connects the Great Western Highway at Bathurst to the Landsborough Highway at Augathella, Queensland. It passes through major towns including Orange, Dubbo and Bourke.

The proposal crosses the Mitchell Highway at about 6.5 kilometres east of Narromine. At this location, the Mitchell Highway comprises a single lane of travel in each direction on a single carriageway, with a posted speed limit of 110 kilometres per hour.

Oxley Highway

The Oxley Highway runs generally east-west and connects Port Macquarie to the Mitchell Highway at Nevertire via Tamworth, Gunnedah, Coonabarabran and Gilgandra.

The proposal crosses the Oxley Highway at about 18 kilometres west of Gilgandra. At this location, the Oxley Highway comprises a single lane of travel in each direction on a single carriageway, with a posted speed limit of 110 kilometres per hour.

Castlereagh Highway

The Castlereagh Highway runs generally north-south and connects the Great Western Highway at Marrangaroo (near Lithgow) to the Carnarvon Highway at St George, Queensland. It passes through major towns including Gilgandra and Walgett.

The proposal crosses the Castlereagh Highway at about 18 kilometres north-west of Gilgandra. At this location, the Castlereagh Highway comprises a single lane of travel in each direction on a single carriageway, with a posted speed limit of 110 kilometres per hour.

Kamilaroi Highway

The Kamilaroi Highway runs generally east-west and connects the New England Highway at Willow Tree (between Muswellbrook and Tamworth) to the Mitchell Highway at Bourke. It passes through major towns including Gunnedah, Narrabri and Walgett.

The proposal crosses the Kamilaroi Highway at about 1.2 kilometres north-west of the Newell Highway at Narrabri. At this location, the Kamilaroi Highway comprises a single lane of travel in each direction on a single carriageway, near the transition point between 50 kilometres per hour and 80 kilometres per hour posted speed zones.

Tomingley Road

Tomingley Road runs north-south and connects the Newell Highway and Mitchell Highway. Tomingley Road provides a direct link between Tomingley and Narromine,

The proposal crosses Tomingley Road immediately north of Pinedean Road, about 7.5 kilometres south of Narromine. At this location, Tomingley Road comprises a single lane of travel in each direction on a single carriageway, with a posted speed limit of 110 kilometres per hour.

Eumungerie Road

Eumungerie Road runs generally north-south and provides a link between Narromine and Eumungerie.

The proposal crosses Eumungerie Road about 6.4 kilometres north-east of Narromine. At this location, Eumungerie Road comprises a single lane of travel in each direction on a single carriageway, with a default speed limit of 100 kilometres per hour.

Gwabegar Road

Gwabegar Road runs generally north-south and provides a direct link between Baradine and Cuttabri via Gwabegar. North of Gwabegar, Gwabegar Road deviates to the north-east toward Cuttabri, through the Pilliga National Park.

The proposal crosses Gwabegar Road about 8.0 kilometres north of Baradine. At this location, Gwabegar Road comprises a single lane of travel in each direction on a single carriageway, with a posted speed limit of 100 kilometres per hour.

Killarney Gap Road

Killarney Gap Road runs in a north-easterly direction and provides a direct link between Narrabri and Bingara.

The proposal passes to the west of Killarney Gap Road where this road intersects with the Newell Highway, about 3.4 kilometres north of Narrabri. At this location, Killarney Gap Road comprises a single lane of travel in each direction on a single carriageway, with a default speed limit of 100 kilometres per hour.

The McGrane Way

The McGrane Way runs in a north-south direction and provides a link between Tullamore and Narromine.

The proposal connects to the existing rail line to the east of The McGrane Way near Narwonah, around 10.0 kilometres south of Narromine. At this location, The McGrane Way comprises a single lane of travel in each direction on a single carriageway, with a posted speed limit of 100 kilometres per hour.

4.1.3 Local and other roads

The study area includes a network of local roads, private access roads through properties, and forestry access tracks. The local road network provides direct access to properties and to the main road network.

The proposal site is also crossed by a number of private access roads, which provide access to and/or within properties surrounding or close to the proposal site. Within the Pilliga East State Forest and associated state forest areas, 16 unsealed forestry access tracks cross the proposal site. There are also a number of Crown or ‘paper’ roads in the study area.

The local, regional and forestry roads within the study area are listed in Table 4.1, including whether they intersect with the proposal site.

Table 4.1 Local roads within the study area

Road name	Road classification	Surface type	Shoulders	Line marking	Intersects with proposal
Tomingley Road	Regional	Sealed	No	Yes	Yes
Nellie Vale Road	Local – Narromine	Sealed	No	No	No
Dappo Road	Local – Narromine	Sealed/ unsealed	No	No	Yes
Algalah Street	Local – Narromine	Sealed	Yes	Yes	No
Webbs Siding Road	Local – Narromine	Sealed/ unsealed	No	No	Yes

Road name	Road classification	Surface type	Shoulders	Line marking	Intersects with proposal
High Park Road	Local – Narromine	Sealed	No	No	No
River Drive	Local – Narromine	Sealed	No	No	No
Macquarie View Road	Local – Narromine	Unsealed	No	No	No
Eumungerie Road	Local – Narromine	Sealed	Yes	Yes	Yes
Euromedah Road	Local – Narromine	Sealed	No	No	Yes
Rocky Point Road	Local – Narromine	Unsealed	No	No	Yes
Merrits Lane	Local – Narromine	Unsealed	No	No	Yes
Dubbo-Burroway Road	Local – Narromine	Sealed	No	No	Yes
Greenvale Road	Local – Narromine	Unsealed	No	No	No
Edmonstones Road	Local – Narromine	Unsealed	No	No	No
Emogandy Road	Local – Narromine	Unsealed	No	No	Yes
Cobboco Road	Local – Narromine	Unsealed	No	No	Yes
Collie Road	Local – Gilgandra	Sealed	No	No	No
Old Mill Road	Local – Gilgandra	Unsealed	No	No	Yes
Mawbeys Road	Local – Gilgandra	Unsealed	No	No	No
Gilmours Road	Local – Gilgandra	Unsealed	No	No	Yes
Link Road	Local – Gilgandra	Unsealed	No	No	No
Kickabil Road	Local – Gilgandra	Unsealed	No	No	Yes
Yungundi Road	Local – Gilgandra	Unsealed	No	No	No
Milpulling Road	Local – Gilgandra	Unsealed	No	No	Yes
Leeches Creek Road	Local – Gilgandra	Sealed	No	No	Yes
Nancarrows Road	Local – Gilgandra	Unsealed	No	No	Yes
Berida-Bullagreen Road	Local – Gilgandra	Sealed	No	No	No
Berida Road	Local – Gilgandra	Unsealed	No	No	Yes
McClures Lane	Local – Gilgandra	Unsealed	No	No	No
Forans Road	Local – Gilgandra	Unsealed	No	No	Yes
Wyuna Road	Local – Gilgandra	Unsealed	No	No	Yes
Bardens Road	Local – Gilgandra	Unsealed	No	No	Yes

Road name	Road classification	Surface type	Shoulders	Line marking	Intersects with proposal
Brooks Road	Local – Gilgandra	Unsealed	No	No	Yes
National Park Road	Local – Gilgandra	Sealed	No	No	No
East Coonamble Road	Local – Gilgandra	Unsealed	No	No	Yes
Hillside Road	Local – Gilgandra	Sealed/ unsealed	No	No	No
Yarrandale Road	Local – Gilgandra	Sealed	No	No	Yes
Hillside Hall Road	Local – Gilgandra	Unsealed	No	No	No
Youlbung Road	Local – Gilgandra	Unsealed	No	No	No
Windurong Road	Local – Gilgandra	Unsealed	No	No	No
Tarralea Road	Local – Gilgandra	Unsealed	No	No	Yes
Tonderburine-Tooraweenah Road	Local – Gilgandra	Unsealed	No	No	No
Seven Mile Road	Local – Gilgandra	Unsealed	No	No	No
Bedford Park Road	Local – Gilgandra	Unsealed	No	No	No
Box Ridge Road	Local – Gilgandra	Sealed	No	No	Yes
Weenya Road	Local – Coonamble	Unsealed	No	No	No
Gumin Gumin Road	Local – Coonamble	Unsealed	No	No	Yes
Goorianawa Road	Local – Coonamble	Unsealed	No	No	Yes
Fishers Road	Local – Coonamble	Unsealed	No	No	No
Gunnawarra Road	Local – Coonamble	Unsealed	No	No	No
Mungery Road	Local – Coonamble	Unsealed	No	No	Yes
Quanda Road	Local – Coonamble	Unsealed	No	No	No
Wattle Creek Road	Local – Coonamble	Unsealed	No	No	No
Gulargambone Baradine Road	Local – Warrumbungle	Sealed	No	No	No
Munns Road	Local – Warrumbungle	Unsealed	No	No	No
Caledonia Road	Local – Warrumbungle	Unsealed	No	No	No
Baradine Road	Regional	Sealed	No	Yes	Yes

Road name	Road classification	Surface type	Shoulders	Line marking	Intersects with proposal
Carmel Lane	Local – Warrumbungle	Sealed/ unsealed	No	No	No
Gwabegar Road	Regional	Sealed	No	Yes	Yes
Cumbil Road	Local – Warrumbungle	Unsealed	No	No	Yes
Quiet Road	Local – Warrumbungle	Unsealed	No	No	Yes
Pinchmans Road	Local – Warrumbungle	Unsealed	No	No	Yes
Aloes Road	Forestry Roads	Unsealed	No	No	Yes
Pilliga Forest Way	Forestry Roads	Unsealed	No	No	Yes
Coxs Road	Forestry Roads	Unsealed	No	No	Yes
Reillys Road	Forestry Roads	Unsealed	No	No	No
Neds Road	Forestry Roads	Unsealed	No	No	No
Country Line Road	Forestry Roads	Unsealed	No	No	No
Sixteen Foot Road	Forestry Roads	Unsealed	No	No	Yes
Kings Road	Forestry Roads	Unsealed	No	No	Yes
Lanes Mill Road	Forestry Roads	Unsealed	No	No	Yes
Jack Scott Road	Forestry Roads	Unsealed	No	No	Yes
Zot Road	Forestry Roads	Unsealed	No	No	Yes
Billy Reed Road	Forestry Roads	Unsealed	No	No	No
Old Mill Road	Forestry Roads	Unsealed	No	No	Yes
Schatz Road	Forestry Roads	Unsealed	No	No	Yes
Reedy Creek Road	Forestry Roads	Unsealed	No	No	Yes
Dog Proof Fence Road	Forestry Roads	Unsealed	No	No	No
Glenwood Lane	Local – Narrabri	Unsealed	No	No	Yes
Cains Crossing Road	Local – Narrabri	Unsealed	No	No	Yes
Yarrie Lake Road	Local – Narrabri	Sealed	No	No	Yes
Goobar Street	Local – Narrabri	Sealed	No	No	No
The Island Road	Local – Narrabri	Sealed	No	No	Yes
Killarney Gap Road	Regional	Sealed	No	Yes	No

4.1.4 Intersections

The proposal site is located near three highway intersections with the potential to be impacted by the proposal, including the operation of level crossings.

Newell Highway and Cains Crossing Road

The Newell Highway/Cains Crossing Road intersection is give-way controlled, with gravel shoulders provided on the Newell Highway to facilitate left-turning movements to Cains Crossing Road, clear of through traffic movements. Regular and frequent gaps in Newell Highway traffic flow allow traffic to turn into and out of Cains Crossing Road with generally minimal delay. The intersection is located about 160 metres east of the proposal site.

Newell Highway and Glenwood Lane

The Newell Highway/Glenwood Lane intersection is give-way controlled, with gravel shoulders provided on the Newell Highway to facilitate left-turning movements to Glenwood Lane, clear of through traffic movements. Regular and frequent gaps in Newell Highway traffic flow allow traffic to turn into and out of Glenwood Lane with generally minimal delay. The intersection is located about 90 metres east of the proposal site.

Oxley Highway and Nancarrows Road

The Oxley Highway/Nancarrows Road intersection is give-way controlled, with gravel shoulders provided on the Oxley Highway to facilitate left turning movements to Nancarrows Road, clear of through traffic movements. Regular and frequent gaps in Oxley Highway traffic flow allow traffic to turn into and out of Nancarrows Road with generally minimal delay. The intersection is located about 60 metres east of the proposal site.

Other intersections

Traffic volumes throughout the study area are generally sufficiently low that there are minimal delays at the existing intersections. Turning traffic is typically able to find a gap in the opposing traffic flow without waiting for a long period. Table B11.2 lists the intersections within each LGA that are in the vicinity of the proposal site.

Table 4.2 Intersections in the vicinity of the proposal site

Local government area	Intersecting roads	
Narromine LGA	Tomingley Road	Pinedean Road
	Dappo Road	Wallaby Road
	Eumungerie Road	Euromedah Road
	Rocky Point Road	Eumungerie Road
	Merrits Lane	Eumungerie Road
	Burroway Road	Eumungerie Road
	Greenvale Road	Eumungerie Road
Gilgandra LGA	Collie Road	Old Mill Road
	Old Mill Road	Gilmours Road
	Oxley Highway	Nancarrows Road
	Gumin-Gumin Road	Weenya Road
Coonamble LGA	Mungery Road	Goorianawa Road
	Mungery Road	Quanda Road

Local government area	Intersecting roads	
Warrumbungle LGA	Baradine Road	Carmel Lane
	Baradine Creek Road	Quiet Road
	Pinchams Road	Cumbil Road
	Omega Road	Cumbil Road
	Sixteen Foot Road	Cumbil Road
	Aloes Road	Pilliga Forest Way Road
Narrabri LGA	Coxs Road	Windup Road
	Neds Road	Pilliga Forest Way Road
	Country Line Road	Pilliga Forest Way Road
	Sixteen Foot Road	Pilliga Forest Way Road
	Jack Scott Road	Pilliga Forest Way Road
	Twenty Foot Road	Pilliga Forest Way Road
	Zot Road	Billy Reed Road
	Pilliga Forest Way Road	Kuhners Bore Road
	Glenwood Lane	Newell Highway
	Cains Crossing Road	Newell Highway
	Yarrie Lake Road	Bohena Lane

4.1.5 Parking

There is no formal on-street or off-street parking provided along or near the proposal site. On-street and off-street parking opportunities are provided in most towns within and near the site.

Rest areas are provided at various locations along the major highways in the study area (TfNSW, 2020c) as shown in Table 4.3. There are 24 rest areas designated for heavy and light vehicles located along the major highways in the study area (Mitchell Highway, Newell Highway, Oxley Highway and Castlereagh Highway), and an additional four that are suitable for light vehicles only.

Table 4.3 Rest areas in close proximity to the rail corridor

Highway	Section	Heavy vehicle rest areas	Additional rest areas suitable for light vehicles only
Mitchell Highway	Narromine to Trangie	1 driver-reviver during holiday periods (part-time)	0
Newell Highway	Dubbo to Gilgandra	2	2
	Gilgandra to Coonabarabran	9	0
	Coonabarabran to Narrabri	9	1
Oxley Highway	Gilgandra to Collie	1	0
Castlereagh Highway	Gilgandra to Coonamble	2	1

4.2 Traffic volumes, levels of service and safety

4.2.1 Traffic volumes

The existing and forecast traffic volumes on key roads around the proposal are described in the following sections.

Newell Highway - traffic volumes and daily profile

Traffic volumes for the Newell Highway were obtained from TfNSW (2020a). The most recent complete data was available for 2017, and is summarised in Table 4.4. The busiest section of the Newell Highway within the study area (outside of urbanised areas) is south of Gilgandra, with an average of about 3,200 vehicles (two-way) per day, including 31 per cent heavy vehicles. On quieter sections of the highway, the proportion of heavy vehicles is much higher. This is as a result of many heavy vehicles travelling over longer distances, where light vehicle traffic is generally more localised.

Rather than using a morning and afternoon peak, for rural roads such as the Newell Highway it is generally more appropriate to consider a single peak hour. The 100th Highest Hourly Volume is commonly used for this purpose. This is the hourly volume that would be expected to be exceeded less than 100 times per year. It allows the impact of unusual activities, special events and other non-typical situations to be excluded from analysis, whilst maintaining a reasonable traffic volume for assessment purposes.

For the Newell Highway within the study area, based on TfNSW records for 2017, it has been determined that the 100th Highest Hourly Volume represents 10.4 per cent of the AADT. A similar figure is expected for other roads in the study area.

Table 4.4 Newell Highway traffic volumes 2017

Location	TfNSW Site ID	2017 Annual average daily traffic (AADT) (vehicles)	% Heavy vehicles	100th Highest hourly volume
North of Oxley Highway (north of Coonabarabran)	T0498	1,600	44	167
South of Coonabarabran	CBBSTC	2,900	34	298
North of Gilgandra	T0497	1,800	41	190
South of Gilgandra	6146	3,200	31	333
Eumungerie	6145	2,900	28	302

The average daily profile of traffic activity for the Newell Highway is shown in Figure 4.2, noting that the figure below shows the profile for a section of Newell Highway outside of a built up area. Northbound and southbound traffic follows broadly similar profiles, with traffic volumes generally consistent throughout the day. There are no significant peaks in traffic activity, although volumes are generally highest in the mid-morning.

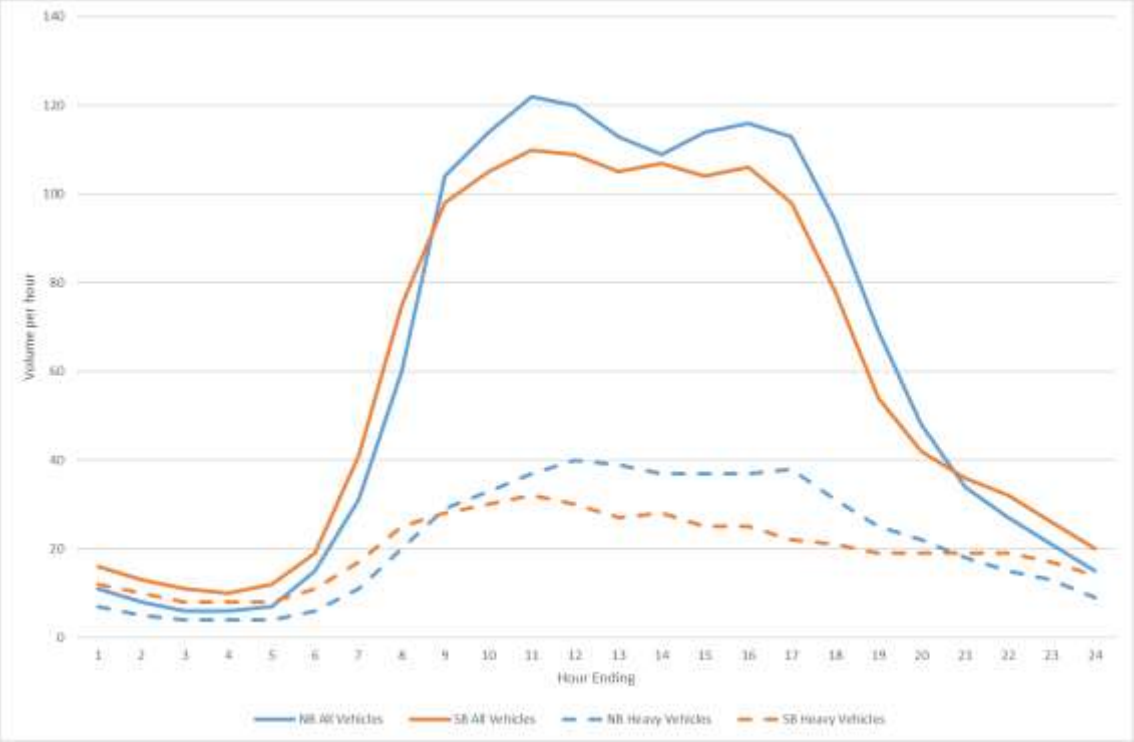


Figure 4.2 Average daily profile, Newell Highway south of Coonabarabran, 2017

Newell Highway - historic volumes and growth

Figure 4.3 shows historical AADT values for the Newell Highway south of Coonabarabran, between 2010 and 2017. The trend in growth in all vehicles has been at 0.93 per cent per annum (linear growth on a 2017 base). Heavy vehicle volumes have grown at 1.4 per cent over the same period. The growth in all vehicles is consistent with the historical growth rate stated in the *Newell Highway Corridor Strategy* (Department of Infrastructure, Transport, Regional Development and Communication, 2019a).

It is noted that the Strategy also suggests that the forecast growth in trucks on the Newell Highway from 2011 to 2031 is over twice this observed rate, however it is expected that Inland Rail would take a substantial proportion of freight that would otherwise travel on the Newell Highway and therefore growth in truck traffic on the highway may be lower than previously estimated.

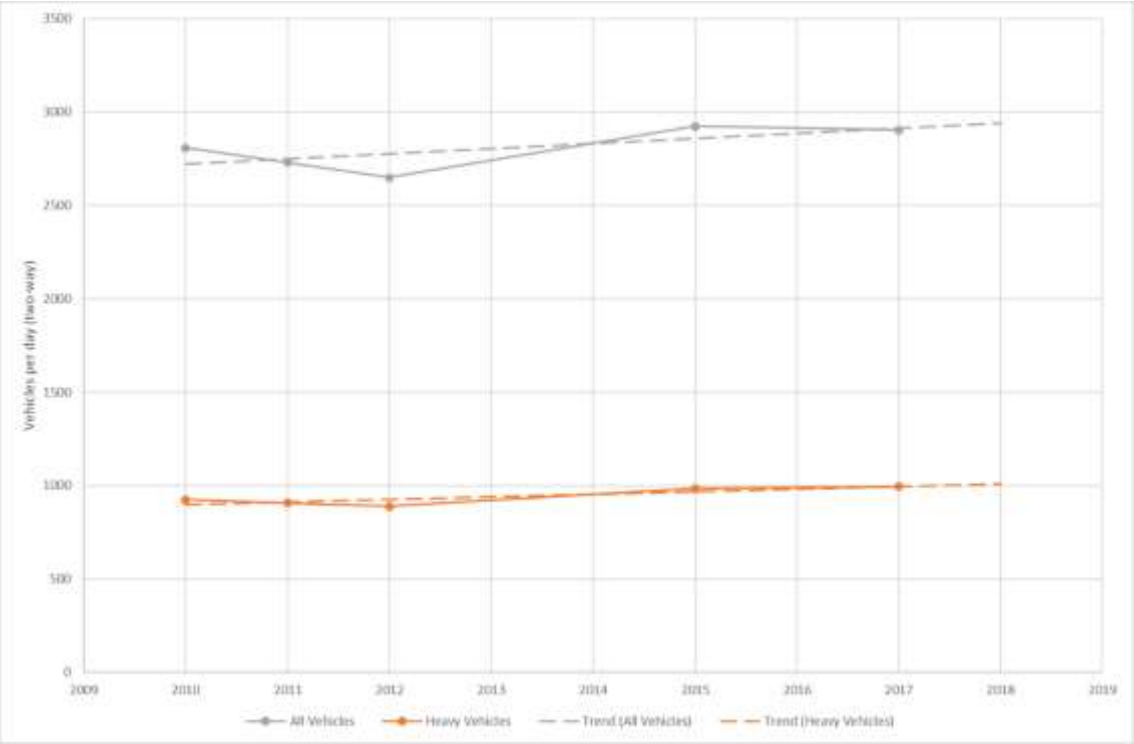


Figure 4.3 Historical growth – Newell Highway south of Coonabarabran

Newell Highway - seasonal profile

Traffic volumes on the Newell Highway are not consistent across the year. There is seasonal variation associated with such factors as agricultural production, freight movement and tourism.

Figure 4.4 shows the Average Daily Traffic (ADT) volume for each month, compared to the Annual Average Daily Traffic (AADT) volume. Traffic is busiest in September (107 per cent of AADT), and quietest in February (90 per cent of AADT). Generally, harvest of winter crops in the study area can begin in late October and continue through to January in higher rainfall areas. During this season, heavy vehicle usage on local and main roads in the study area increases as trucks transport grain and tractors and harvesters move between properties. Farming machinery is generally much larger and slower than other vehicles using the roads.

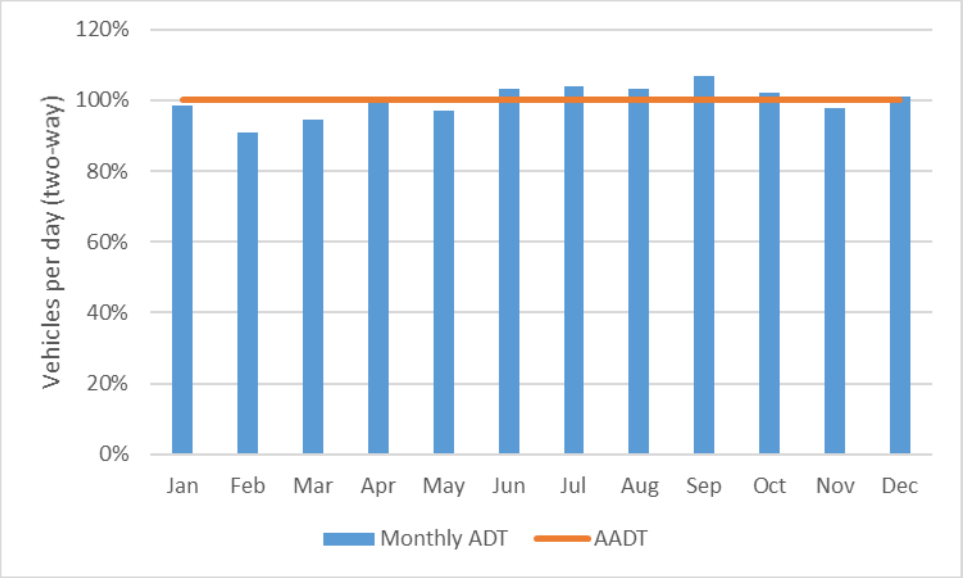


Figure 4.4 Seasonal profile – Newell Highway south of Coonabarabran, 2017

Based on the information available for Newell Highway, it is expected that the wider road network in close proximity to the proposal, would have similar forecast growth and seasonality to that shown for Newell Highway. The seasonal and growth profile of the Newell Highway provides a good indication of activity within and between regional communities along its corridor.

It is noted that this data was not available for other roads in close proximity to the proposal and therefore the Newell Highway is the most appropriate data within the study area. However, it is noted that the lower order roads in close proximity to the proposal are likely to be more affected by seasonality, mostly due to the lower baseline traffic volumes experienced on these roads.

Other roads

To supplement traffic data available from the then Roads and Maritime Services for the Newell Highway, traffic surveys were undertaken at key locations through the study area. These locations, and a summary of the results of the traffic survey, are detailed in Table 4.5. Traffic data was collected over seven days, between 7 November 2018 and 13 November 2018. Table 4.5 details AADT during that period, as well as the proportion of heavy vehicles, and the peak hourly volume.

Surveyed volumes range from 3,581 vehicles per day on the Mitchell Highway, to as few as five vehicles per day on Pilliga Forest Way.

As shown above in Table 4.5, the seasonal profile of Newell Highway (and generally the wider road network) shows that November is a reasonably representative of the average traffic anticipated on the following roads, noting seasonal considerations discussed in section 4.2.1. Changes in traffic operations on lower order roads is anticipated to be minimal due to low traffic volumes experienced on these roads. Therefore, this data has been adopted to analyse the impacts on the road network.

The surveys were undertaken during a period of drought in rural NSW, which is anticipated to have an impact on the traffic volumes within the local area due to agricultural related activities. It can be assumed that lower traffic volumes were generally experienced throughout the 2018/2019 surveys. Harvest movements (and those impacted by drought) are expected to occur outside of peak hour volumes and therefore the volumes shown in Table 4.5 below are expected to be representative of typical conditions on these roads.

Table 4.5 Traffic volumes on key roads, November 2018

Road name	Location	Average Daily Volume (2-way)	% HV	Peak Hour Volume (2-way)
Mitchell Highway	East of High Park Road	3581	15	418
Eumungerie Road	South of Euromedah Road	451	48	62
Dubbo-Burroway Road	West of Eumungerie Road	280	10	42
Cobboco Road	West of Collie Road	17	6	5
Collie Road	West of Old Mill Road	138	13	13
Old Mill Road	West of Mawbeys Road	5	10	5
Leeches Creek Road	East of Gilmours Road	18	25	7
Oxley Highway	East of Berida-Bullagreen Road	369	20	50
Berida Road	West of McClures Lane	14	29	5
Castlereagh Highway	North of Berida Road	856	15	101
National Park Road	East of Castlereagh Highway	162	21	34
Gumin Gumin Road	West of Goorianawa Road	43	26	10
Baradine Road	East of Carmel Lane	141	12	19
Gwabegar Road	North of Cumbil Road	194	15	27
Pilliga Forest Way	East of Cumbil Road	5	10	3
Yarrie Lake Road	West of Williams Drive	1421	14	149
Kamilaroi Highway	East of Logans Lane	1648	15	195
Tomingley Road	South of Craigie Lea Lane	565	36	64
Dappo Road	West of Wallaby Road	9	20	3
National Park Road	North of Hillside Road	93	22	22
Newell Highway	North of Cains Crossing Road	1926	34	191
Newell Highway	South of Cains Crossing Road	1771	37	187
The Island Road	West of Millicent Drive	22	2	6

4.2.2 Road network performance

Road level of service

The *Austroads Guide to Traffic Management Part 3 (Traffic Studies and Analysis)* outlines procedures for estimating the LOS of a section of roadway. Relevant to this assessment is the procedure for evaluating uninterrupted flow facilities which apply where road capacity is not significantly affected by intersection operation.

The LOS is determined with reference to the expected speed of travel (compared to the free flow speed), and the Per cent Time Spent Following (PTSF), which is a measure of the level of opportunities to overtake a slower vehicle. The analysis considers such as factors as lane widths, shoulder provision, heavy vehicle proportion, terrain, overtaking zones and the directional split of traffic.

The Austroads methodology specifies different criteria for determining LOS, depending on the road type:

- The LOS for Class I highways on which efficient mobility is paramount is defined in terms of both per cent time-spent-following and average travel speed.
- On Class II highways, mobility is less critical, and LOS is defined only in terms of per cent time-spent-following.

Austroads provides the following description of each LOS band for two-lane highway facilities with uninterrupted flow:

- "At LOS A, motorists experience high operating speeds on Class I highways and little difficulty in passing. Platoons of three or more vehicles are rare. On Class II highways, speed would be controlled primarily by roadway conditions. A small amount of platooning would be expected.
- At LOS B, passing demand and passing capacity are balanced. On both Class I and Class II highways, the degree of platooning becomes noticeable. Some speed reductions are present on Class I highways.
- At LOS C, most vehicles are travelling in platoons. Speeds are noticeably curtailed on all classes of highway.
- At LOS D, platooning increases significantly. Passing demand is high on both Class I and II facilities, but passing capacity approaches zero. A high percentage of vehicles are now travelling in platoons, and PTSF is quite noticeable.
- At LOS E, demand is approaching capacity. Passing on Class I and II highways is virtually impossible, and PTSF is more than 80 per cent. Speeds are seriously curtailed. The lower limit of this LOS represents capacity.
- LOS F exists whenever arrival flow in one or both directions exceeds the capacity of the segment. Operating conditions are unstable, and heavy congestion exists on all classes of two-lane highway."

The nominal capacity of a two-lane highway is 1,700 vehicles per hour for each direction of travel.

The calculated LOS for various roads in the study area is shown in Table 4.6.

Table 4.6 Existing road Level of Service

Road name	Location	Peak Hour Volume (2-way)[1]	Highway Class	LOS
Mitchell Highway	East of High Park Road	418	I	B
Eumungerie Road	South of Euromedah Road	62	II	A
Dubbo-Burroway Road	West of Eumungerie Road	42	II	A
Cobboco Road	West of Collie Road	5	II	A
Collie Road	West of Old Mill Road	14	II	A
Old Mill Road	West of Mawbeys Road	9	II	A
Leeches Creek Road	East of Gilmours Road	7	II	A
Oxley Highway	East of Berida-Bullagreen Road	50	I	A
Berida Road	West of McClures Lane	5	II	A
Castlereagh Highway	North of Berida Road	101	I	A
National Park Road	East of Castlereagh Highway	34	II	A
Gumin Gumin Road	West of Goorianawa Road	10	II	A
Baradine Road	East of Carmel Lane	19	II	A
Gwabegar Road	North of Cumbil Road	27	II	A
Pilliga Forest Way	East of Cumbil Road	3	II	A
Yarrie Lake Road	West of Williams Drive	149	II	A
Kamilaroi Highway	East of Logans Lane	195	I	B
Tomingley Road	South of Craigie Lea Lane	64	II	A
Dappo Road	West of Wallaby Road	3	II	A
National Park Road	North of Hillside Road	22	II	A
Newell Highway	North of Cains Crossing Road	191	I	A
Newell Highway	South of Cains Crossing Road	187	I	A
The Island Road	West of Millicent Drive	6	II	A

Note 1: The busiest hour during the survey period in November 2018.

Almost all of the analysed roads are currently operating at LOS A. Only the Mitchell Highway and Kamilaroi Highway are operating at LOS B. For the peak hour, LOS C is considered an acceptable minimum depending on duration and vehicle mix for rural and regional locations such as the study area. LOS D is acceptable in only certain circumstances where weekend peaks or occasional recreational activities occur.

Key intersection performance

Traffic volumes throughout the study area are generally sufficiently low that there are minimal delays at intersections. Turning traffic is typically able to find a gap in the opposing traffic flow without waiting for a significant period. Even on the Mitchell Highway, which has the highest peak hour volume in the study area (418 vehicles per hour two-way), the theoretical absorption capacity of the side road approach is some 530 vehicles per hour, in accordance with the service guidelines as outlined in the *Highway Capacity Manual* (Transportation Research Board, 2010), well above the current demand. Based on the surveyed information, the highest anticipated turning movements on Mitchell Highway would be expected from Warren Road, which connects with Eumungerie Road. Eumungerie Road has a peak hour traffic volume of 62 movements and if all movements were assumed to be turning onto Mitchell Highway, there would still be capacity for further turning movements.

4.2.3 Road safety

The five year crash history (July 2013 to June 2018) for various roads within the study area were obtained from the TfNSW Centre for Road Safety (2020b). The data is summarised in Table 4.7.

Table 4.7 Crash history July 2013-June 2018

Street of Crash	Degree of Crash						
	Fatal	Serious	Moderate	Minor	Uncategorised Injury	Non-casualty	Total
Kamilaroi Highway	***6***	***11***	***10***	***1***	***2***	***12***	***42***
Boggabri to Narrabri	5	8	9		2	9	33
Narrabri to Wee Waa	1	3	1	1		3	9
Mitchell Highway	***6***	***25***	***50***	***13***	***5***	***48***	***147***
Dubbo to Narromine	2	15	41	11	4	36	109
Narromine to Nevertire	4	7	2	1	1	2	17
Nevertire to Nyngan		3	7	1		10	21
Newell Highway	***17***	***73***	***106***	***41***	***7***	***132***	***376***
Parkes to Dubbo	5	13	47	17	1	52	135
Dubbo to Gilgandra	6	14	17	2	2	18	59
Gilgandra to Coonabarabran	2	9	9	5	1	15	41
Coonabarabran to Narrabri	2	23	16	7	3	21	72
Dubbo to Narromine			1				1
Narrabri to Moree	2	14	16	10		26	68
Castlereagh Highway (Gilgandra to Coonamble)		2	4	1		7	14
Oxley Highway (Gilgandra to Nevertire)	1	7	4	3	2	10	27
Tomingley Road	3		2	1		1	7
Wamboin Street						1	1

Street of Crash	Degree of Crash						
	Fatal	Serious	Moderate	Minor	Uncategorised Injury	Non-casualty	Total
Yarrie Lake Road		2	1			1	4
Algalah Street		1				1	2
Baradine Road	1	4		2		3	10
Baradine – Coonamble Road				1			1
Berida Road			1				1
Burraway Road			1	1		1	3
Chester Street						1	1
Collie Road	1	1	1				3
Coonabarabran Road				1		1	2
Coonabarabran – Baradine Road	1			1		1	3
Dubbo Street				1			1
Dubbo – Burroway Road						1	1
Eumungerie Road	1		3			1	5
Gwabegar Road		1				3	4
Total	37	127	183	67	16	225	655

The majority of crashes occurred on the Newell Highway, with the Mitchell Highway also experiencing a higher number of crashes. This is to be expected given the higher traffic volumes on these roads and the length of the area considered in this assessment. The high proportion of fatal and moderate-serious injury crashes is noted, most likely a factor of the higher travel speeds prevalent on rural roads.

Other key observations from the data include:

- 92 per cent of crashes occurred on State Highways
- 69 per cent of crashes involved a light vehicle, 18 per cent a heavy truck and 18 per cent a bus
- 61 per cent of crashes occurred at in a 100 or 110 kilometres per hour speed zone
- 57 per cent of crashes involved a single vehicle
- 28 per cent of crashes occurred at intersections
- 27 per cent of crashes occurred at night
- The highest proportion of crashes were at intersections between adjacent approaches (nine per cent), head-on (four per cent) and opposing vehicles turning (four per cent).

A review of the crash statistics above with respect to the traffic volumes collected in November 2018 and the distance of these roads segments, provides a ratio of the number of crashes per 100 million vehicle kilometres travelled (VKT) for each road. The specific segments for each of the Newell Highway, Kamilaroi Highway and Mitchell Highway outlined above have been utilised for this crash analysis. Table 4.8 below summarises the crash rates per 100 million vehicle kilometres travelled for casualties and fatalities as well as providing total rates for all segments.

Table 4.8 Ratio of casualties per 100 million vehicle kilometres travelled

Road	Casualties per 100 million VKT	Fatalities per 100 million VKT
Mitchell Highway - *Dubbo to Narromine*	7.7	0.9
Eumungerie Road	2.3	2.3
Collie Road	13.7	6.8
Oxley Highway	11.4	1.4
Castlereagh Highway	1.4	0.0
Baradine Road	42.9	8.6
Gwabegar Road	6.9	0.0
Yarrie Lake Road	1.9	0.0
Kamilaroi Highway - *Narrabri to Wee Waa*	3.5	0.9
Tomingley Road	8.1	8.1
Newell Highway - *Coonabarabran to Narrabri*	6.1	0.5
Road Segments Analysed	**5.9**	**1.0**

It is noted that for the above assessment, only the crashes classified as Fatal or Serious were utilised for the assessment. The higher ratios noted above being Collie Road, Oxley Highway and Baradine Road, are due in part to the low traffic volumes experienced on these roads.

The *Road Traffic Casualty Crashes in New South Wales* (TfNSW, 2019a) details that in 2018 across NSW there were 6.67 serious injuries and 0.44 fatalities per 100 million VKT. When reviewing Table 4.8 above, generally the roads within the study area exhibit higher fatality rates than the state average, however serious injury rates are quite similar or slightly lower than the state average. The higher proportion of fatalities in the study area when compared with the state average is typical of regional and rural areas.

4.3 Other transport facilities

4.3.1 Existing rail infrastructure

Two main rail networks operate in the study area:

- Country Regional Network – carries passengers and some freight.
- NSW Interstate, Hunter Valley and Metropolitan Freight Networks – carries mainly freight, with limited passenger services in some areas.

Freight

Both the Country Regional and NSW Interstate, Hunter Valley and Metropolitan Freight Networks operate within the study area.

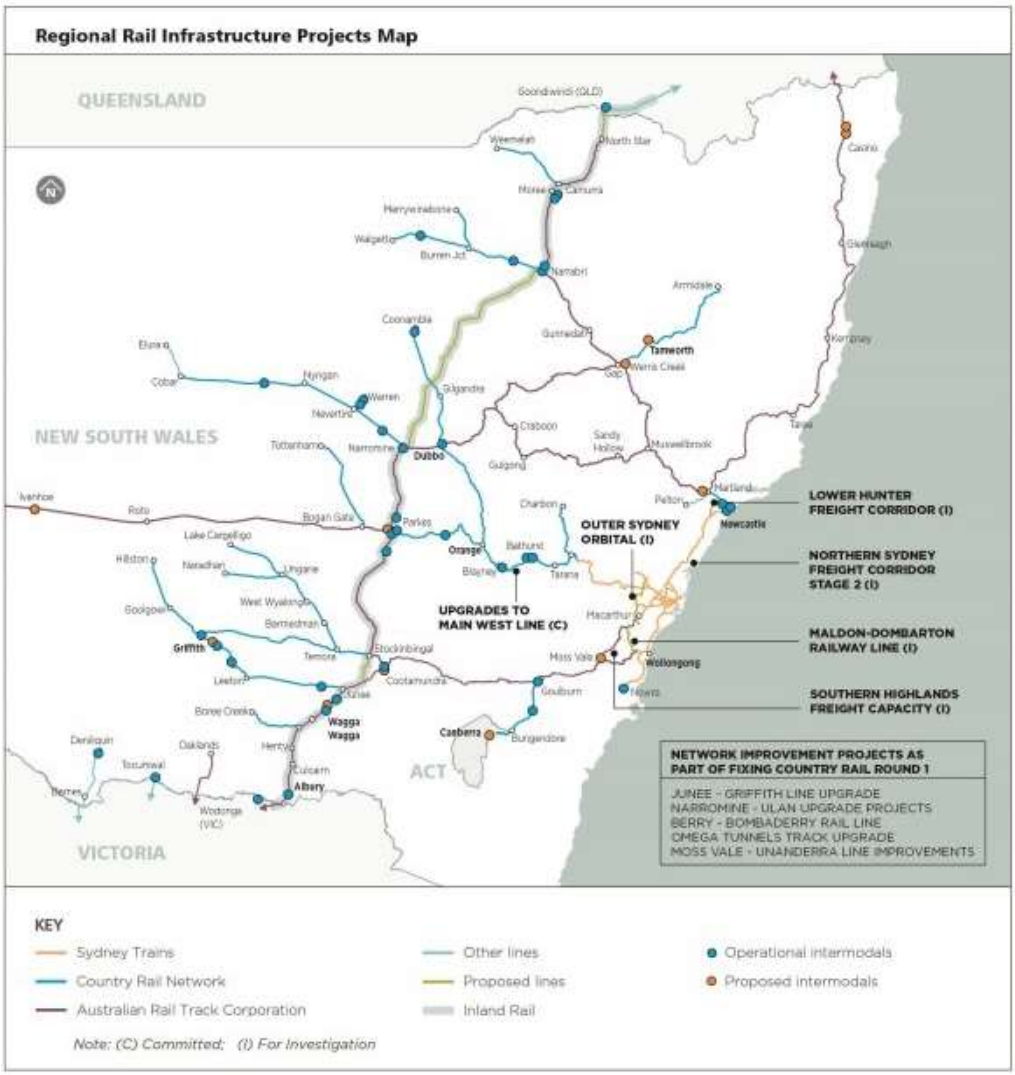
The Country Regional Network includes lines connecting Dubbo to Cobar, Dubbo to Coonamble, and Narrabri to Walgett. Within the study area, the existing ARTC rail network intersects with the Country Regional Network at Narromine and Narrabri, near the existing passenger train stations.

The network is shown in Figure 4.5.

On the existing line between Narrabri and Wee Waa, there is typically one train in each direction timetabled on each of Monday, Wednesday and Friday, carrying general freight. On the existing line between Dubbo and Cobar there is typically one train in each direction on each of Tuesday, Wednesday, Thursday, Friday and Saturday.

On the existing rail line between Parkes and Narromine, there are typically multiple trains in each direction each day, with multiple uses (being general freight, passenger, intermodal and minerals).

The existing line between Dubbo and Coonamble is only used seasonally for transport of grain from silos along the route. The seasonal nature of grain harvest means that volumes can be inconsistent within and between years.



Source: https://www.transport.nsw.gov.au/operations/logistics-network/nsw-rail-network

Figure 4.5 Freight rail network

Passenger services

NSW TrainLink operates passenger rail and coach services in and near to the study area, including the following services as summarised in Table 4.9.

Table 4.9 Passenger services within the study area

Mode	Service	Destinations	Frequency
Coach	Broken Hill Town	Dubbo to Nyngan	Twice daily (three times on Thursday)
Coach	Goodooga	Dubbo to Lighting Ridge	Once daily
Coach	Lithgow	Lithgow to Baradine	Once daily
Train	North West Xplorer	Sydney to Moree	Once daily
Coach	Burren Junction	Narrabri to Burren Junction	Return services on Fridays only

Trains operate from Sydney to Dubbo and Moree once per day in each direction, with additional coach connections from Orange and Lithgow to Dubbo.

A map showing the regional train and coach services in provided in Figure 4.6.

Source: https://transportnsw.info/regional-western-line

Figure 4.6 Regional train and coach map

Level crossings

There are five existing level crossings located within the proposal site adjacent to the proposed connections with existing rail lines. These are located on:

- Berida Road, on the line between Dubbo and Coonamble
- Yarrie Lake Road, on the line between Narrabri and Wee Waa
- Narwonah Siding Road, on the line between Tomingley West and Narwonah
- Old Backwater Road, on the line between Narwonah and Narromine
- Dandaloo Road, on the line between Narwonah and Narromine.

All of these level crossings have passive forms of control, consisting of give way or stop signs. No changes to these level crossings are proposed.

4.3.2 Public transport

In addition to the NSW TrainLink passenger rail and coach services described in section 4.3.1, there are a number of bus services that provide links to and within the study area. These are listed in Table 4.10 and shown in Figure 4.7.

Table 4.10 Bus services in the study area

Route	Route type	Operator	Number of services (bi-directional)	Road utilised in proximity to study area
Narromine to Dubbo	Regular passenger	Ogden's Coaches	Weekday – 12	Mitchell Highway
Narromine to Dubbo	Regular passenger	Dubbo Bus Lines	Weekday – 2	Mitchell Highway
Gulargambone to Uluma	School	Ogden's Coaches	Weekday – 2	Castlereagh Highway
Gulargambone to Eureka	School	Ogden's Coaches	Weekday – 2	Box Ridge Road
Gilgandra to Kickabil	School	Ogden's Coaches	Weekday – 2	Collie Road
Gilgandra to Collie	School	Ogden's Coaches	Weekday – 2	Oxley Road
Gilgandra to Curban	School	Ogden's Coaches	Weekday – 2	Castlereagh Highway
Gilgandra to Breelong	School	Ogden's Coaches	Weekday – 2	Castlereagh Highway
Gilgandra to Balladoran	School	Ogden's Coaches	Weekday – 2	Newell Highway
Gilgandra to Innisfail	School	Ogden's Coaches	Weekday – 2	Leeches Creek Road
Narrabri Town to Narrabri West	Regular passenger	Forest Coach Lines	Weekday – 10	Newell Highway
Narrabri Town Loop	Regular passenger	Forest Coach Lines	Weekday – 1	-
Narrabri to Gunnedah	Regular passenger	Forest Coach Lines	Weekday – 2	Kamilaroi Highway
Narrabri to Wee Waa	Regular passenger	Forest Coach Lines	Weekday – 2	Kamilaroi Highway

Route	Route type	Operator	Number of services (bi-directional)	Road utilised in proximity to study area
Farr Park to Wee Waa	Regular passenger	Forest Coach Lines	Weekday – 2	-
Pilliga to Wee Waa	Regular passenger	Forest Coach Lines	Weekday – 2	-
Narrabri school routes	School	Forest Coach Lines	Weekday – 6	-

As shown in Table 4.10 above and in Figure 4.7, only 13 of the bus services are anticipated to be impacted by the proposal, as they operate on roads that would be crossed by the proposal.

4.3.3 Pedestrians and cyclists

Pedestrian and cyclist activity is minimal adjacent to the proposal, with no facilities for pedestrians or cyclists provided along the major highways in the study area, although cycling is catered for along road shoulders where these exist.

Footpaths and pedestrian crossing facilities are provided in most towns within and near the study area.

4.3.4 Travelling stock reserves

Travelling stock reserves are parcels of Crown land originally reserved for the use of travelling stock. The travelling stock reserve network is now used for a range of purposes, including:

- travelling stock, emergency stock refuge and transport of stock to market
- providing biodiversity corridors
- providing access and connection to country for Aboriginal peoples
- maintaining heritage.

In the study area, the majority of travelling stock reserves are to the west of Narromine, Gilgandra and the Pilliga. A 'livestock highway' (a linked string of travelling stock reserves) extends from Narromine to Coonamble via Tenandra. Incomplete corridors are located from Dubbo to Walgett via Gilgandra and Coonamble, and from Binnaway to Pilliga via Coonabarabran.

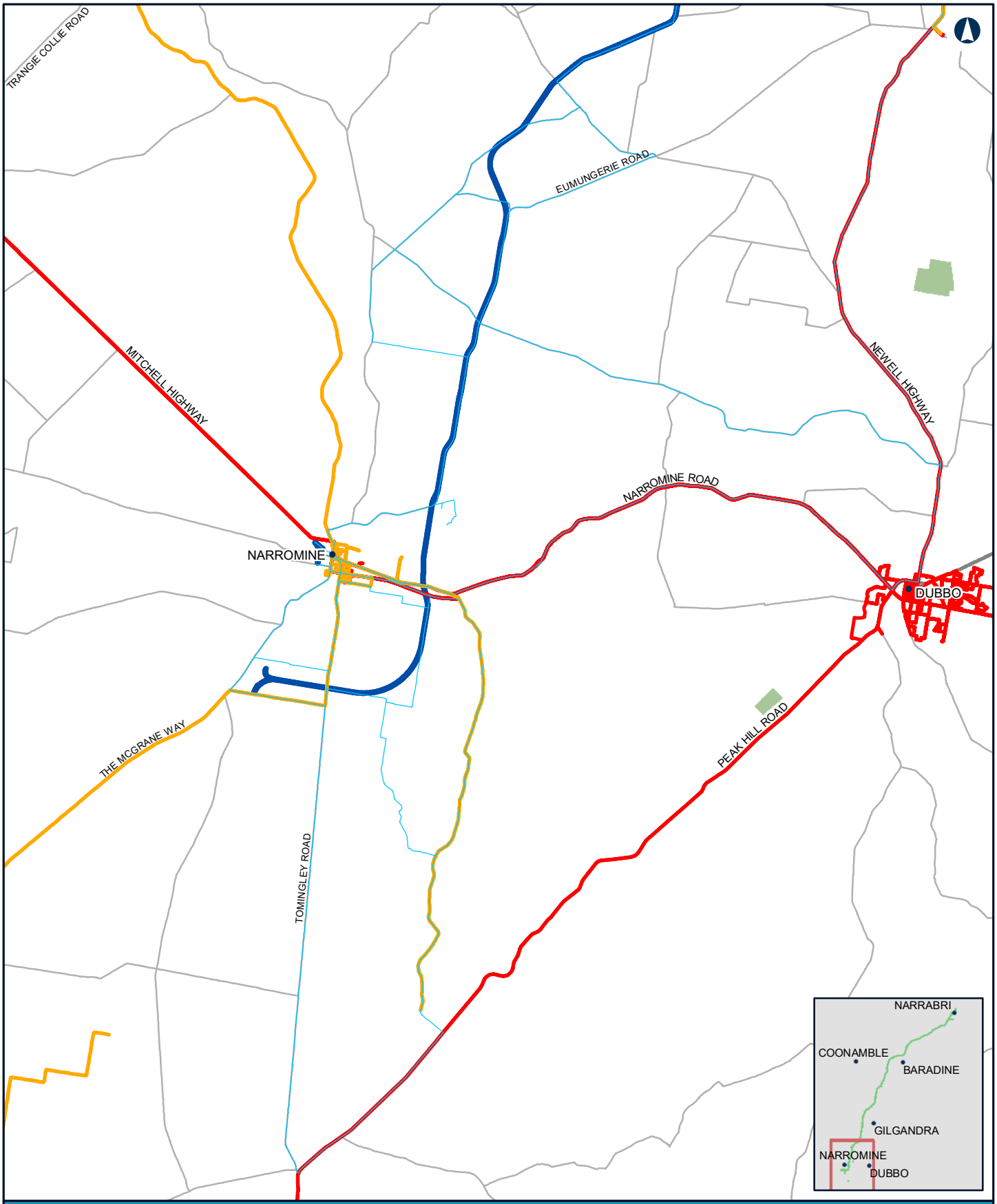
The proposal site crosses about nine travelling stock reserves, located at Narromine, Kickabil, Curban, Gilgandra, Bohena Creek and Narrabri.

The locations of these travelling stock reserves are shown in Figure 4.8.

4.3.5 Land use

Land uses within the study area are primarily regulated by the EP&A Act. The EP&A Act relies on a series of environmental planning instruments to implement zoning controls on land. Each of the local government areas in the study area have adopted local environmental plans to define detailed controls, which largely follow a standardised format.

The study area has largely been zoned for primary production purposes (zone RU1) and forestry purposes (zone RU3). These two land use zones represent over 98 per cent of land in the study area and have been largely consistent over a long period of time. There is limited other proposed land use developments near the proposal. Refer to, *ARTC Inland Rail Narromine to Narrabri Agriculture and Land Use Assessment* (JacobsGHD, 2020a) for further information regarding land use within and near the proposal site.



NARROMINE TO NARRABRI

Bus services - Narromine

Figure 4.7a

0 4 8 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal
- Construction access route
- Bus route
- School bus route
- Road
- Arterial road

Date: 19/06/2020 Paper: A4
Author: JacobsGHD Scale: 1:310,000

Data Sources: Basemap layers: NSWSS; Alignment, project elements: GHDJACOBS; Bus routes: GTFS; School bus routes; Ogden's Coaches

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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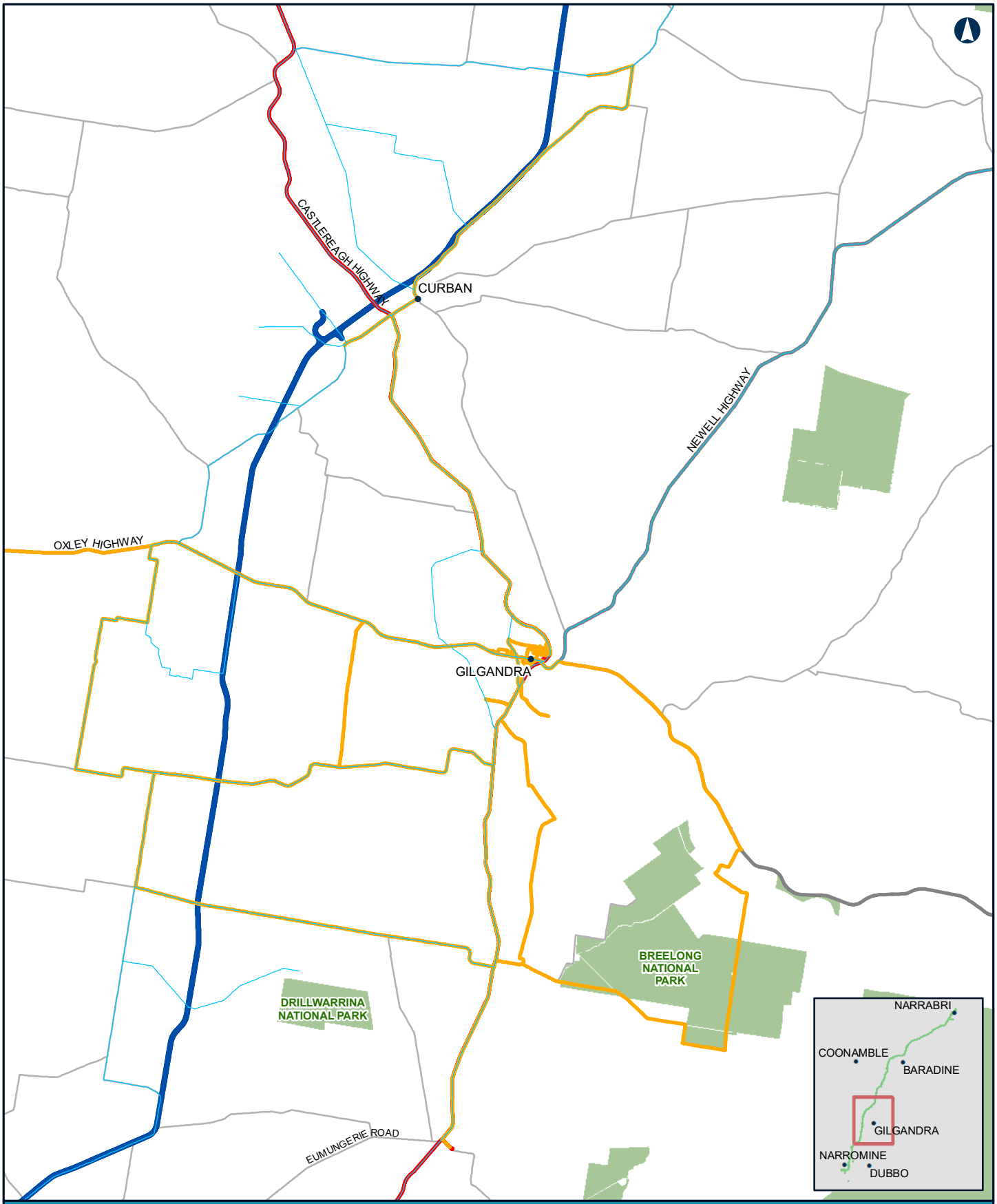

NARROMINE TO NARRABRI Bus services - Gilgandra Figure 4.7b

0 4 8 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal
- Construction access route
- Bus route
- School bus route
- Road
- Arterial road

Date: 19/06/2020 Paper: A4
Author: JacobsGHD Scale: 1:280,000

Data Sources: Basemap layers: NSWSS; Alignment, project elements: GHDJACOBS; Bus routes: GTFS; School bus routes; Ogden's Coaches

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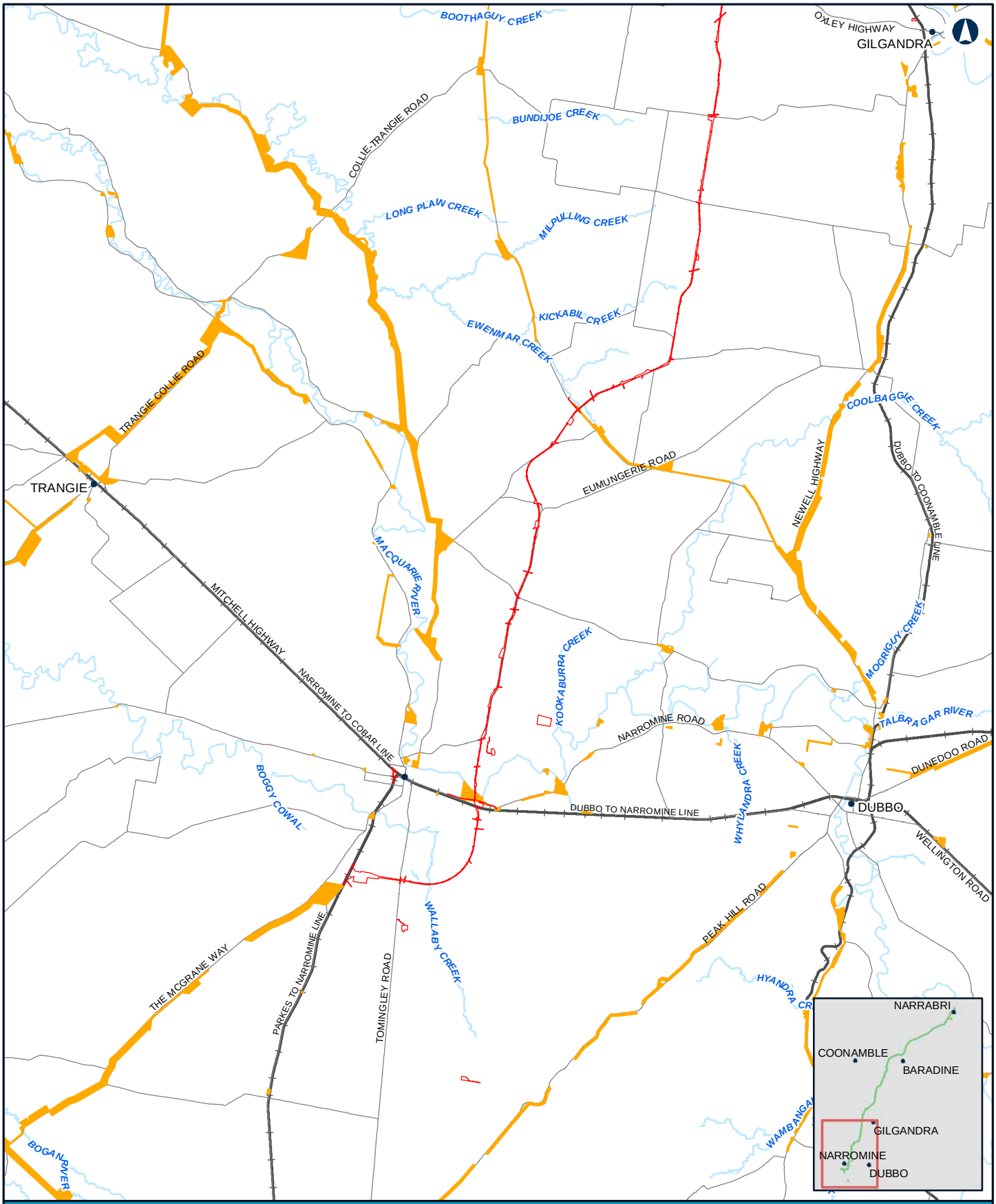

NARROMINE TO NARRABRI Travelling stock reserves Figure 4.8a

0 5.5 11 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:400,000
Data Sources: Basemap layers: NSWSS; TSR: Local Land Services (LLS); Footprints: GHDJACOBS

LEGEND

- The proposal site
- Travelling stock reserves

INLAND RAIL ARTC

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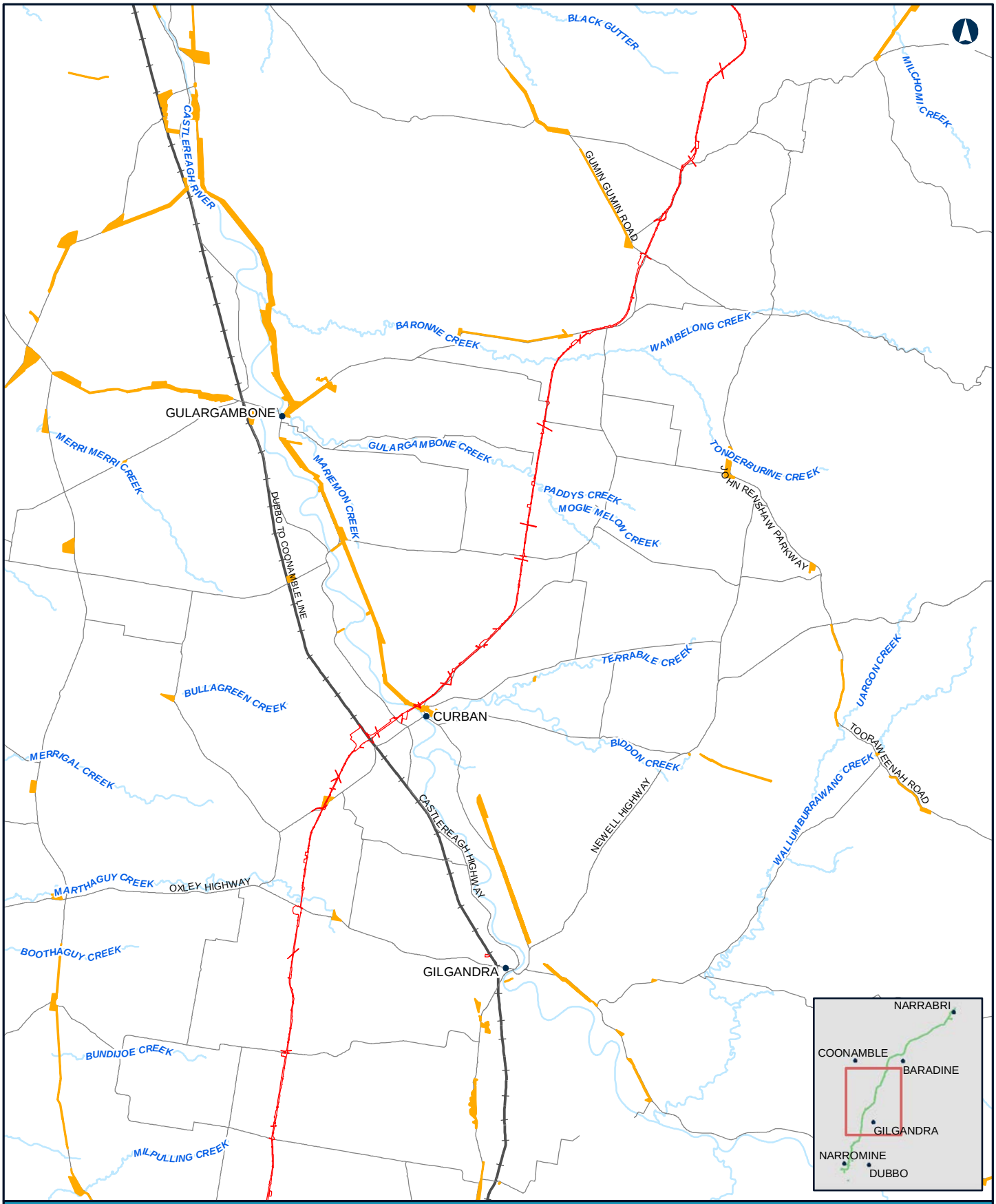

NARROMINE TO NARRABRI Travelling stock reserves Figure 4.8b

0 5.5 11 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:400,000
Data Sources: Basemap layers: NSWSS; TSR: Local Land Services (LLS); Footprints: GHDJACOBS

LEGEND

- The proposal site
- Travelling stock reserves

INLAND RAIL ARTC

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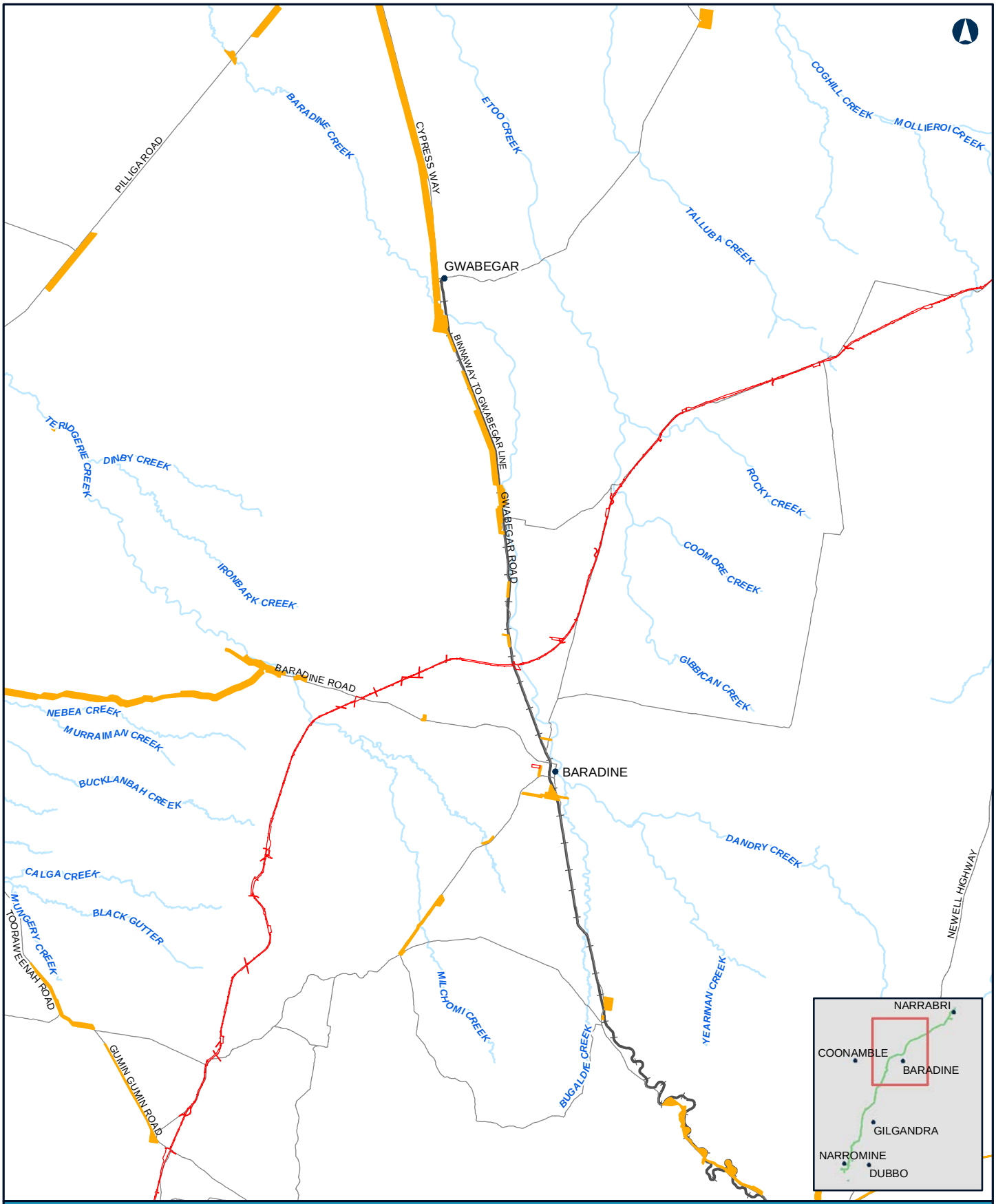

NARROMINE TO NARRABRI Travelling stock reserves Figure 4.8c

0 5.5 11 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Travelling stock reserves

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:400,000
Data Sources: Basemap layers: NSWSS; TSR: Local Land Services (LLS); Footprints: GHDJACOBS

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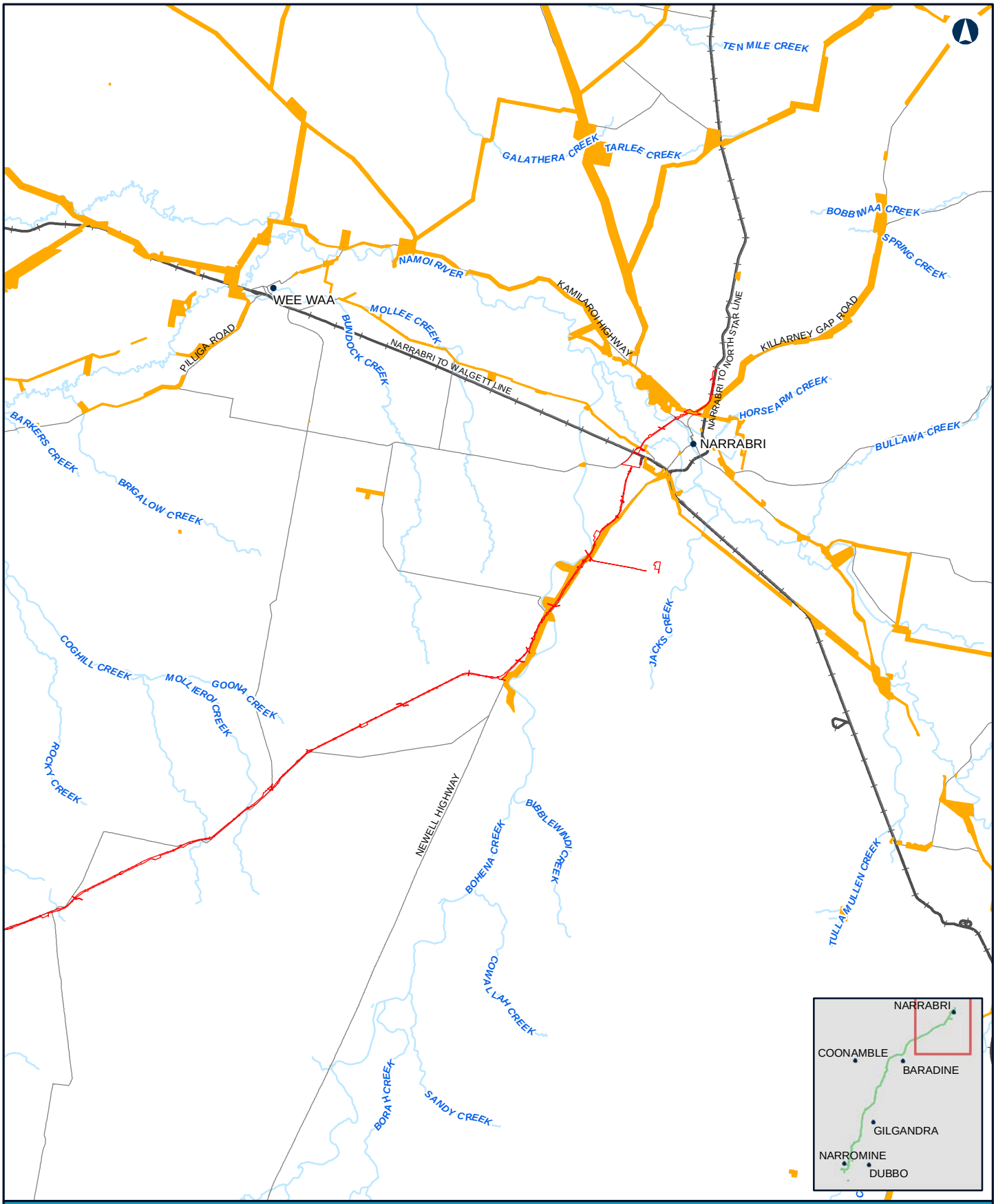

NARROMINE TO NARRABRI

Travelling stock reserves

Figure 4.8d

0 5.5 11 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Travelling stock reserves

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:400,000
Data Sources: Basemap layers: NSWSS; TSR: Local Land Services (LLS); Footprints: GHDJACOBS

INLAND RAIL ARTC

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5 The proposal

This section describes the proposal features, construction and operation of the proposal where relevant to the traffic and transport impact assessment. Further information regarding the proposal is provided in section 1.2 and in the EIS.

5.1 Proposal features

5.1.1 Rail infrastructure

Rail connections

The proposal connects with four existing rail lines that are part of the ARTC and Country Regional Network rail networks (refer section 4.3.1). The connections are described in Table 5.1.

Table 5.1 Connections with other rail lines

Existing Rail Line	Connection
Parkes to Narromine	The southern end of the proposal would connect to the northern end of the Parkes to Narromine Line (which forms part of Inland Rail). The proposed connection is located about 2.2 kilometres south of Craigie Lea Lane. Providing this connection would involve adjusting about 500 metres of the Parkes to Narromine Line (as part of the proposal). The connection would ultimately provide for all train movements between the proposal and the Parkes to Narromine Line. However, the north to east leg is a possible future connection that may be constructed at a later date.
Dubbo to Coonamble Line	An at-grade connection would provide connectivity between the proposal and the Dubbo to Coonamble Line at Curban. The connection would provide a route for train movements from east to south and from west to north. The connection would include about 4.6 kilometres of new track. Two of the legs of the connection that enable movements from west to south and east to north are possible future connections that may be constructed at a later date.
Narrabri to Walgett Line	The proposal would cross the Narrabri to Walgett Line on a bridge to the west of Narrabri. About 1.8 kilometres of new track would be provided to allow trains from the west to access the proposal and travel south. Access for trains travelling from west to north is possible via the existing track through Narrabri. The proposed connection is a possible future connection that may be constructed at a later date.
Narrabri to North Star section of Inland Rail (currently the Mungindi Line)	The northern end of the proposal would connect to the southern end of the proposed Narrabri to North Star section of Inland Rail (currently the Mungindi Line) about two kilometres north of the intersection between the Newell Highway and Killarney Gap Road. Providing this connection would involve adjusting about 600 metres of the Narrabri to North Star section of Inland Rail (as part of the proposal). This connection would allow trains travelling south on the Narrabri to North Star section of Inland Rail to join the proposal or existing track through Narrabri and for trains travelling north on the proposal to join the Narrabri to North Star section of Inland Rail.

The proposal does not include connections with the following existing lines:

- Dubbo to Narromine Line – the proposal crosses the Dubbo to Narromine Line and Webbs Siding Road to the east of Narromine on a bridge. No connection is provided as access to Inland Rail would be available to the south of Narromine where the proposal connects with the Parkes to Narromine section of Inland Rail.
- Binnaway to Gwabegar Line – the proposal would cross the non-operational Binnaway to Gwabegar Line at-grade to the north of Baradine, with no connection provided.

As part of the proposal, approval is also being sought for the Narromine West connection. The proposed new connection (rail junction) would provide connectivity between the Parkes to Narromine Line and Narromine to Cobar Line. The Narromine West connection is a possible future connection and may be constructed at a later date.

Bridges and culverts

Bridges and culverts are provided where the proposal crosses existing roads, existing rail lines and watercourses and associated floodplains. The proposal would include 73 new bridges along the proposal site. Of those, the following would be provided over existing public roads:

- Dubbo to Narromine Line bridge which crosses Webbs Siding Road
- Macquarie River bridge which crosses Mitchell Highway and a travelling stock reserve
- Backwater Cowal 1 which would cross Dappo Road however that road would be closed
- Emogandy Creek bridge which crosses Old Mill Road
- Kickabil Creek bridge which crosses Kickabill Road
- Castlereagh River bridge which crosses travelling stock reserves
- Bohena Creek 1 bridge which crosses Cains Crossing Road and a travelling stock reserve
- Narrabi Creek/Namoi River bridge which crosses Yarrie Lake Road, The Island Road, Kamilaroi Highway and a number of private access tracks.

Level crossings

About 51 new public level crossings would be provided along the rail line to maintain vehicular access along public roads that cross the rail corridor. Of these, 12 are proposed to have active controls, which involve providing warning devices in the form of flashing lights and bells, and boom barriers for motorists. Level crossings with active controls are proposed on the following roads:

- Tomingley Road
- Eumungerie Road
- Burroway Road
- Collie Road
- Oxley Highway
- Wyuna Road
- Castlereagh Highway
- Yarrandale Road
- Toorweenah/Gumin Gumin Road
- Mungery Road
- Baradine Road

- Gwabegar Road.

Passive controls are proposed to be provided at other crossings, in the form of static warning signs (eg stop) that are visible on approach. This signage is unchanging with no mechanical aspects or light devices.

The approach to considering level crossing options has taken into account relevant NSW and Australian level crossing policies, which emphasise to minimise the number of level crossing, as far as reasonably practicable. Further information regarding how the level crossings assessment was undertaken, including how it has considered these relevant policies, is provided below.

There are also five existing level crossings, within the study area, as discussed within section 4.3.1. However, no changes are proposed to these existing level crossings therefore they have not been considered further in this traffic and transport assessment.

Assessment of level crossings

Public road rail interfaces are points where the rail alignment crosses a public road. The proposal would require the crossing of state-controlled roads, local government roads as well as road controlled by Crown Lands and the Forestry Corporation of NSW. The proposed rail corridor interacts with about 125 public roads, including 42 unformed public road reserves.

The *Construction of New Level Crossings Policy* (TfNSW, 2014) notes that building new level crossings is to be avoided wherever possible, and all other options, including grade separation and use of existing level crossings, should be explored before a new crossing is proposed.

Therefore, a methodical process of review was undertaken to determine the appropriate treatment at public road rail interfaces, in consultation with potentially impacted landowners.

Considerations in the review process included:

- determining the interface location and type: ie public roads, private access roads, farm tracks, pedestrian interfaces and travelling stock routes
- assessing the need for the interface: Legal and physical access to both properties and severed properties is retained, potential traffic levels, land use, nearby interfaces, adjoined properties, vertical geometry of the rail alignment (in the context of the property and access for other local connectivity)
- determining feasible options for public road interfaces.

The process for identifying and assessing feasible options for public road interfaces broadly involved the following main steps:

- identifying opportunities for grade separation
- determining locations where provision of a level crossing would not be practicable and where road closures or realignments are likely to be required
- determining the preferred type of level crossings treatments (ie active or passive).

Further information on these steps is provided below.

Opportunities for grade separations

ARTC's policy is that rail-road interfaces would be automatically grade separated in the following three instances:

- rail–road crossings with four rail tracks
- rail–road crossings of freeways and highways of four or more lanes (current and committed future plans)
- where grade separation is the logical option for topographical or engineering reasons.

Provision of grade separations were considered where the height between the existing road and the proposed rail line was sufficient to provide for the required legal clearance for road traffic.

Within the proposal site there are no instances where existing roads that cross the proposal are elevated relative to the rail line. The provision of a rail bridge over the road (and other existing features as required) was determined to be the only viable option for consideration at these locations. Rail bridges over roads that would be provided as part of the proposal site are as per those noted earlier in this section.

Locations where provision of a level crossing would not be reasonably practicable

This step involved identifying where:

- provision of a new level crossing was not possible due to height differences between the road and rail
- provision of a new level crossing was not possible due to the location of crossing loops
- road crossings were closely spaced along the rail line and could be consolidated into a single crossing.

Generally, public roads would be retained wherever possible. However, where public roads cross the proposal rail corridor, the road would need to be closed in the following instances:

- the road exists only as a road reserve and is not being used as a road (ie no formed road exists) or required for legal access
- grade separation and raising/lowering the road is not reasonably practicable
- providing a level crossing on the existing road alignment would not be possible
- there is a nearby grade separation or level crossing enabling diversion of the road.

Formed public roads would only be proposed for closure where the impact of diversions or consolidations is considered acceptable, or the existing location is not considered safe and cannot be reasonably made safe. Further information regarding changes to public roads is provided in section 5.1.2.

Determining the preferred level crossing treatments

Where it has been determined that a level crossing is the preferred solution, a consistent methodology which aligns with the Office of the National Rail Safety Regulator guidelines (2019) has been used to develop proposed level crossing treatments.

This approach involves applying the Australian Level Crossing Assessment Model (ALCAM) to determine the 'risk score' for each level crossing, and then undertaking cost-benefit analysis to assess whether higher levels of protection are justified (eg upgrade passive protection to active, active to grade separation).

ALCAM is the nationally accepted risk tool for level crossings which looks at a range of factors including road and rail volumes and speeds, heavy vehicle use, sighting distances and road/rail geometry. The road inputs are validated by the relevant road manager through the stakeholder consultation process.

The ALCAM assessment has been carried out separate to this traffic and transport assessment. The requirement to minimise safety risks is an ongoing process that must be adhered to in future design changes.

Level crossings would be provided with warning signage, line marking, and other relevant controls; in accordance with the relevant ARTC and Australian standards. Through the application of this process, the safety risks would be eliminated or minimised SFAIRP.

In accordance with *Rail Safety National Law (NSW) No 82a* requirements, public road crossings would be subject to an Interface Agreement with the relevant road manager in order to ensure that safety risks are also identified and minimised so far as is reasonably practicable during the operations phase.

The interface agreements would be prepared to cover each public road crossing location to ensure a formal written agreement between the responsible road and/or rail managers is in place consistent with the requirements of section 105 of the *Rail Safety National Law (NSW) No 82a*, including responsibilities of parties for implementing safety measures and a process for monitoring these.

Further information regarding the methodology undertaken to determine the preferred level crossing treatments is provided in Appendix C.

Travelling stock reserves

Where existing travelling stock reserves are severed by the proposal, access across the proposal has been provided for by means of level crossings or stock underpasses at bridges and culverts (where topography and sizing permits).

Stock underpasses that would be provided for travelling stock reserves as part of the proposal are summarised in Table 5.2.

Table 5.2 Stock crossings (underpasses)

Chainage (approx.)	Land use	Description
563	Travelling stock reserve (R34248)	Access beneath the proposal is provided by the Macquarie River bridge
652.4	Travelling stock reserve R48903 and R23332)	Access beneath the proposal is provided by the Castlereagh River bridge
828.5 to 836	Travelling stock reserve (R44590 and R941)	Access beneath the proposal is provided by a bridge over Bohena Creek at chainage 828.9
849	Travelling stock reserve (R27999)	Access beneath the proposal is provided by culverts

Based on consultation with Local Land Services and Crown Lands the following travelling stock reserves would not be provided with an underpass:

- Travelling stock reserve (R3420) (chainage 595) – access is provided at the adjacent level crossing at the intersection with Collie Road
- Travelling stock reserve (R43452) (chainage 642) – access across the alignment not required
- Travelling stock reserve (R23332 (northern portion)) (chainage 652.5) – access is provided at the adjacent level crossing at the intersection with East Coonamble Road.

Further consultation would be undertaken with Local Land Services during detailed design to confirm all arrangements.

5.1.2 Road infrastructure

As noted in section 5.1.1 the proposal interacts with about 125 public roads, including 42 unformed public road reserves, consisting of paper roads or nominal tracks.

To facilitate construction and operation of the proposal various changes to the existing road network including some road realignments and closures at various locations and provision of new access roads to various properties are required.

Changes to public roads would be undertaken in accordance with the minimum safe standard of the existing road, unless otherwise agreed with the responsible road authority. Design considerations include the design and sign-posted speed, one or two lanes, typical section, lane widths, road reserve width, sealed or unsealed pavement, drainage and road surface/finish.

Road closures

In some instances, where it is not feasible to provide a level crossing, permanent road closures are required in certain locations. Access would be provided via a road realignment to a new level crossing or around the proposal via an existing road. Public roads that are impacted by road closures are outlined below:

- Dappo Road
- Brooks Road
- Nalders Access Road
- Munns Road.

Of the above roads, only Dappo Road would be closed completely and not realigned around the proposal site.

In addition to the abovementioned public roads being closed, the proposal would also result in the closure and realignment of:

- Bardens Road, which is a vehicle track managed by Gilgandra Shire Council
- Fourteen forestry tracks/roads within State forests managed by the Forestry Corporation of NSW.

Of the 42 paper roads and nominal tracks that the proposal site interacts with, one would be provided with an underpass and three would be provided with passive level crossings.

Approval for closures, where required, would be progressed in accordance with the relevant legislative requirements and in consultation with the responsible road authority.

Road realignments

For the majority of the proposed level crossings, the road would need to realigned to provide a safe crossing of the rail corridor. Depending on the circumstances this would involve:

- Horizontal and vertical realignment – typically involves relocating the road within a new road corridor to improve the angle of crossing for safety reasons (ie line of sight) at a level crossing or divert the road to a new level crossing. The road would also be raised as required, on its approach and departure at a level crossing to match the height of the rail line.
- Vertical realignment – typically involves raising the road on its approach and departure at a level crossing to match the height of the rail line within the existing road corridor but in some instances may require minor adjustments to the existing road corridor.

The proposal would involve the realignment of 53 public roads. The works to public roads include realigning Pilliga Forest Way in the Pilliga East State Forest for a distance of about 6.7 kilometres to avoid the new rail corridor. The other 52 roads are proposed to have short sections realigned to suit the proposed new level crossings, including any additional tie-in work that may be required.

5.2 Construction

5.2.1 Construction strategy

The construction strategy is based on an approach of dividing the overall alignment into four main construction zones, with each construction zone made up of a number of work fronts. The construction zones are:

- Zone 1: Narromine – the southern end of the proposal site to Leeches Creek Road
- Zone 2: Gilgandra – Leeches Creek Road to Black Hollow
- Zone 3: Baradine – Black Hollow to the Pilliga East State Forest
- Zone 4: Narrabri – Pilliga East State Forest to the northern end of the proposal site.

Construction works in each construction zone would be completed by between two to three active construction teams. For the duration of construction, public roads would be used as access routes to transport people and materials to the proposal site. A construction haul road would be built within the proposal site, parallel to the railway alignment. This would be accessed via the public road network and carry the majority of people, plant, equipment, and materials.

The construction works would indicatively follow the key steps outlined in Table 5.3.

Table 5.3 Key construction steps

Step	Description
Site establishment and preliminary activities	• Site establishment: construction of compounds and temporary workforce accommodation, borrow pits, water infrastructure; and commencement of bulk material deliveries such as ballast, capping, rail etc • Preliminary activities: clearing and grubbing, installation of environmental mitigation measures, and construction of haul roads • Traffic: movement of employee, vehicles, plant, and equipment to compounds and workforce accommodation. Heavy vehicle haulage of bulk materials
Main construction works	• Rail works: construction of the main line track, crossing loops, turnouts, and watercourse crossings • Road construction: road underpass construction, changes to local road alignments, and level crossings • Traffic: daily movement of employees and bulk materials to site
Testing and commissioning	• Testing and commissioning of the rail line and communications/signalling systems • Possession • Regulatory approval
Finishing and Rehabilitation	• All disturbed areas not required for ongoing operations would be rehabilitated • All construction sites decommissioned • Traffic: removal of vehicles, plant, equipment, and materials

5.2.2 Indicative construction program

It is anticipated that overall construction would take about 48 months, subject to weather conditions. An indicative construction program is shown in Figure 5.1.

To prepare for the main construction works, materials would be delivered to the multi-function compounds up to six months prior to site establishment.

Bulk earthworks and construction of the Macquarie River, Castlereagh River and Narrabri Creek/Namoi River bridges are significant construction activities, which are expected to take up to 36 months.

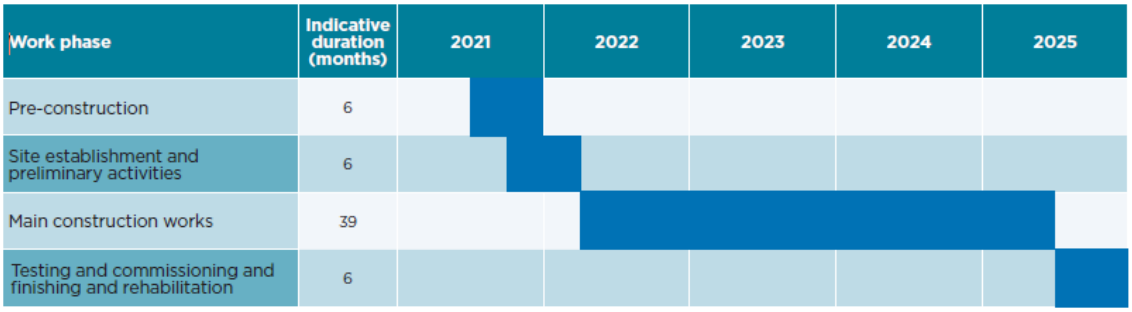


Figure 5.1 Indicative construction program

5.2.3 Construction infrastructure

Borrow pits

It is proposed to establish four borrow pits on private land for supply of general and structural fill. The borrow pits are required to either balance the cut/fill or minimise the need to import material over long distances and as such, reduce potential impacts to public roads. Access to the proposal site from borrow pits would be via new access roads connecting the borrow pit to the nearest public road, then via the public road network to the proposal site. The material would then travel via the construction haul road within the proposal site. The proximity of the borrow pits to the proposal site would minimise the impact to the public road network.

The location of the borrow pits is shown on Figure 1.3. Borrow pit A located on Tantitha Road, Narromine, has the longest transport distance to the proposal compared to the other borrow pit locations.

Compounds

Temporary facilities to support the construction would be required at regular locations along the proposal site. The general function of the compounds is for project offices and to store plant, equipment, and materials used for construction. Major construction work would have multi-function compounds. These compounds would contain and support a range of construction activities and would be used to minimise land use impacts elsewhere along the proposal site. Compounds would be the main destination for delivery of bulk materials from suppliers and quarries outside the proposal site.

Temporary workforce accommodation

To accommodate the construction workforce, the proposal includes temporary workforce accommodation near the major population centres along the proposal site (ie Narromine, Gilgandra, Baradine and Narrabri) as shown on Figure 1.3. Each temporary workforce accommodation location is expected to operate for the duration of construction and accommodate up to 500 people.

The accommodation in each construction area is located relatively close to the proposal site, minimising travel distances. The general workforce would be transported between the proposal site and the temporary workforce accommodation via shuttle buses. It is anticipated the majority of the movement of the workforce would happen at the beginning and end of the work day. Specialist contractors, foreman, and superintendents may use private vehicles for more flexible mobility. During construction, there would be increased bus movements with up to 16 vehicle movements per day (two-way) in most construction areas to and from the temporary workforce accommodation. These are not expected to result in any significant impacts on residential streets where the temporary workforce accommodation is located within Gilgandra and Baradine. Further, these movements would be distributed across various public roads within each construction area (Figure 5.3 to Figure 5.6) depending on the activity being undertaken

Concrete batch plant and precast yard

Elements of the proposal, such as the larger bridges and flood mitigation structures (culverts etc), would require substantial volumes of concrete, where road transport is not viable due to limited local supply or distances involved. Concrete batching plants would be located in select compounds and would be delivered to the required locations within the proposal site using the haul roads (as far as practicable) within the proposal site to minimise public road impacts. Concrete materials such as cement and sand would be delivered to the construction compounds via the public road network as detailed in Table 5.6.

A pre-cast yard would be established at the Curban multi-function compound, supplying precast bridge elements, culverts, and sleepers to various locations across the proposal site. This site has ready access to the Oxley Highway and Dubbo to Coonamble Line, to enable materials to be delivered to the site by major transport routes. Curban is centrally located relative to the broader proposal works area. Large pre-cast deliveries to site that are not immediate to the compound at Curban can make use of both the Castlereagh and Newell Highways which are approved B-double and higher mass limit routes, as shown in Figure 4.1.

In some locations concrete would be sourced from commercial suppliers with delivery to the proposal site via the public road network as detailed in Table 5.6 and then within the proposal site via the construction haul road within the construction footprint as far as practicable to minimise public road impacts.

Capping and ballast

Earthworks from the proposal are unlikely to be suitable for capping and ballast and therefore this material would typically need to be sourced from commercial quarries. Due to annual limits on quarry extraction licences, the capping and ballast would need to be delivered to the proposal site and stockpiled over a period of up to three years prior to construction.

Potential existing quarries have been identified in Dubbo and Narrabri and would deliver to each construction area depending on the construction activity being undertaken. These quarries have approved routes available on public roads. The temporary construction access routes would supplement the existing haulage routes to access the proposal site as detailed in Table 5.6.

Additional construction activities

Additional traffic generating construction activities would include the delivery of water, spoil, and plant and equipment. Traffic from these activities would travel mainly along the rail corridor on the construction haul road with minor use of public roads or use over a short term.

Construction water would be sourced from boreholes along the rail corridor. Deliveries would be made along the construction haul road as far as practicable to the areas it is required, minimising any use of public roads.

There would be excess spoil from the construction of the proposal that would be unsuitable for use in the track formation. The excess spoil would be stockpiled along the alignment and, towards the end of construction or when permissible, the spoil is proposed to be reused to backfill the borrow pits.

Prior to the main construction works, plant and equipment would be delivered to site in a one to four week period. For the duration of construction, the plant and equipment would remain within the construction footprint using the construction haul road. The final plant and equipment requirements would be confirmed by the contractor as part of the Construction Environmental Management Plan (CEMP).

5.2.4 Construction traffic and access

Construction vehicles

Vehicle activity would be generated from the site establishment, construction, and finishing and rehabilitation of the proposal.

A range of vehicles would be used during construction as summarised in Table 5.4. Final vehicle requirements would be identified by the construction contractor and documented in the CEMP.

Table 5.4 Construction vehicles

Vehicle type	Vehicle description
Light vehicles	Cars, utilities
Heavy vehicles – General	Flat bed semi-trailer truck, concrete truck, water carts, lube truck, fuel truck, low loader, mobile crane, ancillary trucks
Heavy vehicles – Haulage	B-double truck, 40 tonne dump truck
Buses	20 seater bus
Heavy vehicles – oversized or overmass	750 tonne crane, other Class 1 vehicle combinations (for bridge component and construction vehicle delivery)

Construction traffic volumes

It is anticipated that overall construction would take about 48 months, subject to weather conditions. This would comprise about six months for site establishment, 39 months for the main construction work and about six months for finishing and rehabilitation.

As noted in section 5.2.3 the main traffic generating aspects of construction activities are the workforce, borrow pits, capping and ballast, and precast concrete. Traffic for these activities typically originates from areas geographically separate to the rail corridor and require the use of public roads to access the nearest haul road access point. As the proposal is constructed progressively, traffic volumes would vary depending on the activities being undertaken.

As such, a ‘worst case’ scenario for each construction area has been developed for this assessment based on construction traffic volumes and road classification as summarised in Table 5.5. It should be noted the ‘worst case’ construction traffic volumes are the total traffic volumes generated from each construction activity irrespective of time. Construction traffic volumes illustrated over the construction program is shown in Figure 5.2.

Table 5.5 shows for each construction area, activities associated with the main construction would have the higher impact to the public road network. The exception being the Baradine construction area, which is expected to have a relatively low impact overall. During construction, there would be increased heavy vehicle movements with up to 380 vehicle movements per day (two-way) (in the Gilgandra construction area), making up the majority of traffic generated.

However, heavy vehicle traffic movements would be distributed across various public roads and travel at different times within each construction area depending on the activity being undertaken as discussed further below.

Figure 5.2 shows the daily construction traffic profile on public roads for the construction of the proposal. This figure illustrates the construction traffic profile over the 48-month construction period and the distribution through each construction area. The construction traffic includes all vehicles and would be distributed across various public roads depending on the activity being undertaken as discussed further below.

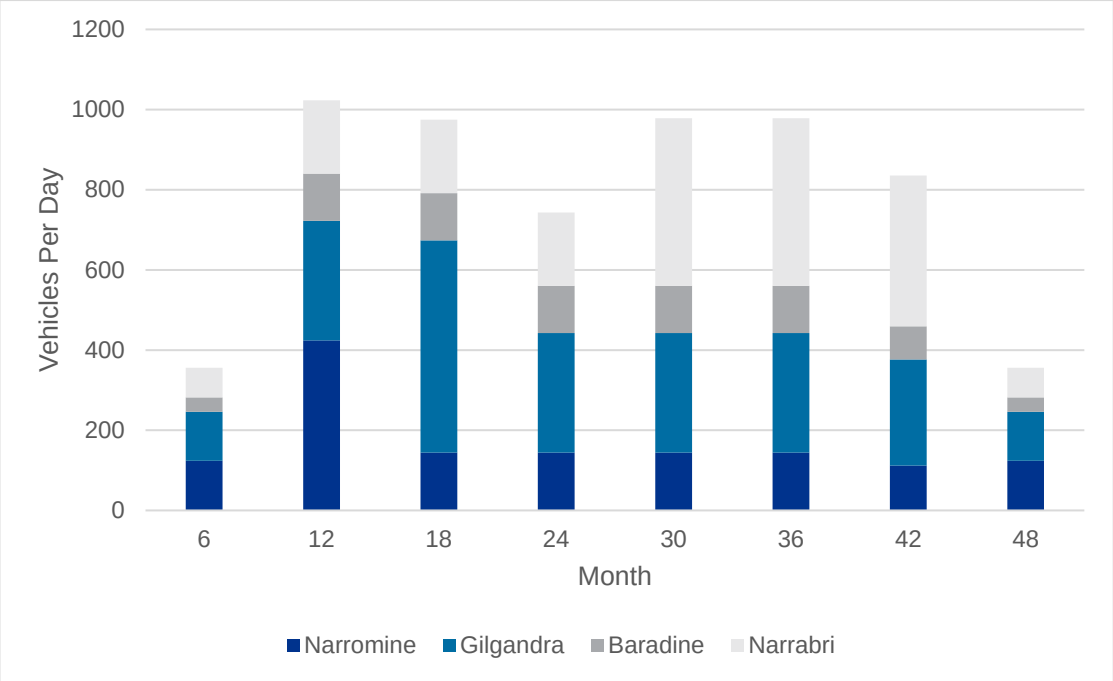


Figure 5.2 Construction traffic daily profile

Table 5.5 Summary of worst case construction traffic volumes on public roads

Construction area	Stage	Vehicle type	Vehicle description	Movements per day (two-way)	Movements per hour (two-way)
Narromine	Site establishment / Finishing and rehabilitation	Light vehicles	Cars and utilities	70	8.3
		Heavy vehicles	General	42	4.9
			Bus	12	6
			Total heavy vehicles	**54**	**10.9**
	Main construction	Light vehicles	Cars and utilities	98	11.6
		Heavy vehicles	Haulage	260	30.6
			General	50	5.9
			Bus	16	2
			Total heavy vehicles	**326**	**38.5**
Gilgandra	Site establishment / Finishing and rehabilitation	Light vehicles	Cars and utilities	68	8
		Heavy vehicles	General	38	4.5
			Bus	16	0.5
			Total heavy vehicles	**54**	**5**
	Main construction	Light vehicles	Cars and utilities	150	17.7
		Heavy vehicles	Haulage	198	23.2
			General	165	19.7
			Bus	16	2
			Total heavy vehicles	**379**	**44.9**
Baradine	Site establishment / Finishing and rehabilitation	Light vehicles	Cars and utilities	8	1
		Heavy vehicles	General	4	0.5
			Bus	8	1
			Total heavy vehicles	**12**	**1.5**

Construction area	Stage	Vehicle type	Vehicle description	Movements per day (two-way)	Movements per hour (two-way)
	Main construction	Light vehicles	Cars and utilities	46	5.5
		Heavy vehicles	Haulage	11	1.3
		Heavy vehicles	General	34	4.1
			Bus	10	1.3
			Total heavy vehicles	**55**	**6.7**
Narrabri	Site establishment / Finishing and rehabilitation	Light vehicles	Cars and utilities	36	4.2
		Heavy vehicles	General	22	2.6
			Bus	16	2
			Total heavy vehicles	**38**	**4.6**
	Main construction	Light vehicles	Cars and utilities	82	9.7
		Heavy vehicles	Haulage	229	26.9
			General	91	10.8
			Bus	16	2
			Total heavy vehicles	**336**	**39.7**

Construction access routes

Construction access routes have been developed to minimise the impact to the road network and major population centres. Access routes would mainly be used by the workforce (buses), as well as transport from borrow pits and delivery of capping and ballast, and concrete. The access routes would use existing arterial, main, and local roads depending on the origin of the trip and then enter the construction footprint. Within the construction footprint haul roads would be used for the transport of materials and people.

Access routes within the four construction areas are shown in Figure 5.3 to Figure 5.6. Public roads used for access are detailed in Table 5.6. Detailed maps showing construction access routes are also provided in the EIS. The construction access routes shown add on to, supplement or overlay existing haulage routes that operate currently from suppliers, quarries, and depots. However, the figures are not exhaustive and may exclude some existing TfNSW approved heavy vehicle routes or individual approvals to use the public road network (refer to Figure 4.1 for existing heavy vehicle routes within the study area).

Table 5.6 Construction access routes

Construction area	Construction activity	Public roads
Narromine	General	The McGrane Way, Algahah Road, Dandaroo Street, Webbs Siding Road, Derribong Avenue, Cathundril Street, Tomingley Road, Dappo Road, Pinedean Road, Mitchell Highway, Barraway Street, Trangie Road, Warren Road, Eumungerie Road, Euromedah Road
	Workforce	Derribong Avenue, Algalah Street, Webbs Siding Road, Warren Road, Trangie Road, Collie Road, Castlereagh Highway
	Borrow pits	Tomingley Road, Tantitha Road, Pinedean Road, Euromedah Road, Eumungerie Road
	Capping and ballast	Eumungerie Road, Newell Highway, Mitchell Highway, Burraway Road, Narromine Road, Wellington Road, Old Mill Road
	Concrete	Newell Highway, Mitchell Highway, Collie Road, Castlereagh Highway
Gilgandra	General	Leeches Creek Road, Newell Highway, Hargraves Road, Warren Road, Oxley Highway, Nancarrows Road, Federation Street, Castlereagh Highway, Kamber Siding Road, Berida Road, Forans Road, Curban Railway Road, National Park Road, East Coonamble Road
	Workforce	Newell Highway, Castlereagh Highway, National Park Road, Milpulling Road, Leeches Creek Road, Kamber Siding Road, Mcclures Lane, Tarralea Road, Box Ridge Road, Gumin Gumin Road, Goorianawa Road, Weenya Road
	Marthaguy Creek bridge	Oxley Highway, Berida Bullagreen Road
	Capping and ballast	Oxley Highway, Castlereagh Highway, National Park Road, Wellington Road, Newell Highway, Nancarrows Road
	Concrete	National Park Road, Weenya Road, Seven Mile Road
Baradine	General	Munns Road, Gulargambone Baradine Road, Namoi Street, Walker Street, Lachlan Street, Worrigal Street, Baradine Road, Gwabegar Road, Cumbil Road
	Workforce	Baradine Road, Pilliga Forest Way, Cumbil Road, Gulargambone Baradine Road, Goorianawa Road, Mungery Road, Munns Road, Gwabegar Road, Quiet Road
	Capping and ballast	Newell Highway, Baradine Road, Wave Hill Road, Old Gunnedah Road, Pilliga Forest Way, Cumbil Road
	Concrete	Wellington Rd, Baradine Road, Castlereagh Highway

Construction area	Construction activity	Public roads
Narrabri	General	Newell Highway, Cooma Road, Mooloobar Street, Yarrie Lake Road, Dangar Street, Gibbons Street, The Island Road, Tibbereena Street, Killarney Street, Barwan Street, Old Gunnadeh Road, Wee Waa Road, Saleyards Road
	Workforce	Newell Highway, Pilliga Forest Way, Dangar Street, Cooma Road, Schatz Road, Castlereagh Highway
	Borrow pits	Newell Highway
	Capping and ballast	Newell Highway, Wave Hill Road, Old Gunnedah Road, Pilliga Forest Way, Mooloobar Street
	Concrete	Newell Highway, National Park Road, Curban Biddon Road, Newell – Oxley Highway, Yarraman Road, 20 Foot Road

Construction haul roads

To minimise construction movements and associated impacts on the public road network, temporary construction haul roads would be constructed within the construction footprint. The construction haul roads would be the preferential transport to work fronts and compounds. Public roads would be used for travel between the source/origin and the nearest haul road access point. The haul roads provide the opportunity to remove a large portion of construction traffic from using the public road network, particularly materials haulage (cut/fill, concrete, capping and ballast), by keeping the majority of the journey between compounds and work fronts. Materials haulage that would use the haul road as far as practicable to minimise travelling on public roads, is discussed in section 5.2.3.

The haul roads would generally be located next to the final rail alignment on both sides with temporary public road crossings provided as required. Access points would be controlled with gates and the construction footprint would be fenced. Road crossings and access from public roads would be designed to the appropriate standards in consultation with the appropriate road authority.

The haul roads would generally allow for:

- safe separation of light and heavy vehicles within the proposal site by having individual designated haul roads
- heavy vehicle haulage (ie cut/fill movements along the proposal site)
- plant and equipment deliveries, including equipment relocation between work fronts and compounds
- personnel movements between work fronts using both mini busses and light vehicles.

The haul roads may not be continuous along the proposal site and would vary depending on:

- the volume of material to be moved
- property boundaries
- environmental and other constraints (such as ecological and heritage features)
- geographical limitations (such as watercourses that cannot be easily traversed).

Construction access points

Access to the construction footprint would be via new connections off the existing road network.

To facilitate construction of site accesses, some minor changes to the public road network in the immediate vicinity of the access points may be required. This could include new temporary turning lanes, reduced speed limits and traffic control. Changes to roads would be undertaken in accordance with the minimum safe standard of the existing road, unless otherwise agreed with the responsible road authority. Design considerations include the design and sign-posted speed, one or two lanes, typical section, lane widths, road reserve width, sealed or unsealed pavement, drainage and road surface/finish.

The design of site access point treatments would be undertaken with regard to the standards and guidelines set out in the following documents and would be developed in consultation with the road manager (ie council or TfNSW):

- Austroads Guide to Road Design with Roads and Maritime Services Supplements
- Austroads AP-G17/04, Pavement Design – A Guide to the Structural Design of Road Pavements
- Austroads AGPT06-09, Guide to Pavement Technology Part 6: Unsealed Pavements.

There would be minor disruptions to public road users around construction site access however, given the relatively low volumes on the public roads these are not expected to be significant. These would be managed in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP.

5.2.5 Workforce

The construction workforce is expected to be up to 2,000 people. For the majority of the construction period, the workforce would average up to about 500 people in each of the four construction areas. For some limited items of work, an additional short-term workforce may also be required.

5.2.6 Typical working hours

Construction work would typically be undertaken during the primary proposal construction hours which are as follows:

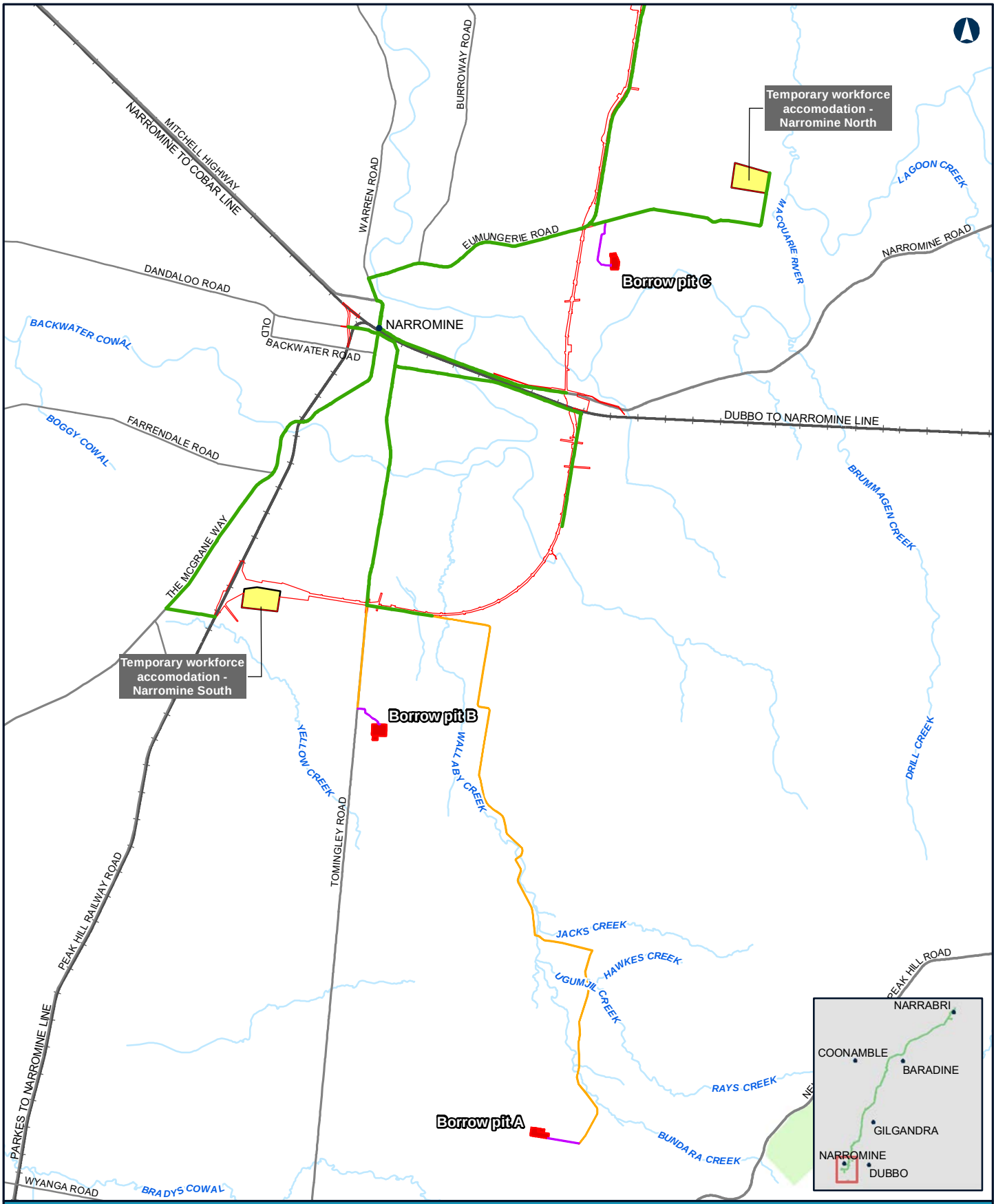
- Monday to Friday: 6am to 6pm
- Saturday: 6am to 6pm
- Sunday: 6am to 6pm
- Public holidays: no work.

The following activities are proposed to be undertaken outside the primary proposal construction hours:

- delivery of oversized plant or structures where required by the police or other authorities for safety reasons
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- large concrete pours for the Macquarie River, Castlereagh River and Narrabri Creek/ Namoi River bridges, to allow it to be completed in one pour and avoid high temperatures during the daytime
- girder/bridge deck installation at bridges on selected public roads, to minimise impacts to road users and workers
- utility works (such as connections) to minimise disruption to customers. The above works are not expected to exceed 48 hours at any one location.

Work during possessions

Some works associated with connections/interactions with operational rail lines may be carried out during scheduled weekend rail corridor possession periods (that is, the times that the movement of trains along the rail corridor are stopped for maintenance). This could include, for example, the connection of the tracks at either end or some finishing works. Rail corridor possessions are typically for a 72 hour period, four times a year. During possessions, works may need to be carried out on a 24-hour basis to minimise the duration of impact.



NARROMINE TO NARRABRI Construction access routes – Narromine Figure 5.3

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:150,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

LEGEND

- The proposal site
- Access roads
- Temporary workforce accomodation
- Road
- Existing railway
- Borrow pit
- New haul road
- Public road

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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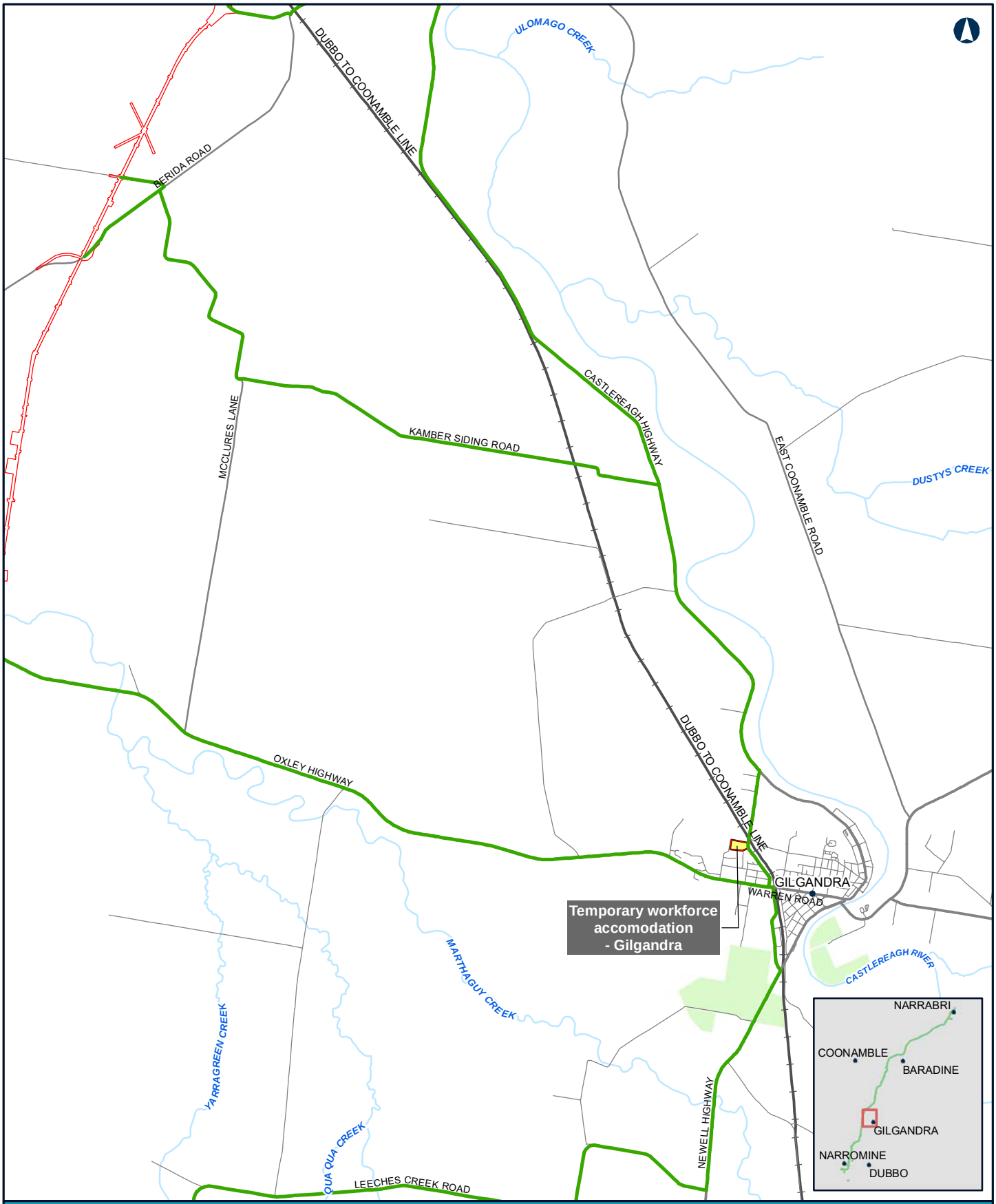

NARROMINE TO NARRABRI Construction access routes – Gilgandra Figure 5.4

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:100,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

LEGEND

- The proposal site
- Access roads
- Temporary workforce accomodation
- Road
- Existing railway

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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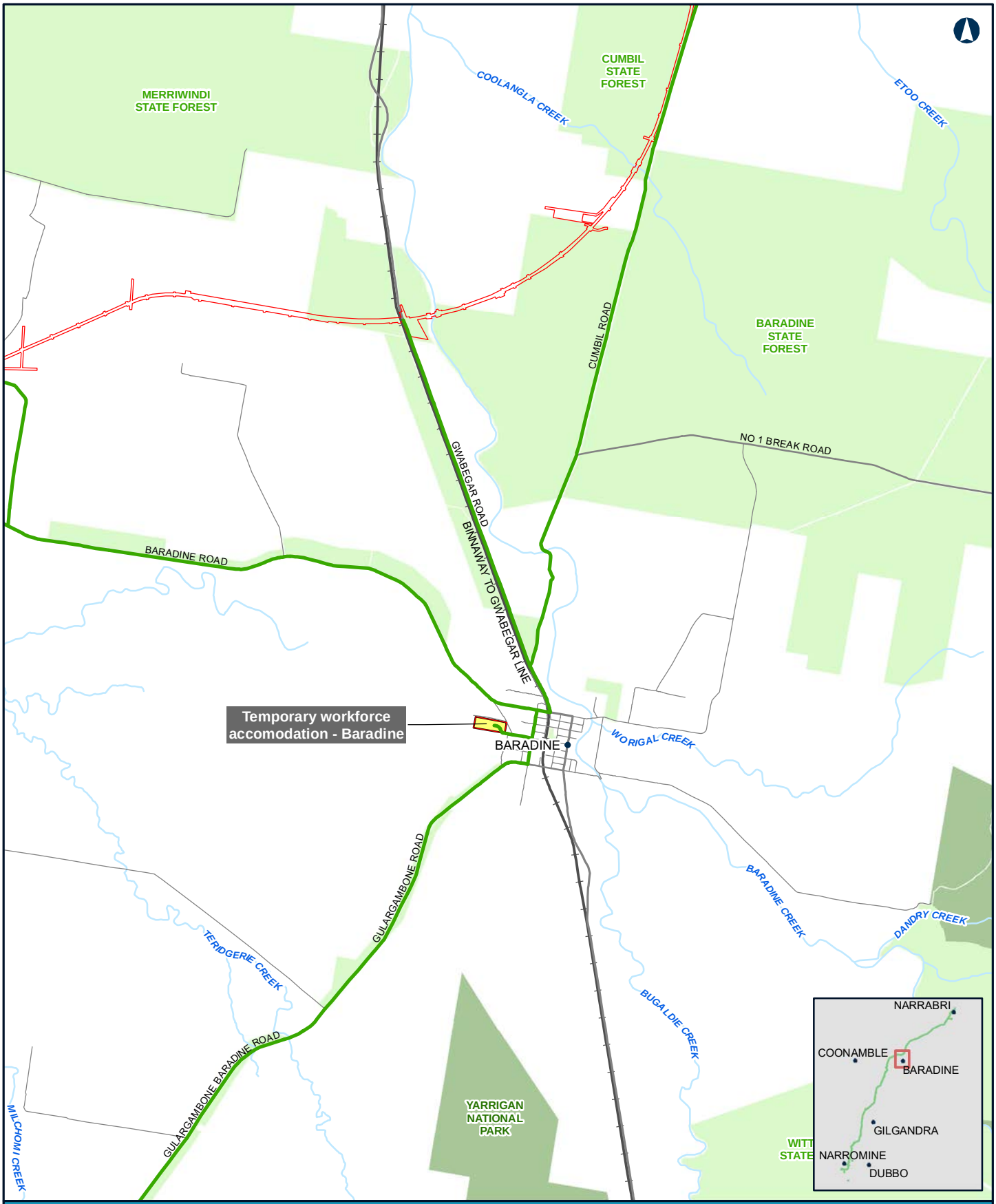

NARROMINE TO NARRABRI Construction access routes – Baradine Figure 5.5

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:100,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

LEGEND

- The proposal site
- Access roads
- Temporary workforce accomodation
- Road
- Existing railway

INLAND RAIL ARTC

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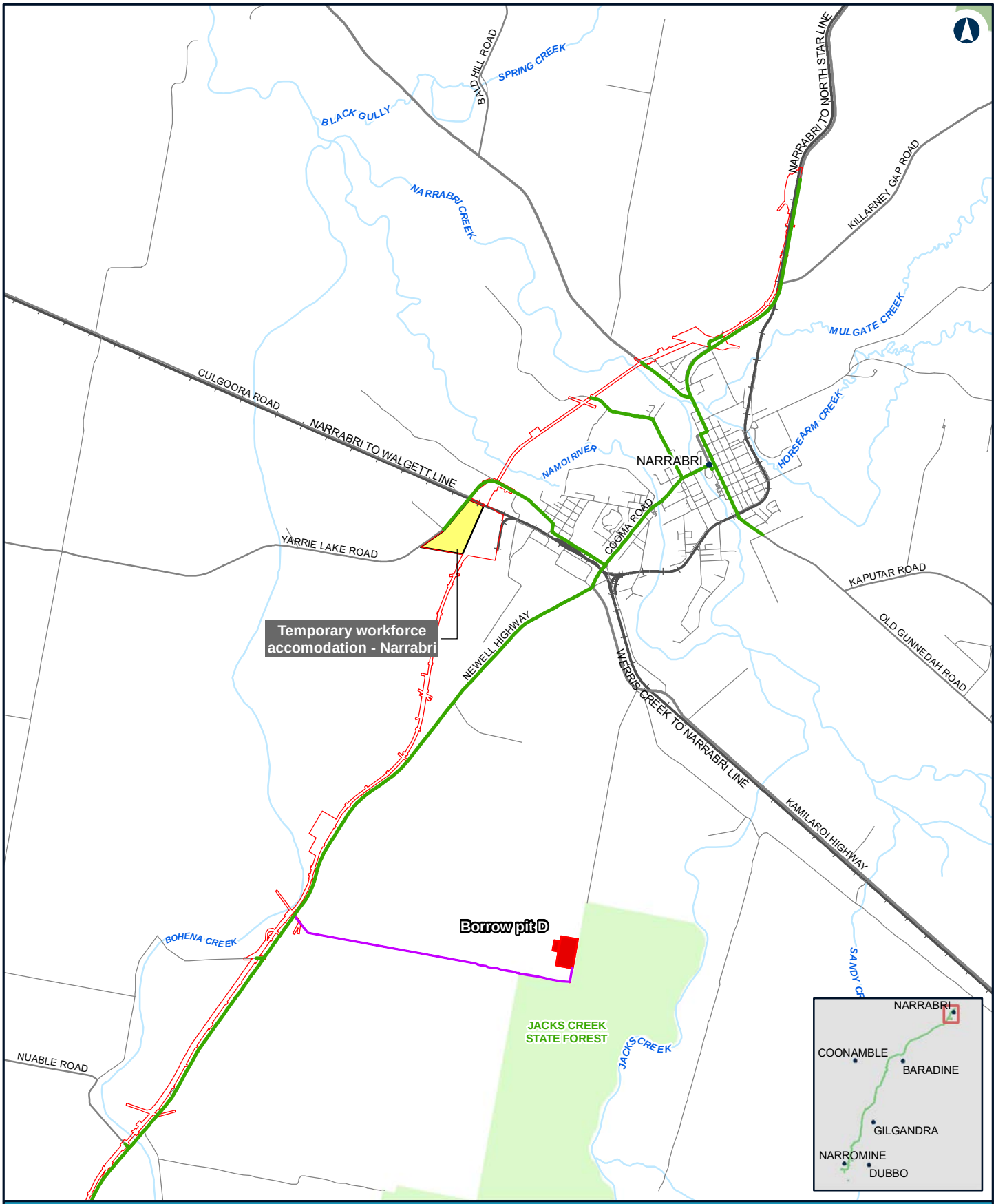

NARROMINE TO NARRABRI Construction access routes – Narrabri Figure 5.6

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 55

LEGEND

- The proposal site
- Access roads
- Temporary workforce accomodation
- Road
- Existing railway
- Borrow pit
- New haul road

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:100,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

INLAND RAIL ARTC

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5.3 Operation

5.3.1 Forecast rail operations

Inland Rail traffic would be in addition to the existing rail traffic using other lines that the proposal intersects, as described below. This forecast growth has taken into account potential for an increase in rail traffic created by the Inland Rail program.

5.3.2 Maintenance activities

Standard ARTC maintenance activities would be undertaken during operations. Typically, these activities include minor maintenance works, such as bridge and culvert inspections, rail grinding and track tamping, through to major maintenance, such as reconditioning of track and ballast cleaning as required.

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6 Impact assessment

An impact assessment has been undertaken, in accordance with the SEARs and ARTC requirements, to review the potential impacts of the proposal during the construction and operational phases and develop mitigation measures to minimise the consequence and/or likelihood of these risks.

6.1 Construction impacts

6.1.1 Rail infrastructure

Construction of the proposal would result in temporary impacts to traffic and access within the study area, and an increase in both light and heavy vehicle movements on the local road network. The extent of the impacts would depend on the location of the works, and the origin of material and/or workers. The traffic and transport impacts associated with construction of the rail infrastructure are described in this section. Traffic and transport impacts associated with construction of the road infrastructure are described in section 6.1.2.

Road level of service impacts

Construction would generate additional vehicle movements, including light and heavy vehicles. Light vehicles would generally be used by construction workers moving to and from the construction work areas and/or compounds. Heavy vehicle movements would generally be associated with trucks delivering materials and would also include buses delivering workers from the temporary accommodation facilities.

Total daily traffic generation associated with construction of the proposal (over 48 months) is about 1,000 vehicle movements (two-way), including 670 heavy vehicle movements (two-way). The total peak hour for traffic generation would occur at the beginning and end of each shift, with up to 60 vehicle movements (one-way) across the proposal, including some 40 heavy vehicles (one-way).

Further information about the estimated amount of traffic that would be generated is provided in section 5.2.4. Heavy vehicle traffic movements would be distributed across various public roads in the vicinity of each construction area depending on the activity being undertaken.

Both the existing and incremental construction trips generated by the proposal are relatively low with high levels of service maintained on the road network. Notwithstanding, an assessment process that considers the incremental construction traffic impacts and any need for additional analysis including changes to intersection treatments is provided. This assessment process helps to ensure that where required, more detailed intersection modelling is carried out using SIDRA analysis to assess traffic impacts and understand any required mitigations. Some traffic assessment guidelines require SIDRA analysis if project traffic volumes are five percent greater than existing conditions. With low existing traffic volumes in much of the study area, traffic increases greater than five percent are easily triggered despite no impacts on levels of service.

The assessment process provided below includes various triggers which generate the requirement further analysis, all of which are grounded in traffic engineering principles regarding capacity and rural road design treatments:

1. Carry out LOS analysis on existing traffic volumes (process as described in section 4.2.1).
2. Carry out above LOS analysis on Opening Year traffic volumes with background traffic growth of one per cent (provides a conservative base case).

3. Apply incremental construction traffic volumes on base case traffic volumes:
    a. Hold point – if traffic volumes exceed 5 per cent increase, carry out the following:
        i. Are there road capacity constraints (absorption capacity analysis) on the target road resulting from additional turning movements?
        ii. Do turning volumes trigger warrants for turning treatments based on intersection flows? (Austroads).
4. If 'Yes' to any of the above, carry out SIDRA intersection modelling.
5. Carry out LOS analysis on Opening Year + construction traffic volumes.

Table 6.1 details the anticipated changes on key local roads during the construction phase of the proposal. It is noted that roads that have very low traffic volumes have not been reviewed within the table below, as these roads are expected to operate well within a LOS A even with the increased traffic volumes due to the construction of the proposal. Anticipated changes are viewed from the construction traffic generated as outlined in section 5.2.4.

Table 6.1 demonstrates that during the construction phase of the proposal, there would be an incremental increase of up to 33 vehicle movements (two-way) on specified access routes. However, this increase is expected to have a negligible impact on the operation of the road network with the LOS not materially changing from the existing conditions.

While the assessment analysis provided in Table 6.1 indicates that further analysis is only required for the Kamilaroi Highway, SIDRA analysis has also been carried out on the Mitchell Highway and Newell Highway as these roads carry some of the highest traffic volumes in the study area and are located relatively close to the urban centres of Narromine and Narrabri respectively. The impact on these key roads is described below.

The **Mitchell Highway** is the busiest of the roads likely to be used for construction access, and as discussed in section 4.2.1 has a peak hourly volume of about 418 vehicles movements (two-way). However, there are only 4 traffic movements (two-way) are anticipated to be added on the Mitchell Highway and therefore it is forecast to operate at LOS B, as per existing conditions including for background growth.

Currently the **Newell Highway** has 191 vehicle movements (two-way) operating during the peak hourly period, and it is proposed to increase the peak traffic volumes during construction by up to five movements (two-way), to 210 vehicle movements (two-way) with background growth. This increase in traffic volume does not have an impact on the LOS, as shown in Table 6.1. The anticipated maximum hourly volume on all of the roads expected to be used for construction access is within the threshold for LOS B.

The **Kamilaroi Highway** has 195 vehicle movements (two-way) operating during the peak hourly period, and it is proposed to increase the peak traffic volumes during construction by up to 28 movements (two-way), to 237 vehicle movements (two-way) with background growth. This increase in traffic volume does not have an impact on the LOS, as shown in Table 6.1, however it does trigger a review based on review of turning movement warrants. Notwithstanding this, the SIDRA analysis as provided in Appendix B indicates that there are no material impacts on intersection performance on this road.

SIDRA analysis as provided in Appendix B shows that priority intersections with each of the Kamilaroi, Mitchell and Newell Highways with construction related turning volumes above those anticipated does not impact intersection performance or trigger any changes in design as a result of queuing or other considerations.

Table 6.1 Impact of construction traffic on road Level of Service

Road	Existing Year (2018)		Opening Year (2025)		Opening Year with Construction Traffic						
	Two -way hourly volume	LOS	Two -way hourly volume	LOS	Two-way construction volumes	Two-way hourly volume	Change in hourly volume (%)	LOS	Capacity Restricted (Absorption)	Turning Warrant Review	SIDRA Required
Mitchell Highway	418	B	448	B	4	452	0.9	B	No	Yes	No
Eumungerie Road	62	A	66	A	5	71	7.5	A	No	No	No
Dubbo-Burroway Road	42	A	45	A	5	50	11.1	A	No	No	No
Cobboco Road	5	A	5	A	0	5	0.0	A	No	No	No
Collie Road	14	A	15	A	9	24	60.0	A	No	No	No
Old Mill Road	9	A	10	A	20	30	207.3	A	No	No	No
Leeches Creek Road	7	A	8	A	5	13	66.6	A	No	No	No
Oxley Highway	50	A	54	A	30	84	56.0	A	No	No	No
Berida Road	5	A	5	A	28	33	522.3	A	No	No	No
Castlereagh Highway	101	A	108	A	30	138	27.7	A	No	No	No
National Park Road	34	A	36	A	15	51	41.1	A	No	No	No
Gumin Gumin Road	10	A	11	A	5	16	46.6	A	No	No	No
Baradine Road	19	A	20	A	4	24	19.6	A	No	No	No
Gwabegar Road	27	A	29	A	8	37	27.6	A	No	No	No
Pilliga Forest Way	3	A	3	A	10	13	310.9	A	No	No	No
Yarrie Lake Road	149	A	160	A	8	168	5.0	A	No	No	No
Kamilaroi Highway	195	B	209	B	28	237	13.4	B	No	Yes	Yes
Tomingley Road	64	A	69	A	33	102	48.1	A	No	No	No
Dappo Road	3	A	3	A	0	3	0.0	A	No	No	No
National Park Road	34	A	36	A	15	51	41.1	A	No	No	No
Newell Highway	191	A	205	A	5	210	2.4	A	No	No	No

Key intersection performance impacts

As discussed in 4.2.1 the Mitchell Highway (the highest peak hour volume road) would have capacity at intersections to absorb increased traffic. From Table 5.5, there would be hourly traffic volumes of up to 63 traffic movements (two-way). These movements would be distributed across various public roads within each construction area. Therefore, it is not expected that there would be significant impacts to intersections in the study area.

Other traffic impacts from vehicle movements

As described in section 5.2.1, construction would be undertaken concurrently along four construction areas and the majority of traffic would be generated during the main construction activities in these areas.

It is expected that construction vehicle movements, particularly delivery trucks, would be spread out across the day. This would also assist in minimising any additional delays for vehicles turning from side roads at intersections along the construction access routes.

As noted in section 5.2.3, borrow pit A in Narromine has the longest transport distance to the proposal compared to the other borrow pit locations and would therefore have the most impact to public roads. During construction, there would be increased heavy vehicle movements with up to 270 vehicle movements per day (two-way). The access route from the borrow pit uses local roads with low existing traffic volumes. While there would be an increase in traffic it would not impact the level of service and therefore not expected to result in any significant impacts to these public roads.

The stockpiled capping and ballast would be delivered to the work front via the construction haul road to the extent practicable to minimise the impact to public roads. Distribution of these heavy vehicle movements over three years and across public roads in each construction area would minimise potential impacts to the public road network. These movements would increase traffic from these quarries but would be within the existing operational limits of any commercial quarry.

Traffic generated from the spoil removal would travel along the construction haul road minimising the use of public roads. There would be minor impacts to public roads from the haulage to borrow pits being close to the construction footprint.

Temporary intersection treatments and management could be required at various locations to accommodate haulage and other movements, particularly where the haul road crosses major public roads. The treatments would vary depending on the location, traffic conditions and haulage movements and would be considered in the traffic, transport and access management plan which would be prepared as part of the CEMP.

Some construction transport would require the use of oversize and over-dimension vehicles. Movement of these vehicles would be subject to route-specific planning, with approvals obtained as required from Transport for NSW and the relevant local council. Minor delays to travel may be experienced by drivers due to the use of these vehicles. However, deliveries by these vehicles would generally be undertaken outside of standard construction hours. Given this, and the low volumes of traffic on the majority of roads within the study area, the potential impact on the road network is considered minor.

Traffic impacts from construction activities

Installing girder/bridge deck components over the following public roads would require temporary short-term closure of these roads for safety reasons:

- Webbs Siding Road
- Mitchell Highway

- Old Mill Road
- Kickabil Road
- Cains Crossing Road
- Yarrie Lake Road
- The Island Road
- Kamilaroi Highway.

To minimise the potential for traffic and access impacts, short-term closures would be undertaken during the night over a maximum two-day period. Where required, detours would be established. Closures would be managed in accordance with a traffic, transport and access management plan. This plan would define the traffic management measures and communication required to manage traffic through or adjacent to work areas to ensure that access and road functionality is maintained.

Where the proposal site intersects with public roads, access to these roads would be maintained. There may be minor delays to traffic (about one to two minutes) as a result of 'stop and go' traffic control arrangements.

As discussed in section 5.1.1, there are 51 new level crossings (39 passive and 12 active) to be constructed as part of the proposal. During construction, there may be some minor disruptions to road traffic movements at these locations as a result of reduced speed limits and traffic control. These would be managed in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP.

As discussed in section 5.2.6, during construction there may be activities such as emergency works and utility works undertaken outside of the primary construction hours (6am to 6pm). The activities would have localised impacts to the location of the works and utility works are not expected to exceed 48 hours in one location. Given this, the activities would also be outside of peak hour with generally lower traffic volumes and would have minor disruptions to the local road network.

Road safety impacts

During construction there would be changed arrangements on several roads subject to increased truck activity as a result of reduced speed limits and traffic control. There is also potential for incidents between construction traffic and public road users. It is proposed to construct a haul road within the construction footprint in order to minimise heavy vehicle movements on the public road network. As discussed in section 5.2.4, access to the construction footprint would be designed with the relevant standards and guidelines to provide suitable safe access to public roads.

As discussed in section 4.2.3, crash rates within the study area are typical of rural conditions in that they are relatively high when compared with state and regional averages. Crash rates per 100 million VKT are typically high on low-volume roads, such as in the study area, but may be based on few crashes. While the proposal would result in additional traffic generated within the study area during construction, the likelihood of an incident would be managed in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP. These documents would provide policies, procedures for access to and from site locations including measures to mitigate risk through interactions with the public road network. In addition, road safety audits would be conducted as part of the detailed design process to ensure any potential risks to road safety, either due to road network changes that would occur.

Emergency vehicle movements

As described above, construction of the proposal would result in temporary impacts to traffic and access within the proposal site, and an increase in both heavy and light vehicle movements on the local road network. This could cause delays and/or potential access restrictions to emergency vehicle movement in the proposal area. However, as road network performance would not decline as a result of construction, any delays would likely be minor.

Impacts from delays and potential access restrictions would be managed through the implementation of the traffic and access management plan and appropriate traffic controls, which would consider emergency vehicle access and movements. Ongoing liaison with local councils, Transport for NSW and emergency services would be undertaken as part of the detailed design to identify additional measures to mitigate any potential impacts to emergency vehicle movements due to construction traffic.

Freight rail network impacts

The new railway alignment would interact with a number of existing freight rail lines, operational and non-operational, as discussed in section 4.3.1. The proposal would include connection into the existing lines, bridges over the existing lines, and potential future connections. There would be the potential for temporary impacts on existing rail freight operations where connections to existing rail lines are proposed.

The works associated with connections/interactions with operational rail lines would generally be carried out during scheduled weekend rail corridor possession periods (that is, the times that the movement of trains along the rail corridor are stopped for maintenance), in accordance with standard operating procedures for ARTC. For example, the connection of the tracks at either end or some finishing works. Rail corridor possessions are typically for a 72 hour period, four times a year. During possessions, works may need to be carried out on a 24 hour basis.

As part of the pre-construction activities early delivery of rail and sleepers would commence up to six months before site establishment. This is intended to minimise construction traffic and access impacts during other construction activities. It is currently proposed that the rail and sleepers be delivered to the multi-function compounds by trains using the existing rail network. This would be subject to availability of train paths and in consultation with relevant stakeholders to minimise the impact to existing train operations.

Public transport impacts

There would be minor disruptions to coach services that use roads near the construction footprint as a result of reduced speed limits and traffic control. These would be managed in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP.

The timetabled passenger rail service (North West Xplorer, as mentioned in section 4.3.1) would have minor disruptions when the new rail alignment is connected. Works associated with connections to existing rail lines are generally during scheduled weekend rail corridor possession periods. Possession periods typically occur four times a year for a 72 hour period. During these times, it is expected that train replacement services (bus services) would be offered to the public.

Parking impacts

Parking would be provided in compounds within the proposal site for buses, light vehicles and trucks. Parking locations would be detailed in the traffic, transport and access management plan. Given the rural setting of the proposal, there is effectively no demand for parking associated with existing land uses outside of the major population centres.

Rest areas within the proposal site would not be used for parking unless in an emergency. Buses would be utilised to transport the majority of the workforce from the accommodation site to the proposal site, minimising private vehicle use and potential for increased parking demand. Bus parking would be available in the compounds and accommodation sites for safe boarding and alighting away from public roads.

Hence, given that all parking associated with the proposal would be accommodated on-site, there would be no impacts to parking supply and demand.

Pedestrian and cyclist impacts

As discussed in section 4.3.3 pedestrian and cyclist activity is minimal adjacent to the proposal, with no facilities for pedestrians or cyclists provided along the major highways and local roads in the study area, although cycling is catered for in road shoulders where provided.

There would be minor disruptions to cyclists that use roads near the construction footprint as a result of reduced speed limits and traffic control. These would be managed in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP.

Construction of the proposal would require transport of bulk materials (eg from quarries and commercial concrete suppliers) through population centres including Dubbo, Gilgandra and Narrabri. This would generate more traffic on the existing roads which may cause minor delays but there would be no impact to pedestrian and cyclist routes and infrastructure as the existing road network is adequate to cater for transport of materials and no road or footpath closures or reconfigurations would be required.

Property access impacts

During construction there may be some minor disruptions to property access, including state forest access tracks, as a result of reduced speed limits and traffic control. Property access and access tracks would be maintained for the duration of construction and where needed alternative arrangements or configurations made. These would be managed in consultation with the affected stakeholders and in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP.

Pavement condition impacts

There would be increased traffic on existing public roads from the introduction of construction traffic. The main impact would come from heavy vehicles. Haulage routes utilise major transport roads (refer to Figure 5.3 to Figure 5.6), where possible, like the Newell Highway which would be able to support the loading. Prior to planning the use of any local roads, consultation with the council would be undertaken to determine their suitability for use.

Prior to construction an existing pavement condition survey would be undertaken on all impacted roads. Throughout construction, pavement condition monitoring would be carried out as required to ensure safe and appropriate road conditions for all users. At the completion of construction, a final pavement condition survey would be undertaken to identify any impacts as a result of the proposal.

Following the final pavement condition survey, if there is significant meditation works required to return the pavement to its previous condition, this would be conducted at the contractor's expense and they would be required to liaise with the relevant council (or asset owner) to receive approval of the remediation works.

Travelling stock reserve impacts

Constructing the rail corridor in proximity to existing travelling stock reserves has the potential to affect access along these routes where these cross the proposal site. Works would be managed such that necessary access on the travelling stock reserves would be maintained, or where this is not possible alternative access arrangements would be provided in consultation with the NSW Local Land Services and would be defined in the traffic, transport and access management plan.

6.1.2 Road infrastructure

Impacts from traffic, road network, and access

As discussed in section 5.1.2, the proposal includes a number of road realignments and closures to public and private roads. The road realignments would be constructed off-line to minimise the disruption to traffic. Changes or realignment of public roads would be undertaken in accordance with the minimum safe standard of the existing road, unless otherwise agreed with the responsible road authority. Minor delays are expected during tie-in with the existing road from speed reduction and traffic control. The proposed road realignments include realigning Pilliga Forest Way. Given the low traffic volumes along this road (about five vehicles per day two-way – see Table 4.5) these works are expected to result in minimal impacts on existing traffic during construction. Detours and/or diversions would be provided as required to maintain access. These would be managed in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP.

Road closures are proposed on local roads and other low order roads (ie paper roads and forestry roads). Given the low traffic volumes on the local and low order roads (Dappo Road has about nine vehicles per day two-way – see Table 4.5), there would be minor impacts to the local traffic and localised impacts from access restrictions. These would be managed in consultation with the affected stakeholders and in accordance with the traffic, transport and access management plan which would be prepared as part of the CEMP.

Other traffic, road network and access impacts during construction of the road infrastructure would generally be consistent with those described in section 6.1.1.

Other transport impacts

There are no bus routes that operate on roads proposed for realignment or closure. The proposed road infrastructure works would not impact on existing freight or passenger line services within the study area.

Pedestrian and cyclist activity is expected to be minimal in the vicinity of the proposed road infrastructure works. There are no pedestrian and cyclist facilities along local and low order roads except for road shoulders, where provided for cyclists to use. As such, there would be minor disruptions to pedestrians and cyclists.

6.2 Operational impacts

6.2.1 Rail infrastructure

Traffic and road network impacts

Traffic impacts

During operation, there would be some vehicular traffic generated associated with maintenance and operations, however this is not expected to be a significant increase to existing conditions. As there are no proposed changes to passenger train services within the proposal rail corridor, there is not expected to be an increase in traffic to the train stations at Narromine or Narrabri. Therefore, there is expected to be minimal traffic generation as a result of this proposal.

There is potential for minimal traffic increases in some locations, due to maintenance requirements and staff changeovers during operation of the proposal. However, these vehicle movements are expected to be very low, about one or two vehicles in attendance in any one location daily.

The proposal may open up new opportunities for land uses associated with primary production and forestry through improved access to the rail network for freight. This would generate local trips by light vehicles and trucks and associated freight requirements. It is expected that if land surrounding the proposal is to be developed, a substantial portion of freight haulage would be accounted for by the proposed rail connection, rather than increasing the vehicle traffic within the local area. It is noted that there is potential for staff and local deliveries accessing the newly developed area would increase the number of vehicles within the local area, however this is expected to have a minimal impact on the operation of the roads and any new development would be subject to a separate approval process to determine potential impacts on the operation of the road network.

The number of freight movements utilising the wider road network is anticipated to reduce as a result of the proposal, and therefore improving the overall operation of the road network, in particular, the Newell Highway.

Level crossings

The key traffic impact of the proposal would be the potential impacts on travel time as a result of increased train activity, and therefore increased time of road closure, at proposed level crossings. As noted in section 5.1.1 about 51 new public level crossings would be provided along the rail line, of which 12 are proposed to have active controls, and 39 are proposed to have passive controls.

The review of the proposed level crossings is based on the following assumptions:

- trains would have a maximum overall length of 1,800 metres
- train speed would be 115 kilometres per hour
- at passive level crossings, traffic would stop 20 seconds before the arrival of the train and traffic would not recommence until five seconds after the train has passed
- active level crossings would have a 30 second pre-train warning period, as well as a 10 second period after the train has passed.

Active crossings would be provided on public roads at the following locations:

- Tomingley Road (69 vehicle movements in peak hour)
- Eumungerie Road (66 vehicle movements in peak hour)
- Burroway Road (45 vehicle movements in peak hour)

- Collie Road (15 vehicle movements in peak hour)
- Oxley Highway (54 vehicle movements in peak hour)
- Wyuna Road (four vehicle movements in peak hour)
- Castlereagh Highway (108 vehicle movements in peak hour) (see Table 6.2 below)
- Yarrandale Road (nine vehicle movements in peak hour)
- Toorweenah/Gumin Gumin Road (10 vehicle movements in peak hour)
- Mungery Road (12 vehicle movements in peak hour)
- Baradine Road (20 vehicle movements in peak hour)
- Gwabegar Road (29 vehicle movements in peak hour).

The amount of vehicle movements provided for the above roads are representative of two-way movements during the peak time of day, as noted during traffic surveys undertaken as part of the assessment. These volumes have been adjusted for forecast growth to provide the estimated volume of two-way movements during the peak hour on those roads, in the opening year of the proposal.

The other highways that the proposal crosses (Mitchell Highway and Kamilaroi Highway) are grade separated (rail over road) and as such, no level crossing is required.

For the purpose of this assessment, the delays at the worst case active level crossing (highest traffic volume impacted) have been calculated. A review of the existing traffic volumes specified within Table 4.5 demonstrates that Castlereagh Highway carries the highest traffic volume in close proximity to the rail corridor, which is 108 vehicle movements (two-way) during the peak period in 2025 and 125 two-way movements in 2040. Table 6.2 below details the maximum delay experienced at the proposed active level crossing at Castlereagh Highway and the anticipated number of vehicles delayed (if a train was to pass during the peak period). The proposed delay of 96 seconds is typical for level crossings for freight carrying train lines. The calculations of the probability assessment are provided within Appendix A.

Table 6.2 Castlereagh Highway delays per train

Scenario	Maximum delay at crossing (seconds)	Number of vehicles delayed (two-way)
2025 with 1,800 m maximum length	96	6 vehicles (Typical queue 39 metres)
2040 with 1,800 m maximum length	96	7 vehicles (Typical queue 46 metres)

The delays detailed in Table 6.2 are based on the assumptions outlined above for an active level crossing (ie the deployment of boom gates, bells and lights) and background traffic growth through to 2040.

It is noted that in full operation there would be up to 10 trains (both directions) in operation (in 2025) on Inland Rail daily. It is noted that throughout the day there would be times when an active crossing would be blocked due to a passing train. However, due to the low number of vehicles during the peak period on Castlereagh Highway, and even less outside of peak periods, the number of vehicles impacted by the proposed level crossing is expected to be low.

The presence of level crossings may present safety risks to motorists due to potential collisions with trains. In accordance with the safety measures as outlined within the ALCAM assessment process, the proposed level crossings have been designed to ensure that all crossing points

have adequate safety measures to mitigate the likelihood of incidents between passing trains and passenger vehicles. At passive crossings, ARTC standard signage would be provided and at active crossings boom gates and bells would ensure passenger vehicles are aware of the passing train.

Heavy vehicle corridor use

The *National Key Freight Route Maps* (Department of Infrastructure, Transport, Regional Development and Communication, 2019) identifies Newell Highway and Mitchell Highway as key freight routes in close proximity to the proposal. While these routes are close to the proposal, there is no proposed impact on these roads by the rail corridor, as the Mitchell Highway is proposed to be grade separated from the rail alignment. Therefore, the operation of Mitchell Highway is proposed to be not impacted by the proposal.

Secondary access routes for the heavy vehicle network within the area are identified as Kamilaroi Highway and Castlereagh Highway. The impact on Castlereagh Highway due to the proposal and provision of level crossings is discussed above.

As the proposal intersects Kamilaroi Highway nearby Narrabri Creek, it is proposed that the rail corridor and Kamilaroi Highway would be grade separated and therefore no impact on this freight route is anticipated.

Road safety impacts

While the proposal would increase the number of interfaces between road and rail within the corridor, the potential safety impact due to introduced conflicts would be mitigated such that there is no significant increase in crash risk expected.

Key mitigation treatments are described as follows:

- Review of road rail interfaces has been undertaken and an appropriate crossing treatment has been selected based on a range of factors including safety (grade separation, active level crossing or passive level crossing).
- Sufficient advance warning signage would be provided on roads leading up to level crossings to ensure all drivers are aware that there is a crossing point nearby and to reduce the risk of rear end collision with queued vehicles.

The likelihood of an incident on the wider road network due to heavy vehicle interaction is anticipated to reduce as the proposal would reduce the number of trucks utilising the wider road network by moving freight to rail, therefore creating a safer environment for the remaining road users.

It is noted that the two roads with the highest number of crashes detailed in section 4.2.3, being Mitchell Highway and Newell Highway, are not proposed to be impacted by the proposal, due to the proposal running parallel to Newell Highway and being grade separated from Mitchell Highway. Therefore, the road safety is not anticipated to be significantly impacted by the proposal.

Public transport impacts

No impacts to passenger train services as a result of the proposal are expected.

Bus routes which cross the proposal would be provided with a treatment to facilitate vehicular access via either grade separation of road and rail, or a passive or active level crossing. Some delays may be experienced, however the likelihood of significant delay due to passage of a train is relatively low.

The majority of the bus services operating within the study area operate twice a day (school bus services), and therefore the likelihood of being impacted by a passing train is minimal. However, if a bus is stopped at a proposed level crossing there would be short delays, of up to two minutes, associated with a train passing.

Other transport impacts

The proposal would not have any impacts to train paths when in operation. Connections with existing lines would be provided via new rail junctions providing greater opportunity for movement of freight by rail. All train movements on and between Inland Rail and existing lines would be managed in accordance with existing operational procedures. The arrangements for connections between Inland Rail and other lines has been developed in consultation with all relevant Government parties.

Access to the rail corridor

During operation, minimal impacts are anticipated as access to the rail corridor would be provided at defined access points with sufficient sight distance and a safe ingress/egress path connecting to the existing road network. These elements would be built in accordance with the relevant standards and guidelines and in consultation with the road authority.

Parking impacts

Parking would be provided, in key maintenance locations where required, within the rail corridor for light vehicles and trucks. Given the rural setting of the proposal, there is effectively no demand for parking associated with existing land uses outside of the major population centres. Hence, given that all parking associated with the proposal would be accommodated on-site, there would be no impacts to parking supply and demand.

Pedestrian and cyclist impacts

There would be little impact to pedestrians and cyclists given the generally low volumes within most of the proposal area. Pedestrians and cyclists utilising the roads proposed for level crossings may experience delays at these crossings due to passing trains. The introduction of road closures and realignments may impact some existing travel paths resulting in longer travel distances and times for pedestrians and cyclists. Such impacts are expected to be limited as key pedestrian and cyclist networks in the study area are located within rural centres which are less impacted by network changes.

It is noted that there would be access control in place to restrict pedestrians from being able to access the rail corridor and walk over the tracks.

Travelling stock reserves

As noted in section 5.1.1, the proposal would involve alternative access across the proposal site by means of a level crossing for two existing travelling stock reserves (travelling stock reserve R3420 and travelling stock reserve R23332). At both these locations there is the potential for stock to interact with road traffic during crossing of the rail alignment. This may result in minor disruptions/delays to local traffic.

This impact is considered minor given the rural setting of the proposal and that there is already potential for stock and road vehicles to interact in this area given the proximity of the routes to the roads. The potential for interaction is currently, and would continue to be managed through the use of approved stock warning signs which are required when stock is grazing or moving near or on a road. Signs must be:

- displayed when stock is being walked or grazed along or within 300 metres of a public road, except where a stock-proof fence separates the stock from the road
- positioned so that a motorist is warned at a fair and reasonable distance of the presence or likely presence of stock
- clearly visible to motorists who approach stock in either direction
- positioned so that there are no more than five kilometres and no less than 200 metres between the sign and a place where a vehicle would encounter the stock.

Further consultation would occur with the NSW Local Land Services and the relevant road authorities during detailed design to manage the potential for impacts to road traffic due to the proposed changes to the travelling stock reserves, particularly at level crossings.

6.2.2 Road infrastructure

Traffic and road network impacts

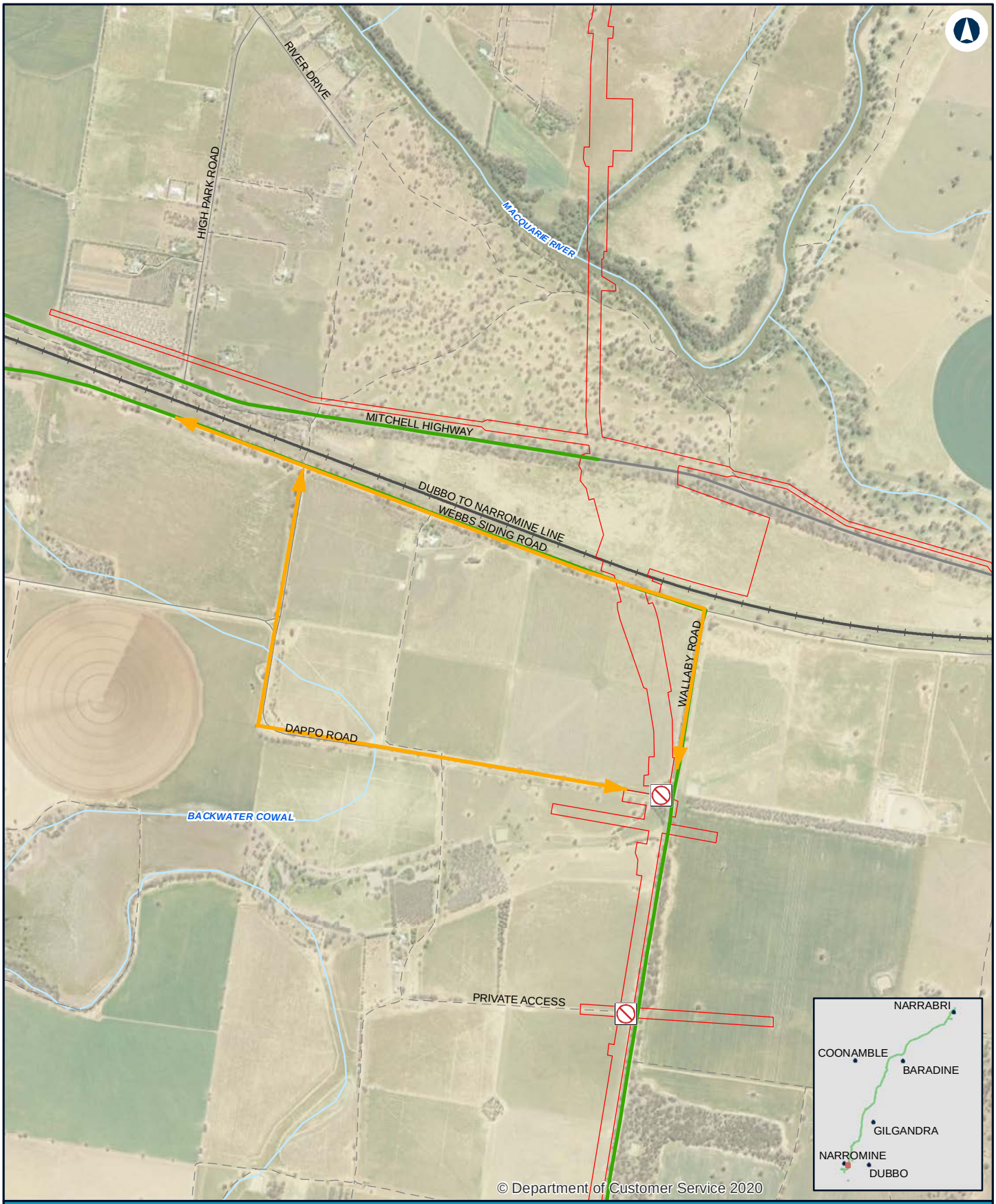
As described in section 5.1.2 the proposal would require the closure and/or realignment of a number of roads.

The majority of road closures would involve closure near the end of the road and realignment to a new level crossing or around the proposal via an existing road. Of the public roads described in section 5.1.2 only Dappo Road would be completely closed.

The council managed formed roads that are proposed to be closed, and the proposed alternative access arrangements, are listed in Table 6.3

Table 6.3 Proposed public road closures and alternative access arrangements

Road proposed for closure	Alternative access across the new rail corridor
Dappo Road	This road would be completely closed and road users would need to use Webbs Siding Road instead, located about one kilometre to the north (as shown in Figure 6.1).
Brooks Road	This road would be closed and diverted to a crossing via National Park Road, located about 900 metres south of the road's current intersection with National Park Road.
Nalders Access Road	This road would be closed and diverted to a crossing via National Park Road, located about 2.6 kilometres south of the road's current intersection with National Park Road.
Munns Road	This road would be closed and diverted 650 metres to the north of its existing location.



NARROMINE TO NARRABRI Alternative Dappo Road vehicle access Figure 6.1

0 0.25 0.5 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 6/07/2020 Paper: A4
Author: JacobsGHD Scale: 1:20,000
Data Sources: Basemap layers: NSWSS; Study area, project elements: GHDJACOBS

LEGEND

- The proposal site
- Access roads
- Road closures
- Alternative Dappo Road vehicle access
- Road
- Track
- Existing railway

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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Other access tracks, forestry roads/tracks and unformed roads would also be closed as noted in section 5.1.2.

Road closures may result in additional travel distance for road users. However, at the majority of locations where road closures are proposed, the impacts would be minor (about one to two kilometres).

A total of 53 public roads are also proposed be realigned to suit the proposal. Of these 52 would require short distance realignments to suit the proposed new level crossings. The proposal would also require realignment of about 6.7 kilometres of Pilliga Forest Way within Pilliga East State Forest. This realignment would minimise the number of new level crossings within the state forest.

For proposed road realignments, including the realignment of Pilliga Forest Way, no significant changes to travel distance are expected. New sections of road would be more or less the same length as the existing roads.

Detailed maps showing the location and arrangements for all road closures and/or realignments are provided in the EIS.

Pedestrian and cyclist impacts

It is noted that the public roads that are proposed to be closed and/or realigned are generally rural roads and therefore have little to no volume of pedestrians and cyclists currently utilising these roads. It is anticipated that in these locations that due to the low levels of cyclists and pedestrians, that there would be little to no impact on the operation of cyclists or pedestrians. It is noted that in these locations, pedestrian and cyclist access across the rail corridor would not be maintained, however alternative crossing points would be provided.

Access impacts

Where creation of the rail corridor would sever a property that currently has legal access to a public road, access would continue to be provided to both parts of the lot from a public road (or roads). Access across the rail corridor to the severed part of a lot may be provided by a level crossing. However, minimising the number of new level crossings provided as part of the proposal is desirable for safety reasons, as described in section 5.1.1. Access would continue to be maintained, and/or potential impacts managed, by:

- providing alternative access from a public road where available
- acquiring severed land, if rendered unusable
- providing common access points to serve multiple lots or properties (ie consolidation)
- providing a stock underpass under the rail corridor.

The proposal would seek to maintain access to properties by a reasonable public road route. This approach minimises the potential for private access impacts.

Alternative access, generally in the form of a level crossing and/or access road, would be provided where the proposal would sever the existing access to a public road. This may affect private landholders, with potential effects including increased travel distances and/or changes to the movement of equipment and stock. ARTC would continue consultation with landowners during detailed design to finalise preferred treatments at each location. Design and layout of crossing solutions would be based on:

- feedback from consultation with landowners on specific property requirements
- safety standards (criteria for minimum sight distances for trains and vehicles)
- availability of alternative access arrangements

- rail design and landform
- stock movements
- vehicle access requirements (for example farm machinery, frequency of use).

The provision of level crossings and the design of the level crossing would be determined in accordance with the relevant ARTC and Australian Standards and in consultation with landowners.

Further information on the potential for private property impacts, and measures to manage these potential impacts, is provided in *Inland Rail Narromine to Narrabri Agriculture and Land Use Assessment* (JacobsGHD, 2020a).

6.3 Cumulative impacts

For an EIS, cumulative impacts can be defined as the successive, incremental, and combined effect of multiple impacts, which may in themselves be minor, but could become significant when considered together. The methodology and projects considered for the cumulative impact assessment are provided in detail in the EIS (Part D chapter D1). The study area for the cumulative traffic assessment is identified transportation and haulage routes of the projects. Seven major projects were identified as having a cumulative impact and sufficient information to undertake a cumulative impact assessment. These include:

- APA - Western Slopes Pipeline
- Inland Rail – Narrabri to North Star
- Inland Rail – Parkes to Narromine
- Narrabri Gas Project
- Silverleaf Solar Farm, Narrabri
- Gilgandra Solar Farm
- Narromine Solar Farm.

Figure 6.2 shows the projects with the potential for cumulative impacts with the proposal.

6.3.1 Construction

The proposal would connect into two other Inland Rail projects (Parkes to Narromine and Narrabri to North Star) and both involve the upgrade of the existing rail lines. Parkes to Narromine is planned to be completed in 2020, before the planned start of the proposal, and would not have any cumulative impacts from construction.

Narrabri to North Star is planned to be constructed from 2020 to 2024 and would overlap with the construction of the proposal. A previous report produced by ARTC, analysed the construction impacts of this Inland Rail project (ARTC, 2017).

The report found, daily construction traffic generated would be 400 vehicle movements, including 234 heavy vehicle movements. The peak hour would occur at the beginning and end of each shift and generate 116 vehicle movements (one-way), including some 41 heavy vehicle movements.

The generated traffic would be distributed over the whole project and be produced from similar construction activities to the proposal. The cumulative impacts are mainly expected to be around the Narrabri area. However, the impacts are expected to be minor, as the indicative program for Narrabri to North Star, shows the Narrabri section to be constructed early on in the program.

Other haulage routes may experience increased traffic as traffic movements from the Narrabri to North Star project crossover with suppliers in the vicinity of the proposal. Construction traffic generated north of Narrabri is not envisioned to impact the proposal.

It is understood that the proposed Gilgandra Solar Farm, the Narromine Solar Farm and the Narrabri Gas Project (Santos) would potentially be under construction during the same timeframe as the proposal. It is expected that the shared haulage routes are likely to be arterial roads, and therefore acceptable to accommodate haulage for both projects. If any local roads are to be shared for construction access, this would be managed through the approval process of the CEMP.

6.3.2 Operation

The Inland Rail program would reduce the overall number of trucks driving along the eastern coast of Australia and instead move these freight movements via the new rail corridor. The removal of trucks from the road network would have the below benefits for the community between Narromine and Narrabri as well as the wider NSW and East Coast area:

- Fewer trucks on the road would reduce the wear and tear on the pavement on the roads and therefore reduce the overall maintenance costs required on these roads.
- The removal of long haul truck movements on the road network has significant safety improvements for the local areas near the proposal (Narromine and Narrabri) but also the wider road network.
- The reduction of long haul truck movements reduces the likelihood of an incident due to driver fatigue.

It is noted that the other projects located in close proximity to the proposal would have a small number of daily light vehicle movements (staff movements) associated with each project. The solar farms are not anticipated to generate a significant number of vehicle movements once operational and therefore are anticipated to have a negligible impact on the operation of the wider road network.

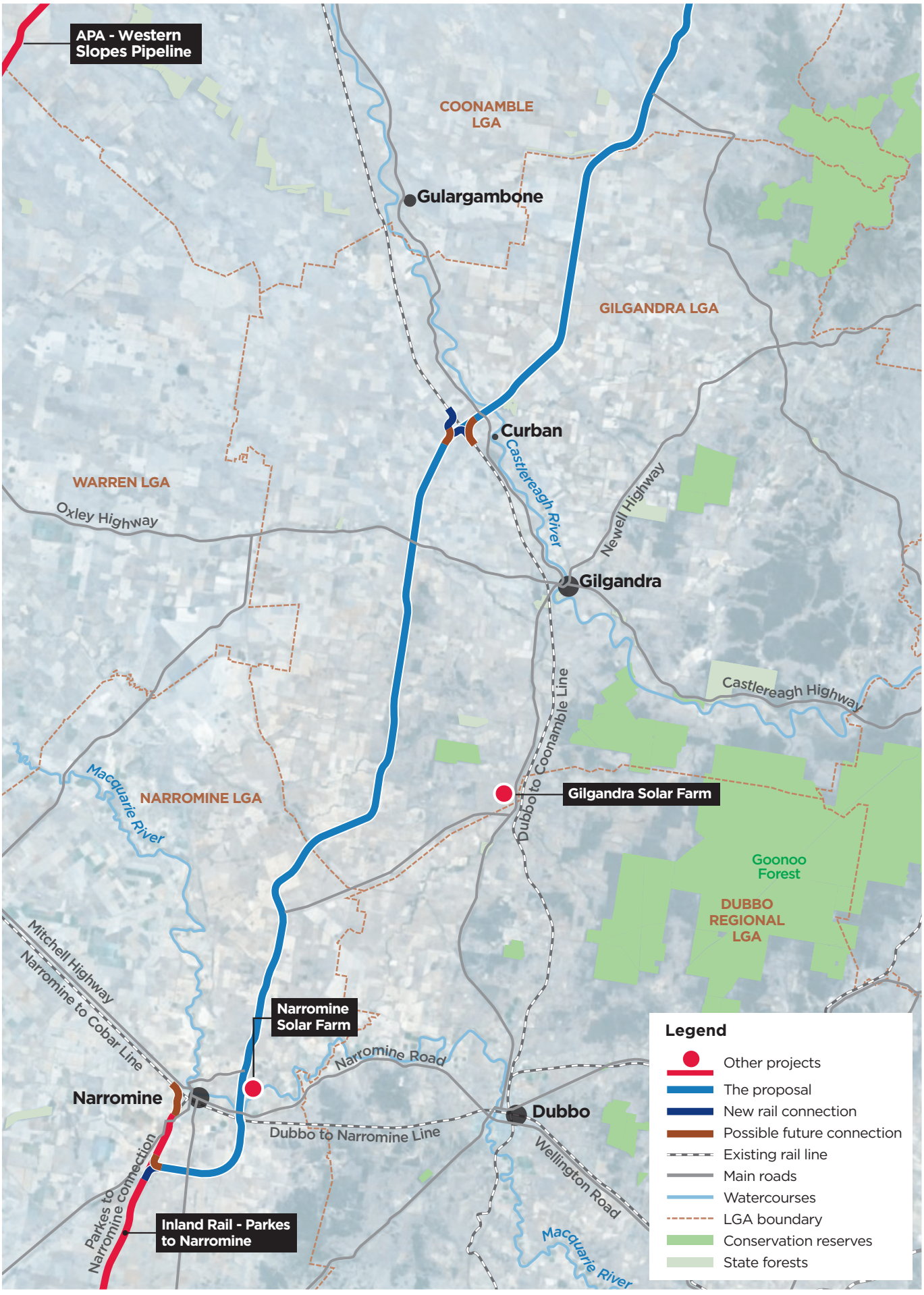

Figure 6.2a **Projects with the potential for cumulative impacts**

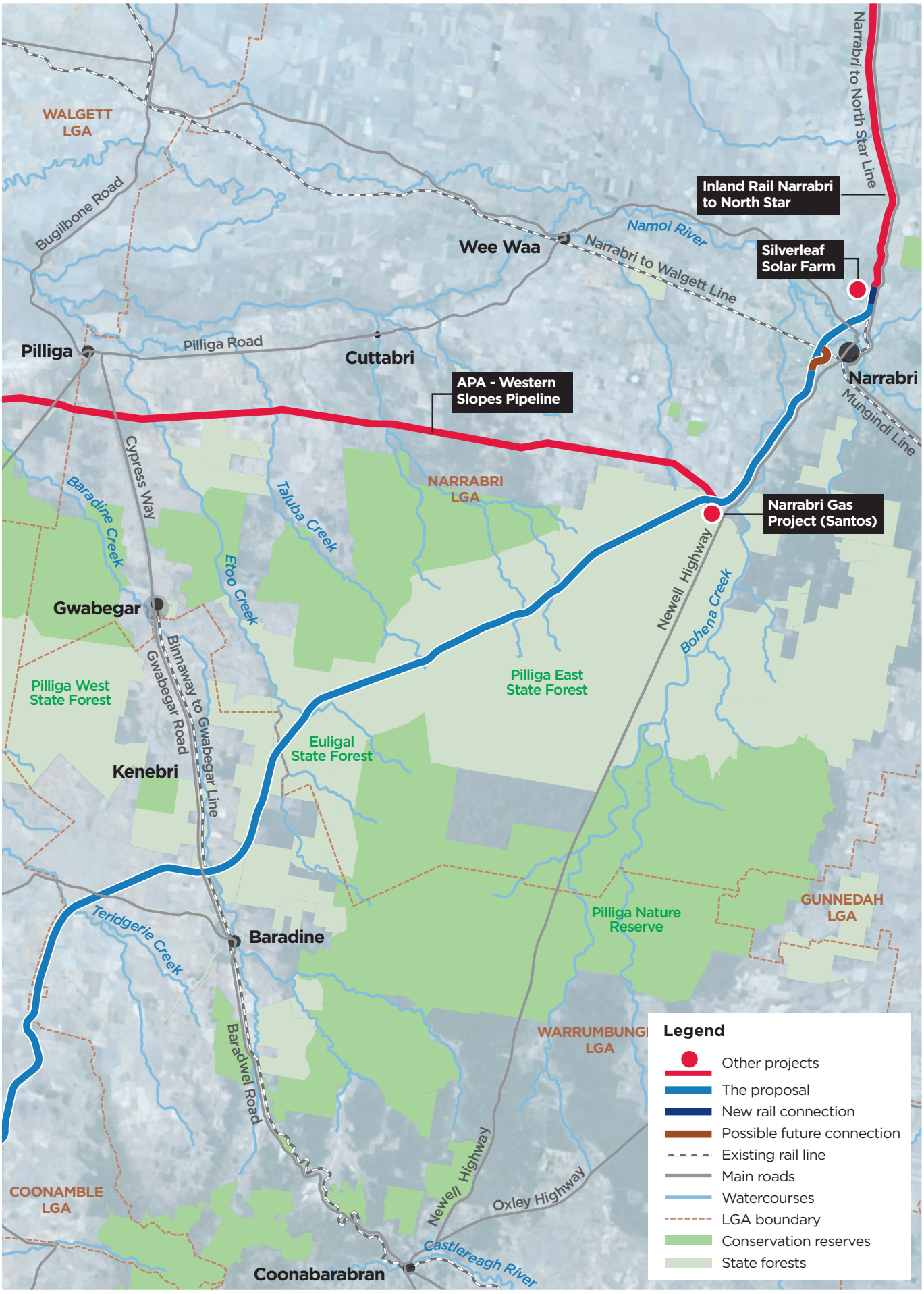

Figure 6.2b **Projects with the potential for cumulative impacts**

6.4 Regional freight task and proposal benefits

The Melbourne to Brisbane corridor is one of the most important freight routes in Australia, supporting key population and employment precincts along the east coast and inland NSW. With the eastern states of Australia forecast to experience strong population growth over the next 40 years there will be increasing pressure placed on existing infrastructure and services, including interstate freight transport.

While the existing rail mode share of freight between Melbourne and Brisbane varies between 22 to 27 per cent for non-bulk freight, to 60 to 90 per cent for commodities transferred in bulk (ARTC, 2010) the projected growth in the overall freight task will place continued pressure on the road network unless there is an increased use of rail.

Issues associated with increased use of road based transport corridors include the following:

- increasing local and regional capacity constraints in the medium to long term
- reduced travel time reliability as freight mixes with local traffic and private vehicles in areas to experience high population and employment growth, also leading to increased accident rates
- increased conflicts as freight mixes with other modes through town centres.

Rail is generally the most productive and efficient mode for freight travelling from regional areas to export ports and urban destinations. Through bypassing the Sydney metropolitan area, journey times would decrease along with improvements to service reliability, improving the competitiveness of rail transport relative to road transport (ARTC, 2014).

Beyond broader benefits to efficiency and competitiveness, a mode shift away from trucks and road based movements toward an inland rail corridor would provide benefits local to the immediate Narromine to Narrabri corridor. The Newell Highway is used as a road based freight corridor for trips between Melbourne and Brisbane. A mode shift of freight movements toward rail would reduce the number of trucks along the Newell Highway which runs immediately parallel to the alignment of Inland Rail, helping to reduce conflicts with other modes especially as it passes through regional centres.

There is also a number of safety considerations with respect to the proposed improvements due to the proposal. With a significant number of trucks removed from the road as a part of this proposal, this creates a safer environment for other road users utilising these roads (light vehicles, motorcyclists and cyclists), with the likelihood and severity of an accident reduced due to the reduced number of heavy vehicles travelling on the roads. The proposal also reduces the number of long haul truck trips required to be undertaken, which reduces the likelihood of incidents due to driver fatigue or other factors.

7 Recommended mitigation measures

7.1 Pre-construction mitigation measures

The options for reducing the potential for increased delays to road traffic as a result of the proposal during detailed design and prior to construction are summarised below in Table 7.1.

Table 7.1 Detailed design/pre-construction mitigation measures

Issue/Impact	Mitigation measures – Detailed design/pre-construction
Impacts on existing infrastructure and access	Detailed design and construction planning would avoid or minimise the potential for impacts on the surrounding road and transport network, and property accesses, as far as reasonably practicable.
Impacts on existing roads	Input would be sought from relevant stakeholders (including local councils and Transport for NSW) prior to finalising the detailed design of those aspects of the proposal that affect the operation of road and other transport infrastructure under the management of these stakeholders.
Road user safety at changes to the road network	Road safety audits would be carried where changes to the road network are required, in accordance with the Austroads guidelines, to ensure the safety of all road users is considered in the design process.
Road user safety at level crossings	Public level crossings would be designed in accordance with relevant guidelines and standards, including *AS 1742.7:2016 Manual of uniform traffic control devices, Part 7: Railway crossings* and *Guide to Road Design Part 4: Intersections and Crossings* (Austroads, 2017) and ARTC standards, including provision of warning signage, line marking and other relevant controls. Public level crossings with active controls would include boom gates and flashing lights. Where level crossings would provide access for travelling stock routes consultation would be undertaken with Crown Lands and Local Land Services to determine appropriate controls.

7.2 Construction mitigation measures

During the construction phase of the proposal, the following measures would be in place to reduce the potential impact on the existing road and rail networks and their users. The measures have been summarised within Table 7.2.

Table 7.2 Construction mitigation measures

Issue/Impact	Mitigation measures – construction
General impacts of construction activities on traffic, transport, access, pedestrians and cyclists.	A traffic, transport and access management plan would be prepared and implemented as part of the CEMP. It would include measures, processes and responsibilities to minimise the potential for impacts on the community and the operation of the surrounding road and transport environment during construction. The traffic, transport and access management plan would be developed in consultation with local councils, Transport for NSW and public transport/bus operators.

Issue/Impact	Mitigation measures – construction
	Consultation with relevant stakeholders would be undertaken regularly to facilitate the efficient delivery of the proposal and to minimise impacts on road users and landholders. Stakeholders would include the relevant local councils, bus operators, Transport for NSW, emergency services, the Forestry Corporation of NSW (in relation to access within State forests), Crown Land, Local Land Services and other affected property owners/occupants. The community would be notified in advance of any proposed road and pedestrian network changes through signage, the local media, and other appropriate forms of communication. Any additional measures identified as an outcome of consultation would be implemented during construction
Emergency vehicle access	Emergency vehicle access routes which may be impacted by the proposal would be identified and appropriate control measures would be implemented in consultation with the relevant emergency services providers.
Heavy vehicles damaging local roads	A dilapidation survey would be undertaken of the formed public roads within the proposed haulage routes prior and post construction and provided to the relevant road authority. Pavement condition monitoring would be carried out during works, as required.
Construction traffic impacts (temporary workforce accommodation)	The traffic, transport and access management plan would include measures to manage potential traffic impacts at and near temporary workforce accommodation facilities. The plan would include approved access routes and any restrictions on the use of residential streets.

7.3 Operational mitigation measures

It is not considered feasible to avoid any increase in potential delays to road users at the new level crossings as a result of the proposal. However, mitigation measures are outlined below in Table 7.3.

Table 7.3 Operational mitigation measures

Issue/Impact	Mitigation measures – operational
Road user safety at level crossings	The operation of all level crossings on classified roads, constructed as part of the proposal, would be reviewed after Inland Rail commences operation to confirm that the: • level of protection is appropriate • proposed infrastructure is appropriate for the traffic conditions. In accordance with National and State Rail Safety Law requirements, public road crossings would be subject to an Interface Agreement with the relevant road manager in order to ensure that safety risks are identified and minimised as far as practicable during operations.

7.4 Effectiveness of proposed mitigation measures

The mitigation measures specified above are anticipated to reduce the likelihood and/or consequence of the identified risks. Where identified issues/risks are unable to be removed completely, ongoing reviews would be undertaken to determine if any further action is required for each issue.

If any issues are unable to be mitigated through the design, construction or operational process, such as reduced pavement condition following the construction process (heavy vehicle activity), further works would be required to rectify these issues where possible.

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8 Conclusions

The proposed Narromine to Narrabri section of Inland Rail would ultimately allow for faster and more frequent freight train services. The proposal is largely remote from the existing road network, except at the proposed level crossings. The majority of level crossings are at minor roads.

The proposal would have different impacts during construction and during operation of the proposal as described below. The proposal design, including proposed mitigations, has sought to identify and eliminate or minimise risks so far as is reasonably practicable during the construction and operational phases.

8.1 Construction phase

During construction, the main traffic and transport impacts would be related to the movement of construction vehicles to and from the various construction sites along the proposal area. Depending on the construction methodology adopted, there may be up to 1,000 vehicle movements per day. These movements would be spread across the day and the 300 kilometres length of the proposal so while the additional traffic would be noticeable, an adequate level of service is maintained. Access to construction sites and compounds would be subject to specific planning and traffic management arrangements. Accesses would be constructed in accordance with Austroads standards, and other requirements that may be set down by Transport for NSW and/or councils.

It is recommended that a traffic, transport and access management plan be produced to guide the interaction of construction activities with the public road network. The plan should be prepared in consultation with the local councils (Narromine, Gilgandra, Coonamble, Warrumbungle and Narrabri shire) bus and other transport operators and Transport for NSW and be subject to periodic review and update as agreed between the stakeholders.

8.2 Operational life of the proposal

Once the proposal is operational, minimal traffic generating activity is anticipated. The primary traffic impacts relate to changes in conditions due to the proposed level crossings and the associated delays. Traffic activity at most level crossings in the proposal area is low, and the volume of traffic likely to be delayed by train activity is not substantial and the anticipated delays would be small (approximately one and a half minutes).

There would be a small number of public roads which would be closed and/or realigned due to the proposal, but these roads all currently carry very low volumes and alternate access to the wider road network is available or provided by the proposal and therefore a minimal increase in trip time is anticipated.

The Melbourne to Brisbane corridor is one of the most important freight routes in Australia, supporting key population and employment precincts along the east coast and inland NSW. With the eastern states of Australia forecast to experience strong population growth over the next 40 years there will be increasing pressure placed on existing infrastructure and services, including interstate freight transport. Rail is generally the most productive and efficient mode for freight travelling from regional areas to export ports and urban destinations.

Beyond broader benefits to efficiency and competitiveness, a mode shift away from trucks and road based movements toward an inland rail corridor would provide benefits local to the immediate Narromine to Narrabri corridor. The Newell Highway is used as a road based freight corridor for trips between Melbourne and Brisbane. A mode shift of freight movements toward rail would reduce the number of trucks along the Newell Highway which runs immediately parallel to the alignment of Inland Rail, helping to reduce conflicts with other modes especially as it passes through regional centres. Once operational, all level crossings on public roads would be reviewed to confirm that safety requirements are met and that the treatments are appropriate for traffic conditions. Interface agreements with the relevant road managers at crossings would help ensure that safety risks are identified and minimised as far as practicable during operations.

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Appendices

TECHNICAL REPORT

10

Traffic and Transport Assessment

Appendix A Calculations

Calculations for Castlereagh Highway Level Crossing Probabilistic Assessment as per section 6.2.2

Key information

108/125 vehicle movements in peak hour period (2025 and 2040 volumes respectively)

15% Heavy vehicle proportion

54% peak directional flow (one-way)

Assume light vehicle length of 10 m and heavy vehicle length of 25 m

115 km/h train calculations

Train passing time: $1800\ m\ @\ 115\frac{km}{h}\ \left(31.94\frac{m}{s}\right) = \frac{1800m}{31.94m/s} =$ 56 seconds

Vehicle queuing time:

$$30s\ (\text{pre train warning}) + 10s(\text{post train clearance}) + 56s\ (\text{train passing time}) = 96\ \text{seconds}$$

2025 Analysis

Expected number of vehicles arriving = peak hour volume/ 3600 x boom gate down time:

(108/3600) x 96 seconds = 2.9 vehicles (mean number of vehicles arriving)

Probability assessment to determine the 95th percentile queue length, utilising the mean (2.9 veh) and deviation

85th percentile queue = 5 vehicles

95th percentile queue = 6 vehicles

Queue length = 95th percentile queue x one-way direction percentage x (25 m x heavy vehicle percentage) x (10 m x (1- heavy vehicle percentage)

Queue length = 6 x 0.54 x (25 x 0.15) + 10 x (1-0.15) = 39 metres

2040 Analysis

Expected number of vehicles arriving = peak hour volume/ 3600 x boom gate down time:

(125/3600) x 96 seconds = 3.3 vehicles (mean number of vehicles arriving)

Probability assessment to determine the 95th percentile queue length, utilising the mean (3.3 veh) and deviation

85th percentile queue = 5 vehicles

95th percentile queue = 7 vehicles

Queue length = 95th percentile queue x one-way direction percentage x (25 m x heavy vehicle percentage) x (10 m x (1- heavy vehicle percentage)

Queue length = 7 x 0.54 x (25 x 0.15) + 10 x (1-0.15) = 46 metres

TECHNICAL REPORT

10

Traffic and Transport Assessment

Appendix B SIDRA Analysis

SIDRA analysis

A SIDRA analysis has been undertaken to review the operation of the proposed haul road with three major roads, being the Newell Highway, Mitchell and Kamilaroi Highways, to determine the anticipated delays and queuing associated with the proposal haul road and any impacts on the existing road network. Figure B.1 and Figure B.2 below show the layouts used for the SIDRA models.

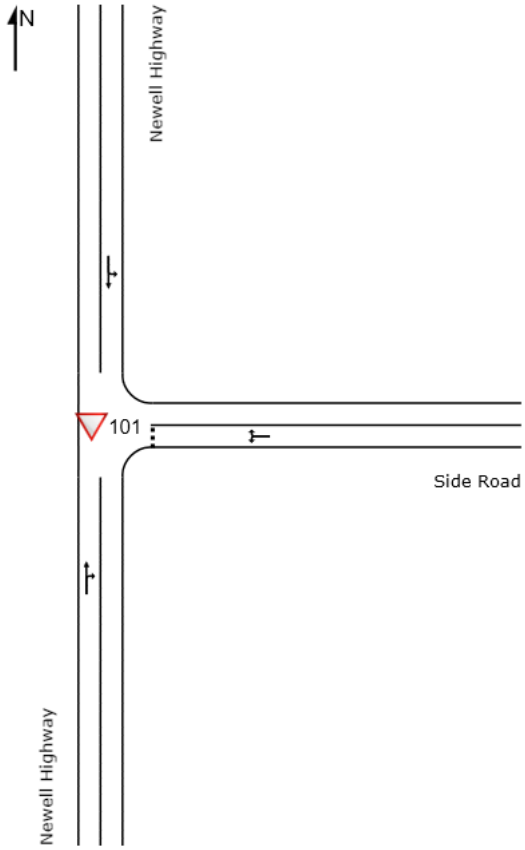

Figure B.1 Newell Highway and haul road intersection layout

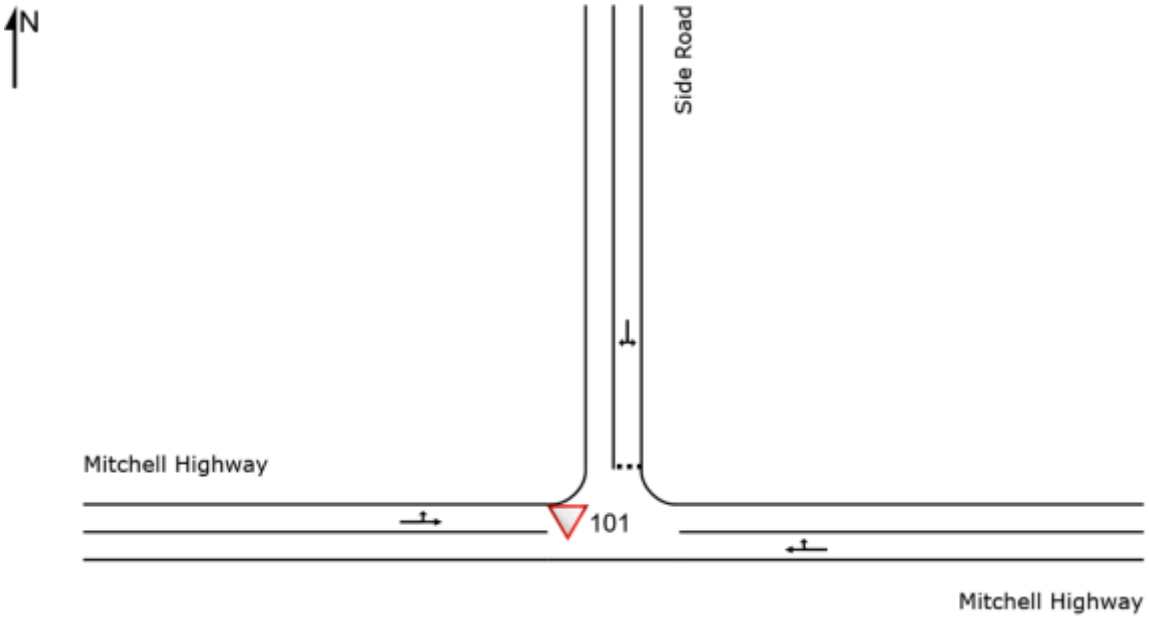

Figure B.2 Mitchell Highway and haul road intersection layout

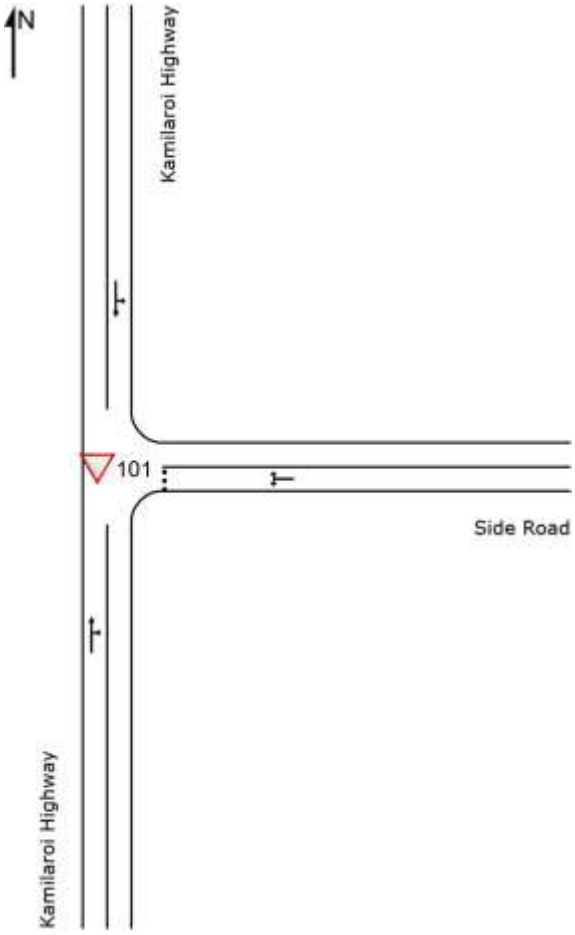

Figure B.3 Kamilaroi Highway and haul road intersection layout

In order to review a potential worst case scenario, for the purpose of this assessment is has been assumed that 100 vehicle movements during the peak hour period would occur associated with the proposed haul road and being split evenly between movements in each direction.

Vehicle movements associated with Mitchell Highway and Kamilaroi Highway has assumed that the movements will be split evenly between access to/from the east and west of the proposed haul road. Vehicle movements associated with Newell Highway have been assumed to be split 60 per cent to/from the north and the remaining 40 per cent of traffic to travel to/from the south.

Table B.1, Table B.2 and Table B.3 provide a summary of the intersection performance in 2025 (taking into account a one per cent growth rate on these roads).

Table B.1 Newell Highway and proposed haul road intersection SIDRA results

Leg	Degree of Saturation	Level of Service	Average Delay (s)	95th percentile queue (m)
Newell Hwy (S)	0.137	A	1.2	2.2
Haul Road	0.062	A	7.5	1.9
Newell Hwy (N)	0.216	A	5.4	0.0

Table B.2 Mitchell Highway and proposed haul road intersection SIDRA results

Leg	Degree of Saturation	Level of Service	Average Delay (s)	95th percentile queue (m)
Mitchell Hwy (E)	0.079	A	1.7	2.0
Haul Road	0.058	A	7.3	2.1
Mitchell Hwy (W)	0.090	A	1.1	0

Table B.3 Kamilaroi Highway and proposed haul road intersection SIDRA results

Leg	Degree of Saturation	Level of Service	Average Delay (s)	95th percentile queue (m)
Kamilaroi Hwy (S)	0.068	A	1.7	1.6
Haul Road	0.058	A	7.3	1.9
Kamilaroi Hwy (N)	0.128	A	1.0	0

As shown in the above tables, the proposed intersections of the haul road with Mitchell Highway, Newell Highway and Kamilaroi Highway are proposed to operate with minimal impact to existing traffic movements, with little to no delays experienced on the haul road or main road.

TECHNICAL REPORT 10

Traffic and transport assessment

Appendix C Public level crossing treatment methodology

Public level crossing treatment methodology

Introduction

The key principles guiding the decision-making process for determining treatments at public road–rail interfaces includes:

- Using a risk-based decision-making process focused on minimising risk So Far As Is Reasonably Practicable (SFAIRP)
- Consistency in the determination of road–rail interface treatments across the projects of the Inland Rail Program
- Applying a consistent methodology to determine if the cost of the potential available treatment is grossly disproportionate to the level of risk to safety and the projected benefits
- Ensuring the feasibility of the Inland Rail Program by proposing cost-effective solutions.

An overview of the process followed in the assessment of road–rail interfaces across the Narromine to Narrabri (N2N) project and the methodology followed in the development of road–rail interface treatments is outlined below.

Process overview—determination of road rail interface treatments

Identification of all potential road–rail interfaces within the proposal site

An important objective of level crossing investigations is the clear and accurate identification of all road–rail interfaces within the proposal site. The list of identified road–rail interfaces is then provided to the relevant road manager for review in order to ensure that all interfaces and the associated road infrastructure managers have been correctly identified.

Identify opportunities to minimise the number of proposed road–rail interfaces

Initial consideration will be given to the elimination of level crossing risks by assessing all road–rail interfaces for closure. This is in line with the Transport for New South Wales (TfNSW) *Level Crossing Closures Policy* (n.d.), which notes that:

> *'in order to manage the risks to safety associated with road and rail interfaces, the closure of public and private level crossings in NSW is to be pursued, where it is practical and cost effective to do so'.*

Road closures will only be progressed if endorsed by the relevant road manager.

Review whether the road–rail interfaces meet the criteria for automatic grades separation

ARTC's policy is that road-rail interfaces will be automatically grade separated in the following three instances:

1. Road-rail interfaces with four rail tracks (current)
2. Road-rail interfaces of freeways and highways of four or more lanes (current and committed future plans)
3. Where grade separation is the logical option for topographical or other technical engineering reasons.

All other crossings will be assessed using the Inland Rail Level Crossing Risk Tool.

Inland Rail Level Crossing Risk Tool

Where a road–rail interface is required, a methodology has been developed to identify what risk treatments should be implemented at individual road–rail interfaces as part of the Inland Rail project scope. This methodology is in the form of a formalised Level Crossing Risk Tool that identifies risk treatments and assists ARTC in being able to demonstrate that risks to safety would be managed SFAIRP for both new and existing road–rail interfaces.

The Australian Transport Council, in May 2003, agreed to adopt the Australian Level Crossing Assessment Model (ALCAM) as the only comprehensive level crossing assessment model in Australia. ALCAM is an assessment tool used to identify key potential risks at level crossings and assess the overall effects of proposed treatments. It does not specify what treatment is warranted at level road-rail crossing sites nor attempt to define a 'safe' or acceptable level of risk. This is a decision for each rail infrastructure manager.

In line with Office of the National Rail Safety Regulator (ONRSR) recommendation around the use of quantitative risk assessment techniques, a tool was developed which moved from a 'warrant' approach (e.g. decisions around control types based on basic metrics such as road type or traffic volumes) to a cost benefit analysis (CBA) approach for safety risk management. The approach uses ALCAM as one of the main inputs into the decision process for the recommended level of control at Inland Rail level crossings.

ARTC use a consistent methodology to develop all proposed road–rail interface treatments across the Inland Rail Program. In June 2020, the ONRSR finalised an audit of the *Inland Rail Road–Rail Crossing Strategy*, which included a number of the TfNSW level crossing interfaces on the N2N project. The audit recognised a consistent, systematic and comprehensive process for the assessment of level crossings is applied to determine adequate treatments, noting that the approach ensures level crossing safety risks are eliminated or minimised, SFAIRP. There were no findings or recommendations identified by the audit requiring action by ARTC.

Section 10 of ONRSR's *Policy on Level Crossings* (ONRSR, 2019) provides support for the use of ALCAM as follows:

> *'ONRSR accepts the use of ALCAM as a tool to help prioritise investment (when used in conjunction with other relevant factors, such as recent occurrence history). This tool has been endorsed by state and territory ministers.'*

Consideration of factors other than ALCAM that may influence the recommended level of control are also taken into account, where relevant, on a case-by-case basis, including:

- Collision and near-collision history
- Traffic and transport impacts
- Local knowledge of driver or pedestrian behaviour.

The assessment incorporates a compliance check against *AS1742.7-2016 Manual of uniform traffic control devices, Part 7: Railway crossings* (Standards Australia, 2016).

Level crossing treatment (control) options considered as part of the process include:

- Installation of passive (stop sign) level crossings—compliant with AS1742.7-2016
- Installation of active level crossings (flashing lights and boom barriers)
- Grade separation
- Other treatments identified based on-site specific risks.

Active controls are where a device, such as flashing lights or boom barriers, is activated prior to and during the passage of a train through the level crossing.

Cost benefit analysis

Part of the test as to whether risks have been managed SFAIRP is to determine whether the cost of the additional control is grossly disproportionate to the benefit gained via a CBA. From a financial perspective, three key inputs are required for the CBA:

1. *The avoided cost if an additional risk control is implemented*—the risk tool relies on ALCAM, which provides a quantitative measure of risk, which also enables the modelling of risk reduction generated by changing the controls at the level crossing. Risk reduction (benefits) can be calculated by comparing two risk scores for two scenarios, e.g. one level crossing with stop signs and one with flashing lights and boom barriers.
2. *The cost of implementing the additional risk control*—this is a combination of the capital cost of the additional control and the annual maintenance and repair cost over the life of the additional control.
3. *What would be considered grossly disproportionate*—from a legal perspective, the ONRSR *Meaning of Duty to Ensure Safety So Far As Is Reasonably Practicable Guideline* provides some guidance on what would be considered grossly disproportionate—the 'Grossly Disproportionate Factor' or GDF. The guideline suggests that the GDF may be dependent on the likelihood and consequence, with low risks having a factor of 2 and high risks having a factor of 10.

The use of ALCAM assessments in the determination of level crossing treatments

ALCAM assessments are undertaken for all proposed public road level crossings in the proposal site, thus providing a baseline risk score. The proposal functionality in the ALCAM system is used to model what the ALCAM risk score would be, assuming the introduction of Inland Rail. This incorporates forecast train speeds, volumes and train lengths. Updated road traffic counts, including a breakdown between light are heavy vehicles, are also collected for all public roads and included in this analysis.

If a crossing is assessed as being non-compliant for a passive stop sign control, the next level of control is applied. For example, if, based on the updated train speeds, sufficient sighting distance for a stop sign crossing as per *AS 1742.7-2016 Manual of uniform traffic control devices Part 7: Railway crossings* (Standards Australia, 2016) cannot be achieved, then the minimum control is flashing lights and boom barriers.

Even when a crossing is compliant for a passive stop sign control, the next level of control is modelled in ALCAM and a cost benefit/GDF analysis is undertaken, until the risk factor is reduced and a cost-effective level of crossing protection is established. For example, a passive control would be compared to a boom barrier control, which would then be compared to a grade separated control.

Preliminary design

A preliminary level of design is first undertaken to confirm that a level crossing with the proposed control, which complies with the relevant standards, can be constructed. This design incorporates any road design standards that have been provided by the relevant road infrastructure manager.

Site-specific level crossing treatments are then reviewed with the respective road infrastructure managers as the project progresses through the design process.

Interface agreements

In accordance with National and State Rail Safety Law requirements, all current and proposed public road crossings will be subject to an Interface Agreement.

Conclusion

The objective is to develop a consistent methodology in the selection of level crossing treatments that is acceptable to key stakeholders and minimises risk SFAIRP.

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