

Department of Planning and Environment

Narrabri Special Activation Precinct

Transport Report

April 2023



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Narrabri Special Activation Precinct Transport Report

Department of Planning and Environment

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WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Acknowledgement of Country

We acknowledge country and pay respects to the Gomeroi/Gamilaroi/Gamilaraay/Kamilaroi people as the Traditional Owners and Custodians of the land and waters on which the Narrabri Special Activation Precinct is located on.

We recognise their continued connection to Country and that this connection can be seen through stories of place and cultural practices such as art, songs, dances, storytelling and caring for the natural and cultural landscape of the area.

We also recognise the continuing living culture of Aboriginal people, and the significance of Narrabri in that living culture. We recognise the contemporary stories of displacement and the cultural significance of Narrabri in the continued journey of self-determination in Australia.

Glossary

Level of Service	A measure of how well a piece of transport infrastructure is performing based on the user's perception, levels range from A (good performance) to F (poor performance).
PBS	Performance-Based Standards – Scheme allowing innovative and optimised heavy vehicle design provided the meet safety and infrastructure standards to ensure they fit the existing road network and are safe.

Abbreviations

DCP	Development Control Plan
DPE	Department of Planning and Environment
DSRC	dedicated short-range communication
EbD	enquiry by design
ETCS	European Train Control System
HML	higher mass limit
HPV	High Productivity vehicles
IoT	internet of things
LCL	less than container load
LGA	local government area
LIDAR	light detection and ranging
M2M	machine to machine
N2IP	Northern NSW Inland Port
NSW	New South Wales
pcu	passenger car unit
PBS	Performance-Based Standards
PMF	peak mean flood
RAV	restricted access vehicles
RGDC	Regional Growth NSW Development Corporation
SAP	Special Activation Precinct

Executive summary

The Narrabri Special Activation Precinct (SAP) is one of the six distinctive areas throughout regional NSW to bring together planning and investment to stimulate economic growth across a range of industries including freight and logistics, manufacturing, waste management and recycling, energy generation and agricultural and food processing activities. Narrabri SAP was declared the sixth and final SAP investigation area as its location has a strong reputation and proximity to one of Australia's highest productive grain regions and strong transport linkages to road and rail including the future Inland Rail.

The transport technical assessment is the focus for this report and provides a key technical input for the overall Narrabri SAP Structure Plan. The preferred structure plan for the Narrabri SAP has been assessed to develop a fixed transport infrastructure and transport services plan to support the Narrabri SAP. The transport assessment has used two approaches to identify the transport network that will manage the impact of the new development on the community:

- quantitative assessment of the impact of the additional employment and residential development on the road network
- qualitative assessment of the transport needs of the land use including freight, heavy vehicles, active transport, public transport and travelling stock reserves.

Summary of findings

Road network

The existing road network can support the creation of the SAP in the short-term with targeted treatments to protect residential amenity, improve road safety and provide active transport connections. Upgrades of Yarrie Lake Road and Kiandool Road are proposed to cater for the increased number of trucks travelling to and from the SAP. In the medium-term, a new SAP Link Road has been proposed between Yarrie Lake Road within the SAP and the Newell Highway near Highfield Lane. The new east-west link road would include a grade-separated road crossing of the Inland Rail corridor.

The capacity of the Newell Highway at the Dangar Street bridge within the urban area of Narrabri is likely to be exceeded during the development timeframe of the SAP (estimated timeframe of 2031), requiring an upgrade of the existing Newell Highway or the creation of a new parallel route. The timing of the upgrades is dependent on the rate at which new jobs within the SAP and township are created and the increase of background traffic on the Newell Highway over the same timeframe.

The establishment of the new Mount Kaputar residential area will alter traffic patterns within Narrabri. The road network upgrades proposed take into consideration the needs of both the SAP and the new residential area. The residential area should be supported by a minimum of two access points to the State road network, ideally from both the Newell and Kamilaroi Highways.

Heavy vehicle route

The proposed SAP Link Road is proposed to be designed for Performance Based Standards (PBS) Level 3 vehicles to future proof it for the future vehicle needs of the Northern NSW Inland Port. It is envisaged that this road would become the main heavy vehicle route into the SAP replacing the interim route via Narrabri West.

Emergency vehicle and evacuation routes

Flood modelling has indicated that the existing road network in the vicinity of the SAP is susceptible to flooding. The proposed SAP Link Road would create a new route (via road) with flood immunity. It offers the potential to become an alternative flood-free route when existing routes are blocked.

Rail network

The Northern NSW Inland Port offers the opportunity to establish an intermodal facility and leverage the benefits of Inland Rail. This would include a rail siding 2,400 m in length with a width of 100 m which includes container storage and loading areas. It would be split into open access at its eastern end and dedicated access on the western end from adjacent land uses. An area has been identified at the far western edge of the SAP boundary on the Walgett Branch Line to accommodate a bulk handling facility.

Any plans to operate passenger rail services on the Inland Rail would require the funding and construction of the rail connection from the Walgett Branch Line to Inland Rail, the reconfiguration of the Narrabri West siding as well as relocating the rail station from the town centre to Narrabri West. This significant change in rail operations would move the town's rail station closer to the new residential growth area but would also lead to more train movements across the level crossing on the Newell Highway. It would also facilitate the repurposing of the rail line for the proposed green loop open space corridor.

Active transport

While facilities for walking and cycling are currently limited to main movement corridors, the SAP creates the opportunity to promote these modes of travel as employment increases. The most critical elements are to link the SAP and the proposed new Residential Growth Area to Narrabri West, and use the existing facilities between Narrabri West and Narrabri Town Centre to expand the reach of the active transport network. Improved crossing facilities are needed to improve pedestrian and cyclist safety at critical locations around the network.

Public transport

It is proposed that bus Route 457A could be extended into the SAP as an on-demand component of the service. In addition, a new bus route is proposed linking the new Residential Growth Area and the Narrabri Town Centre.

Travelling stock

The proposed transport improvements for the SAP will have minimal impact on the travelling stock reserves.

Sustainable transport

To position the SAP to take advantage in advancements in sustainable transport, a location for an electric vehicle (including trucks) and hydrogen fuel cell recharging facility should be identified as part of the transport and logistics component of the future development. With the SAP Link Road being directly connected to the Newell Highway, this facility should be in a convenient location to broaden its attraction and convenience.

Parking

The existing Development Control Plan (DCP) provisions for parking are suitable for new development within the SAP. However, this requires further validation by the Delivery Plan. Parking for trucks and trailers should be provided within individual properties based on the anticipated demand. The Delivery Plan should consider whether the anticipated business types in the light industrial area proposed east of Inland Rail are adequately covered by the existing controls, or whether additional guidance is necessary.

Aviation

The need to increase the number of flights beyond those planned as part of the proposed Narrabri Gas Project will depend on the type of businesses in the SAP and commodities manufactured in the SAP. If there is an increase in industry-generated freight and/or passenger demand, there may be a need to investigate opportunities to increase the number of days that flights operate to and from Narrabri. Increases in passenger demand may also require more travel choices for Airport passengers to connect to the town centre and the SAP.

Business efficiency and innovation

Create an internal road network in the vicinity of the Northern NSW Inland Port (and adjoining light industry, agriculture and food processing and manufacturing areas), that supports an intelligent road system to make use of circular economy opportunities and emerging technology.

Summary of infrastructure recommendations

A summary of the recommended infrastructure includes:

1 Rail network:

- a Inland Rail to Walgett Branch Line connection
- b N2IP rail siding – 2400 m siding to accommodate 1800 m long trains in the SAP Inland Port Precinct
- c an additional bulk loading siding on the western edge of the SAP boundary in the SAP Energy Precinct
- d grade-separated road crossings of the Inland Rail corridor, designed for double-stacked containers
- e Yarrie Lake Road/Walgett Branch Line rail crossing: upgrade to boom gates
- f Newell Highway/Werris Creek to Mungindi Line rail crossing: upgrade to boom gates.

2 Road network:

- a internal SAP roads to suit the structure plan, including upgrade Yarrie Lake Road, east of Bohena Creek
- b upgrade Newell Highway between Narrabri West and Narrabri town or provide alternative route by 2033 for the central employment scenario (2031 for the high employment scenario), suitable for PBS Level 3 vehicles
- c local road improvements within Narrabri West
- d Mt Kaputar residential precinct access roads and intersections
- e construct the SAP Link Road to Newell Highway by 2060 or before for the central employment scenario (2031 for the high employment scenario), suitable for PBS Level 3 vehicles, including grade separation of the Inland Rail corridor
- f upgrade Yarrie Lake Road, west of Bohena Creek and Kiandool Lane (within and outside SAP boundary).

3 Active transport:

- a shared cycle and pedestrian paths on the northern/western side of Yarrie Lake Road and Goobar Street
- b safe crossing across the Newell Highway, Kamilaroi Highway, Yarrie Lake Road, Goobar Street and Mooloobar Street
- c shared cycle and pedestrian paths connecting the new residential area to Narrabri West Public School and the Narrabri Lake/Narrabri Sports Precinct/Narrabri Showground footpath network
- d providing public bike racks near the areas of greater employee density
- e providing cycle lockers, showers and change areas in businesses with a sufficient number of employees.

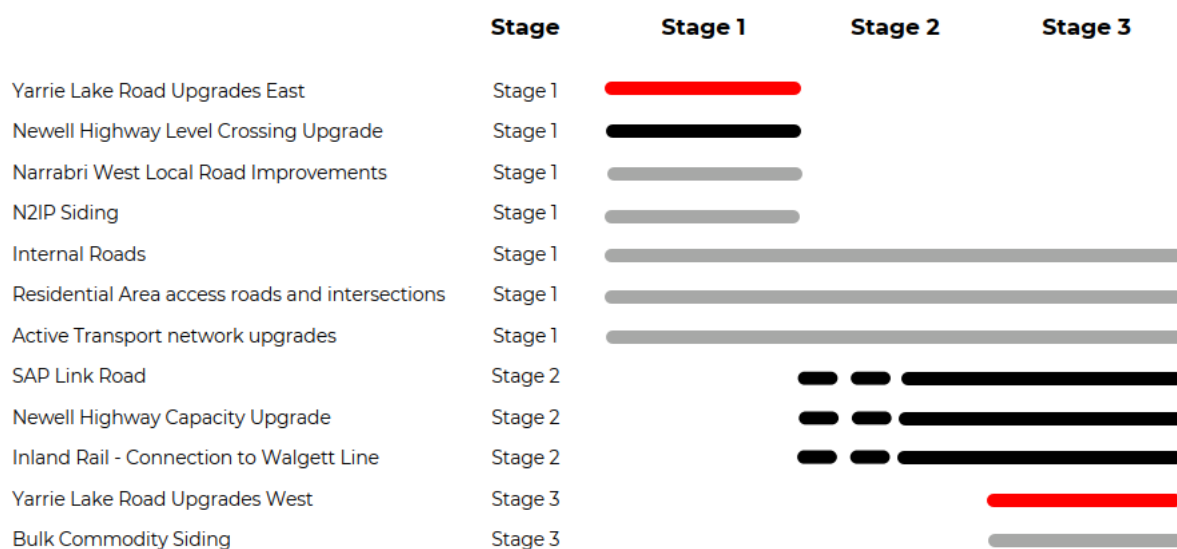
4 Public transport:

- a providing compatible road network and bus stops to enable bus route extension to Route 457A into the SAP with an on-demand component of the service.
- b providing a bus service frequency to meet the needs of typical job/shift hours.
- c providing DDA-compliant bus facilities such as new shelters on bus routes within the SAP with weather protection and shade.

5 Electric vehicle charging facilities for freight vehicles and employee cars.

Indicative timing

The indicative timing of the transport infrastructure upgrades is shown in Figure ES.1. This timing is based on the nexus between the upgrade and the land use generating the need for the upgrade. This timing is influenced by the rate of development and the staged release of land within the SAP and the Mt Kaputar residential area.



Notes Timing of infrastructure is affected by timing and rate of land development within the SAP and residential area

Figure ES.1 Potential infrastructure timing

1 Introduction

1.1 Narrabri strategic significance/context

The New South Wales (NSW) Government, through its introduction of the Special Activation Precincts (SAPs) has identified six distinctive areas throughout regional NSW to bring together planning and investment to stimulate economic growth across a range of industries including freight and logistics, manufacturing, waste management and recycling, energy generation and agricultural and food processing activities. The planning and creation of these areas is partially facilitated and funded through the \$4.2 billion Snowy Hydro Legacy Fund.

The establishment of SAPs is a joint NSW Government Agency initiative by the Department of Regional NSW, Department of Planning and Environment (DPE) and the Regional Growth NSW Development Corporation (RGDC) as part of the 20-Year Economic Vision for Regional NSW. DPE is responsible for preparing the planning framework whereas the Department of Regional NSW manages each precinct.

1.2 Scene setting (local context)

Narrabri is located in the heart of the Namoi Valley on the North West slopes and plains of New South Wales. The word Narrabri means ‘forked waters’, which describes the splintering waterways of the Namoi River, the Narrabri Creek and Horse Arm Creek. The township of Narrabri is the administrative centre of the Shire. Much of the Narrabri Shire population is centralised in the township of Narrabri, Wee Waa and Boggabri, and around the villages of Bellata, Edgeroi, Maules Creek, Baan Baa, Gwabegar and Pilliga. The Narrabri region is known for its fertile soils, abundant natural resources, strong industry and world-leading research.

In November 2020, Narrabri was declared the sixth and final SAP investigation area, enabled by its strong reputation and location within one of Australia’s highest productive grain regions as well as its strong transportation linkages including existing road and rail connections and the future Inland Rail. To facilitate the planning within this precinct DPE engaged WSP to prepare a series of technical studies regarding Transport within and interfacing the Narrabri SAP investigation area. An overview of the investigation area is shown in Figure 1.1.

Set against the backdrop of the Nandewar Ranges and on the banks of the Namoi River, the topography of the area varies from river plains through to mountain ranges. The Namoi River meanders through these plains and acts as the lifeblood of the area supporting agriculture, industry and people. The Namoi traverses the township of Narrabri from north west to south east. A number of smaller tributaries of the Namoi are also located within Narrabri including Mulgate Creek, Horsearm Creek and Long Gully. Narrabri has historically experienced flooding from each of these sources on a regular basis.

Narrabri township is located within the Narrabri Shire local government area (LGA), approximately 530 km northwest of Sydney. As of the 2021 census, the population of Narrabri township was 6,898 persons with 16% identifying as Aboriginal and/or Torres Strait Island Peoples.

The township lies at the junction of the Newell and Kamilaroi highways and has direct rail connection to the Port of Newcastle via the Walgett branch of the Main North line. Once completed, Narrabri will also have a direct connection to the new Inland Rail route which will connect Melbourne to Brisbane via new and upgraded track.

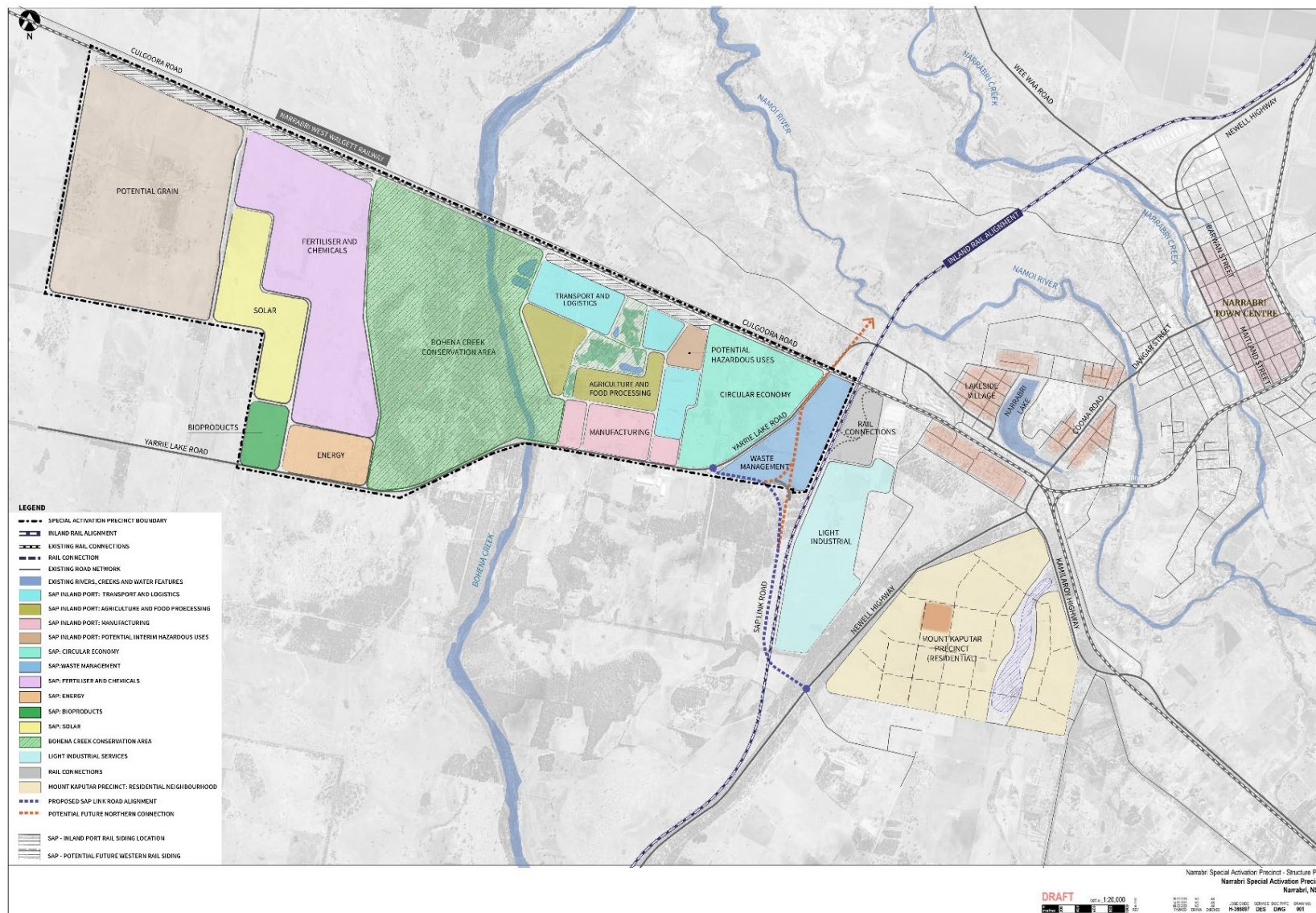


Figure 1.1 Overview of the Narrabri SAP (DPE, April 2023)

1.3 Masterplan process

The Narrabri Masterplan is the initial stage in determining the area and land uses for the Precinct and is guided and informed by DPE in partnership with the Department of Regional NSW and Narrabri Shire Council. Throughout master planning process, community, stakeholder and industry consultation will take place, as well as a range of technical studies to help inform the preparation of a draft master plan.

Creation of the Masterplan is developed across a series of key inputs and includes a range of technical disciplines including urban design, architecture, landscape design, engineering, and environmental disciplines. The Masterplan process and its stages are summarised in Figure 1.2.



Figure 1.2 Narrabri SAP Masterplan process

The following is a summary of key inputs and activities completed to date that support the findings of this technical report:

- **Stage 1 Analysis:** This stage sets the scene for Narrabri SAP by refining the vision and providing a more detailed understanding the SAP. This stage is supported by overview findings from a site visit, baseline assessment across various technical topics, and identification of key opportunities and constraints.
- **Stage 2 Identification of Options:** Various scenarios of the Narrabri SAP were developed in conjunction with council and inputs from the technical findings from the baseline assessment. A preliminary Enquiry by Design (EbD) workshop was held on 29 and 30 March 2022 to develop a range of initial land use scenarios for further assessment.
- **Stage 3 Draft Structure Plan:** Develops more detailed structure requirements based on the preferred land use scenario based on the range of options assessed in Stage 2. The preferred land use scenario was assessed through a final EbD workshop held between 5 and 8 September 2022 to study the interdisciplinary constraints and key infrastructure requirements. This technical report assesses the land use Structure Plan from the final EbD workshop from a Transport perspective. Figure 2.3 is an overview of the Narrabri SAP preferred land use scenario.

Following Stage 3 Draft Structure Plan, further community and stakeholder consultation will occur in the form of an exhibition period which includes display of technical reports from the Draft Structure Plan, Draft Master Plan, and SEPP.

1.4 Report structure

This Transport report has been prepared to provide key inputs for the Narrabri SAP Structure Plan. The remainder of this report is structured as follows:

- **Narrabri SAP overview – Structure Plan**

Chapter 2 is overview of the Narrabri SAP including key elements of the SAP as well as relationship with the Northern NSW Inland Port, the Narrabri Town Centre, and existing and proposed Residential Growth Area. In addition, an indicative summary of land uses, employment, and population are summarised.

- **Local context**

Chapter 3 provides an overview of local context from a Transport perspective summarising key strategic plans, policy, and planning documentation as well as existing conditions of the area.

- **Methodology**

Chapter 4 includes a description of the process used in undertaking the study, list of stakeholders involved, and information relied upon as part of the study.

- **Assessment and findings**

Chapter 5 provides technical inputs and findings for the Structure Plan against the visions and aspirations of the Narrabri SAP from the context of a Transport perspective.

- **Recommendations and conclusions**

Chapter 6 summarises recommendations and conclusions based on findings and inputs for Transport within the Narrabri SAP.

2 Narrabri SAP overview – structure plan

2.1 Overview

The Narrabri SAP boundary was developed at the Final EbD workshop and covers an area of 2,629.45 ha. It is located to the west of the existing township and incorporates two areas separated by an environmental buffer zone. This boundary was utilised as a basis for all technical studies and was refined during the master planning and technical assessment process as summarised in Section 1.3. Figure 2.1 provides an overview of key elements of the Narrabri SAP.

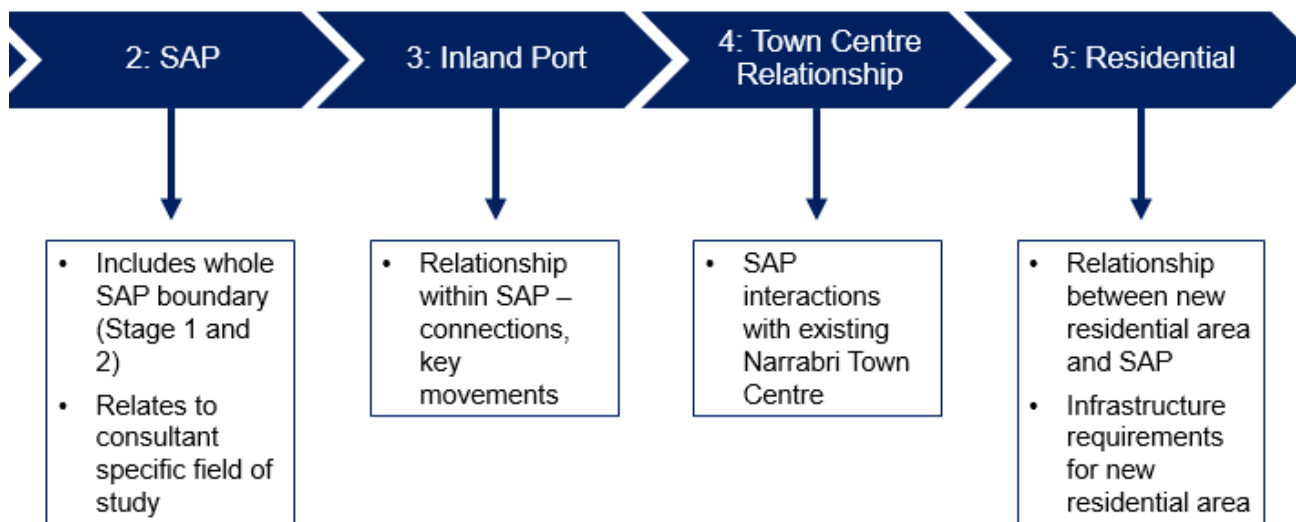









Figure 2.1 Overview of key elements of Narrabri SAP

2.1.1 Visions and aspirations

The vision and principles for the Narrabri SAP is grounded by the *7 Elements of Great Places* which is based on the United Nation's *The New Urban Agenda framework*. The Narrabri SAP Vision and Principles were developed with this framework and summarised in Table 2.1. They were refined during the final EbD to respond to feedback from stakeholders and consultants. This vision will guide the design and development of the precinct and the assessment of the merits of each of the scenarios.

Strengthening our relationship with Country and Water; the Narrabri SAP will retain the Town Centre as the heart of Narrabri, unlock greater economic growth for the region, leveraging from the Inland Rail, the Northern NSW Inland Port and the Narrabri Gas Project.

Table 2.1 SAP vision – 7 Elements of Great Places

Element	Vision
 Equity	Strengthen the existing community and businesses giving them the tools and the reason to stay whilst attracting economic and residential growth for Narrabri that will 'give back' to Narrabri. Respect the cultural and lifestyle diversity by providing access to housing, health, education, social and community infrastructure to enhance the liveability and lifestyle of Narrabri.
 Identity	Establish a legacy at Narrabri for future generations to be proud of which reflects diversity, protects and respects the site's natural features, heritage and vegetation whilst integrating a cultural lens across the entire SAP in all actions.
 Greenery	Use science and local knowledge to define constraints and opportunities, enabling the protection of community and environment with a strong focus on safety, flood and bush fire risk, water security and bio values.
 Urbanity	Reinforce the Town Centre as the heart of Narrabri breaking down boundaries, addressing basic social deficits and embracing diversity to achieve a liveable and lovable place that is safe, connected and active.
 Mobility	Plan for both regional and local equitable access for future residents, visitors and workers of all ages, abilities, and economic position; aiming to improve health, convenience and social connectedness.
 Wellness	Prioritising the community's health, well-being and sense of belonging and setting a new environmental sustainability benchmark for energy intensive development.
 Resilience	Grow and retain the local small industry community whilst up-skilling and attracting new industries and enterprises; setting a standard for innovation and circular economy across the board and including energy-intensive industries.

2.1.2 Staging

For the delivery of the Narrabri SAP, an indicative staging delivery plan is assumed to commence in 2024 and ongoing toward 2030 and beyond. Staging at this time is assumed across three stages:

- **Stage 1:** east of Bohena Creek with a focus on the transport and logistics land use (e.g. the inland port development), associated light industrial industry and assumed development of 600 new residential lots.
- **Stage 2:** remaining development east of Bohena Creek including associated industrial industry, waste management and circular economy land uses.
- **Stage 3:** west of Bohena Creek focussing on more hazardous heavy industry land development (such as energy, fertiliser and chemical production), bulk grain handling, and assumed development of a further 1,800 new residential lots.

Figure 2.2 provides an overview of the infrastructure delivery for the Narrabri SAP.

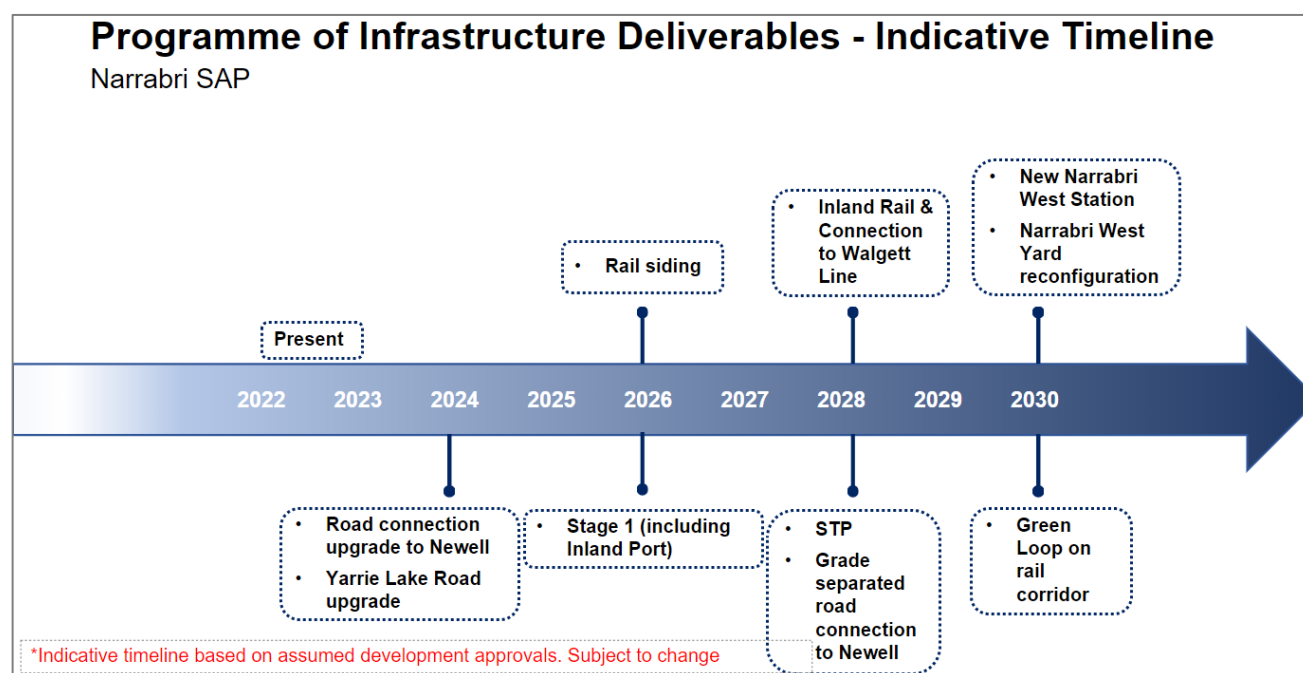


Figure 2.2 Indicative program and staging of infrastructure deliverables (subject to change)¹

¹Note: Reference of the 'Green Loop' is considered a long-term strategic concept and is not assessed in this report.

2.1.3 Land uses

Land uses and size within the Narrabri SAP and external to the SAP are summarised in Table 2.2 and Figure 2.3 provides an overview of the land uses.

Table 2.2 Overview of land use and sizing within and outside the Narrabri SAP

Land use within the Narrabri SAP boundary	Area (ha)	Land use outside of the Narrabri SAP boundary	Area (ha)
Fertiliser and Chemicals	366.62	Rail connection	44.92
Solar	144.14	Light Industrial (North)	106.75
Grain (Potential)	527.48	Light Industrial (South)	187.30
Western Rail Siding	37.75	Residential (2060 Target)	597.15 ³
Energy	63.31		
Bioproducts	40.79		
Inland Port (Rail siding and additional rail siding reserve)	36.07		
Transport and Logistics	108.20		
Interim Potential Hazardous Uses	19.19		
Waste Management and Recycling	94.32		
Agricultural and Food Processing	90.88		
Manufacturing	72.59		
Circular Economy ¹	181.75		
High Value Vegetation (To be retained) ²	45.85		
Bohena Creek Conservation Area ²	626.27		
Others (Rail, Roads, Decoupling Infrastructure) ²	174.24		
TOTAL	2629.45	TOTAL	936.12

Source: DPE, 17 February 2023

- (1) Circular Economy land use is identified land that align with circular economy goals by valuing resources, by getting as much use out of products and materials as possible, and reducing the amount of waste generated.
- (2) Non-employment land uses
- (3) The net residential area (excluding flooding area and main indicative connections) = 488.18 ha

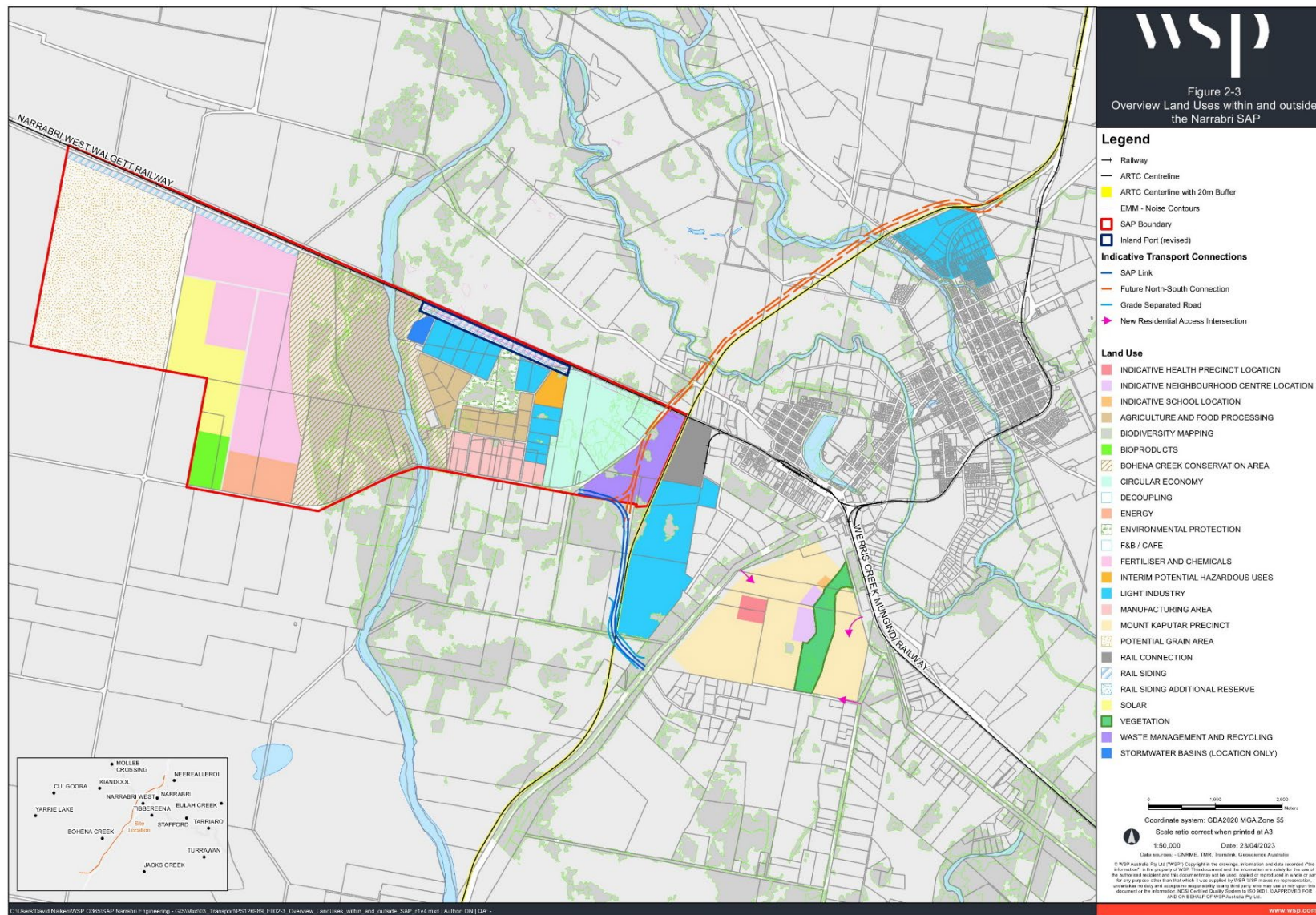


Figure 2.3 Overview land uses within and outside the Narrabri SAP (DPE, April 2023)

2.1.4 Employment

An estimate of the number of forecasted jobs created within the SAP is summarised in Table 2.3.

Table 2.3 Estimated employment requirements (FTEs) within the SAP based on high uptake sensitivity¹

Industry	2027	2032	2042	2062
Fertiliser & Chemicals	260	260	260	260
Energy	10	10	10	10
Bioproducts	0	0	0	50
Transport & Logistics	70	80	90	120
Agricultural & Food Processing	40	220	220	220
Waste Management & Recycling	50	60	110	110
Total	430	630	690	770

Source: *Narrabri SAP Economic Analysis Updated employment figures following September 2022 Enquiry by Design (EbD) Workshop (Aurecon, 2022-10-10)*

(1) Employment numbers correspond to high uptake sensitivity with gas project

Assumptions related to these estimates include:

- It is assumed that the employment in the grain, rail siding, interim potential hazardous uses and circular economy areas would not increase substantially or is included in the estimates for other land uses.
- The employment numbers in Table 2.3 do not include a specific allowance for the land allocated for Manufacturing. DPE has advised that the total employment estimate should be considered the maximum number. For the purposes of this assessment, we have assumed that the manufacturing jobs are included within the Agricultural and Food Processing estimate (as they are adjacent to each other).
- It is assumed that the Transport and Logistics employment forecasts include those associated with the Inland Port and light industrial within the SAP.
- The numbers in Table 2.3 do not include an estimate of the number of jobs potentially created in the identified land external to the SAP (Light Industrial North and South or the Residential Growth Area). While the impact of this development is outside the scope of this assessment, we have included a nominal allowance for the purposes of estimating the road network performance for the SAP. Based on the relative proportions of their land areas (3.5 times), it is estimated that the number of jobs in the Light Industrial South area are 245 in 2027, 280 in 2032, 315 in 2042 and 420 in 2062.

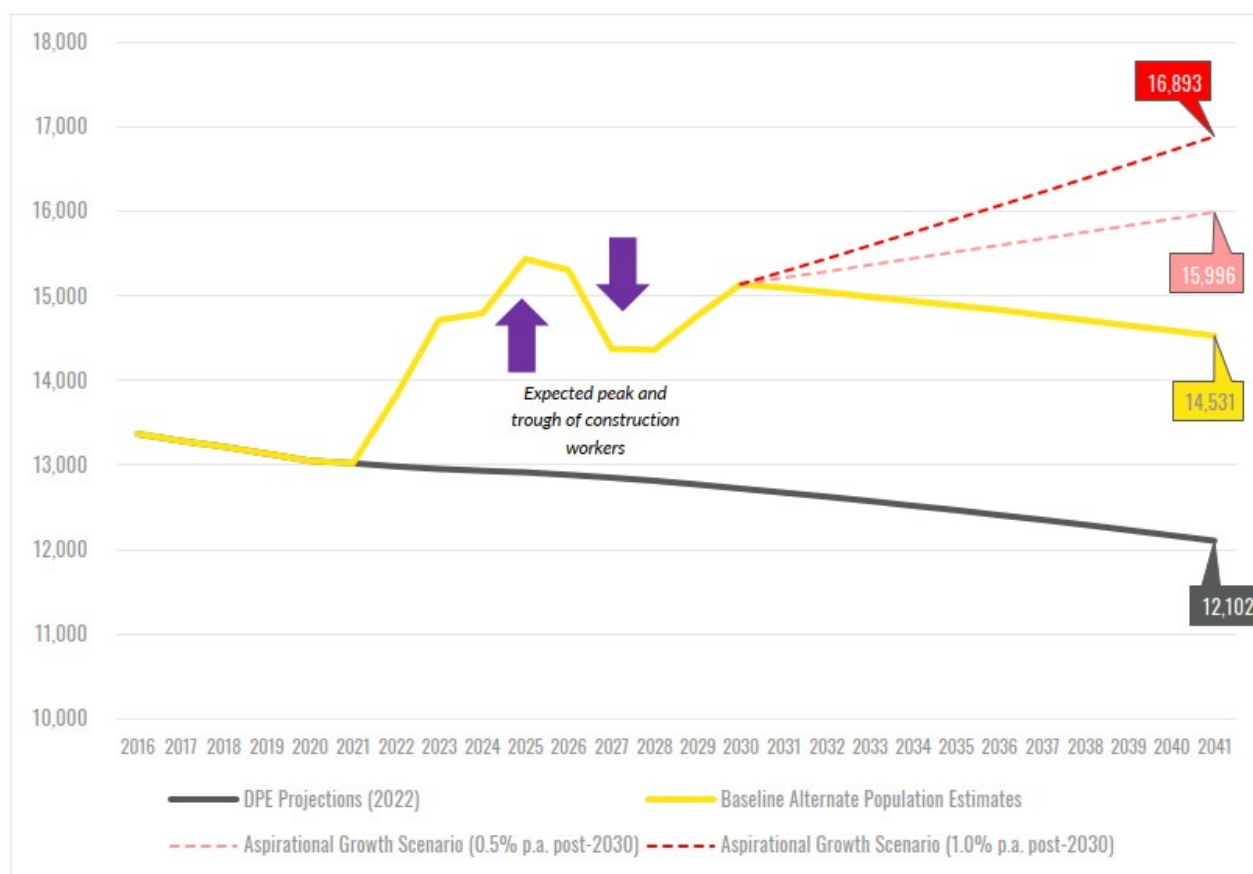
2.1.5 Population

The Narrabri Shire region could reach a resident population between 14,500 and 16,900 residents by 2041 as shown in Figure 2.4. Based on these estimates the potential dwelling need for the Narrabri Shire region would be between 7,000 and 8,000 dwellings by 2041. Accordingly, the population estimate scenarios could require between 1,000 and 2,100 additional dwellings over the coming 20 years to 2041, equating to between about 50 to 110 additional dwellings per annum. These estimates identify a significant uptick in housing supply would be required to meet population growth.

Population information¹ used in the assessment of trip generation includes:

- 1,003 operational jobs – Cumulative Operational Jobs (Source: Narrabri Shire Council, 2021)
- of these 85% would be new jobs (853)
- of the new jobs, 15% would be filled by people already living in Narrabri Shire, while the remaining 85% would be filled by new employees to Narrabri Shire = 725 new workers
- the population increase associated with new operational workers (assuming 2.5 people per household)
= 1,812 people coinciding with peak employment within the SAP.

Population estimates indicate that the SAP would increase the potential workforce as well as the population of Narrabri as a whole. The peak increase in workers is expected to occur in 2025/2026. Figure 2.4 shows that the increase in new workers and their families would be greater than a possible decline in overall population within Narrabri Shire.



Source: Atlas Economics/DPE (2022)

Source: Atlas Economics developed alternate population forecasts for DPE, November 2022

Figure 2.4 Narrabri Shire Population projections

¹ Atlas Economics population forecasts for DPE, November 2022

For the purposes of this assessment, we have assumed that the maximum increase of new residents would be contained within the new residential area, and that it would be maintained, even if there is a decline in the population in current residential areas within Narrabri Town.

Housing analysis for the Narrabri SAP has indicated that 1,075 new dwellings may be required in Narrabri in the future². This assumes that the number of people per dwelling may decline over time. Equating the number of household trips to the number of people living in SAP, the higher number of dwellings/lower number of people per dwelling is not expected to change the overall number of trips generated. It is assumed that all new dwellings will be located in the new residential area.

The 1,075 dwellings in the new industrial area will be occupied by a mixture of existing and new residents. The number of new workers has been used as the basis for estimating the traffic generation from the additional dwellings, with an assumption of one new worker per household. Traffic from existing residents relocating to the new residential area is assumed to be covered by the traffic growth rates outlined in Section 4.5 to avoid double counting. Further details on the traffic generation rates and assumptions are provided in Section 4.3.

² Narrabri Special Activation Precinct Housing Analysis Paper (Atlas Urban Economics, November 2021)

3 Transport context

3.1 Strategic plans, policy, and planning

Table 3.1 provides an overview of plans, policy, and planning for this report.

Table 3.1 Overview of plans and policy

Plan or policy name	Description
The Inland Rail Programme Business Case, ARTC (September 2015)	The Inland Rail Programme Business Case was completed in 2015 and outlines the strategic rationale and the programme definition and feasibility. The business case provides high level forecast daily train numbers for the section between Narromine and Narrabri, of 8.7 trains per day in 2025 and 7.5 trains per day in 2040 due to double stacking and increased train lengths. For the section between Narrabri and Moree, historic usage was 2.8 trains per day in 2015, with forecast usage of 13.2 trains per day in 2025 and 12.5 trains per day in 2040. Inland Rail will provide significant new capacity for freight rail movements to the north and south into the future, with new major infrastructure including a new rail corridor to the west of Narrabri and grade separated crossing of the Kamilaroi Highway.
Newell Highway Corridor Strategy Summary Report, PWC, (June 2019)	This <i>Newell Highway Corridor Strategy Final Report</i> , commissioned by the Australian Government, documents the approach and findings for arriving at an evidence-based 10 year investment roadmap to ensure that the corridor continues to serve the needs of its users in the longer term. Of particular importance is the interdependency with the Inland Rail project, and how road and rail will work together to meet the growing freight task and reduce costs for regional supply chains. A holistic, multimodal view of freight transport that leverages the strengths of each mode is a key consideration for enhancing the overall efficiency of Australia's transport networks.
Regional NSW Services and Infrastructure Plan, Transport for NSW (March 2018)	The Regional NSW Services and Infrastructure Plan is the NSW Government's blueprint for transport in regional NSW until 2056. It sets out the government visions which will shape transport planning and decision making in regional NSW. This plan forms part of a suite of supporting plans to Future Transport 2056. Future Transport 2056 plans for a future transport network that is customer focussed, fosters successful places and strong economy, operates with safety and suitable performance, provides accessible services and is sustainable.
NSW Freight and Ports Plan 2018–2023 (September 2018)	The NSW Freight and Ports Plan 2018–2023 (September 2018) is a plan for the direction of the NSW government investment supporting freight and ports in NSW which projects the volume of exports and imports to grow substantially. Its key actions are to enable regional growth and the future operation of critical freight infrastructure.
New England North West Regional Plan 2036, NSW Department of Planning & Environment (August 2017)	New England North West Regional Plan will guide the NSW Government's land use planning priorities and decisions to 2036. It contains an overarching framework to guide more detailed land use plans, development proposals and infrastructure funding decisions. To achieve the visions, the plan sets out four regionally focused goals which are further translated into 24 directions and supported by actions. The plan set out directions and actions for the Narrabri SAP and also identified priorities for Narrabri LGA.

Plan or policy name	Description
Newell Highway Corridor Strategy, Transport for NSW (May 2015)	The <i>Newell Highway Corridor Strategy</i> (May 2015) will be delivered over a 20-year timeframe, in line with the NSW <i>Long Term Transport Master Plan</i> (updated by Future Transport 2056), Regional Transport Plans and other relevant national and State planning frameworks. The strategy sets the direction for managing the Newell Highway from road safety and transport efficiency to asset management issues. This strategy is some 7 years old, and it is understood that Transport for NSW are currently in the process of updating this document.
NSW Heavy Vehicle Access Policy Framework	The NSW freight task set to increase by 28 per cent between now and 2036. The NSW Heavy Vehicle Access Policy Framework Moving More with Less (the Framework) is an important reform to meet the freight task with better safety and efficiency outcomes for industry and community. The Framework identifies 30 metre PBS Level 2B Vehicles as the next PBS vehicle to be permitted wider access on NSW roads using a staged approach. These vehicles can operate on the existing B-double network with minor infrastructure upgrades. The Framework will also address access for other HPVs such as Modern Road Trains which meet the PBS Level 3 Standards along the Newell highway and eventually a PBS 3A network east of the Newell Highway.
Road Safety Plan 2021	The Road Safety Plan 2021 sets initiatives to address our road safety goals. NSW has been now halfway through the implementation of the NSW Road Safety Strategy 2012–2021. The Road Safety Plan 2021 (The Plan) has been developed to set new priorities. The Plan adopts the internationally recognised Safe System approach. These initiatives will be incorporated into all stages of the Narrabri SAP study as relevant.
Net Zero Plan Stage 1: 2020-2030	The NSW Government has set the objective of achieving net zero emissions by the year 2050. The Plan sets out how the delivery of this objective will be progressed over the next decade. One application of the technology is seen in the long-haul transport industry, due to the long travel distances that can be achieved. With Narrabri's position on the Newell Highway and the distance to its major freight destinations/ports, the SAP is in a prime position to benefit from this, if facilities can be integrated into the development.
NSW Electric and Hybrid Vehicle Plan	Global transformation is taking place from the traditional petrol, diesel and gas operated vehicles to electric, hybrid and hydrogen fuel cell vehicles (EVs). This Electric and Hybrid Vehicle Plan presents a comprehensive approach to how NSW is preparing for this transition.
Connected and Automated Vehicle Plan	Vehicle connectivity and automation are game-changing technological innovations with the potential to transform the future mobility of people and goods. Connectivity and automation are distinct technologies, developing in parallel and converging to offer greater benefits. Connected and Automated Vehicle Plan (CAV Plan) supports both Future Transport 2056 and the Technology Roadmap by setting out the opportunities and challenges of CAVs, and the steps NSW will take to prepare for and support CAVs to benefit the community. CAV Plan is a five-year plan framed around five priority areas, with goals and actions identified as shown in to achieve each priority.
Narrabri Shire Council Strategic and Development Planning	The Narrabri Local Strategic Planning Statement (LSPS), also known as Narrabri 2040 provides a vision, a set of priorities and actions to optimise the opportunities of development in Narrabri. The LSPS outlines the Narrabri LGA economic, social and environmental land use needs over the next 20 years. It sets clear planning priorities about what will be needed. A structure plan has been developed to guide future development of Narrabri.

Plan or policy name	Description
Northern NSW Inland Port Prospectus, Narrabri Shire Council (2020)	The Northern NSW Inland Port (N2IP) will accommodate a diverse range of industries and will appeal to existing Shire businesses wanting to expand and new companies looking for a thriving community to establish.
Northern NSW Inland Port Planning Proposal - Draft, Integrated Consulting for Narrabri Shire Council (November 2020)	Strategically positioned, the addition of new Inland Rail infrastructure will have a huge impact on Narrabri Shire and continue to improve freight transportation efficiencies. The Northern NSW Inland Port will feature a freight and logistics terminal with access to Inland Rail, as well as a facility to support business operations.
Narrabri CBD Masterplan Report prepared by All About Planning for Narrabri Shire Council (2014)	This Narrabri CBD Masterplan is a key document guiding future CBD upgrade work and strategic planning initiatives. Positive economic and social outcomes for the Narrabri CBD have been provided for together with significant streetscape and amenity improvements. This report relates solely on CBD upgrades which are located in town on the eastern side of Narrabri Creek adjacent to the Newell Highway and local streets along it.
Development Control Plans, Industrial Development Code and Parking Code, Narrabri Shire Council	The industrial development code and parking code were referenced to provide additional consideration to the SAP site road, parking, active transport and site facility provisions for end of trip facilities.
Narrabri Airport Masterplan 2014-2034 prepared by Aviation Projects for Narrabri Shire Council (2014)	The Master Plan identified a 30 year plan for upgrading Narrabri Shire Airport to address the need to accommodate the future demand for passenger air services largely driven by the growing resource industry in the area, as well as to make best commercial use of the available land at the airport. A staged development plan for airfield infrastructure with trigger points for development was prepared to implement elements of the proposals of the Master Plan in a focussed and strategic manner.
The Namoi Region Road Network Strategy, Namoi Unlimited (2018)	The Namoi Region Road Network Strategy was developed in 2018 by Namoi Unlimited – a Joint Organisation of Councils in the New England North West region of NSW. The Strategy identified pinch points on the Oxley Highway (B56), the Kamilaroi Highway (B51), New England Highway (A15) and Fossickers Way (B95).

3.2 Existing conditions

Narrabri is a key regional centre in the New England and North West Region of New South Wales. It is strategically located on the regional New South Wales transport network at the junction of north-south and east-west rail and road connections. As a regional centre, Narrabri supports surrounding towns and villages, existing industries such as agriculture and mining and is also the focus of emerging economic development in the sectors of energy, manufacturing and logistics.

Strategic planning undertaken by Narrabri Shire Council led to the development of a concept for a Northern NSW Inland Port (N2IP). This facility would leverage existing transport (rail and road) infrastructure, both established and new industries, and act as a catalyst for future growth of the town of Narrabri. The key catalyst for Narrabri is the nation shaping transport project Inland Rail. This new rail link will create direct access to the ports of Brisbane and Melbourne as well as freight hubs in New South Wales such as Parkes and Wagga Wagga. There is also potential to connect with existing freight rail networks to access the Port of Newcastle. Coordinated strategic planning between local and state government established the designation of a Special Activation Precinct (SAP) in Narrabri to support the realisation of this identified economic development opportunity and enhancement of existing transport assets and industry.

There are two areas of focus for the development of the Narrabri SAP:

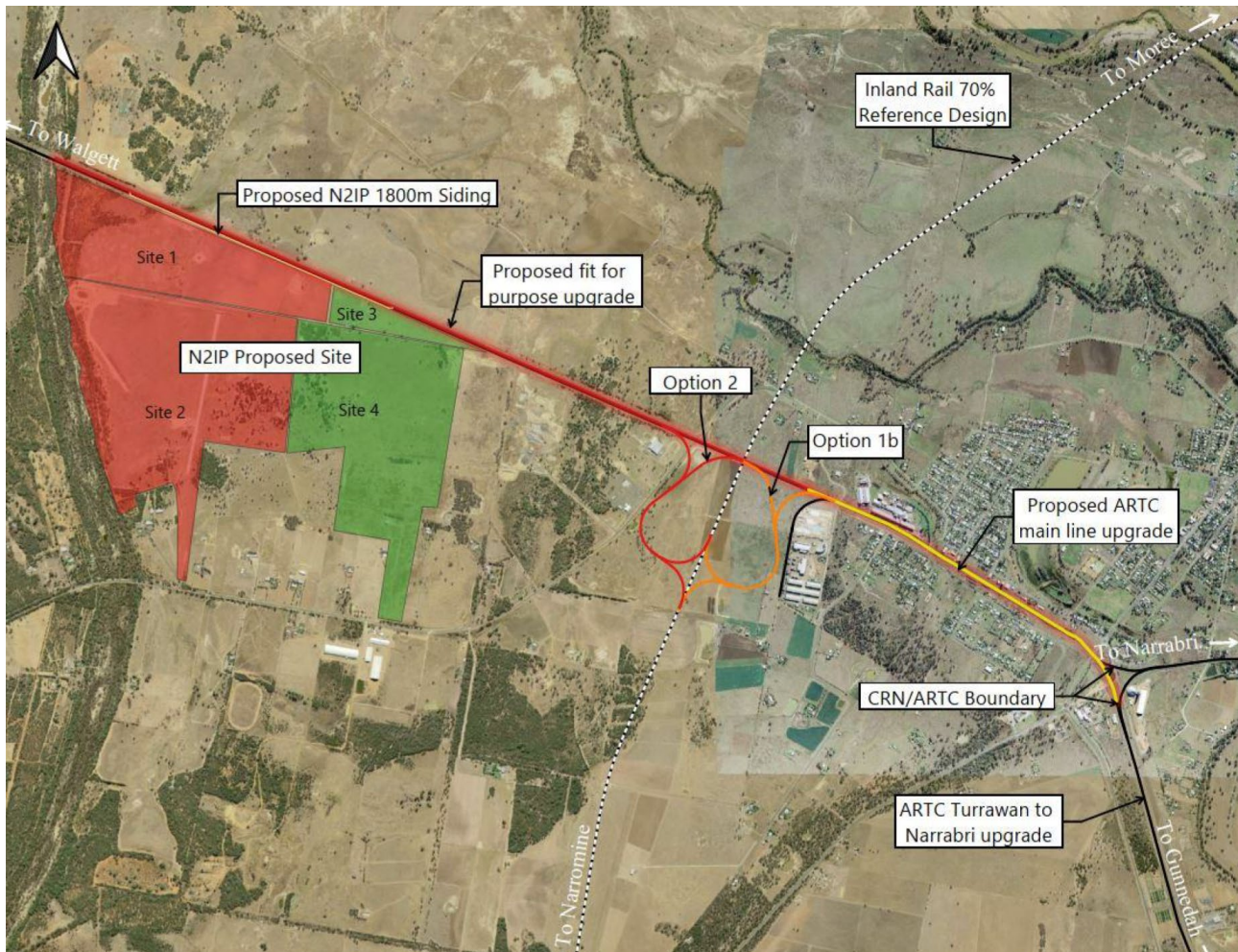
- 1 Leveraging and growing employment and investment opportunities associated with its proximity to Inland Rail, the Walgett Branch Line, the proposed Northern NSW Inland Port (N2IP) and proposed Narrabri Gas Project.
- 2 Planning/facilitating housing, infrastructure and community and social needs to support growth. Narrabri's population from the 2016 Census was 13,350 residents with 12.2 per cent being Aboriginal and/or Torres Strait Islander.

3.2.1 Rail

Inland Rail is a new 1,700 km rail line between Melbourne and Brisbane via regional Victoria, New South Wales and Queensland which is a combination of existing and new sections of track. The Narrabri SAP lies at the border of two sections of the Inland Rail project, Narromine to Narrabri, and Narrabri to North Star. The Inland Rail corridor will travel to the west of the town of Narrabri on a new alignment which will be located on embankments and a viaduct to provide flood immunity.

Currently, rail lines exist from the east to the north via the town centre (Werris Creek to Mungindi Line) operated by ARTC and from the west (Walgett Branch Line – Country Regional Network CRN) operated by UGL. NSW TrainLink also operates passenger services via the Werris Creek to Mungindi Line from Newcastle to Moree via Narrabri. Current intermodal facilities and freight terminals in the Narrabri area include Inland Packing and Storage (AGT Foods Australia and Viterra (containerised grain)), Arrow Commodities (bulk grain) and GrainCorp (bulk grain).

The SAP process creates the opportunity to enhance and simplify rail operations to leverage the network benefits that the Inland Rail project and the strategic location of the SAP investigation area offers. This includes the design of Inland Rail to facilitate double stacking of containers for trains using the Walgett Branch Line. This will create a direct connection from the Walgett Branch Line to the Inland Rail in both north and south directions. It will also connect the Werris Creek to Mungindi Line to Inland Rail, opening up new markets to the east and facilitating enhanced rail access to the Port of Newcastle. Options for the Inland Rail to Walgett Branch Line connections are shown in Figure 3.1. Through enhancing the junction of the key railway corridors, the efficiency of freight rail operations between the Inland Rail, ARTC and Country Regional Networks could be simplified. This would also benefit future passenger rail services.



Source: Narrabri – Options Assessment Gate 4 Report, SNC Lavalin (22 July 2021)

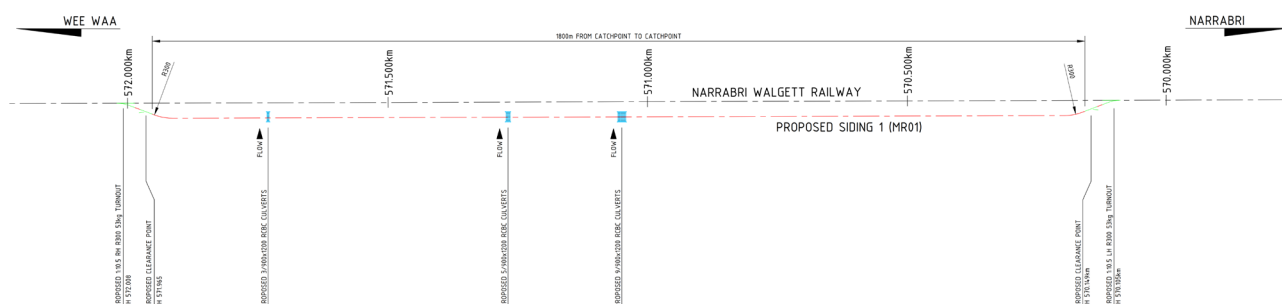
Figure 3.1 Overview of N2IP siding and connections

Through establishing east-west rail connections to Inland Rail, the opportunity exists to investigate the value of maintaining the existing rail corridor that travels through the centre of Narrabri for passenger services only. Passenger services could be redirected to the new Inland Rail corridor however this would require the establishment of a new station to serve Narrabri. The most likely location for this new station is at Narrabri West. This opportunity also presents significant amenity benefits for the community in terms of noise reduction and severance for existing and future residential development sites. It also creates the opportunity for the repurposing of what would become a disused rail corridor.

A core component for the SAP is the proposed Northern NSW Inland Port (N2IP) and the associated rail sidings and intermodal terminal. The N2IP allows the Narrabri SAP to take full advantage of the benefits Inland Rail brings, in being able to access local and global markets faster and more efficiently.

A N2IP siding has been proposed as part of the N2IP development to handle container imports and exports to and from the Narrabri region. This siding would be located to the south of the Walgett Branch Line and has been designed to accommodate 1800 m long trains. A concept has been developed for the N2IP container siding and a bulk loading facility for the purposes, shown in Figure 3.1. The plan may include provision for hardstand and container movements, and/or bulk material loading. Road access to the siding would be from the south (from Yarrie Lake Road) within the SAP. The N2IP may provide opportunities to consolidate the existing freight terminals within Narrabri into a single freight hub further driving efficiencies.

A concept for the siding was developed by BG&E for the purposes of cost estimation in 2019. The proposed siding extends from approximately 570.105 km to 572.008 km, with a usable working length of 1816 m. The schematic layout is shown in Figure 3.2.

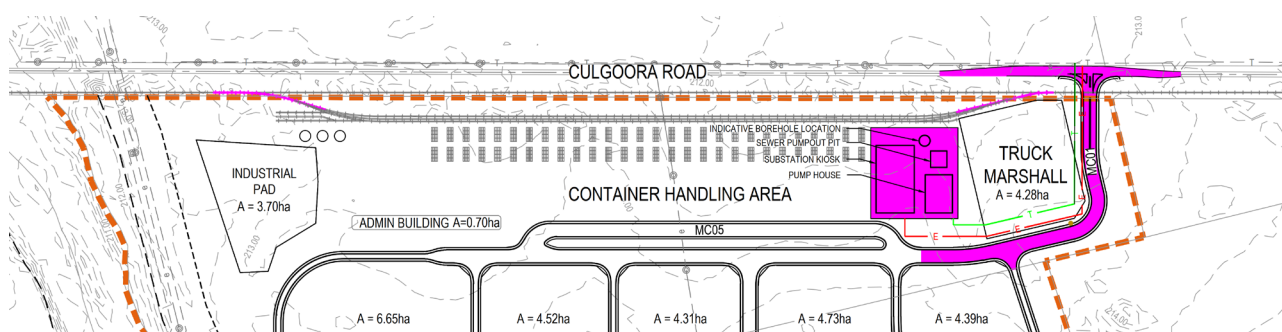


Source: Narrabri Shire Industrial and Logistics Hub – Schematic Layout, BG&E (10 December 2019)

Figure 3.2 N2IP siding schematic layout

Container terminal

The BG&E concept was preceded by a layout developed by Arcadis for the Narrabri Shire Logistics and Industrial Hub Strategic Business Case, shown in Figure 3.3. This concept provides some detail on the proposed land uses and container handling footprint adjacent to the siding, however, has assumed a 1000 m siding length, subsequently revised in later designs. The road connection to Culgoora Road is no longer part of the proposed due to safety concerns about the potential level crossing, the length of trucks and the proximity of the road and rail line.



Source: Narrabri Shire Industrial and Logistics Hub – Schematic Layout, BG&E (4 March 2019)

Figure 3.3 N2IP siding plan layout

The siding concept recommended for the Narrabri SAP adopts the BG&E layout with reference taken from the Arcadis concept for space proofing of the container handling area. The under construction Wagga Wagga Riverina Intermodal Freight and Logistics (RiFL) Hub was also used as a reference case for the size of the container hardstand area and associated access and infrastructure. Approximately 100 m wide area for handstand, access and associated trackside development/infrastructure should be space-proofed in the Narrabri SAP scenarios.

The siding concept would allow trains up to 1800 m to be loaded/unloaded clear of the Walgett Branch Line.

Bulk loading

Discussion with stakeholders has identified to need and opportunity for an additional/separate bulk loading facility to be included as part of the SAP area to increase the functionality of the precinct.

The UGL Regional Linx Standard Working Timetable (effective 10 June 2022) shows 900m grain trains departing Wee Waa, and the ARTC Master Train Plan (effective 28 August 2022) shows 1024m grain trains departing Narrabri, providing a reference for the length of grain train to be accommodated in a potential bulk facility.

Ideally, the bulk facility would allow for a train to be incremented through the loader without breaking the train, however, the length available adjacent to the Walgett Branch Line is constrained by the proposed N2IP sidings and Yarrie Lake Road. If a shorter bulk siding length is required, two approximately 900–1050 m long sidings could be provided, where a grain train would be split into two separate rakes to then be incremented through the loader without impacting the Walgett Branch Line. This is a similar arrangement to the existing Arrow Commodities siding in Narrabri, with a minimum siding length of approximately 475 m.

Other configuration options of combining the container siding and the bulk siding may be possible, however, further design investigation would be required to confirm feasibility and layout.



Source: Background image: – Schematic Layout, BG&E (4 March 2019)

Figure 3.4 Existing Arrow Commodities siding

The space-proofing of land adjacent to the bulk siding is far less significant than the container siding, typically requiring the bulk loader, associated storage silos, access roads, and weighbridges. This could be generally accommodated in an area approximately 70 m wide by 200 m long at the midpoint of the siding.

3.2.2 Road

The Newell Highway is the major north-south inland highway in the regional NSW transport network which stretches from Victoria to Queensland and passes through Narrabri. The Kamilaroi Highway is an east-west highway which travels through New England to the North West of the state. Together these strategic road links support the establishment of an inland terminal and intermodal facility in Narrabri.

The Newell Highway currently travels through urban areas of Narrabri which introduces noise, amenity and safety issues in the urban areas of the town. The highway's routes through the town centre also requires several right turn movements which are sub-optimal on a route that is used by a significant proportion of heavy vehicles. The establishment of an inland port will likely increase vehicle volumes and place more pressure on this key corridor. The presence of this corridor within the urban area of Narrabri compromises the ability to achieve improved place outcomes. Unlike other towns along the Newell Highway, the opportunity to re-route the highway around Narrabri is constrained by several river crossings (Namoi River, Narrabri Creek) and the large extent of the adjacent flood prone areas.

It is noted that traffic volumes, especially truck volumes are influenced by the time of year. Agricultural cycles and seasons (especially at harvesting time) will influence the number of trucks using the road network, especially the Newell Highway and Kamilaroi Highway.

Whilst the SAP investigation area is well situated in terms of the rail network, road access to the site is limited. The existing route from the Newell Highway passes through the local community of Narrabri West. Upgrading of the local road network including Yarrie Lake Road to facilitate increased heavy vehicle movement to and from the SAP investigation area would also be required. Interactions with the various rail corridors and junctions also complicates road access. Avoiding the establishment of level crossings is preferred for both road safety and freight movement efficiency outcomes. Access to the SAP investigation area and the associated supporting internal road network is yet to be planned and will require coordinated planning with both rail, and land use integration.

3.2.3 *Public transport*

Public transport service provision including bus, passenger rail (train) within Narrabri is consistent with that provided in other regional centres within NSW. The development of the Narrabri SAP provides the opportunity to create an exemplar regional centre transport network and provide appropriately scaled and timed services to support the growth of the town. This will provide real choices for customers beyond the private vehicle which is currently the most used mode of travel within Narrabri.

Opportunities to improve local bus services though linking the SAP and key activity centres such as the town centre, hospital, residential areas could be undertaken by a new bus route. This route would be supported through upgraded bus infrastructure and an expansion of existing on demand services to cover all areas of Narrabri over extended time periods than local bus services.

3.2.4 *Aviation*

Through the proposed Narrabri gas project, upgrades to Narrabri Airport have been planned by the project's proponents to enhance access to places outside of the region. Currently air services to Narrabri are infrequent and limited in terms of their connections. Opportunities to maximise the airport's use for passenger, freight and emergency services should be further considered in the context of regional transport planning for the New England North West.

3.2.5 *Active transport*

Improving active transport (walking and cycling) is a key focus for state and local government. The health and environmental benefits are compelling and have the ability to enable zero emission and reduce flow-on costs to the health sector. Active transport also has a direct positive impact in terms of amenity, particularly in areas such as the town centre and passive and active open space areas helping to achieve Movement and Place objectives.

The considerations of pedestrians and cyclists in the planning of transport infrastructure associated with the SAP will reduce conflicts with heavy vehicles. Access to open space and major activity and employment centres should be enhanced to increase the liveability for current future residents of Narrabri. Improving active transport connectivity both within the SAP and between the SAP and Narrabri Town Centre needs to be undertaken in collaboration with Narrabri Shire Council.

The conversion of a section of the Werris Creek to Mungindi Line within Narrabri to create a green loop has been proposed as a potential active transport connection between the SAP and the town centre. This green loop is an urban design concept that has several operational impacts to existing transport networks into the medium term.

The conversion of disused rail corridors to 'rail trails' has been successfully achieved in other locations, including around Newcastle and the Hunter Valley. This conversion assumes that a connection to Inland Rail facilitates the closure of a section of the Werris Creek to Mungindi Line. If this rail line closure does not eventuate or is not considered financially viable, an alternative active transport connection to the town centre would be required.

The benefits to the community of this green loop needs to be considered further in the context of funding priorities of other active transport infrastructure required to achieve 15 minute neighbourhoods as identified in the recently released in the State Infrastructure Strategy.

3.2.6 *SAP development principles*

The baseline report contained a series of opportunities and constraints maps for road, rail, public transport and active transport. From these a series of development principles were recommended to guide the planning of the SAP and the creation of the land use scenarios.

- Rail network:
 - coordinate Inland Rail infrastructure delivery with SAP development staging to minimise journeys requiring additional grade separation of the new rail line until this can be planned/delivered as an integrated project. Note that coordinated planning and delivery will be subject to funding and timing of individual programs
 - maximise Inland Port advantages with efficiencies, economies of scale and locating related businesses within 450 m to 750 m of rail line for related businesses.
- Freight network:
 - locate highest freight volume businesses directly adjacent to Inland Port to minimise handling and create efficiencies
 - fatigue management centre, trailer interchange and a high quality service centre within the SAP and externally on the Newell Highway
 - identify space for possible hydrogen fuel cell and electric truck recharging facility within the SAP and on the Newell Highway
 - maintain access to the land fill site during construction of SAP development.
- Road network:
 - separate heavy vehicles and local traffic where possible, predominantly through Narrabri West
 - consider an efficient connection to the Newell Highway, prioritised for freight with grade separation over the rail line
 - design an internal road network to enable movement within the SAP and take pressure off Yarrie Lake Road with access between the Newell Highway and SAP site to be investigated and confirmed
 - integrating safety features with road function, accounting for needs of different road users in each environment
 - allocate space for dedicated EV charging locations as well as future hydrogen refuelling site within the SAP or alternatively on the Newell Highway.
- Movement and place:
 - considering impacts on established residential areas in Narrabri West when developing freight access links between the Newell Highway and the SAP
 - linking the 'place' serving area to the surrounding land use and act as a hub and southern anchor for the Narrabri public transport and active transport network.
- Public transport:
 - extension of existing local bus services into the SAP and expansion of hours of operation through on demand services to suit businesses and shift work
 - provide DDA-compliant bus stop facilities within the SAP.
- Active transport:
 - plan active transport routes between SAP and Narrabri West and from Narrabri West to the town centre
 - provide DDA-compliant footpaths and safe connected cycle links for internal roads within the SAP to encourage more people to walk within the SAP
 - public bike racks near the shared employee 'places'
 - Delivery Plan provisions for end of trip facilities.

4 Methodology

With the final structure plan scenario resulting from the Final EbD, a traffic and transport assessment of the proposed infrastructure and services has been undertaken to support the vision. The aim is to present a consolidated future transport vision for Narrabri.

The assessment identifies heavy-vehicle routes and potential high productivity vehicle (HPV) access routes, key emergency-vehicle routes, flood emergency evacuation routes, as well as access routes and parking strategies for the precinct's workers. It also identifies active transport opportunities for the SAP and infrastructure that helps to facilitate sustainable transport.

Recommendations included in the integrated transport network plan balance the current and future needs of all transport users. The delivery plan includes trigger points for development and staging packages aligned with the master plan, based on the identified network performance criteria.

4.1 Road network assessment process

The future impact of the SAP development on the road network has been assessed using current traffic surveys, agreed future growth assumptions and an estimate of the trips generated by the new SAP and related development for each of the three land use scenarios. This assessment has been undertaken in a spreadsheet model, reflecting the high-level strategic nature of the planning, which is to be used to compare the relative requirements of the three land use scenarios.

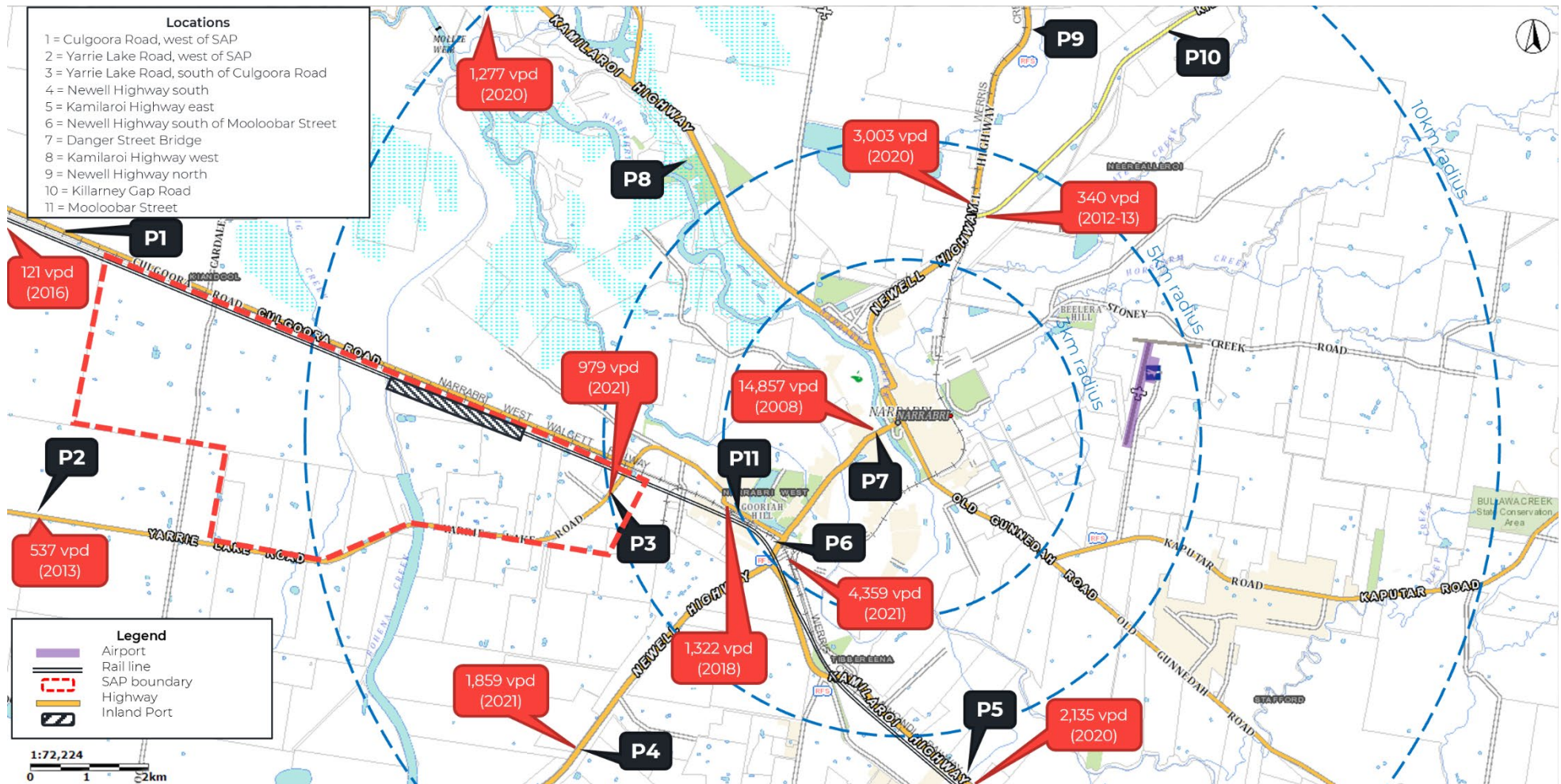
The process includes:

- 1 assessing planned future growth in population and employment in Narrabri
- 2 agreement on the future baseline traffic growth rates with Transport for NSW
- 3 estimating trip generation for the three development scenarios based on the employment and industry type and the corresponding residential growth to support increased worker numbers
- 4 assigning the trips to the network in the spreadsheet model to forecast the changes in volume on the critical road network.

This information will be used to provide advice on the number of roads and access points, road classification, and the timing and nature of road upgrades.

4.2 Assessment locations

The assessment of the road network has been completed at the key mid-block road locations outlined in Figure 4.1.



Base image source: Six Maps

Figure 4.1 Road network assessment locations and average daily traffic volumes

4.3 Traffic generation calculation

The traffic generation rates of industrial businesses can vary greatly, depending on the levels of activity, number of employees, nature of deliveries of input materials and exporting of the final product.

4.3.1 Traffic generation guidelines

The Transport for NSW publication *Guide to Traffic Generating Developments (Version 2.2, October 2002)* lists the following rates:

- Road transport terminals:
 - Daily vehicle trips = 5 per 100 m² gross floor area
 - Peak hour vehicle trips = 1 per 100 m² gross floor area.
- Factories:
 - Daily vehicle trips = 5 per 100 m² gross floor area
 - Evening peak hour vehicle trips = 1 per 100 m² gross floor area.
- Warehouses:
 - Daily vehicle trips = 4 per 100 m² gross floor area
 - Morning peak hour vehicle trips = 0.5 per 100 m² gross floor area.

The Transport for NSW *Technical Direction (TDT13/04a) Guide to Traffic Generating Developments Updated traffic surveys* provides more recent rates for business parks/industrial estates and low-density residential dwellings in regional NSW:

- Business parks and industrial estates:
 - AM peak hour vehicle trips = 0.70 per 100 m² gross floor area
 - PM peak hour vehicle trips = 0.78 per 100 m² gross floor area.
- Low-density residential dwelling:
 - AM peak hour vehicle trips = 0.71 per dwelling
 - PM peak hour vehicle trips = 0.78 per dwelling.

The 1,075 new dwellings will be occupied by a mixture of existing and new residents. The number of new workers has been used to estimate the traffic generation from the additional dwellings, with an assumption of one new worker per household. Traffic from existing residents relocating to the new residential area is assumed to be covered by the traffic growth rates outlined in Section 4.5.

4.3.2 Regional industrial area traffic generation

The trip generation can vary greatly by business type and location. To provide a benchmark from an actual industrial estate in regional NSW, trip generation was estimated for the existing Bomen business area near the Wagga Wagga SAP using information provided by the local businesses and assumptions about employee density, floor space and employee and truck movement. The resulting rates are compared to the published Transport for NSW traffic generation rates to determine their applicability to the Narrabri SAP context.

The estimated daily traffic generation rates varied as follows:

- 0.3 to 6.8 one-way car traffic movements per day per 100 m² gross floor area
- 0.2 to 4.0 one-way truck traffic movements per day per 100 m² gross floor area.

Upon adding up all the trip generation for the businesses surveyed, the overall average daily traffic generation rate was:

- 3.3 one-way car traffic movements per day per 100 m² gross floor area
- 0.5 one-way truck traffic movements per day per 100 m² gross floor area
- 3.8 one-way total vehicle movements per day per 100 m² gross floor area.

This rate is similar to the Transport for NSW warehouse rate, and approximately 80 per cent of the factory and road transport terminal traffic generation rates.

4.4 Road capacities

To assess how well a road section will perform for a particular forecast traffic volume, a nominal theoretical lane traffic capacity has been assigned based on Austroads and Roads and Maritime Services guidance depending on the type of road. Table 4.1 shows the assumed traffic volumes (measured in passenger car units per hour (pcuph)) and the Level of Service from A to F (equated to a volume to a volume to capacity ratio (V/C Ratio)). For these calculations, trucks are converted to passenger car units using a factor based on their length. Roads were classified as a rural highway, urban highways with clearways, urban highways with interruptions or an industrial street.

Table 4.1 Assumed road lane traffic capacities by road type and associated LOS (as determined by V/C ratio)

Level of Service	Rural highway undivided		Urban divided/ undivided highways or roads, with clearways		Urban divided/ undivided highways or roads with interruptions		Local collector streets	
	V/C ratio	MSF (pcuph)	V/C ratio	MSF (pcuph)	V/C ratio	MSF (pcuph)	V/C ratio	MSF (pcuph)
A	0.15	210	0.35	560	0.35	420	0.35	315
B	0.27	380	0.5	800	0.5	600	0.5	450
C	0.43	600	0.75	1,200	0.75	900	0.75	675
D	0.64	900	0.9	1,440	0.9	1,080	0.9	810
E	1	1,400	1	1,600	1	1,200	1	900
F	10	> 1,400	10	> 1,600	10	> 1,200	10	> 900

Notes: V/C: ratio of traffic demand to nominal capacity on a road network, LOS: Level of Service, MSF: Maximum Service Flow, measured in passenger car units per hour (pcuph)

For this assessment, to obtain effective use of current road assets, the threshold for upgrading a road has been assumed as the transition **between LoS D and LoS E**, i.e. 900 pcuph for a rural highway, 1,440 pcuph for urban highways with clearways, 1,080 pcuph for urban highways with interruptions and 810 pcuph for industrial streets.

The transition from LoS D to E is used as the threshold for upgrade as daily fluctuations in traffic volumes and conditions may mean above-capacity operation on some days. It also plans for upgrades before LoS E operation which has unstable flow where minor disruptions can cause delays. The transition from LoS E to F is assumed to be the theoretical capacity of the lane. LoS F represents above-capacity operation, with extensive delays.

Recent traffic counts on Yarrarie Lake Road, Culgoora Road and Newell Highway indicate that there are currently low truck volumes compared to car volumes. Assuming an increase in truck traffic on the future SAP-generated road network, a truck to passenger car unit (pcu) equivalent factor of 2.0 was used to estimate the impact of trucks on road capacity. This means that in terms of traffic volume demand, a truck is equivalent to 2.0 passenger car units (pcu).

For comparison, the average factor across the day for the Newell Highway calculated from traffic surveys was 1.43, with a factor of greater than 2.0 occurring late at night.

4.4.1 Trip distribution assumptions

The light and heavy vehicle proportions were extracted from the Transport for NSW *Technical Direction (TDT13/04a) Guide to Traffic Generating Developments Updated traffic surveys* which provides more recent travel survey results for business parks/industrial estates and low-density residential dwellings in regional NSW.

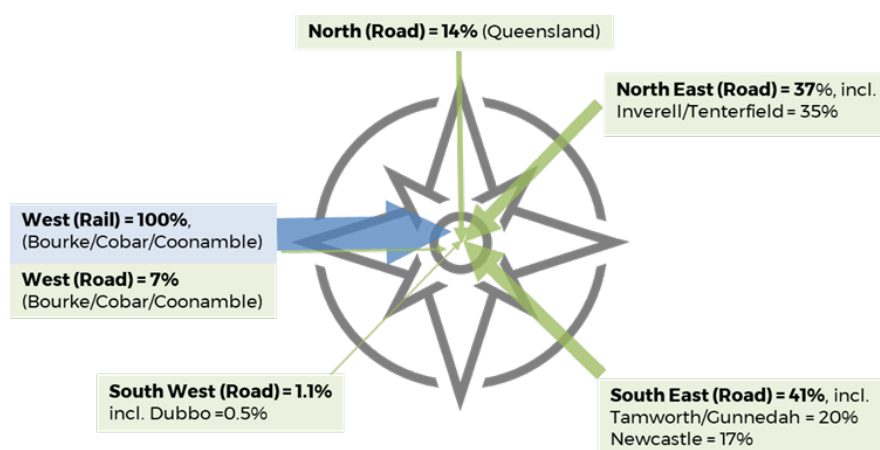
Table 4.2 Adopted light and heavy vehicle proportions

Land use	Light vehicles	Heavy vehicles
Industry	80%	20%
Residential	95%	5%

The adopted in and out directional splits are 80 per cent in and 20 per cent out AM peak direction split for light vehicles, reverse in the PM peak, 50 per cent in and 50 per cent out for heavy vehicles on average throughout the day.

The in/out trips were further segregated by travel directions before being assigned to the road network. For heavy vehicle movements, the directional split was assumed to follow the existing freight travel patterns indicated in Figure 4.2, as identified in the baseline report.

Imports to Narrabri



Exports from Narrabri

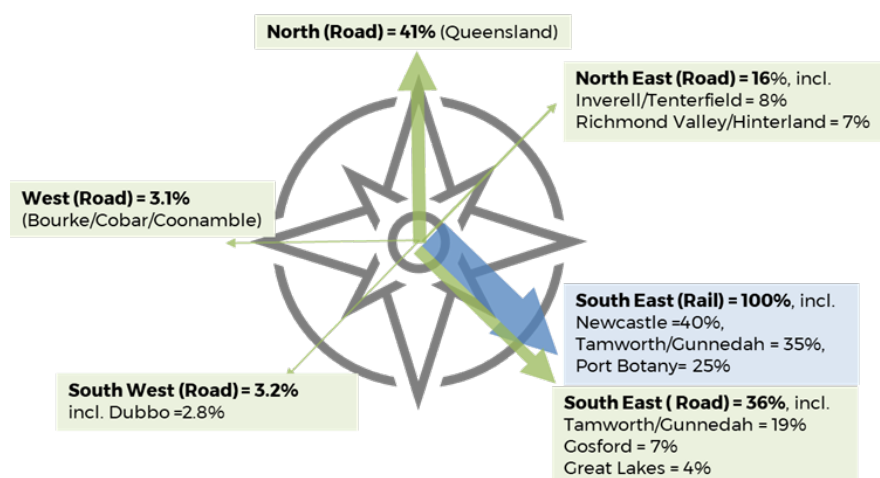


Figure 4.2 Existing freight travel patterns to/from Narrabri

For light vehicle movements, the directional split was assumed to follow the most recent population census which presents how the populations geographically distribute and likely travel to/from. This directional split was further updated for each scenario by incorporating the land use forecast.

Table 4.3 Summary of population distribution in Narrabri

Existing	In	Out
N	1.9%	1.9%
NE	6.2%	6.2%
SE	6.6%	6.6%
SW	4.6%	4.6%
W	4.0%	4.0%
West town	22.0%	22.0%
Central town	21.8%	21.8%
North town	33.0%	33.0%
Total	100%	100%

Source: 2016 Census mesh block counts

The shortest travel distance/travel time has been adopted as the principle for trip assignment. For the new alternative route for north-south traffic options proposed for each scenario, the trip re-assignment follows this principle and only shifts when there are travel distance/time benefits.

4.5 Background traffic growth

Consultation with Transport for NSW was undertaken to determine appropriate assumptions for background traffic growth. Based on historic traffic data and recent studies (including the Newell Highway Corridor Strategy Summary Report, PWC, (June 2019)), the following assumptions were advised by Transport for NSW.

- Newell Highway: 2.2% per annum traffic growth.
- Kamilaroi Highway: 1.5% per annum traffic growth between Narrabri and Gunnedah to the East (influenced by mining activity at Whitehaven Coal (South of Turravan) and Tarrawonga Coal Mine (South of Baan Baa).
- Kamilaroi Highway: 1.0% per annum growth west of Narrabri (reflecting commuter travel between Narrabri and Wee Waa).

Inland Rail is expected to change the movement of commodities by road when it becomes operational in 2027. This is likely to reduce the number of trucks travelling north-south on the Newell Highway. However, this will potentially be offset by an increase in trucks travelling to the Inland Port.

Recent road upgrades along the Newell Highway have improved its ability to accommodate PBS Level 3A combination heavy vehicles. This potentially means more freight being moved by fewer vehicles, i.e. a smaller number of larger heavy vehicles.

Given that these offsetting impacts affect a relatively small number of regional truck trips, these impacts have been assumed to be considered within the agreed traffic growth percentages listed above. Given that the larger number of cars trips within Narrabri are likely to have a larger influence on the performance of the road network within the study area, the impact of these future changes is likely to be small.

4.6 Assessment criteria

The following criteria have been used in recommending a transport network for the structure plan land use scenario:

- Road network:
 - impact on the performance of existing roads within the SAP, Narrabri West and on the state road network (Newell Highway and Kamilaroi Highway). Performance should not exceed Level of Service D on the Highways or the capacity within Narrabri town streets
 - directness (length) of new road upgrades required to support the SAP
 - amount of new road upgrades required to support the SAP
 - volume of trucks passing through residential areas
 - ability to provide efficient movement of performance based standards (PBS) vehicles to major freight destinations/origins
 - impact on traffic conditions between Narrabri West and Narrabri town (especially across bridge crossings of Narrabri Creek and Namoi River)
 - minimising at grade level rail crossings to reduce road and rail conflict points.
- Rail:
 - minimises interaction with Inland Rail (least potential for disruption of Inland Rail and its connections)
 - minimises road crossings of active rail lines
 - locates compatible businesses near Inland Port and rail corridors
 - impact on existing passenger rail services.
- Public transport:
 - facilitates the extension of existing local bus services to form a southern anchor rather than requiring a new service
 - aids connection of the SAP to existing residential areas
 - supports efficient bus network by placing highest passenger-generating businesses around a future transport hub.
- Active transport:
 - connects to cycle and pedestrian networks
 - minimises crossings of busy roads
 - supports establishment of a walkable centre by placing highest pedestrian and cycle-generating businesses around a future core area.
- Travelling stock reserves:
 - minimise crossing of travelling stock reserves.

4.7 Stakeholder consultation

This section outlines the outcomes of transport-focussed stakeholder liaison undertaken for the Narrabri SAP Transport Assessment. Stakeholders were initially canvassed to identify any critical issues to be considered as part of the land use plan, and to obtain data and information to assist in the assessment of the Narrabri SAP master plan options and their subsequent impact on the transport network. Several meetings have been undertaken to discuss and refine proposals for road and rail network upgrades as the land use scenarios have evolved.

4.7.1 *Narrabri Shire Council*

During meetings held with Narrabri Shire Council, transport issues that have been discussed include:

- potential reuse of the Werris Creek to Mungindi Line through Narrabri town area for potential active transport connections and to reduce its separation impact that influences the ability for the town to grow
- potential use of Inland Rail for replacement passenger rail services if the above were to occur
- potential road upgrades to reduce/remove through truck traffic from town streets
- improvements to transport connection to Narrabri Airport.

4.7.2 *Transport for NSW*

Transport for NSW has been consulted on the following issues:

- planned road upgrades on the surrounding road and rail network
- potential future road upgrades to assist access to/from the SAP
- feedback on potential future road upgrades to reduce through truck traffic through Narrabri town streets
- the need to maintain passenger services on the Werris Creek to Mungindi Line given planned upgrades
- active transport proposals
- freight network improvements including a new rail siding on the Walgett branch line
- potential grade separation configurations and requirements
- traffic speeds and road design considerations
- intersection configurations.

4.7.3 *ARTC*

Australian Rail Track Corporation (ARTC) was consulted regarding the interaction between the Inland Rail project and the SAP precinct in relation to the following:

- design of Inland Rail project
- need for connection between Inland Rail and Walgett Branch Line
- potential use of double-stacked containers on freight trains
- design considerations from N2IP to Inland Rail.

5 Assessment and findings

5.1 Road network

The assessment of the road network has been undertaken based on the high uptake sensitivity scenario as the worst case for the impact of the SAP on the road network. The assessment has considered time periods of years 2027, 2032, 2042 and 2062 mid-block road at the locations shown in Figure 4.1.

5.1.1 State road network

In terms of the state road network, the assessment of the road capacity for the baseline and of the SAP scenarios has indicated that, in general, the current network has sufficient traffic capacity for the additional traffic generated by the SAP. The one exception is the Newell Highway at the Dangar Street bridge:

- Without the Narrabri SAP, the Newell Highway at Dangar Street bridge would reach capacity by approximately 2060.
- With the Narrabri SAP development, the Newell Highway at Dangar Street bridge would require an upgrade by 2031. This is tied to the generation of traffic associated with 630 jobs within the SAP. This upgrade could include widening the bridge to two lanes in each direction, or the construction of an alternative route across the Namoi River and Narrabri Creek.
- The rate of job creation has a minor impact on the timing of the Newell Highway at Dangar Street bridge upgrade. For example, if the central uptake sensitivity scenario were to eventuate, the need for the upgrade would be delayed until approximately 2033, while the low uptake sensitivity scenario would delay this to 2036.

If a new route is preferred to an upgrade of the existing Newell Highway bridge at Dangar Street, a possible alignment for a new north-south route is shown in the orange dashed line and blue line (the SAP Link Road) in Figure 5.1.

Any upgrade of the Newell Highway between Narrabri Town and Narrabri West should include provision of pedestrian and cycle facilities to reinforce the connection between the SAP, new residential area and Narrabri West to Narrabri Town.

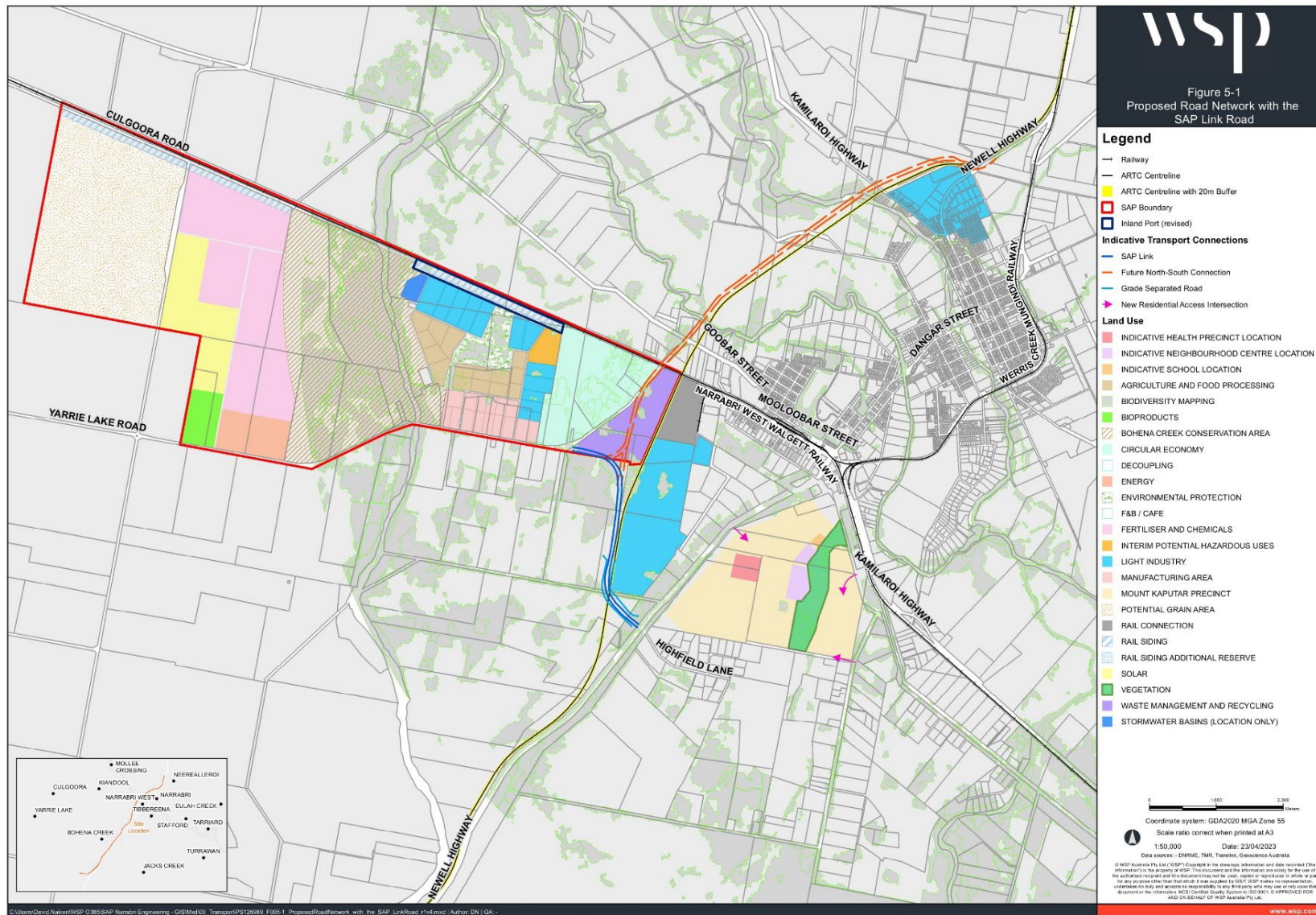


Figure 5.1 Proposed road network with the SAP Link Road

5.1.2 Local road network

Development within the Narrabri SAP will place additional pressure on the local road network between the SAP site and the Newell Highway. The main issue is the increase in industrial traffic, especially truck traffic passing through streets in Narrabri West. Mooloolbar Street and Goobar Street which are on the fringe of the existing residential area. However, there are residences, the post office and a church that front onto these roads. An increase in heavy vehicle and late-night traffic is likely to have an adverse impact on the amenity of this residential area.

The traffic volumes forecast for Mooloolbar Street and Goobar Street exceed the upgrade threshold of the streets by 2031 (approximately 590 jobs). The proposed treatment is to construct a new road (SAP Link Road) to link the SAP to the Newell Highway with a grade separated crossing of the Inland Rail corridor. The indicative alignment (subject to detailed investigation) of the proposed SAP Link Road is shown in Figure 5.1.

The SAP Link Road is likely to divert the majority of SAP generated traffic away from Narrabri West by providing a new connection to the Newell Highway south of Narrabri, with minimal interruptions. It would provide an efficient connection from the Newell Highway to the Inland Port (a large generator of truck traffic). Depending on the location of the business within the SAP, it would also provide time competitive travel to the Kamilaroi Highway and Newell Highway in other directions. It is recommended to be built to a high standard, suitable for heavy vehicles including larger vehicles and Performance-Based Standard (PBS) trucks.

The high uptake sensitivity scenario indicates that 82% of the 770 jobs will be realised by 2032. If the rate of job creation is slower than the high uptake sensitivity scenario, the need for the SAP Link Road would be delayed. The central uptake sensitivity scenario would delay the need for the SAP Link Road until approximately 2060. However, to minimise the impact on Narrabri West streets and obtain an efficient connection to the Northern NSW Inland Port, the SAP Link Road could be considered for introduction earlier. Depending on the availability of funding, the early construction of the SAP Link Road may be considered catalytic infrastructure for the transport and logistics (and other) components of the SAP.

In the interim until the SAP Link Road is constructed, there will be higher traffic volumes on Mooloolbar Street, Goobar Street and Yarrie Lake Road. To address the issues that this additional traffic will create, a package of proposed short-term road infrastructure projects are recommended in Table 5.1. These upgrades are designed to remain beneficial after the SAP Link Road is operational.

Table 5.1 Short-term upgrades to streets in Narrabri West

Issue	Proposed treatment
Road safety of increased use of existing streets	<ul style="list-style-type: none"> Painted line marking on Mooloolbar Street to visually narrow the traffic lanes and define parking areas Improved level crossing signage and warning equipment at the rail crossing of Yarrie Lake Road, south of Culgoora Road Add edge and centre line marking on Yarrie Lake Road.
Traffic affecting residential amenity	<ul style="list-style-type: none"> Change intersection priority at intersection of Baranbar Street and Goobar Street to give priority to Goobar Street west and Baranbar Street south, to discourage traffic from entering residential area Heavy vehicle restriction on Baranbar Street and Ugoa Street to protect residential amenity Streetscape treatment on Goobar Street, Burigal Street and Buri Street to reinforce residential nature Entry treatments on Baranbar Street and Bukhai Street to discourage truck access.
Connect SAP to active transport network	<ul style="list-style-type: none"> Connect active transport path to Newell Highway to Narrabri Lake path Active transport bridge over Long Gully Extend active transport path from the SAP to Narrabri Lake – surface and construction to match the rural environment.

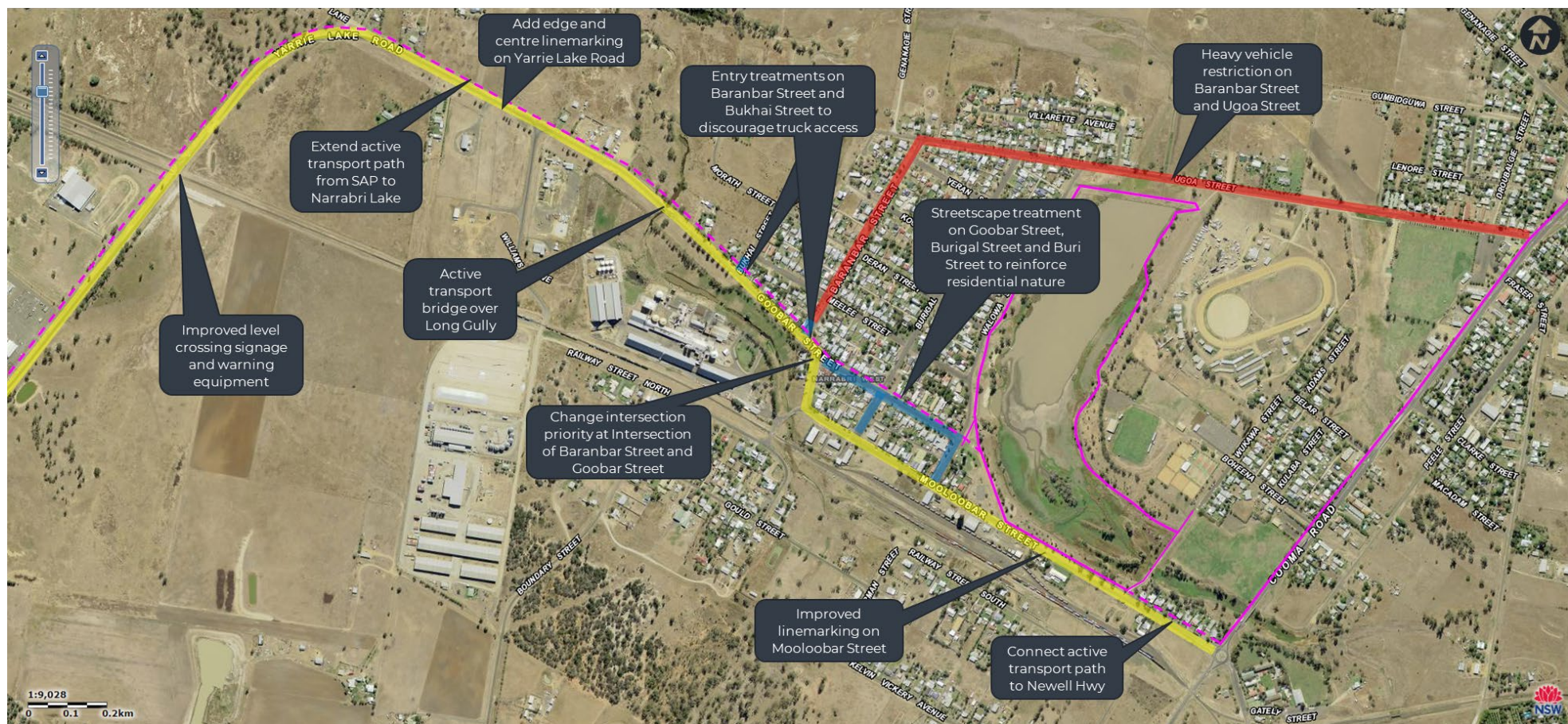


Figure 5.2 Short-term upgrades to streets in Narrabri West

5.1.3 *New residential growth area*

The trip generation of the dwellings in the residential area has been included in the analysis of the road network capacity. The school, neighbourhood centre and health centre shown in the Structure Plan are assumed to serve the new residential area. These land uses will contain trips within the Mount Kaputar residential precinct, resulting in fewer trips having to travel outside the precinct. As they are located within a walkable and cyclable distance of residences, they offer the potential for fewer car trips, further reducing traffic on internal roads.

Based on the number of dwellings and the capacity of the local roads, it is recommended that a minimum of two access roads be provided into the new residential area. It is expected that a separate analysis of their access needs would be undertaken at a later date. Figure 5.1 also shows the potential accesses into the new residential area. At this stage, the network within the residential area has not been shown, assuming that it will be designed to discourage through-trips.

The position of the new residential area offers the opportunity for access to both/either the Newell Highway and/or Kamilaroi Highway. If access was only provided to the Kamilaroi Highway, which has the lower traffic volume, this would increase the distance vehicles have to travel to get to the properties near the Newell Highway. It would also be less resilient if an incident were to occur on the only road providing access.

If access is provided to both the Newell Highway and the Kamilaroi Highway, the road network supporting the residential area would be more flexible and resilient. However, care would be needed to not create a rat-run which would affect the amenity of the residential area and road safety along the through-route.

Flooding in Narrabri occurred in late October 2022. If existing low-lying houses were to be relocated within the new residential growth area instead of being repaired in place, there could be an increase in traffic along the Newell Highway between Narrabri town centre and the new residential area. Sensitivity testing at the rate of an additional 12 houses being built per year in the new residential area has indicated that this level of migration has a negligible impact on the timing of road upgrades.

5.1.4 *West of Bohena Creek*

Yarrie Lake Road west of Bohena Creek and Kiandool Lane will provide the access routes to the proposed bulk handling facility and energy precinct within the SAP. Kiandool Lane is currently an unsealed road. The proposed bulk handling facility has the potential to generate truck traffic and some car traffic associated with operations and staff movements, while the energy precinct is expected to generate mostly a small volume of staff traffic.

Both Yarrie Lake Road and Kiandool Lane are expected to have sufficient traffic capacity for the anticipated traffic. However, they may require a carriageway upgrade to support the increase in truck traffic. Yarrie Lake Road between Kiandool Lane and Bohena Creek is expected to require the same upgrade as east of Bohena Creek. Kiandool Lane is currently unsealed. It will require sealing, similar to the Yarrie Lake Road carriageway, when the bulk handling facility commences operation.

5.1.5 *Road network performance*

The road network performance at key assessment locations is summarised in Table 5.2 to Table 5.4. It includes the forecasted background traffic growth and the SAP resultant traffic generation based on the land use, job and population assumptions outlined in Section 4.3. It considers the existing road network (as shown in Table 5.2) and the traffic re-distribution if a SAP Link Road is to be introduced (as shown in Table 5.3).

Most key locations for assessment would achieve a satisfactory Level of Service (LoS) C or better throughout the assessment years. With the existing road network, Dangar Street would reach its upgrade threshold by 2031 with the Narrabri SAP development resulting in an unsatisfactory LoS E or F. Mooloobar Street would reach its upgrade threshold by 2031 with the Narrabri SAP development resulting in an unsatisfactory LoS E.

The introduction of the SAP Link Road would alleviate the traffic on Mooloobar Street which would retain a satisfactory LoS C or better throughout the assessment years. However the SAP Link Road would have no effect on easing the traffic pressure on Dangar Street. Subject to a more detailed assessment for the Delivery Plan, Dangar Street would still require an upgrade by 2031 to satisfy the operational demand. This could include widening to two lanes in each directions or localised intersection upgrades at congestion points.

Table 5.2 Road network performance at key assessment locations – high uptake sensitivity scenario, without upgrades

Gate Location	Road	Direction	2027 AM		2027 PM		2032 AM		2032 PM		2042 AM		2042 PM		2062 AM		2062 PM	
			v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS
P1	Culgoora Rd	EB	0.02	A	0.03	A	0.02	A	0.03	A	0.02	A	0.04	A	0.02	A	0.04	A
		WB	0.03	A	0.02	A	0.03	A	0.03	A	0.03	A	0.03	A	0.04	A	0.03	A
P2	Yarrie Lake Rd	EB	0.06	A	0.05	A	0.07	A	0.06	A	0.07	A	0.06	A	0.08	A	0.07	A
		WB	0.04	A	0.05	A	0.04	A	0.06	A	0.05	A	0.06	A	0.05	A	0.07	A
P3	Yarrie Lake Rd	EB	0.15	A	0.28	C	0.20	B	0.40	C	0.22	B	0.44	D	0.25	B	0.49	D
		WB	0.28	C	0.15	A	0.39	C	0.20	B	0.43	D	0.22	B	0.48	D	0.25	B
P4	Newell Hwy	NEB	0.14	A	0.12	A	0.20	A	0.19	A	0.23	A	0.21	A	0.29	A	0.25	A
		SWB	0.12	A	0.14	A	0.18	A	0.21	A	0.21	A	0.23	A	0.25	A	0.29	A
P5	Kamilaroi Hwy	SEB	0.11	A	0.12	A	0.14	A	0.14	A	0.15	A	0.16	A	0.18	A	0.19	A
		NWB	0.12	A	0.12	A	0.15	A	0.15	A	0.17	A	0.16	A	0.20	A	0.19	A
P6	Newell Hwy	NB	0.37	B	0.26	A	0.55	C	0.34	A	0.60	C	0.38	B	0.71	C	0.47	B
		SB	0.21	A	0.35	B	0.27	A	0.53	C	0.31	A	0.58	C	0.38	B	0.68	C
P7	Dangar St	NB	0.79	D	0.84	D	0.94	E	0.96	E	1.04	F	1.07	F	1.26	F	1.30	F
		SB	0.82	D	0.78	D	0.93	E	0.93	E	1.05	F	1.03	F	1.27	F	1.25	F
P8	Kamilaroi Hwy	NWB	0.07	A	0.07	A	0.07	A	0.07	A	0.08	A	0.08	A	0.09	A	0.09	A
		SEB	0.07	A	0.07	A	0.08	A	0.08	A	0.08	A	0.08	A	0.10	A	0.09	A
P9	Newell Hwy	NB	0.14	A	0.14	A	0.17	A	0.17	A	0.19	A	0.20	A	0.24	A	0.25	A
		SB	0.12	A	0.12	A	0.13	A	0.13	A	0.16	A	0.15	A	0.20	A	0.20	A
P10	Killarney Gap Rd	NEB	0.05	A	0.05	A	0.06	A	0.07	A	0.07	A	0.08	A	0.08	A	0.09	A
		SWB	0.08	A	0.07	A	0.10	A	0.10	A	0.11	A	0.10	A	0.13	A	0.12	A
P11	Mooloolobar St	EB	0.28	C	0.49	D	0.34	C	0.64	D	0.38	C	0.70	E	0.44	D	0.82	E
		WB	0.47	D	0.26	B	0.61	D	0.32	C	0.67	E	0.35	C	0.79	E	0.41	C

Note: EB = eastbound, WB = westbound, NB = northbound, SB = southbound

Table 5.3 Road network performance at key assessment locations – high uptake sensitivity scenario, with SAP Link Road

Gate Location	Road	Direction	2027 AM		2027 PM		2032 AM		2032 PM		2042 AM		2042 PM		2062 AM		2062 PM	
			v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS
P1	Culgoora Rd	EB	0.02	A	0.03	A	0.02	A	0.03	A	0.02	A	0.04	A	0.02	A	0.04	A
		WB	0.03	A	0.02	A	0.03	A	0.03	A	0.03	A	0.03	A	0.04	A	0.03	A
P2	Yarrie Lake Rd	EB	0.06	A	0.05	A	0.07	A	0.06	A	0.07	A	0.06	A	0.08	A	0.07	A
		WB	0.04	A	0.05	A	0.04	A	0.06	A	0.05	A	0.06	A	0.05	A	0.07	A
P3	Yarrie Lake Rd	EB	0.06	A	0.07	A	0.07	A	0.08	A	0.08	A	0.10	A	0.09	A	0.11	A
		WB	0.06	A	0.06	A	0.07	A	0.06	A	0.09	A	0.08	A	0.10	A	0.09	A
P4	Newell Hwy	NEB	0.14	A	0.12	A	0.20	A	0.19	A	0.23	A	0.21	A	0.29	A	0.25	A
		SWB	0.12	A	0.14	A	0.18	A	0.21	A	0.21	A	0.23	A	0.25	A	0.29	A
P5	Kamilaroi Hwy	SEB	0.11	A	0.12	A	0.14	A	0.14	A	0.15	A	0.16	A	0.18	A	0.19	A
		NWB	0.12	A	0.12	A	0.15	A	0.15	A	0.17	A	0.16	A	0.20	A	0.19	A
P6	Newell Hwy	NB	0.40	B	0.40	B	0.56	C	0.52	C	0.61	C	0.57	C	0.72	C	0.68	C
		SB	0.35	A	0.38	B	0.46	B	0.55	C	0.50	B	0.59	C	0.59	C	0.69	C
P7	Dangar St	NB	0.79	D	0.84	D	0.94	E	0.96	E	1.04	F	1.07	F	1.26	F	1.30	F
		SB	0.82	D	0.78	D	0.93	E	0.93	E	1.05	F	1.03	F	1.27	F	1.25	F
P8	Kamilaroi Hwy	NWB	0.07	A	0.07	A	0.07	A	0.07	A	0.08	A	0.08	A	0.09	A	0.09	A
		SEB	0.07	A	0.07	A	0.08	A	0.08	A	0.08	A	0.08	A	0.10	A	0.09	A
P9	Newell Hwy	NB	0.14	A	0.14	A	0.17	A	0.17	A	0.19	A	0.20	A	0.24	A	0.25	A
		SB	0.12	A	0.12	A	0.13	A	0.13	A	0.16	A	0.15	A	0.20	A	0.20	A
P10	Killarney Gap Rd	NEB	0.05	A	0.05	A	0.06	A	0.07	A	0.07	A	0.08	A	0.08	A	0.09	A
		SWB	0.08	A	0.07	A	0.10	A	0.10	A	0.11	A	0.10	A	0.13	A	0.12	A
P11	Mooloolbar St	EB	0.20	B	0.26	B	0.22	B	0.29	C	0.27	B	0.34	C	0.32	C	0.42	C
		WB	0.24	B	0.18	B	0.27	B	0.20	B	0.31	C	0.25	B	0.39	C	0.29	C
P12	SAP Link	NB	0.19	A	0.08	A	0.28	A	0.12	A	0.29	A	0.12	A	0.33	A	0.14	A
		SB	0.08	A	0.19	A	0.12	A	0.29	A	0.12	A	0.29	A	0.14	A	0.33	A

Note: EB = eastbound, WB = westbound, NB = northbound, SB = southbound

Table 5.4 Road network performance at key assessment locations – high uptake sensitivity scenario, with SAP Link Road and Newell Highway upgrade (2032)

Gate Location	Road	Direction	2027 AM		2027 PM		2032 AM		2032 PM		2042 AM		2042 PM		2062 AM		2062 PM	
			v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS	v/c	LoS
P1	Culgoora Rd	EB	0.02	A	0.03	A	0.02	A	0.03	A	0.02	A	0.04	A	0.02	A	0.04	A
		WB	0.03	A	0.02	A	0.03	A	0.03	A	0.03	A	0.03	A	0.04	A	0.03	A
P2	Yarrie Lake Rd	EB	0.06	A	0.05	A	0.07	A	0.06	A	0.07	A	0.06	A	0.08	A	0.07	A
		WB	0.04	A	0.05	A	0.04	A	0.06	A	0.05	A	0.06	A	0.05	A	0.07	A
P3	Yarrie Lake Rd	EB	0.06	A	0.07	A	0.07	A	0.08	A	0.08	A	0.10	A	0.09	A	0.11	A
		WB	0.06	A	0.06	A	0.07	A	0.06	A	0.09	A	0.08	A	0.10	A	0.09	A
P4	Newell Hwy	NEB	0.14	A	0.12	A	0.20	A	0.19	A	0.23	A	0.21	A	0.29	A	0.25	A
		SWB	0.12	A	0.14	A	0.18	A	0.21	A	0.21	A	0.23	A	0.25	A	0.29	A
P5	Kamilaroi Hwy	SEB	0.11	A	0.12	A	0.14	A	0.14	A	0.15	A	0.16	A	0.18	A	0.19	A
		NWB	0.12	A	0.12	A	0.15	A	0.15	A	0.17	A	0.16	A	0.20	A	0.19	A
P6	Newell Hwy	NB	0.40	A	0.40	B	0.56	B	0.52	B	0.61	B	0.57	C	0.72	C	0.68	C
		SB	0.35	A	0.38	A	0.46	B	0.55	B	0.50	B	0.59	B	0.59	C	0.69	C
P7	Dangar St	NB	0.79	D	0.84	D	0.47	B	0.48	B	0.52	C	0.54	C	0.63	C	0.65	C
		SB	0.82	D	0.78	D	0.47	B	0.46	B	0.52	C	0.52	C	0.64	C	0.62	C
P8	Kamilaroi Hwy	NWB	0.07	A	0.07	A	0.07	A	0.07	A	0.08	A	0.08	A	0.09	A	0.09	A
		SEB	0.07	A	0.07	A	0.08	A	0.08	A	0.08	A	0.08	A	0.10	A	0.09	A
P9	Newell Hwy	NB	0.14	A	0.14	A	0.17	A	0.17	A	0.19	A	0.20	A	0.24	A	0.25	A
		SB	0.12	A	0.12	A	0.13	A	0.13	A	0.16	A	0.15	A	0.20	A	0.20	A
P10	Killarney Gap Rd	NEB	0.05	A	0.05	A	0.06	A	0.07	A	0.07	A	0.08	A	0.08	A	0.09	A
		SWB	0.08	A	0.07	A	0.10	A	0.10	A	0.11	A	0.10	A	0.13	A	0.12	A
P11	Mooloolobar St	EB	0.20	B	0.26	B	0.22	B	0.29	C	0.27	B	0.34	C	0.32	C	0.42	C
		WB	0.24	B	0.18	B	0.27	B	0.20	B	0.31	C	0.25	B	0.39	C	0.29	C
P12	SAP Link	NB	0.19	A	0.08	A	0.28	A	0.12	A	0.29	A	0.12	A	0.33	A	0.14	A
		SB	0.08	A	0.19	A	0.12	A	0.29	A	0.12	A	0.29	A	0.14	A	0.33	A

Note: EB = eastbound, WB = westbound, NB = northbound, SB = southbound

Table 5.4 presents the road network performance with the SAP Link Road and Newell Highway upgrade, both proposed to occur by 2031. For the purposes of this assessment, it is assumed that the upgrade involves adding an additional traffic lane to Newell Highway in each direction at Dangar Street. Dangar Street would hence achieve a satisfactory Level of Service (LoS) D or better throughout the assessment years with the proposed Newell Highway upgrade. However, further assessment could consider whether upgrades at localised congestion points could assist flow sufficiently to result in satisfactory traffic flow.

5.1.6 Intersections

The roundabout of Newell Highway, Mooloobar Street and Old Turrawan Road was assessed using SIDRA software as the intersection analysis tool and the results are summarised in Table 5.5.

Until 2042, this roundabout would still perform satisfactorily without triggering the need for SAP Link Road. The queuing developed on the Newell Highway south approach may affect the level railway crossing. By 2062 this intersection would exceed its capacity and generate significant delays and queuing which would highly likely affect the level railway crossing on the Newell Highway south approach.

The results indicate that with the Narrabri SAP development traffic generation and background traffic growth, the introduction of the SAP Link Road would alleviate the traffic through this roundabout and retain a satisfactory LoS B without the need for any intersection upgrade throughout the assessment years. No queuing would build beyond the level railway crossing on the Newell Highway south approach. Note that the SIDRA intersection modelling does not include queuing and delay impacts on the Newell Highway associated with the adjacent level railway crossing when trains cross the road.

Table 5.5 The roundabout of Newell Highway, Mooloobar Street and Old Turrawan Road performance summary

	2022 existing		2042 without SAP Link Road		2062 without SAP Link Road		2062 with SAP Link Road	
	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Total volume (vehicles per hour)	771 vehicles	705 vehicles	2,023 vehicles	1,932 vehicles	2,491 vehicles	2,379 vehicles	1,872 vehicles	1,754 vehicles
Degree of Saturation	0.27	0.233	0.91	0.91	1.28	1.24	0.78	0.61
Average Delay	9 seconds on Mooloobar Street west approach right turn	9 seconds on Mooloobar Street west approach right turn	40 seconds on Newell Highway south approach right turn	25 seconds on Mooloobar Street west approach right turn	283 seconds on Newell Highway north approach right turn	236 seconds on Mooloobar Street west approach right turn	17 seconds on Old Turrawan Road east approach right turn	14 seconds on Mooloobar Street west approach right turn
Level of Service	A	A	D	C	F	F	B	B
95% Back of Queue	13 m on Newell Highway north approach	13 m on Newell Highway north approach	155 m on Newell Highway south approach	171 m on Mooloobar Street west approach	Over 900 m on Newell Highway south approach	Over 1000 m on Mooloobar Street west approach	85 m on Newell Highway north approach	49 m on Newell Highway north approach

Notes For priority (sign) and roundabout controlled intersections, Level of Service is based upon the traffic movement with the worst vehicle average delay.

5.1.7 *Level crossings*

Level crossings affecting access to the SAP are located on the Newell Highway, south of Mooloobar Street and on Yarrie Lake Road south of Culgoora Road. There are also level crossings on Mooloobar Street north of Railway Street North and Williams Drive (private access).

At the commencement of the SAP, all level crossings would remain active. This will possibly mean increasing disruption and delay, affecting the reliability to/from the Inland Port.

This would change with the proposed creation of:

- the Narrabri SAP Link Road (including a grade separation of Inland Rail) which would provide an alternative route to the Yarrie Lake Road level crossing
- the possible future road corridor west of Inland Rail connecting the Newell Highway south of Narrabri to the Newell Highway north of Narrabri, which would provide an alternative route to the Newell Highway level crossing for regional traffic.

5.1.8 *Cross-section*

Yarrie Lake Road is currently a two-lane/two-way road with a carriageway width of approximately 7 m and no sealed shoulder. Traffic analysis indicates that the one-lane in each direction capacity is likely to be sufficient in the future. However, an upgrade of the road cross-section is recommended to provide safe and reliable truck movement for vehicles up to PBS Level 3 (42 m long). An upgrade to the road pavement may also be required to accommodate the increase in heavy vehicle traffic.

The design considerations of the cross section are listed below:

- review the posted speed limit during detailed design, taking into consideration the access needs
- limit direct property accesses from Yarrie Lake Road
- align with Austroads Guide to Road Design for urban arterial road design to maximise road capacity, including general traffic lane widths of 3.5 m to 3.7 m (excluding shoulders)
- separated right turn auxiliary lanes at side streets/property accesses to reduce flow interruption to the road network
- spatial provision for footpath and/or shared path appropriately set-back from the road
- provide safe and prioritised pedestrian crossing facilities at all intersections within the SAP. Wide and unprotected crossing points for pedestrians need to be avoided when a large intersection footprint is required for heavy vehicle access.

For internal roads, in addition to 3.5 m travel lanes, kerbside lanes 4.2 m wide would optimise tracking capability accessing side streets for high-efficiency vehicles such as multi-combination trailers. This width would minimise the need for longer vehicles to straddle to the adjacent travel lanes, which would otherwise interrupt the flow of traffic.

Taking into consideration the points above and the recommendations of the Moree Special Activation Precinct Delivery Plan (RGDC, September 2022):

- Yarrie Lake Road: 9 m wide carriageway with localised widening at side road intersections, with a 10 m-wide verge on either side (29 m road reserve)
- Internal SAP roads: 15 m wide carriageway allowing one traffic lane and one parking lane in each direction, with a 10 m-wide verge on either side (35 m road reserve).

5.2 Heavy vehicle routes

The heavy vehicle network around Narrabri is focused on the Newell Highway and Kamilaroi Highway. For the SAP area, Yarrie Lake Road/Goobar Street/Mooloolbar Street connections are approved for 25m/26m B-Double vehicles (excluding HML vehicles) from the Newell Highway up to Bohena Creek ("Corglan" Facility, approximately 6 km west of Narrabri), but not further west.

The SAP is located within an approved area for GML Type 1 A-Double, GML Modular B-triple, GML Type 1 Rigid Truck and 2 Dog, and PBS Level 1 and Type 2A vehicles, extending north from the Newell Highway. However, some of these vehicle types are excluded from Yarrie Lake Road to Wee Waa. The approved connections for different heavy vehicle types are shown in Table 5.6.

Table 5.6 Approved routes for larger heavy vehicles and PBS vehicles from Narrabri

Type of vehicle	North West Kamilaroi Highway to Walgett	North Newell Highway to Moree	North East Killarney Gap Road to Bingara	South East Kamilaroi Highway to Gunnedah	South Newell Highway to Coonabarabran	South West Yarrie Lake Road to Wee Waa
B-double	✓	✓	-	✓ Travel conditions	✓	-
Short Combination	✓	✓	-	✓	✓	-
4.6 m high vehicle	✓	✓	✓	✓	✓	-
Type 1 A-double, GML	✓	Travel conditions	-	✓	Travel conditions	✗
Modular B-triple, GML	✓	✓	-	✓	✓	✗
B-triple, GML	✓	✓	-	Travel conditions	✓	-
AB-triple, GML	✓	✓	-	Travel conditions	✓	-
Type 2 A-triple	-	-	-	-	-	-
Type 1 Rigid truck+ 2 dog	✓	✓	-	-	✓	✗
PBS Type 1, length less than or equal to 20 m, general access*	✓	✓	-	✓	✓	✓
PBS Type 2A, length less than or equal to 26	✓	✓	✓	✓	✓	✓
PBS Type 2B, length between 26 m and 30 m	✓	✓	-	✓	✓	-
PBS Type 3A, length less than or equal to 36.5 m	✓	✓	-	Travel conditions	✓	-
PBS Type 1 and 2 Truck and Dog	✓	✓	-	✓	✓	✗

Source: Transport for NSW HML and RAV MAP, GML and CML (road train), Performance Based Standards Maps

Notes ✓ = approved route, ✗ = not approved, - = no guidance, yet to be evaluated by Transport for NSW

* General Access is subject to a 50 tonne gross mass limit, posted local restrictions and restrictions or limitations specified by the jurisdiction

Special purpose vehicles (including cranes, concrete pumps, etc.) are permitted on certain roads within the SAP area, as are over size and over mass agricultural vehicles operating under the National Notice. Access to the west is permitted for certain types of vehicles via Yarrie Lake Road and Culgoora Road. However, access through Narrabri West to the Newell Highway is not provided. The future SAP Link Road can provide this connection in the future. The rail level crossing on the Newell Highway south of Mooloobar Street is a travel restriction for certain oversize special purpose vehicles.

Other restrictions on heavy vehicles include:

- restrictions on high mass vehicles entering the township of Narrabri: Some High Productivity vehicles (HPV) are required to stop and unload trailers so that they can be transported one at a time across the Namoi Creek Bridge. Other strategies used include unloading the materials and transferring them to smaller semi-trailers. However, this double handling is inefficient and increases costs
- a ‘curfew’ on road train access to the Narrabri Grain Corp terminal during school zone times on Old Turrawan Road in front of Narrabri West Public School. While outside the SAP area, this highlights the conflict between large vehicle access past the community of Narrabri West.

To make the Inland Port to the PBS vehicle network as efficient as possible, it is recommended that:

- the proposed SAP Link Road be prioritised as the heavy vehicle access route and constructed to a minimum level that accepts PBS Level 3 (42 m long) vehicles and special purpose vehicles
- Yarrie Lake Road between the Inland Port and the SAP Link Road be investigated and upgraded if required to accept PBS Level 3 (42 m long) vehicles
- new roads within the SAP should be constructed with suitable dimensions and pavements to accommodate the needs of HML vehicles, 4.6 m high vehicles and PBS Level 3 (including Class 2B and 3A vehicles)
- intersection swept paths to be designed for PBS Level 4 vehicles (up to 53.5 m long – including BAB-Quad vehicles)
- consider locating a fatigue management centre in the SAP, trailer interchange and upgraded service centre facilities. This could include a charging station for electric vehicles
- accommodate the refuelling needs of PBS vehicles, provide electric vehicle fast charging facilities and hydrogen fuelling facilities.

5.3 Emergency vehicle and evacuation routes

WSP has used flood modelling to assess the areas affected by higher flood potential within the Narrabri Creek/Namoi River and Bohena Creek catchments. The results are shown in Figure 5.3. The more hazardous peak mean flood (PMF) for both catchments combined is shown in Figure 5.4. They indicate that:

- areas immediately surrounding Narrabri Creek/Namoi River and Bohena Creek are likely to be affected by flooding soonest, potentially cutting the SAP at Bohena Creek, and blocking access from Narrabri West to the west via Culgoora Road and Yarrie Lake Road
- the Narrabri Creek/Namoi River floodplain between Narrabri Town and Narrabri West, potentially cutting the Newell Highway.

The PMF analysis indicates relatively large areas affected, prompting consideration of evacuation routes. With potential crossing locations of the future Inland Rail limited to Yarrie Lake Road (one of the roads affected sooner) with the existing road network, there is the need for the proposed SAP Link Road to have a dual role as a potential flood evacuation route from the SAP and properties east of Bohena Creek. The part of the SAP west of Bohena Creek will be required to evacuate west along Yarrie Lake Road. This area of the SAP is likely to have smaller employment numbers, potentially affecting fewer people.

As Bohena Creek has an expansive width and identified as a H6 Hazard (highest risk flood classification), Yarrie Lake Road would require major structural upgrades (e.g. raising bank of culverts, high bridge) to be flood immune to cater for heavy vehicles and other traffic. If these upgrades are cost prohibitive, design mitigations would be required. The crossing of Bohena Creek should be upgraded to include debris blockage protection, flood hazard information and a flood depth marker. This would include replacement of culverts with an increased size to fit under the upgraded road and with improved structural integrity (of the culverts and embankment) during a flood event to help the road return to service soon after. It is recommended that proposed future roads be designed to minimise the impact on flooding.

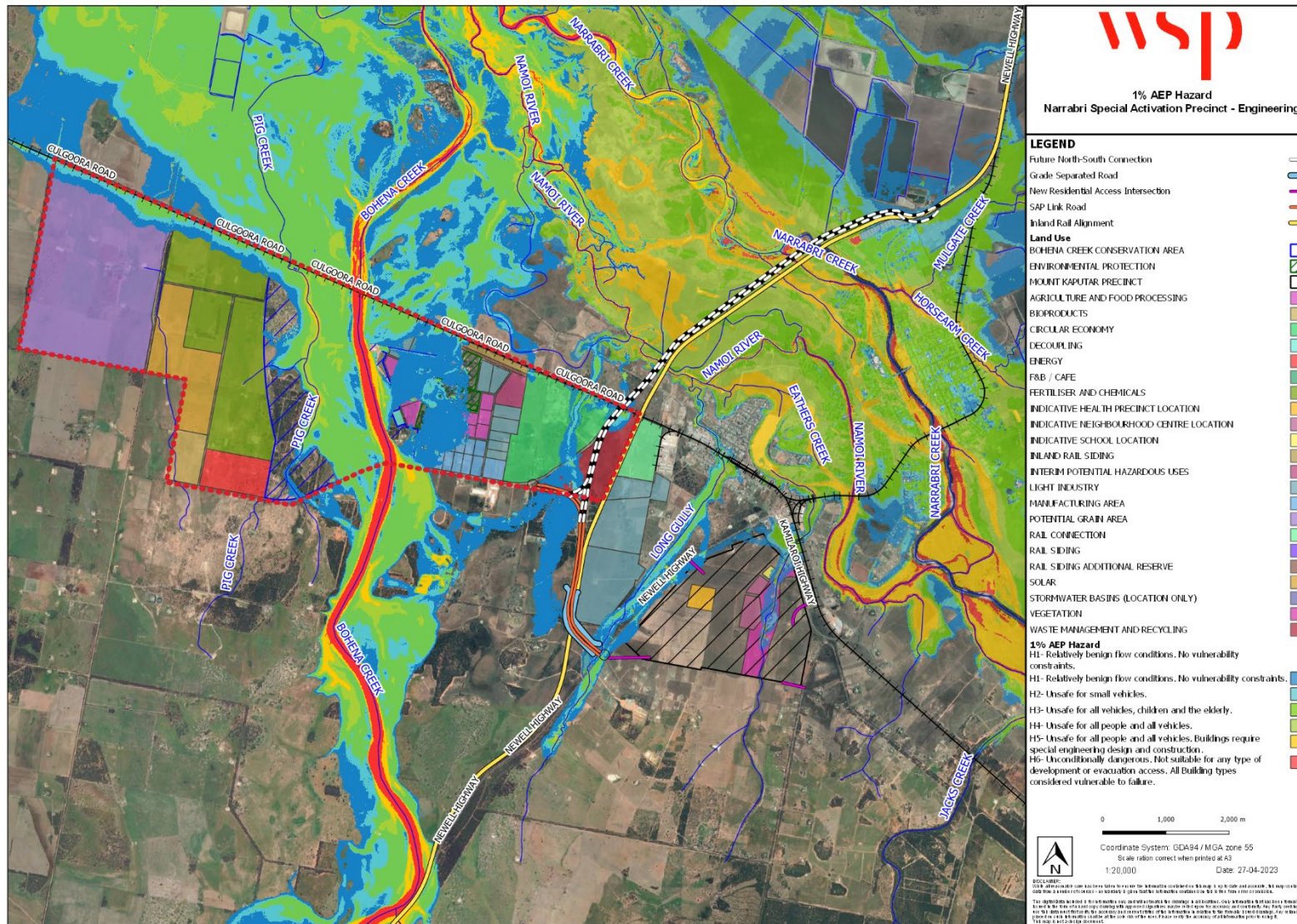


Figure 5.3 Flood modelling 1% AEP with climate change in the Namoi River and Bohena Creek

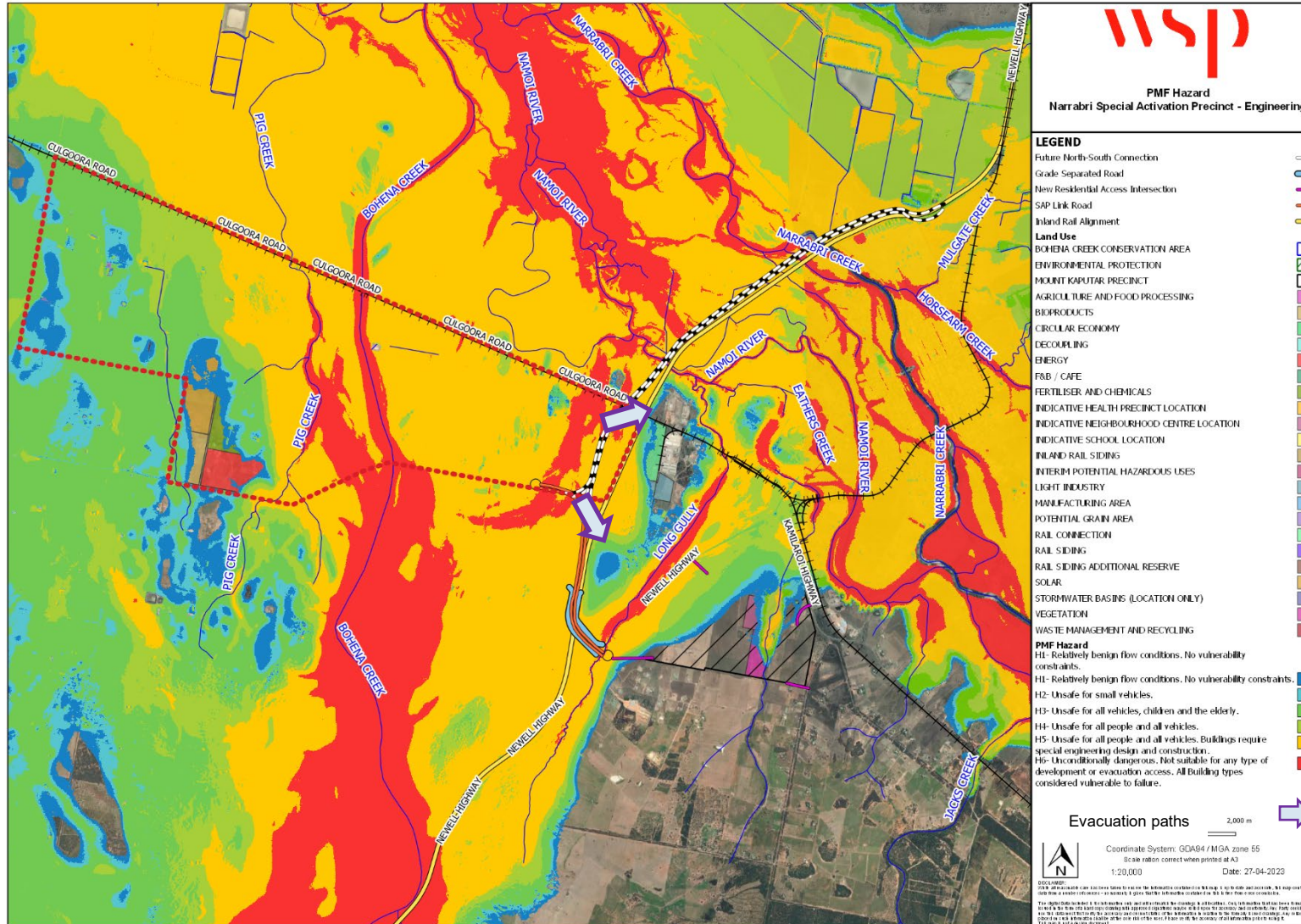


Figure 5.4 Combined Peak Mean Flood (PMF) for Namoi River and Bohena Creek catchments and identified evacuation paths

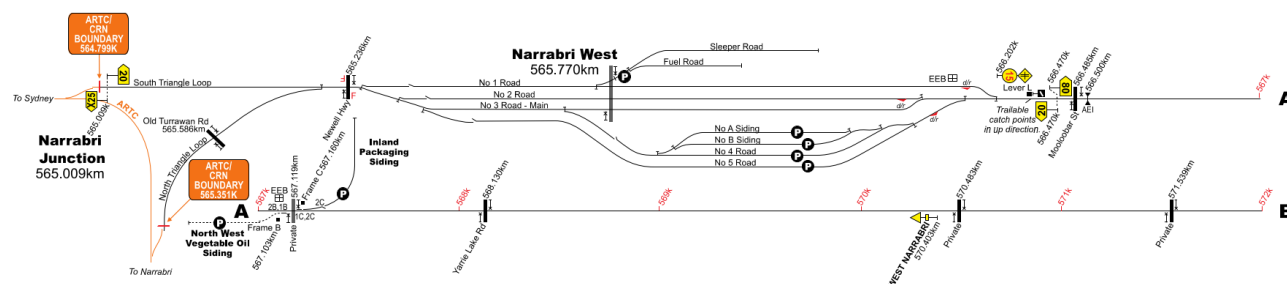
5.4 Rail network

The SAP planning process creates the opportunity to enhance and simplify rail operations to leverage the network benefits that the Inland Rail project and the strategic location of the SAP investigation area offers. This includes the design of Inland Rail to facilitate double stacking of containers for trains using the Walgett Branch Line. This will create a direct connection from the Walgett Branch Line to the Inland Rail in both north and south directions. It will also connect the Werris Creek to Mungindi Line to Inland Rail, opening up new markets to the east and facilitating enhanced rail access to the Port of Newcastle. Through enhancing the junction of the key railway corridors, the efficiency of freight rail operations between the Inland Rail, ARTC and Country Regional Network (CRN) could be simplified. This would also benefit future passenger rail services.

Currently, rail lines exist from the east to the north via the town centre (Werris Creek to Mungindi Line) operated and maintained by ARTC and from the west (Walgett Branch Line) as part of the CRN, for which UGL Regional Linx is the contractor. NSW TrainLink also operates passenger services via the Werris Creek to Mungindi Line from Sydney to Moree via Narrabri. Current intermodal facilities and freight terminals in the Narrabri area include Inland Packing and Storage (AGT Foods Australia and Viterra (containerised grain), Arrow Commodities (bulk grain) and GrainCorp (bulk grain). Transport for NSW has no plans to change these existing services.

5.4.1 Walgett Branch Line (Narrabri West to Walgett via Wee Waa)

A section of the Walgett Branch Line sits within the SAP investigation area and is predominantly a single track with a yard and short storage sidings at Narrabri West, as shown in Figure 5.5. Narrabri West was the site of a former station, opened in 1882, but since closed and few buildings remaining.



Source: Country Regional Network Train Operating Conditions (TOC) Manual, Section 14 – Northern Track Diagrams, UGL Regional Linx (25 March 2022)

Figure 5.5 Narrabri West track diagram and siding layout, Walgett Branch Line

As part of the N2IP, a new siding is proposed to allow trains to be loaded and unloaded clear of the main line so as not to impede existing train paths. However, due to the low number of through train movements, it may be feasible for trains to be stored or shunted for periods on the Walgett Branch Line between scheduled services when space on the siding is not available.

The Walgett Branch Line is normally approved for 21 tonne axle load (TAL) operation but is currently approved for 23 TAL through a TOC waiver (UGL Regional Linx CRN TOC Waiver, CRN 22-113, 30 Jan 2022) between Narrabri West and Walgett. The SAP and N2IP would require 25 TAL operation between the N2IP sidings Werris Creek to Mungindi Line or a connection to Inland Rail. It is noted that \$910,000 was allocated by the NSW Government to the design and planning for a Narrabri to Walgett 25 TAL upgrade as part of the 2020 round of Fixing Country Rail.

5.4.2 *Werris Creek to Mungindi Line (Newcastle to Moree via Narrabri)*

Rail track upgrades are proposed and funded for the Narrabri to Turrawan section of this line. These upgrades include 35 km of track between the Hunter Valley network and Inland Rail. The project will be delivered from Narrabri Coal Junction at Whitehaven Coal, south of Turrawan, to the future interface with Inland Rail at Narrabri North. Works include the replacement of existing steel and timber sleepers with heavy duty concrete sleepers, replacement of the existing rail with upgraded rail, partial level crossing upgrades and associated civil works. The upgrade works will improve the line capability, allowing operation of 25 TAL trains at 80 km/h.

Future considerations of a proposed green loop in the form of a rail trail linking the Narrabri Town Centre with the SAP and future residential areas utilising the Werris Creek to Mungindi Line between Narrabri and Narrabri West have been considered. This would require the closure of this section of the rail line and the shift of passenger and rail freight movements to the Inland Rail via connections with the Walgett Line Branch (noting that the proposed rail connection is currently unfunded). Given the existing use and proposed upgrades to this section of the line (as part of the Narrabri to Turrawan upgrade), further justification for the Green Loop/Rail Trail and the associated mitigation of its flow on impacts to the freight and passenger rail network and the effective life of existing structures would be required by Transport for NSW before the Green Loop proposal could progress as a concept. During stakeholder consultation, concern was also raised around shifting existing passenger services to Inland Rail.

5.4.3 *Inland Rail*

Inland Rail is planned to be a new 1,700 km rail line between Melbourne and Brisbane via regional Victoria, New South Wales and Queensland using a combination of existing and new sections of track and is in various stages of planning and delivery. The Narrabri SAP lies at the border of two sections of the Inland Rail project, Narramine to Narrabri, and Narrabri to North Star. The Inland Rail corridor will travel to the west of the town of Narrabri on a new alignment which will be located on embankments and a viaduct to provide flood immunity. Inland Rail, which passes between the SAP and the Newell Highway, will connect the SAP with Melbourne and Brisbane. The project offers opportunities to leverage the network benefits with the strategic location of the SAP precinct and the Northern NSW Inland Port within it. Note that under the current funding and planning arrangements, access to Brisbane requires trains to join Inland Rail at North Narrabri, and access to Melbourne requires trains to join Inland Rail at North Narrabri, travel north to the nearest passing loop and complete a locomotive run around to then travel south.

At the time of writing, the Inland Rail – Narramine to Narrabri State Significant Infrastructure (SSI) application and Environmental Impact Statement (EIS) are being assessed for planning approval. Section A7.3.6 of the EIS notes that the proposal connects with existing rail lines, however, the construction of the connections is not part of the current planning submission. For the connection to the Walgett Branch Line (Narrabri to Walgett), the EIS states:

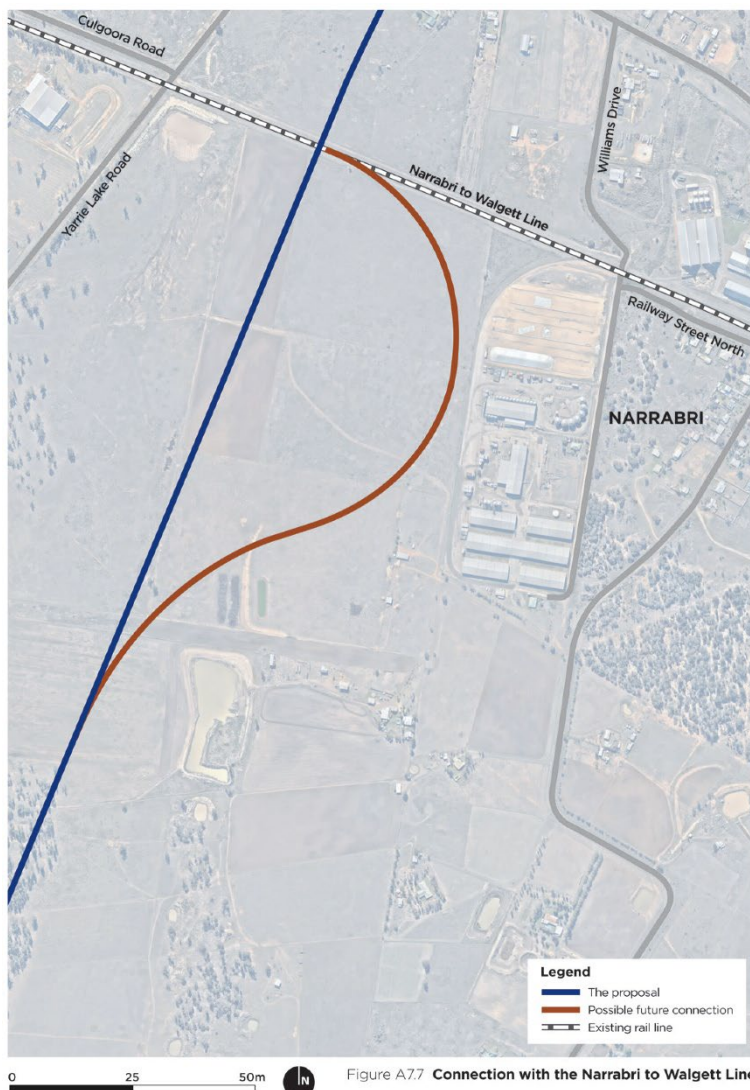
The proposal would cross the Narrabri to Walgett Line on a bridge to the west of Narrabri. About 1.8 km of new track would be provided to allow trains from the west to access the proposal and travel south. Access for trains travelling from west to north is possible via the existing track through Narrabri. The proposed connection is a possible future connection that may be constructed at a later date.

The concept for the connection with the Walgett Branch Line is shown in Figure 5.6.

The section of Inland Rail where it passes over the Walgett Branch Line has been elevated to allow for double stacked trains on the Walgett Branch Line as well as the connection to Inland Rail, both of which will optimise the potential of the N2IP.

ARTC as the proponent of the Inland Rail project will also be required to acquire land adjacent to the Inland Rail corridor to create a buffer and facilitate track maintenance access. In some sections of the corridor, it is likely that excess land will be available, particularly where isolated lots are left. This additional land provides an opportunity to provide parallel access adjacent to the Inland Rail track to accommodate the proposed SAP Link Road for a section. No level crossings of Inland Rail have been proposed for the SAP as this would trigger further planning approvals or amendments, therefore it is recommended that the SAP Link Road extend west of and parallel to Inland Rail, to connect to Newell Highway to the south, 3.5 km south of the Kamilaroi Highway.

To reduce flooding issues, it is recommended that the SAP Link Road would cross Inland Rail on an elevated overpass. Assuming an embankment height of 1.5 m for Inland Rail, a 7.1 m high envelope for rail operations, a 1.5 m deep bridge structure and a 1.0 m contingency, the deck height of the overpass is assumed to be 11.1 m above ground level. Assuming a 3% gradient, which is suitable for heavy vehicles, this would mean a ramp length of 370 m on either side of the Inland Rail corridor to get the SAP road over and back to ground level.



Source: *Inland Rail Narramine to Narrabri Environmental Impact Statement, Chapter A7 – Proposal features and operation*
 Figure 5.6 Connections with the Walgett Branch Line

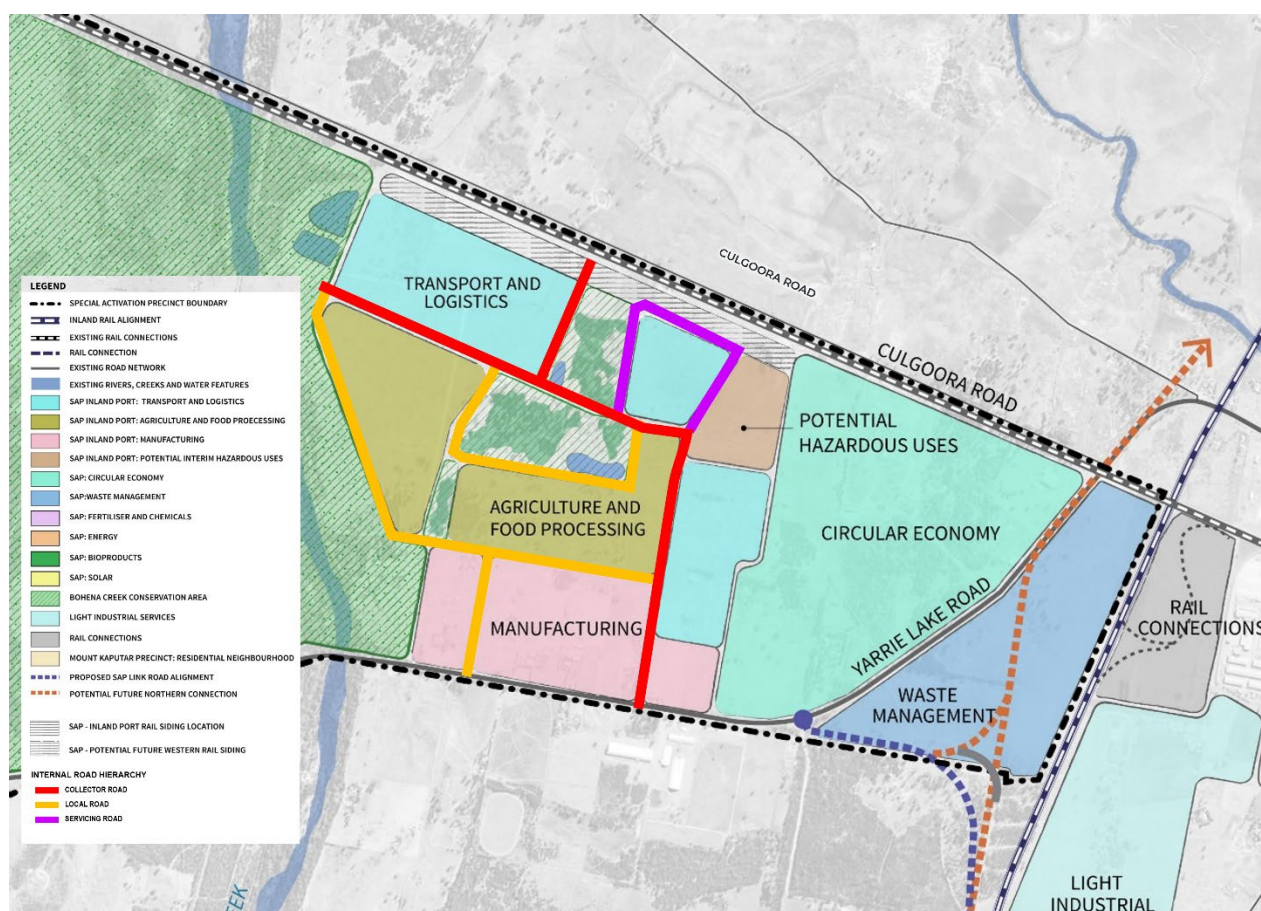
5.4.4 Northern NSW Inland Port (N2IP)

Narrabri Shire Council is developing the Northern NSW Inland Port (N2IP) as a freight and logistics terminal with access to Inland Rail, serving existing agricultural exports, and potential new imports and exports.

N2IP has to-date secured \$16.8 million in funding from the NSW Government for Stage One of the project as at August 2020. The Australian Government also announced on 5 October 2020 that it will invest \$7.8 million in N2IP as part of a \$2.7 billion investment in NSW transport infrastructure. These investments are expected to support enabling infrastructure for N2IP.

Plans developed by Council for the N2IP have been reviewed as part of this work and enhancements have been proposed in discussion with stakeholders to fully integrate the inland port into the SAP site and leverage off the enhanced freight connectivity that it can provide.

The design of intermodal facilities for the N2IP needs to enable double stacking of containers on trains using Inland Rail and the Walgett Branch Line. The associated land uses directly associated with the N2IP also require direct access to the proposed Walgett Branch Line sidings as well as access to the Inland Rail in both north and south directions, as shown in Figure 5.7. Road access to the N2IP facility will be from Yarrie Lake Road. Access from Culgoora Road was not provided to avoid the need for a level crossing or bridge over the Walgett Branch Line.



Source: Narrabri SAP Structure Plan, Hatch Roberts Day (22 February 2023)

Figure 5.7 Overview of proposed N2IP siding and transport and logistics area

5.4.4.1 Functional requirements

The key functional requirements of the N2IP intermodal facility could include:

- yard layout – minimal gradients and allowance for drainage
- single terminal operator providing open access
- siding length – allowance for up to 2400 m long siding to accommodate at least 1800 m trains for intermodal containers and other potential uses (this is the maximum siding length available due to physical constraints on site and adjacent to the Walgett Branch Line)
 - western end of terminal provides direct access for adjacent land uses backing onto hardstand area (such as integrated warehousing/manufacturing facilities.
 - eastern end of terminal provides open access for vehicles external to the terminal area.
- siding width – 100 m wide area adjacent and parallel to the Walgett Branch Line to allow for a single proposed siding, space for container loading/unloading using reach stackers, a container hardstand area for container storage, truck marshalling and turning areas, and supporting infrastructure/buildings
- rail access – turnouts to Walgett Branch Line provided at both ends of the terminal (east and west) to allow for locomotive run around
- truck movements – roadway clearance for 2 x A Doubles
- weighbridge – with gatehouse
- maintenance – for locos and wagons (optional); for reachstackers; workshop
- provisioning – for deliveries and servicing, refuelling, tanks
- pavement type – typically rated for 100–110 tonnes
- consideration of dangerous goods
- power, water and gas supply
- IT communications – fibre; train communications
- security – fencing, cameras, lighting.

5.4.4.2 Intermodal rail sidings

A siding has been proposed as part of the N2IP development to handle container imports and exports to and from the Narrabri region. This siding would be located to the south of the existing Walgett Branch Line and has been designed to accommodate 1800 m long trains clear of the main line as a minimum. A concept has been developed for the N2IP container siding and loading facility (see Figure 5.7) and is subject to further design and approval. The plan includes a 100 m wide area adjacent and parallel to the Walgett Branch Line to allow for a single proposed siding, space for container loading/unloading using reach stackers, a container hardstand area for container storage, truck marshalling and turning areas, and supporting infrastructure/buildings. Turnouts on both ends of the siding will provide rail access and locomotive run around ability. It should be noted that the land parallel to the rail siding and container set down area has been split due to accommodate the presence of high value vegetation within the N2IP site. Road access to the siding would be from the south (from Yarric Lake Road) within the SAP.

5.4.4.3 Bulk loading

Opportunities for an additional/separate bulk loading facility to be included as part of the SAP to increase the functionality of the precinct has been considered. Ideally, the bulk facility would allow for a train to be incremented through the loader without breaking the train, either through using a longer siding, or using a balloon loop. The area on the far western edge of the SAP investigation area on the Walgett Branch Line, shown in Figure 5.8, has been identified as a potential location for a bulk loading facility and a dedicated siding. The space proofing of land adjacent to the bulk siding is far less significant than the container siding, typically requiring the bulk loader, associated storage silos, access roads, and weighbridges. This could be generally accommodated in an area approximately 70 m wide by 200 m long at the midpoint of the siding, if using a parallel siding.

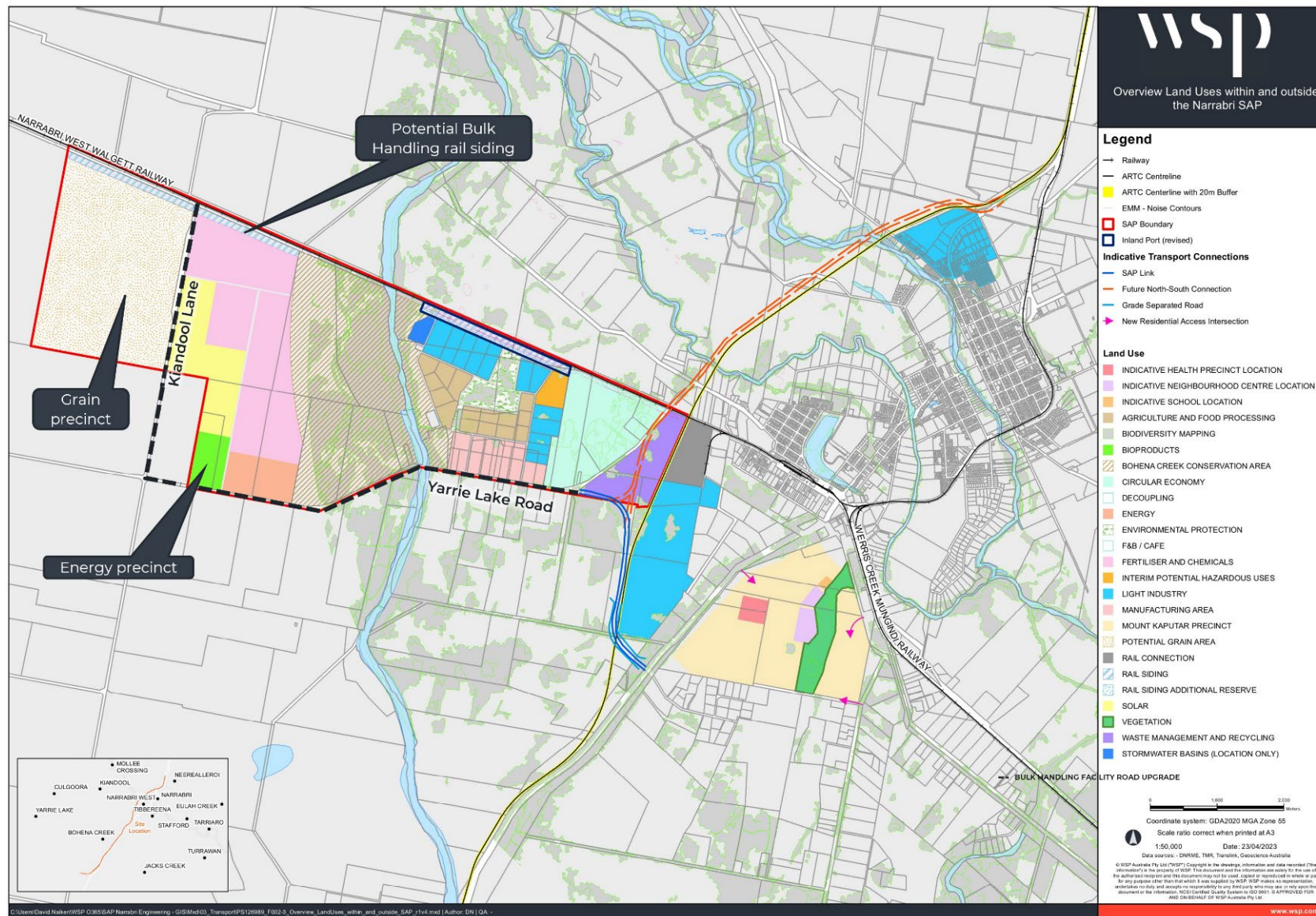


Figure 5.8 Proposed bulk handling facility, on Walgett Branch Line, west of Bohena Creek

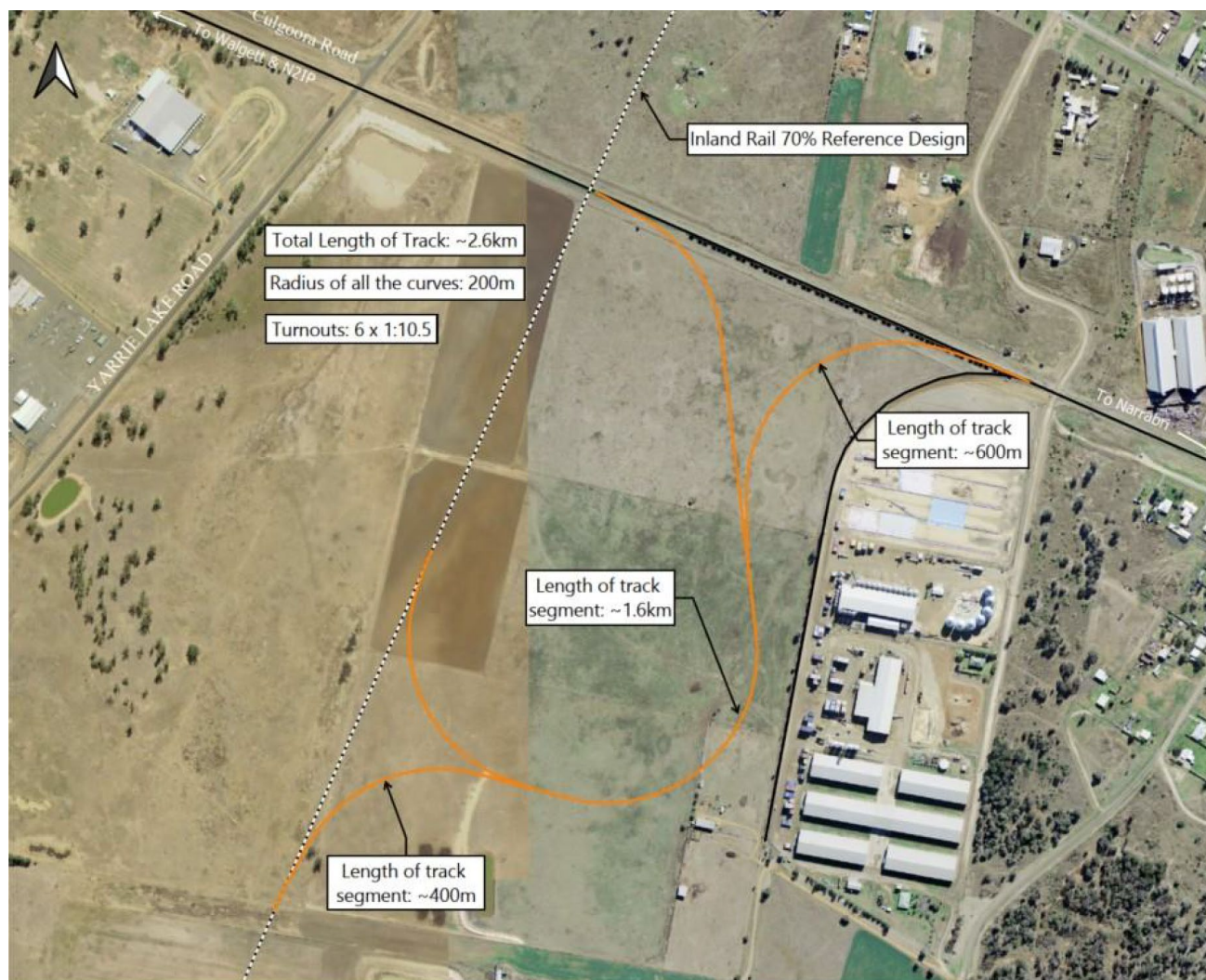
Using a parallel siding, a train would increment through the loader, but depending on the siding length and locating of the loader, may encroach on the Walgett Branch Line. The locomotives would need to perform a run around movement to reattach to the head of the consist.

A balloon loop would allow a train to be loaded without shunting, reducing loading time, and should be long enough to accommodate a full train length so that a train being loaded avoids encroaching on the Walgett Branch Line.

5.4.5 N2IP interface connection proposal

In 2021, a Strategic Business Case was prepared by EY to assess the benefits of new and upgraded infrastructure to improve the connectivity between the proposed N2IP, Inland Rail and the Walgett Branch Line. This would provide both north and south connectivity to Inland Rail, and east and west connectivity to the Walgett Branch Line.

The preferred option developed by SNC Lavalin, noted in the business case, is located on the eastern side of the Inland Rail corridor and provides direct connection in all directions.



Source: Narrabri – Options Assessment Gate 4 Report, Inland Rail Interface Improvement Program, SNC Lavalin, 2021
Figure 5.9 Rail connection option 1B east of Inland Rail bridge over Walgett Branch Line

5.4.6 *Railway stations*

Future considerations of relocating Narrabri railway station to Narrabri West have been discussed in the context of operating passenger services on Inland Rail (assumes rail connection is constructed). This would require the closure of this section of rail line to the east of Narrabri Town Centre. This would lead to an increase in train movements across the Newell Highway level railway crossing south of Mooloolbar Street and Old Turrawan Road intersection.

This proposal has the potential to revitalise the neighbourhood around a new station at Narrabri West, create a new centralised mobility hub for the town located in closer proximity to the new residential growth area, remove a number of level crossings and open up the opportunity for realising the green loop concept.

5.4.7 *Railway level crossings*

No new railway level crossings are proposed as part of the Inland Rail project within the SAP investigation area. Existing railway level crossings are to remain on the Newell Highway south of Mooloolbar Street and Old Turrawan Road intersection (LXM ID 745 – active with flashing lights), Mooloolbar Street (LXM ID 746 – passive with stop signs), Williams Drive (private level crossing) and Yarrie Lake Road (LXM ID 747 – passive with stop signs).

The railway level crossing located on Old Turrawan Road adjacent Narrabri West Public School is proposed to be closed by Narrabri Shire Council to improve road safety around the Primary school. Old Turrawan Road is proposed to be closed and a cul-de-sac formed to the west of the rail line.

It is noted that any additional rail traffic on the Walgett Branch Line will result in a greater frequency of trains at the existing level crossings, particularly at the Newell Highway, will likely trigger upgrades to level crossing controls, and may require a grade separation to eliminate the rail and road user conflict. Updated risk assessments (ALCAM assessment) will need to be undertaken for existing level crossings based on increased train frequencies, changed sight distances, train and vehicle speed to determine the control required.

5.5 *Active transport*

Due to its existing rural/industrial setting remote (4km) from the urban area, pedestrian facilities within the SAP are not currently provided. The SAP provides an opportunity to assist the movement of people to/from the SAP by providing new pedestrian and bicycle facilities.

5.5.1 *Walking*

While the existing pedestrian infrastructure is limited, there is an opportunity to link the SAP to Narrabri Town Centre, Narrabri West and the new residential area. Particular issues to be addressed include:

- safe crossing of busier roads such as the Newell Highway, Kamilaroi Highway and Yarrie Lake Road/Goobar Street/Mooloolbar Street (in the future)
- connecting the new residential area to the SAP and Narrabri Town Centre with dedicated active transport infrastructure next to Yarrie Lake Road and Goobar Street via the existing network including the shared paths on the western side of the Newell Highway from Mooloolbar Street north to Narrabri Town Centre. Goobar Street offers the opportunity to provide footpath facilities to the existing Westland Supermarket and the Narrabri Lake/Narrabri Sports Precinct footpath network
- walking within larger development sites should be encouraged with internal footpaths and tree cover to reduce heat impacts during summer.

5.5.2 *Cycling*

With no existing facilities located within the Narrabri SAP area, a future cycling route has been identified on Yarrie Lake Road and Goobar Street. Considering the anticipated volume of heavy vehicles surrounding the SAP area, it is recommended that part of the cycling provision be designed as an off-road facility in key cycling corridors to provide sufficient separation from increased heavy and general vehicle movements accessing the site.

Provisions to encourage the use of cycling to the SAP include:

- active transport facilities (off road) on one side of Yarrie Lake Road and Goobar Street connecting to shared paths on the western side of the Newell Highway from Mooloolbar Street north to Narrabri Town Centre
- providing public bike racks near the areas of greater employee density
- roads designed to incorporate provision in the shoulder for future shared user paths if required
- providing end of trip facilities including cycle lockers, showers and change areas in businesses with a sufficient number of employees
- providing priority cyclist infrastructure at intersections to support safe crossings
- future preservation of a 'off road green corridor' for recreational purposes such as off-road cycling, walking and bridle trails.

The proposed active transport routes are shown in Figure 5.10 overleaf. The simple network seeks to concentrate activity along the routes shown, to gain value from the network and increase the surveillance along the route.

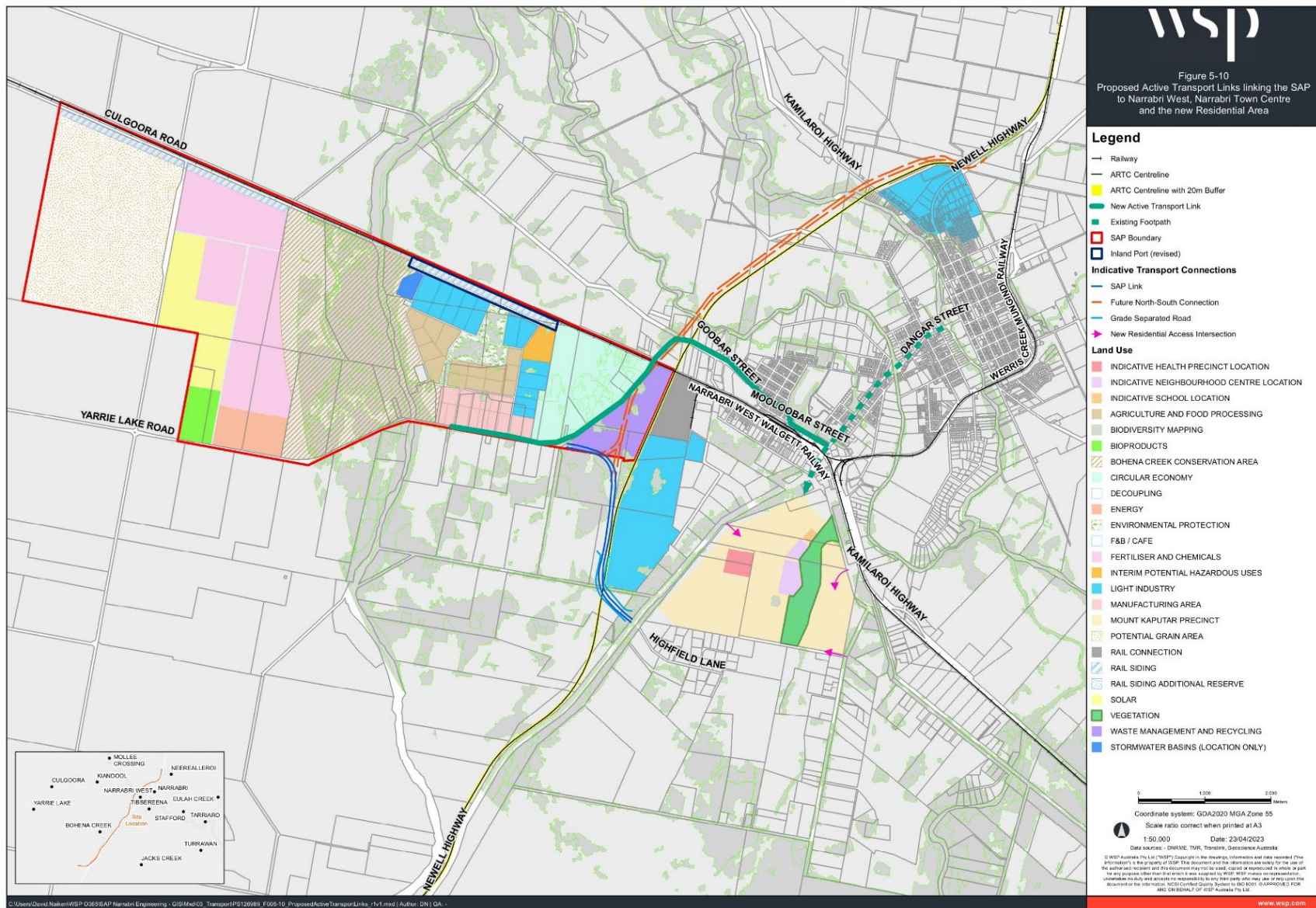


Figure 5.10 Proposed active transport links linking the SAP to Narrabri West, Narrabri Town Centre and the new residential area

5.6 Public transport

To improve transport choices to the new employment within the SAP precinct, bus Route 457A could be extended into the SAP with an on-demand component of the service (similar to routes 457B and 457C) to overcome the long walk distances within the SAP. This would provide a connection to the existing Town Centre and Narrabri West. In addition, there is potentially scope to increase the number of trips on Route 457A to meet typical job/shift hours.

In addition, a new bus route could link the new Residential Growth Area and Narrabri Town Centre. These options are shown in Figure 5.11 overleaf.

All new public transport services should provide full Disability Discrimination Act (DDA) compliant accessible services. This should include providing DDA-compliant bus stops such as new shelters on bus routes within the SAP with weather protection and shade. The location of future bus stops should be identified in the SAP Delivery Plan.

Developing a new regional rail service plan based on Regional Connected Network approach to provide more frequent intraregional travel opportunities at convenient times that customers want between Narrabri and Moree, Tamworth and Armidale.

5.7 Travelling stock

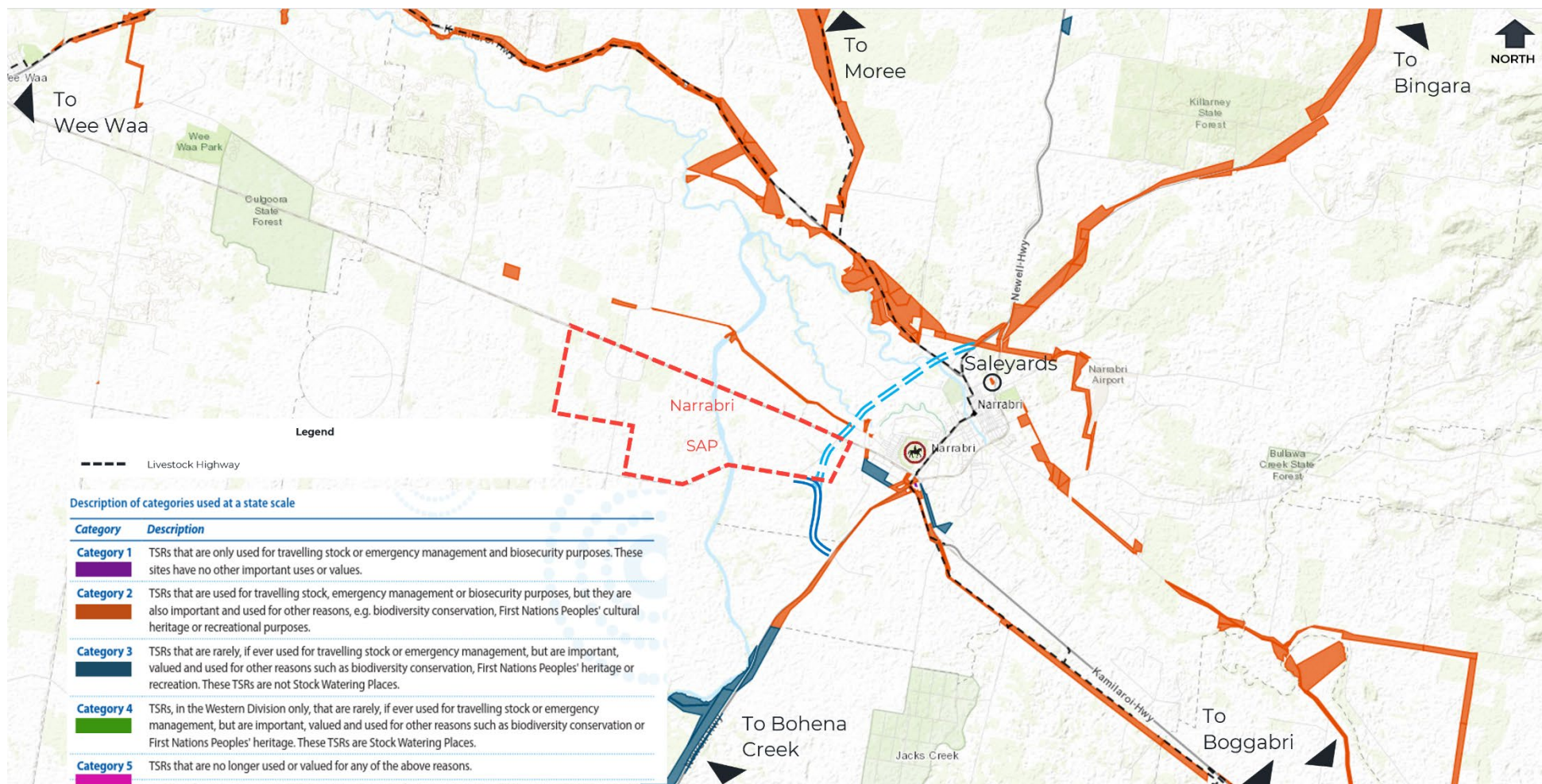
The SAP boundary and potential roads have been superimposed on the travelling stock reserves, shown in Figure 5.12. There appears to be minimal impact on the travelling stock reserves by the SAP.

5.8 Sustainable transport

Global transformation is taking place from the traditional petrol, diesel and gas operated vehicles to electric, hybrid and hydrogen fuel cell vehicles (EVs). The NSW Electric and Hybrid Vehicle Plan is focussed on vehicle availability, charging points and customer information.

For Narrabri SAP, this could mean:

- identify space for possible space hydrogen fuel cell and electric truck recharging facility. Ideally, this facility should be located to benefit the SAP and existing highway traffic
- transforming into electric bus fleet and investing on the supporting depot facilities
- supporting EV charging through strategic land use planning and guidelines, e.g. charging stations incorporated into private development including residential and commercial development. It is recommended that businesses with on-site parking above a certain threshold (say 50 spaces) should be required to ensure that at minimum of 5% of the car parking spaces are designed, constructed and wired to be ‘electric vehicle ready’ for level 2 car chargers in convenient and visible locations.



Source: Travelling Stock Reserves – State Classification Map (trade.maps.arcgis.com)

Figure 5.12 Travelling stock reserves

5.9 Parking

The existing transport mode choice and location of the Narrabri SAP between 2 km and 13 km from Narrabri West (6.5 km and 17.5 km from Narrabri Town Centre) means that private vehicle travel will be the main mode of travel. The proposed improvements in active transport infrastructure and public transport services are designed to create realistic alternatives to car travel.

Parking rates within the SAP are expected to be based on current parking provision within the Development Control Plan³. However, this requires further validation by the Delivery Plan. The Delivery Plan should also consider whether the anticipated business types in the light industrial area proposed east of Inland Rail are adequately covered by the existing controls, or whether additional guidance is necessary.

Provision of truck parking should be made within individual properties within the SAP based on the anticipated demand. It is noted other industrial areas in regional areas have experienced issues with uncontrolled trailer parking creating unsafe situations, especially on streets adjacent to residential areas. Heavy vehicle parking should be discouraged in residential areas.

Suitable sealed parking areas should be provided to heavy vehicles at locations for rest and refreshment in non-residential area. If additional parking is needed for heavy vehicles outside of individual properties, the creation of 4.2 m wide shoulders on Yarrie Lake Road, between Bohena Creek and the intersection with the proposed SAP Link Road, would provide a convenient location for trailer parking away from residential areas. This upgrade could be included in a future upgrade of Yarrie Lake Road to make it suitable for PBS vehicles.

5.10 Aviation

Through the proposed Narrabri gas project, upgrades to Narrabri Airport have been planned by the project's proponents to enhance access to places outside of the region. Currently, air services to Narrabri are infrequent and limited in terms of their connections and frequency. Access to the airport is limited to taxis/private vehicles and there are limited onward travel options for passengers arriving at Narrabri Airport. Opportunities to maximise the airport's use for passenger, freight and emergency services should be further considered in the context of regional transport planning for the New England North West.

A freight connection to the Airport is important for business travel options and the potential for some freight tasks, such as the delivery of high value, specialist equipment or components. The potential for air freight exports will depend on the commodities manufactured in the SAP. If there is an increase in demand, there may be a need to investigate opportunities to increase the number of days that flights operate and to provide more travel choices for Airport passengers to connect to the town centre and SAP.

³ Development Control Plan - Parking Code No 1 Narrabri Shire Council, adopted on Tuesday, 19 January 1993

5.11 Business efficiency and innovation

Freight customers value reliability, efficient travel, and certainty to maximise productivity and reduce costs and energy intensity. Freight customers will increasingly harness data and analytics to achieve efficiencies that make them competitive on a local and international level. From Future Transport Strategy, potential opportunities for business efficiency and innovation include:

- expand the road network that supports higher capacity freight vehicles, allowing more freight to be moved in single trips
- enable higher productivity vehicles to access intermodal terminals and logistics hubs in the ‘first and last mile’. For the Narrabri SAP this means that the road network needs to be improved to cater for these vehicles without the rail lines being a barrier to movement
- enable the uptake of new technologies, such as connected and autonomous vehicles (CAVs). This can be assisted by embedding intelligent sensors and digital systems in both the network and freight vehicle fleet
- support the development of a micro freight hub within the vicinity of the N2IP.

In the future, load sharing applications offer the potential to combine freight loads from different sources to maximise capacity and reduce delivery timeframes. This can be enhanced by the provision of high-capacity data networks. In addition, direct business-to-consumer delivery models and on-demand service models offer the potential for innovative partnerships outside of traditional freight companies.

The NSW Heavy Vehicle Access Policy Framework outlines a strategic approach to heavy vehicle access on State and local roads. Heavy vehicle road reforms – aimed at reshaping the provision of heavy vehicle road infrastructure into an economic service, could see the needs of heavy vehicle users linked with the level of service they receive and the charges they pay. It will also provide a basis for comparing road and rail freight pricing – a stepping stone towards the development of a market for freight where technology, data and analytics could support innovative ways of providing dynamic priority, and freight-as-a-service multimodal offerings.

Upcoming innovations in rail freight to improve efficiency and safety include:

- automatic train control (ETCS)
- integrated systems reduce LCL (Less than container load)
- foldable containers (also applicable to road transport).

Upcoming innovations in road freight to improve efficiency include:

- connected and autonomous vehicles
- truck platooning
- machine to machine (M2M)/telematics.

Last Mile innovations that could have application in the SAP include:

- connected and automated freight distribution vehicles
- drones
- GPS tracking
- Internet of things (IOT) platforms of sensors
- intelligent roadways.

These new technologies are likely to be most beneficial within the Inland Port and adjoining light industry, agriculture and food processing and manufacturing areas. This cluster of properties have the proximity necessary to make use of the circular economy and emerging technologies. It is recommended that the internal road network be planned with the necessary technology needed (optic fibre, LIDAR, DSRC and sensor technology) and a layout that is conducive to connected and autonomous vehicles.

6 Conclusions and recommendations

6.1 Summary of report

6.1.1 Road network

The existing road network can support the creation of the SAP precinct in the short-term based on road capacity. In the medium-term, a new SAP Link Road is proposed between Yarrie Lake Road within the SAP and the Newell Highway near Highfield Lane. The new east-west link road would include a grade-separated road crossing of the Inland Rail corridor. Short-term upgrades to improve road safety, protect residential amenity and improve active-transport connections include:

- painted linemarking on Mooloolbar Street to visually narrow the traffic lanes and define parking areas
- improve rail level crossing signage and warning equipment at the crossing of Yarrie Lake Road, south of Culgoora Road
- add edge and centre linemarking on Yarrie Lake Road
- change intersection priority at intersection of Baranbar Street and Goobar Street
- heavy vehicle restriction on Baranbar Street and Ugoa Street to protect residential amenity
- streetscape treatment on Goobar Street, Burigal Street and Buri Street to reinforce residential nature
- entry treatments on Baranbar Street and Bukhai Street to discourage truck access
- connect active transport path to Newell Hwy to Narrabri Lake path
- active transport bridge over Long Gully
- extend active transport path from SAP to Narrabri Lake paths.

The capacity of the Newell Highway at the Dangar Street bridge within the urban area of Narrabri is likely to be exceeded during the development timeframe of the SAP (estimated timeframe of 2031), requiring an upgrade of the existing Newell Highway or the creation of a new parallel route. The timing of the upgrades is dependent on the rate at which new jobs within the SAP and township are created and the increase of background traffic on the Newell Highway over the same timeframe.

Table 6.1 Road upgrade timing by employment uptake scenario

Road upgrade	Employment uptake			
	Low	Medium	High	High with low-lying house relocation
SAP Link Road	Not required	2058	2031	2031
Newell Highway at Dangar Street	2036	2033	2031	2031
Intersection of Newell Highway, Mooloolbar Street and Old Turrawan Road	—	—	2043 – not needed if SAP Link open	—

The new residential area requires at least two access points from the wider road network to keep traffic volumes within their capacity. For flexibility, it is recommended that access be provided to both the Newell and Kamilaroi Highways. The internal road network should be designed to reduce the risk of rat-running between the highways through the new residential area.

6.1.2 *Heavy vehicle route*

The proposed SAP Link Road is proposed to be designed for PBS Level 3 vehicles to futureproof the new road for future vehicle needs to the Northern NSW Inland Port. It is envisaged that this road would become the main heavy vehicle route into the SAP.

6.1.3 *Emergency vehicle and evacuation routes*

Flood modelling has indicated that the existing road network in the vicinity of the SAP is susceptible to flooding. The proposed SAP Link Road will create a new route (via road) to higher ground. It offers the potential to become a flood-free route when existing routes are blocked.

6.1.4 *Rail network*

To leverage the benefits of Inland Rail and the Northern NSW Inland Port offer the opportunity to establish and intermodal facility. This would include a rail siding 2,400 m in length with a width of 100 m including container stacking and vehicle manoeuvring. It would be split into open access at its eastern end and dedicated access on the western end from adjacent land uses. See Section 3.2.1 for more details.

An area has been identified at the far western edge of the SAP boundary on the Walgett branch Line to accommodate a bulk handling facility.

Any plans to relocate the rail station from the town centre to Narrabri West would require the funding and construction of the connection from the Walgett Branch Line to Inland Rail and the reconfiguration of the Narrabri West siding. This would facilitate the operation of passenger rail services on Inland Rail and move the station closer to the new residential growth area. This would also lead to more train movements across the level crossing on the Newell Highway.

6.1.5 *Active transport*

While facilities for walking and cycling are currently limited to main movement corridors, the SAP creates the opportunity to promote these modes of travel as employment increases. The most critical elements are to link the SAP and the proposed new Residential Growth Area to Narrabri West and use the existing facilities between Narrabri West and Narrabri Town Centre to expand the reach of the active transport network. Improved crossing facilities are needed to improve pedestrian and cyclist safety at critical locations around the network.

6.1.6 *Public transport*

It is proposed that bus Route 457A could be extended into the SAP precinct as an on-demand component of the service (similar to routes 457B and 457C). In addition, a new bus route is proposed linking the new Residential Growth Area and Narrabri Town Centre.

6.1.7 *Travelling stock*

The proposed transport improvements for the SAP should have minimal impact on the travelling stock reserves.

6.1.8 *Sustainable transport*

To position the SAP to take advantage in advancements in sustainable transport, a location for an electric vehicle (including trucks) and hydrogen fuel cell recharging facility should be identified. With the SAP Link Road being directly connected to the Newell Highway, this facility should be in a convenient location to broaden its attraction and convenience.

6.1.9 *Parking*

No changes are proposed to the existing Development Control Plan (DCP) provisions for parking. Parking for trucks and trailers should be provided within individual properties.

6.1.10 Aviation

The need to increase the number of flights beyond those planned as part of the proposed Narrabri gas project will depend on the type of commodities manufactured in the SAP. If there is an increase in demand, there may be a need to investigate opportunities to increase the number of days that flights operate and to provide more travel choices for Airport passengers to connect to the town centre and SAP.

6.1.11 Business efficiency and innovation

Create an internal road network in the vicinity of the Northern NSW Inland Port (and adjoining light industry, agriculture and food processing and manufacturing areas), that supports an intelligent road system to make use of circular economy opportunities and emerging technology.

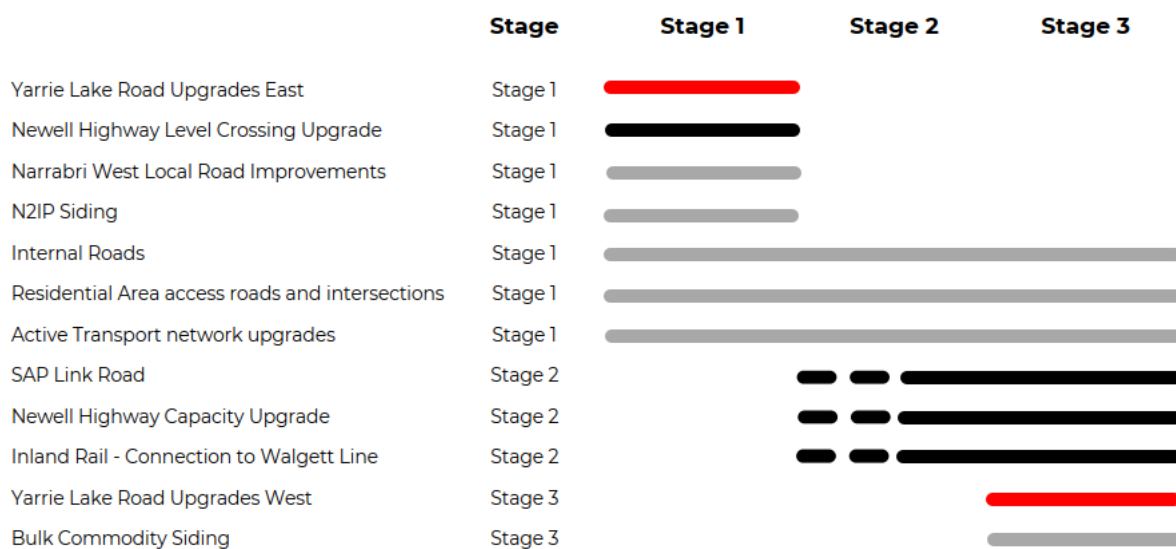
6.2 Summary of infrastructure recommendations

A summary of the recommended infrastructure includes:

- 1 Rail network:
 - a Inland Rail to Walgett Branch Line connection.
 - b N2IP rail siding – 2400 m siding to accommodate 1800 m long trains in the SAP Inland Port Precinct
 - c an additional bulk loading siding on the western edge of the SAP boundary in the SAP Energy Precinct
 - d grade-separated road crossings of the Inland Rail corridor, designed for double-stacked containers
 - e Yarrie Lake Road/Walgett Branch Line rail crossing: upgrade to boom gates
 - f Newell Highway/Werris Creek to Mungindi Line rail crossing: upgrade to boom gates.
- 2 Road network:
 - a internal SAP roads to suit development, including upgrade Yarrie Lake Road, east of Bohena Creek
 - b upgrade Newell Highway between Narrabri West and Narrabri town or provide an alternative route by 2040 for the central employment scenario (2032 for the high employment scenario), suitable for PBS Level 3 vehicles
 - c local road improvements within Narrabri West
 - d Mt Kaputar residential precinct access roads and intersections
 - e construct the SAP Link Road to the Newell Highway by 2060 or earlier for the central employment scenario (2031 for the high employment scenario), suitable for PBS Level 3 vehicles, including grade separation of the Inland Rail corridor
 - f upgrade Yarrie Lake Road, west of Bohena Creek and Kiandool Lane (within and outside SAP boundary).
- 3 Active transport:
 - a shared cycle and pedestrian paths on one side of Yarrie Lake Road and Goobar Street
 - b safe crossing across the Newell Highway, Kamilaroi Highway, Yarrie Lake Road, Goobar Street and Mooloolbar Street
 - c shared cycle and pedestrian paths connecting the new residential area to Narrabri West Public School and the Narrabri Lake/Narrabri Sports Precinct/Narrabri Showground footpath network
 - d providing public bike racks near the areas of greater employee density
 - e providing cycle lockers, showers and change areas in businesses with a sufficient number of employees.
- 4 Public transport:
 - a providing compatible road network and bus stops to enable bus route extension into the SAP with an on-demand component of the service
 - b providing a bus service frequency to meet typical job/shift hours.
 - c providing DDA-compliant bus facilities such as new shelters on bus routes within the SAP with weather protection and shade.
- 5 Electric vehicle charging facilities and hydrogen refuelling infrastructure.

Indicative timing

The indicative timing of the transport infrastructure upgrades is shown in Figure 6.1. This timing is based on the nexus between the upgrade and the land use generating the need for the upgrade. This timing is influenced by the rate of development and the staged release of land within the SAP and the Mt Kaputar residential area.



Notes Timing of infrastructure is affected by timing and rate of land development within the SAP and residential area

Figure 6.1 Potential infrastructure timing

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