UPGRADING THE PACIFIC HIGHWAY

Woolgoolga to Ballina Planning Alliance

UPGRADING THE PACIFIC HIGHWAY

Woolgoolga to Ballina Upgrade

Working paper: Traffic and transport

November 2012

Final

NSW GOVERNMENT Transport Roads & Maritime Services

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Introduction

The NSW Roads and Maritime Services (RMS) is seeking approval to upgrade around 155 kilometres of the Pacific Highway from Woolgoolga to Ballina. The Pacific Highway Woolgoolga to Ballina upgrade project (the project) would achieve four lanes of divided road from about five kilometres north of Woolgoolga to about six kilometres south of Ballina.

The Woolgoolga to Ballina upgrade project is an important component of the overall Pacific Highway Upgrade Program. The Australian and NSW governments have been jointly upgrading the Pacific Highway since 1996. Currently, $4.84 billion (to 2014) has been committed to continue the upgrade of the highway. The Pacific Highway is the primary freight route and interstate link between Sydney and Brisbane and supports major growing population, industrial and export centres and gateways. The corridor has been one of the fastest growing regions in Australia. It is estimated that approximately 40 per cent of Australia's population is linked by this corridor.

Scope and purpose of study

The section of the Pacific Highway between Woolgoolga and Ballina which is the subject of this assessment is located approximately 550 kilometres north of Sydney and 400 kilometres south of Brisbane on the mid north coast of NSW.

Grafton and Ballina are the regional centres located in the study area. These regional centres are key anchors for the growth of the region and drive the need for infrastructure upgrades throughout the regional transport network.

Located along major transport links are regional, major and local towns and centres. These centres provide goods, services and employment to people from surrounding settlements as well as to their own growing populations.

The purpose of this working paper is to describe and assess the traffic and transport issues associated with the proposed upgrade of the Pacific Highway between Woolgoolga to Ballina. This report has been prepared to inform the traffic and transport part of the Environmental Impact Statement for the project.

This report addresses the specific transport objectives of the Pacific Highway Upgrade program, namely to:

- Significantly reduce road accidents and injuries
- Reduce travel times
- Reduce freight transport costs.

In addition to these broad objectives, the overall purpose of this report is to identify and assess the traffic and transport issues identified in the Director-General's environmental assessment requirements for the project. In addition to these specific requirements, it also addresses community and stakeholder concerns expressed through continuing consultation.

Assessment method

The approach for this traffic and transport assessment was based on the evolving concept of the project, recognising the design and consultation iterations that have occurred in recent years. The assessment has been structured along the following lines in order to address the Director General's requirements.

Review of the existing environment:

- Existing traffic and transport network and activity in the study area, principally by a suite of traffic surveys and identification of transport routes
- Recent crash profile for the area, from RMS crash data for 2005-2010
- Regional growth forecasts and forecasts for inter-regional traffic, from Department of Planning and Infrastructure and NSW Government submissions to Infrastructure Australia.

Projection of future traffic:

- Future traffic activity at opening and in future years (10 years and 20 years after opening), was forecast by the development of a SATURN traffic model.
- It has been assumed for the purposes of traffic projections that opening and subsequent forecast dates will be 2016, 2026, and 2036
- Traffic profile for noise and energy assessment, was developed from detailed time-of-day profiling along the project.

Assessment of benefits and impacts:

- Design responses to stakeholder and community consultation, and to impacts on local and regional access, by post-design audit of relevant comment and affected local roads
- Broad operational transport benefits
- Impacts on individual transport services and on local access.

Assessment of construction impacts:

- Construction staging and associated construction traffic impacts
- Impacts on local access during construction.

Consultation feedback

Extensive consultation was undertaken during each of the preceding studies for the previous route development and concept design phases that lead to adoption of the preferred route. For this study, concept design submissions were received as well as feedback for public display.

Key findings

Benefits of reduced travel and travel time despite increased traffic volumes have been estimated, along with benefits of reduced crash frequency. Impacts on local road and property access, public transport, and bicyclist opportunities have been identified. Given the scale of this project and the

proposed time frame for its implementation, construction impacts have been assessed to identify road user delays. These findings are described in more detail in the following sub-sections.

Traffic volumes: without and with the project

Traffic volumes have been forecast using the SATURN traffic model by reference to growth projections under a “do-nothing” scenario of the existing Pacific Highway (Base case), and a “with project” scenario (comprising the new carriageway and remnant sections of the existing Pacific Highway). These have been developed from modelled traffic volumes for each section of the project at opening (2016) and after 10 years of operation (2026), and after 20 years of operation (2036) when the entire project is anticipated to be completed and operating as a class M motorway. Interchange traffic levels have been analysed using SIDRA (a software platform for analysis of intersection performance) to confirm satisfactory Levels of Service.

The growth indicators include regional population, employment and tourism growth. Also, reflections of regional and interregional economic activity that give rise to growth in heavy vehicle transport have been considered. Historical growth patterns have also been referenced, but greater reliance is placed on external factors, rather than simply repeating previous growth drivers. These have been applied individually to the five local government areas in the study area, as appropriate.

Daily travel along the Pacific Highway through the study area is forecast to grow by some 42 per cent from 2012 to 2036. This growth would be derived from general economic activity and population growth, as well as increases in the economy and tourism in the study area driven by the improved access that the highway upgrade would provide. While heavy vehicle traffic represents a high proportion of traffic at night, it is relatively constant throughout the day. By 2036, an annual average daily traffic volume of around 14,000 vehicles is expected between Woolgoolga and Ballina. Currently, on average, a peak of around 9800 vehicles uses the existing Pacific Highway each day.

Road Safety Benefits

The crash rate in the corridor varies across the study areas between 26.7 crashes/100 million vehicle kilometres travelled of travel in Section 10 (Richmond River to Coolgardie Road) to 9.2 crashes / 100 per million vehicle kilometres travelled between Coolgardie Road and Ballina, with an average crash rate of 20.7 over the whole project.

The project objective of increasing travel safety is to achieve 15 crashes / 100 per million vehicle kilometres travelled. On the basis that the crash rate on the existing alignment would continue despite reduced traffic, and that the project would reduce crash rates to the anticipated 15 crashes / 100 per million vehicle kilometres travelled. It is forecast that there would be a 27 per cent reduction in overall crashes in the opening year (2016).

By 2036, it is forecast that the project would reduce the forecast 183 crashes (if the project had not proceeded) to 132 crashes. The greatest crash saving would be between the Glenugie interchange and Tyndale, where the project would result in a saving of 15 crashes, compared to 51 predicted without the project.

Freight and heavy vehicles

The inter-capital freight volume on the existing Pacific Highway in the study area was estimated to be approximately 2.9 million tonnes. Road-based freight transport represents 76 per cent of the Sydney-Brisbane inter-capital freight, while rail represents 11 per cent, coastal shipping 12 per cent and air accounting for one per cent.

Any increase in the freight task is most likely to be absorbed predominantly by road. For the rail mode share to increase, significant investment in rail track and signalling infrastructure to improve travel times and access to Sydney ports is required. The continued upgrade of the Pacific Highway would improve travel times relative to the New England Highway, and provide a high-quality and safer route for road freight between Sydney and Brisbane.

From the freight movement forecasts, road would continue to be the dominant mode. Without the project this growth would be constrained by the current and predicted level of service experienced on the existing highway throughout the study area.

Heavy vehicle travel is anticipated to grow by 15.7 per cent to 2016, but adoption of the project would offset some of this growth, resulting in a net increase of only 6.8 per cent

These savings in travel would continue into the future, culminating in 2036 with a reduction in heavy vehicle travel of 7.7 per cent against retaining the existing highway.

Travel time savings

In a similar vein, Table 3-2 reveals that at opening, total travel time on the existing highway would be expected to increase by 7.9 per cent for all vehicles and 15.7 per cent for heavy vehicles. However, the project would result in a net decrease of 8.2 per cent for all vehicles and 4.7 per cent for heavy vehicles.

By 2036, when total travel time on the existing Pacific Highway is forecast to increase by 41.6 per cent from the current position, the project would have halved this growth, with an annual saving of some 3,850 vehicle hours of travel.

By implementing the project, it is anticipated that total travel in 2036 would be reduced by 150,200 kilometres of travel or 6 per cent, with a savings in time of approximately 3,850 hours or 15 per cent.

Rest areas

Rest areas would be provided at 50 kilometre intervals (approximately) for both northbound and southbound traffic. There would be five rest areas located along the project (two northbound, and three southbound) and these would be consistent with rest area spacing elsewhere along the Pacific Highway. There is also a rest area planned as part of the recently approved Devils Pulpit upgrade (not part of this project).

Typical amenities provided at rest areas would include toilets and areas suitable for recreation and picnicking. Rain water tanks would be provided. However, many of the rest areas are remote from mains water supplies, and potable water cannot be readily provided. Rest areas would be divided into separate sections for commercial and general use. Specific parking provision would be made available for B-doubles, semi-trailers, light commercial vehicles, cars and trailers. It is recognised that lighting of the parking area and stray light from passing traffic are important issues for long haul truck drivers.

Local access: under class M, and initial class A for project sections

The project would provide a four-lane road from Woolgoolga to Ballina, interfacing with the upgraded Pacific Highway at Woolgoolga, the upgrades at Glenugie and Devils Pulpit, and tie-in with the Ballina Bypass upgrade. Ultimately, it would comprise a class M roadway and would be delivered in stages with limited-access interchanges, 110 kilometres per hour divided carriageway,

with adjacent service roads for local and incidental traffic. Some sections would initially be delivered to a class A arterial standard with intersections, 100 kilometres per hour speed limit, and limited service road provision.

As a result, there is a requirement for service roads to provide access from the highway to local properties. The existing Pacific Highway would become a service road in locations where the construction of two new carriageways is required. In areas where the project corridor bisects existing access routes, the realignment of local roads and accesses, along with the construction of new service roads would mitigate this impact.

In all cases local access to the motorway would be by the relevant service road, often the existing highway. Access northbound or southbound would be via an interchange for full class M upgrade. Access on sections to be initially class A would vary, but would permit north or south bound travel.

For some localities or properties additional travel distances or travel time would be necessary to reach destinations currently reached directly via the existing highway.

Construction

In November 2011, the NSW Government made a submission to Infrastructure Australia stating that the completion of the Pacific Highway Upgrade Program by 2016 was one of its top three key transport infrastructure priorities and "*will bring a range of economic, travel time and safety benefits to this important national corridor*".

The submission included a proposed staging for the completion of a dual carriageway upgrade between Woolgoolga and Ballina by the end of 2016 based around the estimated construction period to complete the various project sections.

Earthworks management would be given a high priority to ensure that the best use is made of the materials available from the cuttings within the project to reduce the need to obtain materials from sources outside the project. This would involve the transfer of large quantities of earthworks materials between project sections, given the imbalance of available material along the project. To the maximum extent possible this would be achieved largely along the project, minimising the impact on Pacific Highway traffic.

Some delays may occur on local roads to accommodate their deviation / passing over the dual carriageways. However, it is expected that they would remain open for the majority of the duration of construction as construction would be undertaken in isolation to the existing roadways.

1 Introduction

1.1 Overview

NSW Roads and Maritime Services (RMS) is seeking project approval under the Environment Protection and Biodiversity Conservation Act 1999 for the Woolgoolga to Ballina Pacific Highway upgrade project (the project) which is located on the NSW North Coast.

The project would upgrade around 155 kilometres of highway, forming a major part of the overall Pacific Highway Upgrade Program. The project would provide a four-lane divided carriageway from around five kilometres north of Woolgoolga to around six kilometres south of Ballina. Figure 1-1 shows the regional location of the project. The four-lane divided carriageway would have a wide median to allow for future lanes in each direction.

The Woolgoolga to Ballina upgrade project is one of a number of Pacific Highway upgrades. These are part of the overall Pacific Highway Upgrade Program. The Australian and NSW governments have been jointly upgrading the Pacific Highway since 1996. Currently, $4.84 billion (to 2014) has been committed to continue the upgrade of the highway. The Pacific Highway is the primary freight route and interstate link between Sydney and Brisbane and supports major growing population, industrial and export centres and gateways. The corridor has been one of the fastest growing regions in Australia. It is estimated that around 40 per cent of Australia's population is linked by this corridor (DOTARS, 2007).

The project is an important component of the Pacific Highway Upgrade Program. It is needed to help meet the Australian and NSW government's commitments to upgrade the Pacific Highway between Hexham in NSW and the Queensland border. Both governments have committed to finish its upgrading to four-lane divided highway as soon as possible, with 2016 identified as the target opening date for the purposes of this assessment.

The purpose of this working paper is to describe and assess the traffic and transport issues associated with the upgrade of the Pacific Highway between Woolgoolga to Ballina. The upgrade is referred to as the "project" within this report.

This report has been prepared to inform the traffic and transport part of the environmental impact statement, which accompanies the project approval application for the project.

1.2 Objectives of the Pacific Highway Upgrade Program

The Pacific Highway corridor is a major contributor to Australia's economic activity. As Australia's most heavily used interstate highway (NRMA, 1995), the highway provides a vital piece of national infrastructure. It forms an integral part of the National Land Transport Network. The Pacific Highway is also a key north-south route along the east coast of Australia for freight. Travel time savings, improved safety and enhanced freight carrying capacity are important outcomes for the transport of freight. The project would result in cost savings and efficiency improvements for suppliers and manufacturers transporting raw and end products to markets.

The Pacific Highway Upgrade Program is needed, in part, because of population growth and the associated pressures placed on transport infrastructure. The objectives of the program are to:

- Significantly reduce road accidents and injuries
- Reduce travel times
- Reduce freight transport costs
- Develop a route that involves the community and considers its interests
- Provide a route that supports economic development
- Manage the upgrading of the route in accordance with the principles of ecologically sustainable development (ESD)
- Provide the best value for money.

1.3 The project

The project has been divided into eleven sections between tie-ins with the existing Pacific Highway to aid description, and the impact assessment for the project is described for each of these sections (refer to Table 1-1).

Table 1-1 Project sections and lengths

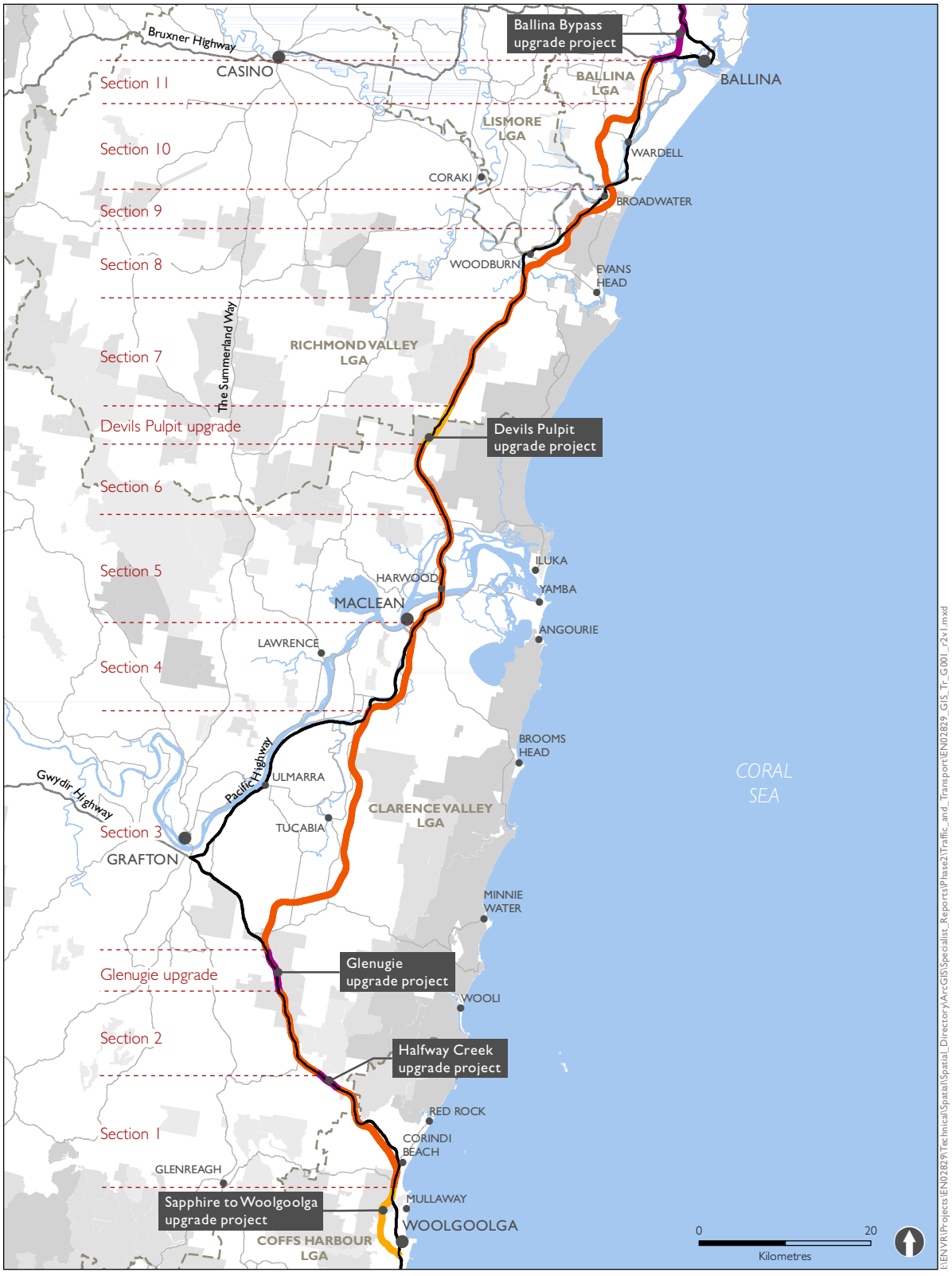
Project section	Location	Station		Length (km)	Opening 2016	+10 years 2026	Future 2036
		Start	Finish				
1	Woolgoolga to Halfway Creek a) Woolgoolga to Range Road b) Range Road to Halfway Creek	0	17.0	17.0 9.6 7.4	 Class M Class A	 Class M Class A	 Class M Class M
2	Halfway Creek to Glenugie upgrade	17.0	28.7	11.7	Class A	Class A	Class M
3	Glenugie upgrade to Tyndale	33.8	68.8	35.0	Class M	Class M	Class M
4	Tyndale to Maclean	68.8	82.0	13.2	Class M	Class M	Class M
5	Maclean to Iluka Road, Mororo a) Maclean to Watts Lane b) Watts Lane to Iluka Road	82.0	96.4	14.4 5.9 8.5	 Class M Class A	 Class M Class A	 Class M Class M
6	Iluka Road to Devil's Pulpit upgrade	96.4	105.6	9.2	Class A	Class A	Class M
7	Devil's Pulpit upgrade to Trustums Hill	111.1	126.4	15.3	Class A	Class A	Class M
8	Trustums Hill to Broadwater National Park	126.4	137.6	11.2	Class M	Class M	Class M
9	Broadwater National Park to Richmond River	137.6	145.1	7.5	Class M	Class M	Class M
10	Richmond River to Coolgardie Road	145.1	158.6	13.5	Class M	Class M	Class M
11	Coolgardie Road to Ballina bypass	158.6	164.0	5.4	Class M	Class M	Class M

An overview of the project alignment and project sections are shown in Figure 1-2 to Figure 1-6.

While the project is for a four-lane motorway standard upgrade (class M), the construction and opening of the project would be staged. Staging could include some sections being constructed and opened initially as a four-lane arterial standard upgrade. These initial arterial (class A) stages are shown in Table 1-1. They would be constructed to motorway standard (class M) in the future.

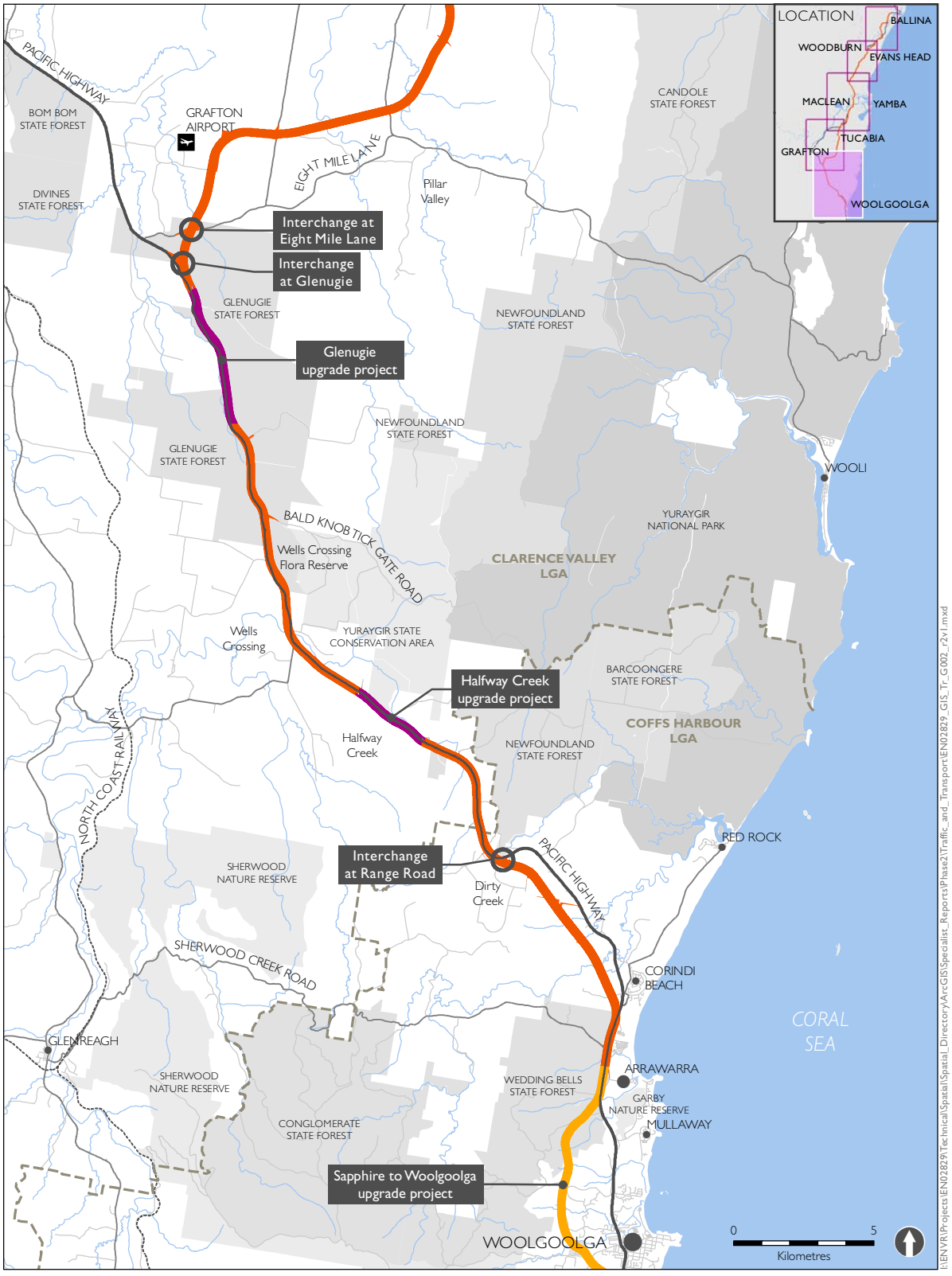
The project does not include the Pacific Highway upgrades at Glenugie and Devils Pulpit, which are located between Woolgoolga and Ballina, as Glenugie is now complete and Devils Pulpit is under construction.

Figure 1-1 Project overview



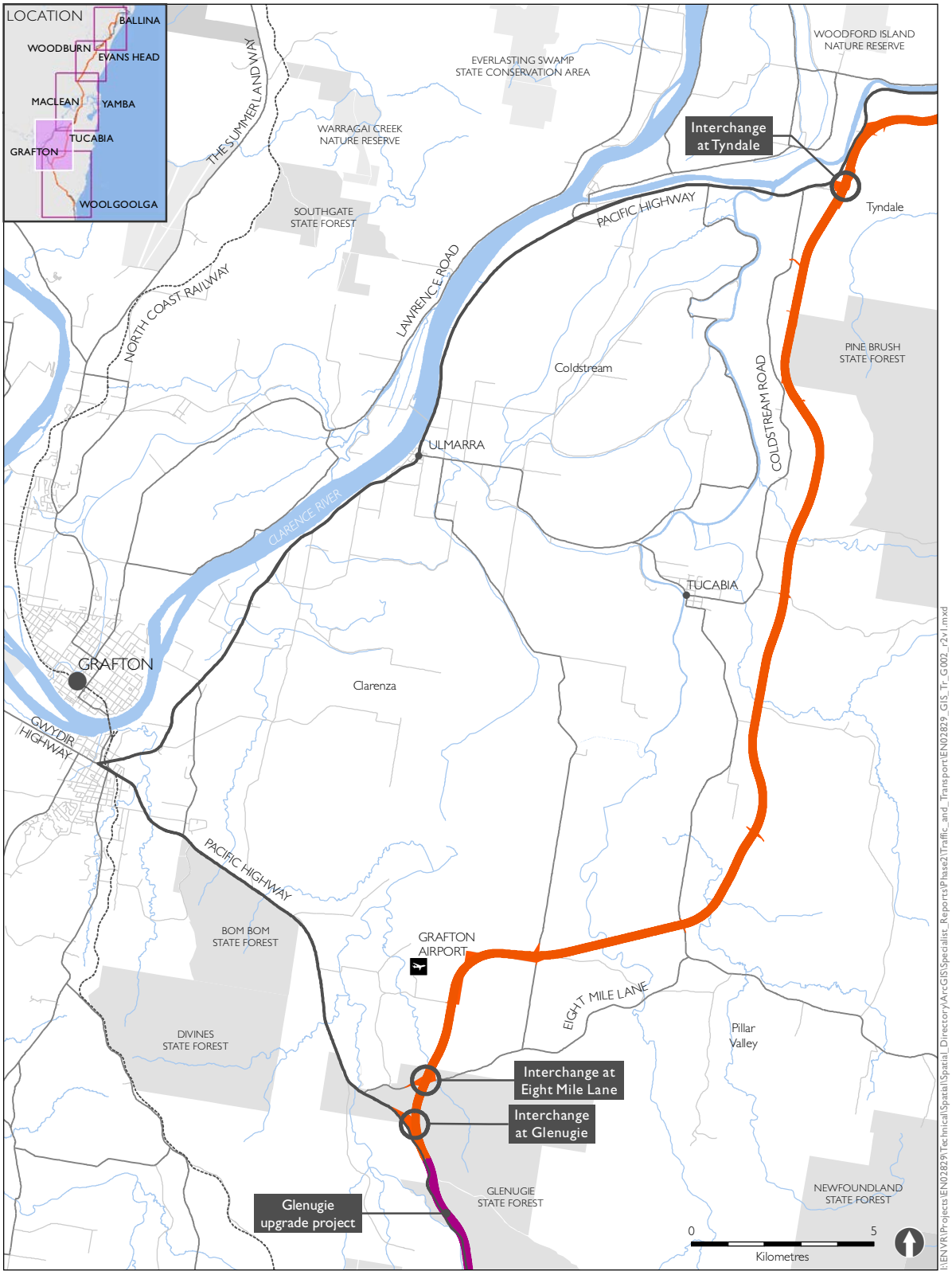
The project
Upgrade completed to dual carriageway
Upgrade under construction
Existing Pacific Highway

Figure 1-2 The project alignment - Arrawarra to Glenugie



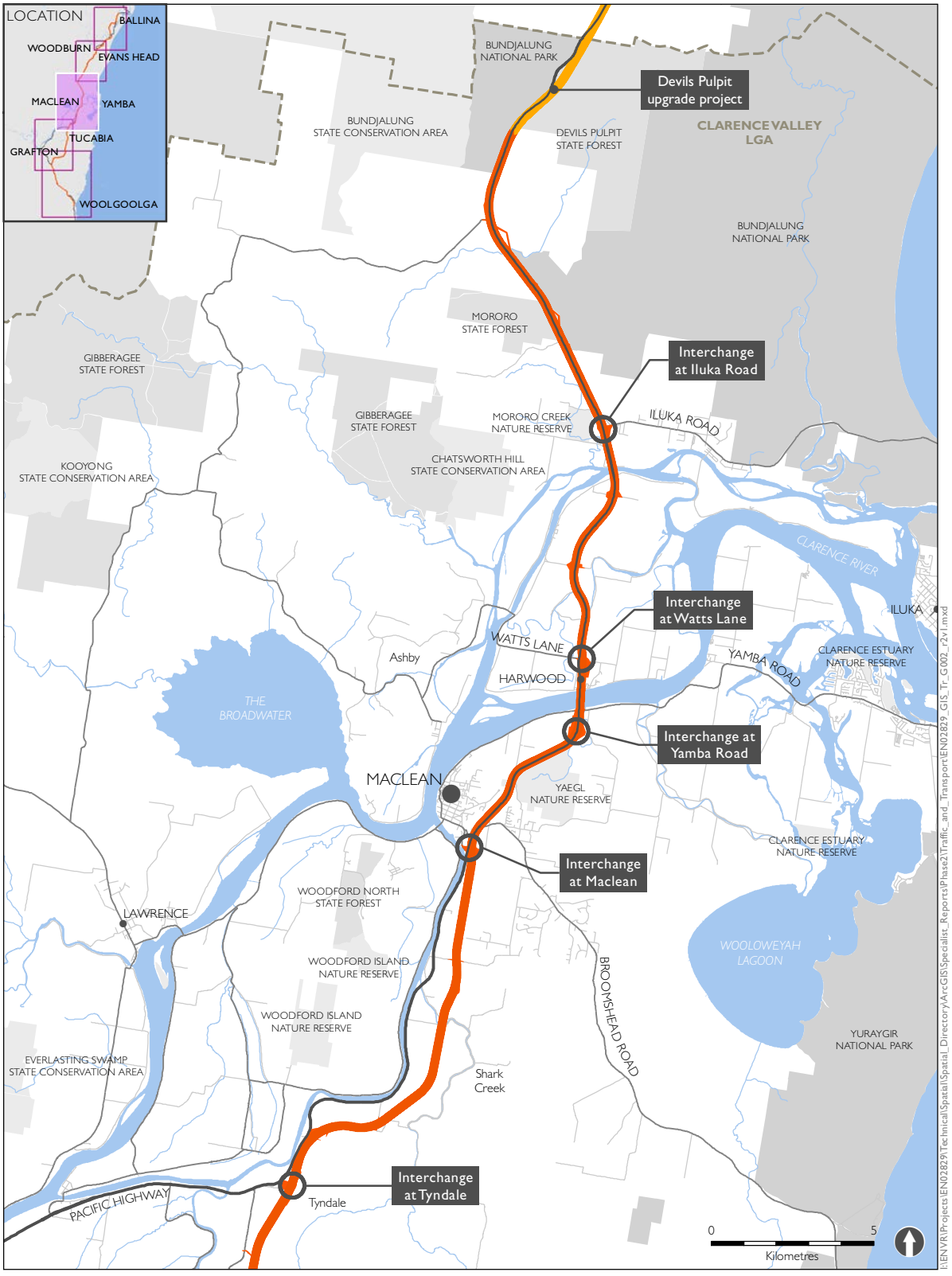
The project
Upgrade completed to dual carriageway
Upgrade under construction
Existing Pacific Highway

Figure 1-3 The project alignment - Glenugie to Tyndale



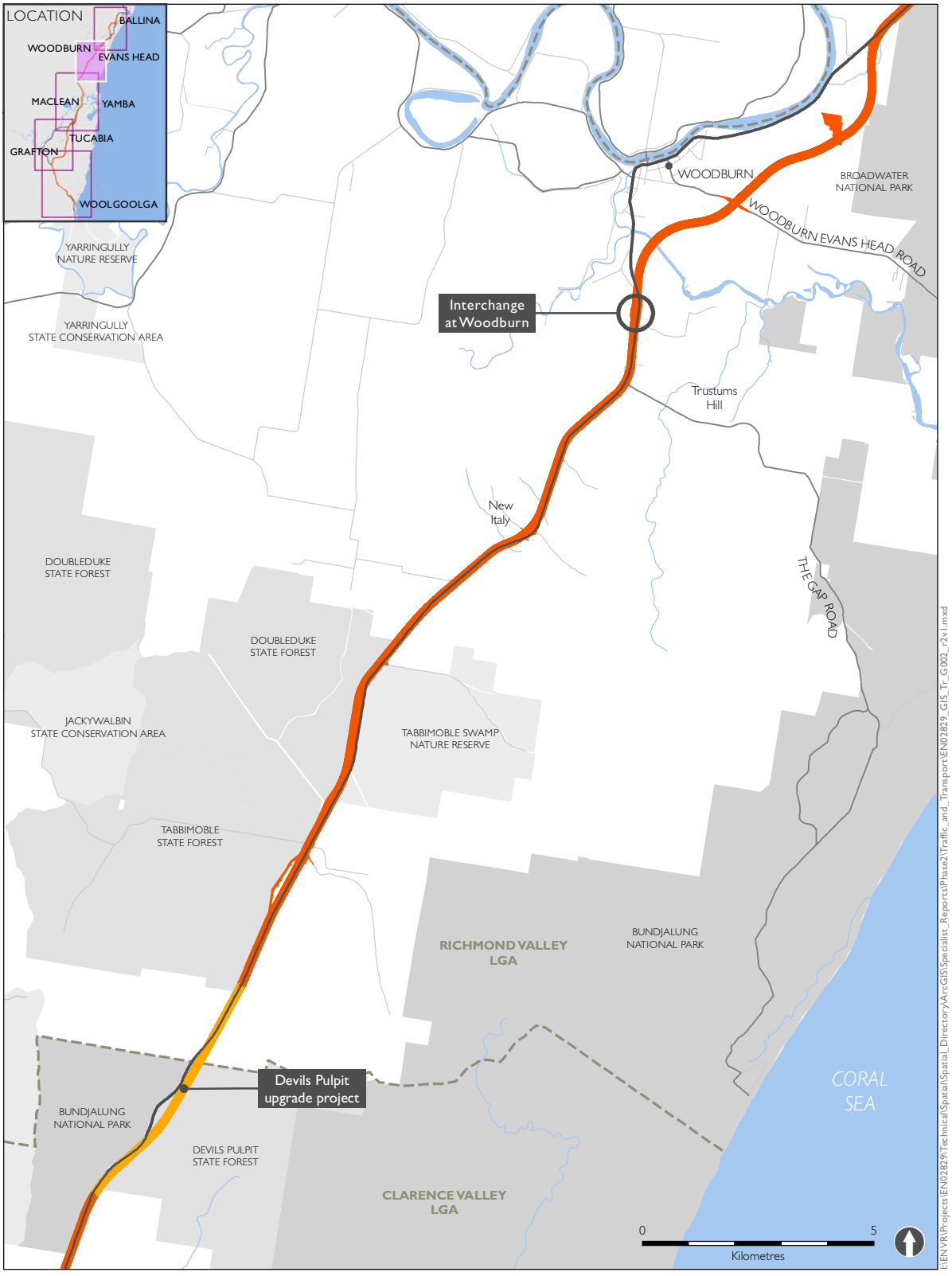
The project
Upgrade completed to dual carriageway
Upgrade under construction
Existing Pacific Highway

Figure 1-4 The project alignment - Tyndale to Devils Pulpit



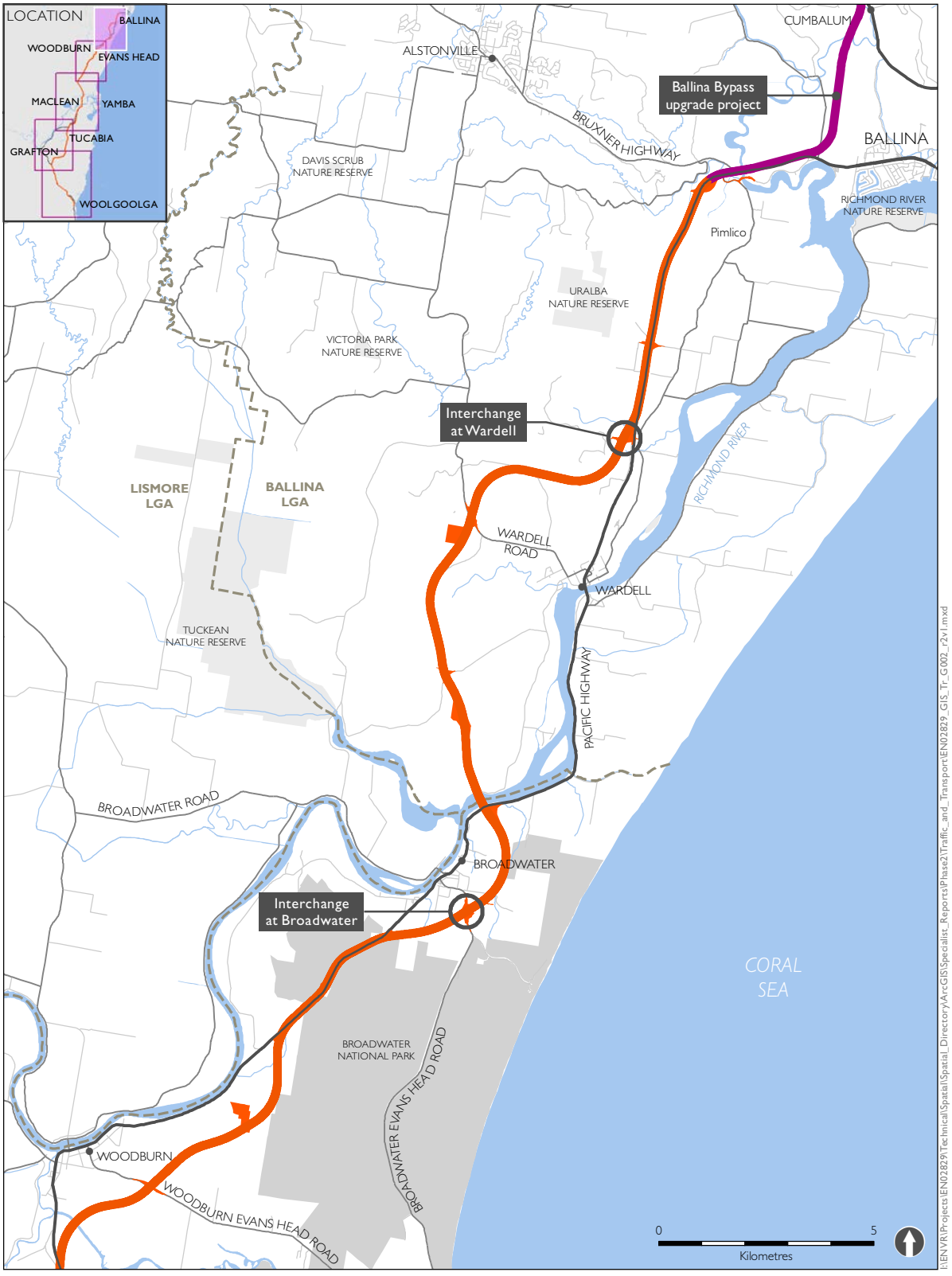
The project
Upgrade completed to dual carriageway
Upgrade under construction
Existing Pacific Highway

Figure 1-5 The project alignment - Devils Pulpit to Woodburn



The project
Upgrade completed to dual carriageway
Upgrade under construction
Existing Pacific Highway

Figure 1-6 The project alignment - Woodburn to Ballina



The project
Upgrade completed to dual carriageway
Upgrade under construction
Existing Pacific Highway

The key features of the project include:

- Around 155 kilometres of motorway standard highway, comprising a four-lane divided carriageway (two lanes in each direction) that can be upgraded to a six-lane divided carriageway in the future, if required
- Bypasses of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell
- Ten interchanges to provide access to and from the upgraded highway at:
    - Range Road (Corindi)
    - Glenugie (Eight Mile Lane)
    - Tyndale (Sheey's Lane)
    - Maclean (Goodwood Street)
    - Yamba Road (Harwood)
    - Watts Lane (Harwood)
    - Iluka Road (Woombah)
    - Woodburn (Trustums Hill Road)
    - Broadwater (Evans Head Road)
    - Wardell (Coolgardie Road)
- About 40 bridge crossings of waterways or floodplains, including bridges over the Clarence and Richmond rivers
- About 55 overbridge and underpasses structures to maintain access along local roads crossed by the project
- Viaducts located where the project would cross low-lying or flood-prone areas
- Service roads and access roads to maintain connections to existing local roads and properties
- Structures to help wildlife cross above or below the project including crossings for tree-dwelling mammals, dedicated culverts under the highway and over-land fauna bridges
- Rest areas located at around 50 kilometre intervals for both northbound and southbound traffic. These are located at:
    - Pine Brush, Tyndale (north and southbound)
    - Mororo Road (southbound)
    - Richmond River (north and southbound)
- Heavy vehicle inspection station located near Halfway Creek.

In addition to these key features, the project would include construction sedimentation basins, operational water quality basins and construction facilities such as compounds and batching plants

Construction would be staged from 2013 onwards following project approval, depending on the availability of funding. Initially the project would be constructed as a combination of class M (motorway) and class A (arterial) as described above. Construction of the project would generally

comprise the conventional techniques employed on most major highway projects, modified for specific environmental or engineering constraints. RMS seeks approval for construction working hours for all day (8am–5pm) on Saturdays and between 6am and 7pm on weekdays.

An indicative outline of construction activities may include:

- Establishment of the construction site and ancillary facilities
- Enabling works, including adjustments to utilities, property adjustments, works to existing drainage and provision of construction access roads
- Clearing and grubbing of vegetation, stripping of topsoil and stockpiling for re-use
- Construction of road cuttings and embankments
- Treating areas of soft soil to stabilise the underlying soil sub-layers
- Installing drainage and bridging structures
- Laying of pavement materials
- Installing pavement markings, signposting, street lighting and progressive landscaping.

The complexity and scale of the project implies that it is not likely to be built in one phase. The project would be delivered in stages as further funding becomes available and to best manage construction and material resources. Stages would be identified that prioritise and target upgrades and works that would best deliver safety and traffic efficiency improvements, and best deliver value for money outcomes.

This working paper assesses the potential impacts of the full motorway standard upgrade for construction and operation. Where there are relevant differences between the full motorway standard upgrade and the initial upgrade to arterial standard, those impacts are also assessed. Impacts are generally identified through the eleven project sections identified above.

Further information on the description of the project and the assessment of other environmental aspects can be found in the main volume of the environmental impact statement.

1.4 Director-General requirements

The overall purpose of this report is to identify and assess the traffic and transport issues identified in the Director-General's environmental assessment requirements for the project (identified in Table 1-2). In addition to these specific requirements, it also addresses community and stakeholder concerns expressed through continuing consultation.

Table 1-2 Director-General's environmental assessment requirements

Environmental assessment requirements	Where addressed in report?
Traffic and transport – including but not limited to: • Demonstration of how the preferred route and road design meets the traffic and transport objectives of the project:	Section 1.4 Section 3.3 Section 3.2 Section 3.4.2
Construction traffic impacts, including: • The identification of routes and the nature of existing traffic on these routes	Section 4.2
• An assessment of construction traffic volumes (including spoil haulage/ delivery of materials and equipment to the road corridor and ancillary facilities)	Section 4.4.1
• Potential impacts to the regional and local road network (including safety and level of service) and potential disruption to existing public transport/ school bus services and access to properties and businesses	Section 4.4 Section 4.6
Operational traffic and transport impacts to the local and regional road network, including: • Changes to access arrangements/ service roads to properties, businesses and State forest road network	Section 3.4.7 Section 3.4.4 Section 3.4.11
• Changes to local road connectivity and impacts on local traffic arrangements, road capacity/ safety, service roads and modified access to the upgraded highway (including potential impacts of changed traffic arrangements on public transport/ school bus services and access for emergency services)	Section 3.4.7 Section 3.4.10 Section 3.4.8
• Traffic capacity of the project and its ability to cater for predicted future growth. Consideration should be given to what effect potential major land use changes in the locality may have on the traffic assessment outcomes	Section 3.4
• Opportunities for the provision of pedestrian and cycle access and connections along the highway and to adjoining communities	Section 3.4.6
• Impacts on maritime use of the Richmond and Clarence rivers and safety of navigation for water based traffic.	Section 3.4.12

1.5 Transport objectives

This report addresses the specific transport objectives of the Pacific Highway Upgrade program that apply to the project, namely:

- Significantly reduce road accidents and injuries
- Reduce travel times
- Reduce freight transport costs.

In addition to these broad objectives, subsidiary objectives for this project have been identified and are tabulated below (Table 1-3).

Table 1-3 Pacific Highway objectives and project transport objectives

Pacific Highway Upgrade Program objective	Project objective	Comment
Significantly reduce road crashes and injuries	Reduce crash rates to 15 crashes or less per 100 million vehicles per kilometres travelled (MVKT).	The provision of a divided, limited-access carriageway is expected to achieve at least this level of crash improvement, representing a 27% reduction in overall crashes.
	Provide a dual carriageway highway with limited or controlled access points and improved overtaking opportunities.	Access to the motorway would be provided via 10 new interchanges. Access to sections initially constructed to arterial road standard would generally allow for direct access from local roads. All sections of the project would provide a divided, dual carriageway as minimum, which would allow overtaking opportunities along the entire length.
	Provide appropriate emergency access facilities.	The project would have a shoulder 2.5 metres wide and a one-metre clearance to the gutter to allow for vehicles to pull over. Combined emergency U-turn bays, maintenance crossovers and stopping bays would be provided every three kilometres.
	Retain existing or provide appropriate driver rest areas.	Five rest areas would be constructed (two northbound and three southbound) at intervals of about 50 kilometres. These would be located at Pine Brush (Tyndale), Mororo Road and at Richmond River. These would provide rest areas additional to those already available.
	Provide a continuous alternative route to the motorway sections to maximise the separation of local traffic from through traffic.	Service roads would provide continuous alternative routes for local and regional traffic, and access to and from the upgraded highway at interchanges. Service roads would generally have a posted speed limit of 80 kilometres per hour, if possible. Initially, some sections would be built as arterial standard and would not have service roads. However, the ultimate upgrade would separate through traffic (which would use the highway) from local traffic (which would use service roads).
Reduce travel times	Increase the capacity of the highway by replacing a two-lane undivided road with a four-lane divided road.	The project would comprise a divided road with two lanes in each direction and a median sufficiently wide to allow further upgrade to three lanes in each direction (six lanes in total), if required.

Pacific Highway Upgrade Program objective	Project objective	Comment
	Provide a route and design that improves traffic flow and allows for consistent travelling speeds.	Posted speed limits would be 100 kilometres per hour where the highway is upgraded to arterial road standard, and 110 kilometres per hour where it is upgraded to motorway standard. By limiting the access points, traffic flow on the highway would be unimpeded by entering or departing traffic. Appropriately located interchanges would ensure that the majority of traffic that does not use the full length of the project would have access to the region without hampering through traffic. The continued upgrade of the highway would improve travel times. At project opening, travel time over the full length of the project is expected to decrease by 25 minutes for all vehicles. This equates to a 19 per cent reduction in travel time from an estimated 2 hours 10 minutes to 1 hour 45 minutes (on average).
	Provide a level of flood immunity that minimises the risk of delays due to flooding.	The project carriageway would be flood-free for the 1 in 20-year flood event on the Clarence River and Richmond River floodplains. Elsewhere, it would be flood-free for the 1 in 100-year flood event.
	Provide facilities for managing and maintaining traffic flow in the event of incidents.	In the event of an incident, the road shoulder and emergency U-turn and stopping bays would enable traffic to continue to flow with minimal interruption. In addition, the divided carriageway would provide more opportunity to set up a contra-flow system in the event of a major emergency.
Reduce freight transport costs	Provide a route and design that increase travel efficiency through reductions in length and improvements in alignment.	The horizontal radius of the project would range between 750 metres and 1200 metres and the vertical grade would range from 4.5% to a maximum of 6%. Compared to the existing alignment, the project would reduce the total distance between Woolgoolga and Ballina from 180 to167 kilometres, a saving of about 13 kilometres.
	Provide a route that improves inter-regional connections and access.	Ten interchanges are proposed to enable access to and from the project and to improve inter-regional connections to key towns and townships.
	Provide a design standard that meets or exceeds B-double truck requirements.	The project has been designed to accord with Pacific Highway Design Guidelines (Draft) (RTA, October 2009 Version R.2). This would ensure consistency with completed sections of the Pacific Highway Upgrade Program. This design would allow the operation of B-double trucks.

1.6 Assessment methodology

The approach for this traffic and transport assessment was based on the evolving concept of the project, recognising the design and consultation iterations that have occurred in recent years. The assessment has been structured along the following lines in order to address the Director-General's environmental assessment requirements.

Reviewed the existing environment:

- Existing traffic and transport network and activity in the study area, principally by a suite of traffic surveys and identification of transport routes
- Recent crash profile for the area, from RMS crash data for 2005-2010
- Regional growth forecasts and forecasts for inter-regional traffic, from Department of Planning and Infrastructure and NSW Government submissions to Infrastructure Australia.

Projected future traffic:

- Future traffic activity at opening (2016) and in future years (2026 an 2036), by development of a SATURN traffic model
- Traffic profile for noise and energy assessment, from detailed time-of-day profiling along the project.

Assessed benefits and impacts:

- Design responses to stakeholder and community consultation, and to impacts on local and regional access, by post-design audit of relevant comment and affected local roads
- Broad operational transport benefits
- Impacts on individual transport services and on local access.

Identified construction effects:

- Construction staging and associated construction traffic impacts
- Impacts on local access during construction.

These are covered in subsequent sections of this report.

1.7 Study area

In this traffic and transport report, the review and assessment of impacts covers the local government areas of Coffs Harbour, Clarence Valley, Richmond Valley and Ballina. Lismore is also included as it is served by the Pacific Highway via the Bruxner Highway and by the Pacific Highway via Woodburn and Coraki from the south. The project crosses south to north through these local government areas, potentially affecting local and regional travel patterns during construction and operation.

2 Existing environment

2.1 Local and regional context

The section of the Pacific Highway between Woolgoolga and Ballina which is the subject of this assessment is located around 550 kilometres north of Sydney and 400 kilometres south of Brisbane on the mid north coast of NSW.

Grafton and Ballina are the regional centres located in the study area. These regional centres are key anchors for the growth of the region and drive the need for infrastructure upgrades throughout the regional transportation network.

Located along major transportation links are regional, major and local towns and centres. These centres provide goods, services and employment to people from surrounding settlements as well as to their own growing populations. Some of them are also important tourist destinations.

The built up areas surrounding the regional major and local towns and centres comprise mainly of residential and rural residential housing and associated farm infrastructure. Growth is mainly along the coast; however rural residential development is dispersed throughout the surrounding study area.

Urban areas are located close to towns and centres and cater for residential and rural residential living. Areas for potential future development have been identified previously and indicate where residential and industrial areas are planned in the region. These areas facilitate the growth of Grafton, Maclean and Yamba.

The study area includes the north coast local government areas of Ballina Shire, Coffs Harbour City Council, Clarence Valley, Richmond Valley and Lismore as shown in Figure 2-1. The Pacific Highway serves the following major towns through these LGAs:

- Coffs Harbour: located to the south of the study area, is the regional and economic centre of the mid north coast of New South Wales. It includes the coastal towns of Coffs Harbour, such as Arrawarra, Woolgoolga and Emerald Beach
- Grafton: located in the centre of the study area, is the regional and economic centre of the Clarence Valley with a population of close to 19,000. Grafton is also at the cross-roads of the Summerland Way, Gwydir Highway and the Pacific Highway. It is an important rail head and freight centre serving the region
- Maclean: located on the Clarence River, about 40 kilometres north of Grafton, services the coastal communities of Brooms Head, and Iluka, as well as the riverside villages of Harwood and Chatsworth
- Yamba is located at the mouth of the Clarence River. The town economy is strongly based on fishing and tourism, but has a diverse range of influences, due to the 'Sea Change' phenomena and the large amount of baby boomers who are starting to retire to the warmer climate

  At the 2006 census (ABS, 2006), Yamba had a population of 5,514, but as a popular tourist destination, it can triple its population in the holiday periods

  The Port of Yamba is one of two regional ports in New South Wales administered by the New South Wales Roads and Maritime Services, the other is at Eden on the South Coast of New

South Wales. A major export from the port is timber. There are regular general cargo services from Yamba to Lord Howe Island, Norfolk Island, and New Zealand

- Ballina: is located to the north of the study area and is a regional centre within the Richmond Valley, servicing the coastal towns of Lennox Head and Byron Bay, as well as Wardell, Tintenbar and Alstonville
- Lismore: is not directly affected, but the LGA has been included in the analysis as the Pacific Highway also serves this area via the Bruxner Highway. In a regional context, Lismore is also accessed more directly from the south via Grafton and the Summerland Way.

In addition to these significant locations, the Pacific Highway serves a number of towns and smaller settlements located along, or accessed directly off, the highway. Such towns include:

- Coffs Harbour: Woolgoolga, Safety Beach, Mullaway, Arrawarra and Corindi Beach
- Clarence Valley: Yamba and Iluka
- Richmond Valley: Woodburn, Wardell and Evans Head.

The project would have benefits for transport and access in the region. Those benefits of particular relevance to transport and access include:

- Future urban land use – the project would provide essential transport infrastructure to support land identified by the NSW Department of Planning and Infrastructure (DP&I) as urban release areas, such as Gulmarrad near Townsend
- Reduce traffic pressure – the project would reduce the demand on traffic surrounding new urban release areas in and near Grafton
- Access and connectivity – the project would improve regional access and travel efficiencies for some residents, tourists and freight transport between destinations within and around the project.

Figure 2-1 Regional location of the project

2.2 Existing regional and local road network

2.2.1 Existing highway

The major road network in the study area, including the project alignment is shown in Figure 2-1. The Pacific Highway is the main north-south route passing through the study area. It is the major interstate and regional route connecting Sydney to Brisbane along the NSW coastline. The North Coast Railway and New England Highway are the main alternative land transport links to the northern parts of NSW, and between NSW and Queensland. However, rail links with Queensland are frustrated by track and gauge incompatibility.

Interconnecting highways within the study area include:

- The Gwydir Highway (Highway 12), an east-west state road linking the Pacific Highway at South Grafton with Glen Innes
- The Summerland Way (Main Road No.83) which connects from the Gwydir Highway at Grafton, then to Junction Hill to Casino and Queensland
- The Bruxner Highway (Highway 16) which connects the Pacific Highway west of Ballina, to the regional centres of Lismore, Casino and Tenterfield to the west.

The Clarence and Richmond Rivers, and their surrounding topography have historically influenced the alignment of the major roads and restricted access within the study area. The Pacific Highway runs from the coastal suburbs of Coffs Harbour and Woolgoolga in the south, along high ground through state forest land to descend onto the Coldstream River flood plain to the southeast of Grafton. The highway then runs parallel to, and east of, the Clarence River to Maclean, crossing the Clarence River at Harwood Bridge. From here, it continues north through low-lying farming lands and national park and state forest land to Woodburn. At Woodburn, the Pacific Highway turns east following the Richmond River before crossing it at Wardell. The Pacific Highway continues north through low lying lands to its intersection with the Bruxner Highway, from which it turns east towards Ballina.

To the south of Grafton, and further north towards and past Maclean, the Pacific Highway is flood-prone. This has impacts on local residents as well as regional and interstate vehicles.

The Pacific Highway provides the primary access to a number of smaller townships and villages in the vicinity of the project. Access to towns located off the Pacific Highway is as follows:

- Access to Evans Head is via Alfred Street and Wagner Street, Woodburn, which is a sealed two-lane two-way road. Both intersections are priority-controlled
- Access to Iluka from the highway is via an at-grade intersection north of the Clarence River. Access to Yamba is south of the Clarence River. Both accesses are sealed two-lane two-way roads. The Yamba interchange is grade separated, as the Yamba access road passes under the bridge over the Clarence River. The intersections of the ramps with Yamba Rd are priority-controlled
- Access to Tucabia is via Old Coldstream Road, Ulmarra or via the Tucabia-Tyndale Road, both of which are sealed two-lane two-way roads. These intersect with the highway at priority-controlled intersections
- Access to Pillar Valley, Minnie Water and Wooli is via Eight Mile Lane to the south of Grafton, or via Old Coldstream Road and Wooli Road, Ulmarra. Both roads are sealed, intersecting with the highway at priority-controlled intersections. Speed limits along these routes in rural areas

are 100 kilometres per hour. Both roads are low lying and prone to flooding in areas. The unsealed Firth Heinz Road, located to the south of Tucabia, is a designated flood detour route to Wooli.

2.2.2 The Pacific Highway carriageway configuration and road side facilities

Between Woolgoolga and Ballina, the Pacific Highway is predominantly undivided, with one lane in each direction However, overtaking lanes are provided at regular intervals in both directions. For the majority of the study area, property access is directly off the highway, with some service roads provided where recent upgrades have been carried out. Some sections of the Pacific Highway in the project have short sections of dual carriageway, eg Swan Creek, Cowper and Mororo, and several sections have benefited from a range of safety improvements or are currently in the process of being upgraded. These include:

- Tyndale realignment (completed in 2000) – single carriageway realignment of 900 metres of the highway and redesign of the intersection at Sheeys Lane
- Halfway Creek (completed in 2004) – 2.5 kilometres of the highway was upgraded to dual carriageway, with the redundant highway carriageway becoming a service road
- Gap Road (completed in 1998) – four kilometre of the highway was improved including some realignment to eliminate a number of sharp bends to the south of Woodburn
- Glenugie – seven kilometres of the highway has recently been upgraded, including 5.8 kilometres of dual carriageway, between Franklins Road and Eight Mile Lane, with part of the existing highway becoming a service road
- Devils Pulpit (under construction) – 6.4 kilometre realignment from 1.2 kilometres south of South Pine Road, to north of Tabbimoble Overflow No. 2. The existing highway would be retained as a service road. Some three kilometres of the project would have wire rope traffic separation.

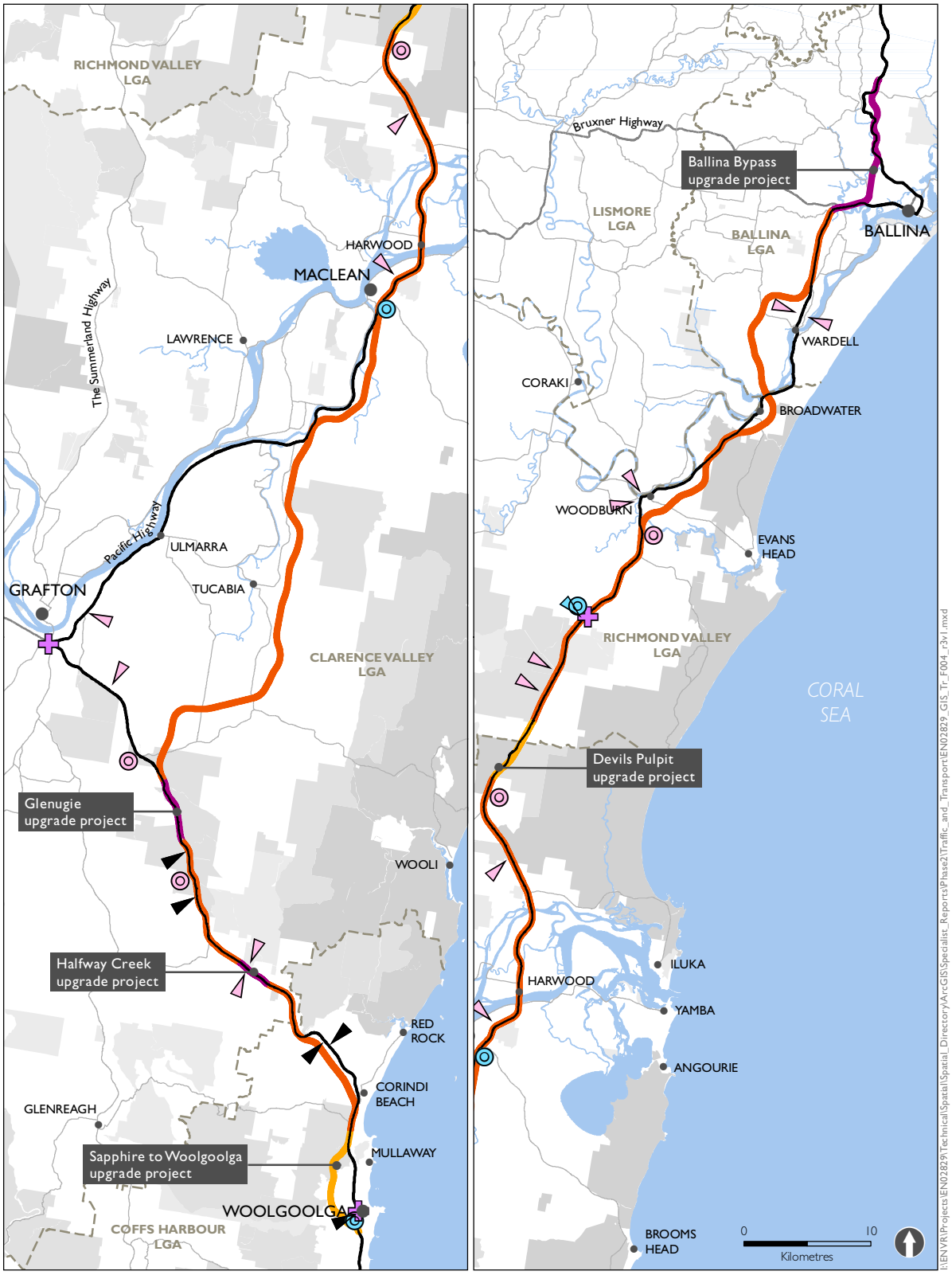
Rest areas and truck stops are located at various points along the Pacific Highway and within each town, as shown in Figure 2-2.

Tourist Information Centres are located within major towns along the existing Pacific Highway alignment. Tourist Information Centres and existing rest areas with direct access off the highway are located at:

- Ferry Park, Maclean. This is located on the western side of the Pacific Highway at Cameron Street
- South Grafton. This is located on the western side of the Pacific Highway between the Gwydir Highway and Spring Street.

In rural areas, school bus drop off bays are located along the route, either at property accesses or on approach roads adjacent to intersections with the highway.

Figure 2-2 Location of existing rest areas along the Pacific Highway



2.2.3 Local road network characteristics

The local road network in the project is dominated by farming access, particularly along the river flats between Grafton and Chatsworth, and between Woodburn and Ballina.

The city of Grafton and the township of Maclean are located away from the existing highway, with their own local access networks. The highway passes through the villages of Woodburn, Broadwater and Wardell. Harwood is bisected by the highway, although connectivity within the village is maintained by an underpass located alongside the Clarence River. Access to the village is via an at-grade intersection at its northern end.

In addition to Grafton, Yamba represents a significant local destination, especially for southbound traffic.

There are a large number of local roads that are intersected by, join or interact with the project alignment. The majority of these roads service very small communities or unpopulated areas and experience very low volumes of traffic movements each day. A detailed review of all local roads along the project alignment has been undertaken. The roads with which the project interacts are listed from the south to the north, by project section in Table 2-1, along with estimates of affected population and indicative traffic volumes.

Without appropriate attention to ensuring connectivity and access, the project would have an impact on these roads either operationally or during the construction phase. These impacts and their amelioration are discussed in Sections 3.4.7 and 4.4.2, with detail provided as to the retained connectivity.

Table 2-1 Local road network characteristics

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Woolgoolga to Halfway Creek (1)	0	Arrawarra Beach Road	Arrawarra	516	Low	Yes
Woolgoolga to Halfway Creek (1)	0.6	Sherwood Creek Road, Arrawarra	Upper Corindi	1092	Low	No
Woolgoolga to Halfway Creek (1)	0.1	Eggins Drive connection to Pacific Highway near Eggins Close	Darlinton Beach	220 dwellings (Approx)	Low	Yes
Woolgoolga to Halfway Creek (1)	2.5	Kangaroo Trail Road, Corindi Beach	Private property	Less than 10 dwellings (assumed)	Low	No
Woolgoolga to Halfway Creek (1)	6.55	Paper Road, 600m north of Post office lane, Corindi Beach	Private property	Less than 10 dwellings (assumed)	Low	No
Woolgoolga to Halfway Creek (1)	9.6	Range Road, Dirty Creek	Dirty Creek	555	Low	No
Woolgoolga to Halfway Creek (1)	9.8	New lookout road, Dirty Creek	NA	NA	Low	No
Woolgoolga to Halfway Creek (1)	9.6	Range Road East, Dirty Creek	NA	NA	Low	No
Woolgoolga to Halfway Creek (1)	10.5	Dundoo Reach Road, Dirty Creek	NA	NA	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Woolgoolga to Halfway Creek (1)	11.4	Dirty Creek Road, Halfway Creek	Barcoongere and Newfoundland State Forests	NA	Low	No
Woolgoolga to Halfway Creek (1)	11.95	Falconers Lane, Milleara	NA	NA	Low	No
Woolgoolga to Halfway Creek (1)	12	The Siding, Milleara	NA	NA	Low	No
Woolgoolga to Halfway Creek (1)	13.2	McPhillips Road, Halfway Creek	Private property	Less than 10 dwellings (assumed)	Low	No
Woolgoolga to Halfway Creek (1)	14.3	Dunmar Lane, Halfway Creek	Private property	Less than 10 dwellings (assumed)	Low	No
Woolgoolga to Halfway Creek (1)	15.65	Grays Road, Halfway Creek	Private property	12 dwellings	Low	No
Woolgoolga to Halfway Creek (1)	15.75	Rediger Close, Halfway Creek	Private property	Less than 10 dwellings (assumed)	Low	No
Halfway Creek to Glenugie (2)	17.5	Lemon Tree Road, Halfway Creek	Private property	Less than 10 dwellings (assumed)	Low	No
Halfway Creek to Glenugie (2)	20.3	Kungala Road, Halfway Creek	Halfway Creek	264	Low	No
Halfway Creek to Glenugie (2)	20.8	Luthers Road, Halfway Creek	Private property	Less than 10 dwellings (assumed)	Low	No
Halfway Creek to Glenugie (2)	23.5	Parker Road, Wells Crossing	Wells Crossing	302	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Halfway Creek to Glenugie (2)	25.1	Bald Knob Tick Gate Road, Wells Crossing	Yuraygir Crown Reserve	NA	Low	No
Halfway Creek to Glenugie (2)	28	Franklins Road, Glenugie	Calamia, Glenugie State Forest	NA	Low	No
Halfway Creek to Glenugie (2)	31.2	Old Pacific Highway (southern connection), Glenugie	NA	NA	Low	No
Glenugie to Tyndale (3)	36	Eight Mile Lane, Glenugie	Glenugie, Pillar Valley, Grafton Regional Airport	650 (approx)	Low	Yes
Glenugie to Tyndale (3)	39.1	Old Six Mile Lane, Lavadia	Grafton Regional Airport	70 (approx)	Low	Yes
Glenugie to Tyndale (3)	41.45	Avenue Road, Lavadia	Private property	Less than 10 dwellings (assumed)	Low	No
Glenugie to Tyndale (3)	41.9	Wants Lane, Lavadia	NA	NA	Low	No
Glenugie to Tyndale (3)	45.5	Wooli Road, Pillar Valley	Wooli, Pillar Way, Tucabia	1135	Low	Yes
Glenugie to Tyndale (3)	48.8	Mitchell Road, Pillar Valley	Private property	Less than 10 dwellings (assumed)	Low	No
Glenugie to Tyndale (3)	51.9	Firth Heinz Road, Tucabia	Private property	25 dwellings	Low	No
Glenugie to Tyndale (3)	55.5	Bostock Road, Tucabia	Private property	Less than 10 dwellings (assumed)	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Glenugie to Tyndale (3)	56.9	Somervale Road, Tucabia	Pine Brush State Forest, Private property	Less than 10 dwellings (assumed)	Low	No
Glenugie to Tyndale (3)	63.6	No Name - From Coldstream Road, Tyndale	Private property	Less than 10 dwellings (assumed)	Low	No
Glenugie to Tyndale (3)	64.9	Crowley Road, Tyndale	Private property	Less than 10 dwellings (assumed)	Low	No
Glenugie to Tyndale (3)	66.6	Benson Lane, Tyndale	Private property	Less than 10 dwellings (assumed)	Low	No
Glenugie to Tyndale (3)	67.2	Sheeys Lane, Tyndale	Private property	25 dwellings	Low	No
Tyndale To Maclean (4)	69.4	Connection to Bondi Hill Road, Tyndale - Access road over main alignment	Private property	Less than 10 dwellings (assumed)	Low	No
Tyndale To Maclean (4)	69.4	Bondi Hill Road, Tyndale	Private property	Less than 10 dwellings (assumed)	Low	No
Tyndale To Maclean (4)	71.2	Byron's Lane, Tyndale	Private property	Less than 10 dwellings (assumed)	Low	No
Tyndale To Maclean (4)	74.05	Norleys Lane, Shark Creek	NA	NA	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Tyndale To Maclean (4)	75.1	Gallagher's Lane, Shark Creek	Private property	Less than 10 dwellings (assumed)	Low	No
Tyndale To Maclean (4)	75.2	Shark Creek Road, Shark Creek	Private property	Less than 10 dwellings (assumed)	Low	No
Tyndale To Maclean (4)	75.4	Stokes Road, Gullmarrad	Private property	Less than 10 dwellings (assumed)	Low	No
Tyndale To Maclean (4)	77	McIntyres Lane, Gulmarrad	Gulmarrad	1644	Low	No
Tyndale To Maclean (4)	77.8	Clyde Essex Drive, Gulmarrad	Gulmarrad	1644	Low	No
Tyndale To Maclean (4)	78.4	Causeleys Lane, Gulmarrad	Gulmarrad	1644	Low	No
Tyndale To Maclean (4)	80.45	Cameron Street, Maclean	Maclean	2600	Low	Yes

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Tyndale To Maclean (4)	80.55	Goodwood Street, Maclean	Private property	Less than 10 dwellings (assumed)	Low	No
Tyndale To Maclean (4)	81.2	Jubilee Street, Maclean	Townsend	817	Low	No
Tyndale To Maclean (4)	81.5	Schwonberg Street, Maclean	Private property	Less than 10 dwellings (assumed)	Low	No
Maclean to Iluka (5)	83.1	Koala Drive/Farlows Lane, Maclean	Private property	30 dwellings	Low	No
Maclean to Iluka (5)	86.2	Yamba Road, Maclean	Maclean, Parmers Island, Yamba	8,500	Medium	Yes
Maclean to Iluka (5)	86.9	River Street, Harwood	Harwood	356	Low	No
Maclean to Iluka (5)	87	Petticoat Lane, Harwood	Harwood	356	Low	No
Maclean to Iluka (5)	87.8	Watt Lane, Harwood	Harwood	356	Low	No
Maclean to Iluka (5)	89.064	Anderson Lane, Harwood	Private property	Less than 10 dwellings (assumed)	Low	No
Maclean to Iluka (5)	89.3	Serpentine Channel Road South, Harwood	Private property	Less than 10 dwellings (assumed)	Low	No
Maclean to Iluka (5)	90	Ryan's Lane, Chatsworth	Private property	Less than 10 dwellings (assumed)	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Maclean to Iluka (5)	90.8	Chatsworth Road/Serpentine Channel Road North, Chatsworth	Chatsworth	215	Low	No
Maclean to Iluka (5)	93.3	Carroll's Lane, Chatsworth	Chatsworth	215	Low	No
Maclean to Iluka (5)	93.85	Chatsworth Road, Chatsworth	Chatsworth	215	Low	No
Maclean to Iluka (5)	93.85	Fischer's Road, Chatsworth	Private property	Less than 10 dwellings (assumed)	Low	No
Maclean to Iluka (5)	94.5	Garrett's Lane East, Wombah	Private property	Less than 10 dwellings (assumed)	Low	No
Maclean to Iluka (5)	94.7	Garrett's Lane/Lewis Lane, Mororo	Private property	Less than 10 dwellings (assumed)	Low	No
Maclean to Iluka (5)	95.45	Iluka Road, Woombah	Woombah	745	Low	No
Maclean to Iluka (5)	96.05	Banana Road, Mororo	Private property	Less than 10 dwellings (assumed)	Low	No
Iluka to Devils Pulpit (6)	98.4	Mororo Road, Mororo	Private property	20 dwellings	Low	No
Iluka to Devils Pulpit (6)	103.4	Old Pacific Highway, Mororo	NA	NA	Low	No
Devils Pulpit to Trustums Hill (7)	102.75	Tullymorgan-Jacky Bulbin Road	Jacky Bulbin Flat	NA	Low	No
Devils Pulpit to Trustums Hill (7)	114.3	Serendipity Road, Tabbimoble	Private property	Less than 10 dwellings (assumed)	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Devils Pulpit to Trustums Hill (7)	114.5	Glencoe Road, Tabbimoble	Tabbimoble State Forest and Doubleduke State Forest	NA	Low	No
Devils Pulpit to Trustums Hill (7)	118.8	Minyumai Road, Tabbimoble	Tabbimoble State Forest	NA	Low	No
Devils Pulpit to Trustums Hill (7)	119.5	Cypress Road, Tabbimoble	Tabbimoble State Forest	NA	Low	No
Devils Pulpit to Trustums Hill (7)	121.1	Swan Bay - New Italy Road, New Italy	New Italy	295	Low	No
Devils Pulpit to Trustums Hill (7)	123.05	Whites Road, New Italy	Private property	Less than 10 dwellings (assumed)	Low	No
Devils Pulpit to Trustums Hill (7)	122.9	Red Gates Road/Turners Road, New Italy	NA	NA	Low	No
Devils Pulpit to Trustums Hill (7)	124.8	Norton's road, New Italy	NA	NA	Low	No
Trustums Hill to Broadwater National Park (8)	127	The Gap Road, The Gap	Bunjalung National Park	NA	Low	No
Trustums Hill to Broadwater National Park (8)	127.5	Wondawee Way, Woodburn	NA	NA	Low	No
Trustums Hill to Broadwater National Park (8)	127.5	Sharpe Road, Trustums Hill	Private property	Less than 10 dwellings (assumed)	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Trustums Hill to Broadwater National Park (8)	128.2	Brickella Road	NA	NA	Low	No
Trustums Hill to Broadwater National Park (8)	128.3	Tuckombil Road, The Gap	NA	NA	Low	No
Trustums Hill to Broadwater National Park (8)	129	Trustums Hill Road, Woodburn	Private property	15 dwellings	Low	No
Trustums Hill to Broadwater National Park (8)	129.3	Pacific Highway, Trustums Hill, Woodburn	Woodburn	775	Low	No
Trustums Hill to Broadwater National Park (8)	131.1	Watsons Road, Woodburn	Private property	Less than 10 dwellings (assumed)	Low	No
Trustums Hill to Broadwater National Park (8)	132.1	Woodburn - Evans Head road, Woodburn	Woodburn, Evans Head	3000	Medium	Yes
Broadwater National Park to Richmond River (9)	140.7	Pacific Highway, Woodburn, Rileys Hill and Broadwater (through Broadwater National Park)	RileysHill, Broadwater	650	Low	No
Broadwater National Park to Richmond River (9)	142.7	Broadwater - Evans Head road, Broadwater	Evans Head, Broadwater	3000	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Broadwater National Park to Richmond River (9)	143.8	Broadwater Quarry Road, Broadwater	Private Property	Less than 10 dwellings	Low	No
Broadwater National Park to Richmond River (9)	143.6	Fisher Street, Broadwater	Broadwater	435	Low	No
Broadwater National Park to Richmond River (9)	144.1	Byrnes Street, Broadwater	Private property	Less than 10 dwellings (assumed)	Low	No
Broadwater National Park to Richmond River (9)	145.6	Pacific Highway, Broadwater	Broadwater	435	Low	No
Richmond River to Coolgardie Road (10)	146	Back Channel Road, Wardell	Private property	Less than 10 dwellings (assumed)	Low	No
Richmond River to Coolgardie Road (10)	148.9	Old Bagotville Road	Private property	Less than 10 dwellings (assumed)	Low	No
Richmond River to Coolgardie Road (10)	149	Montis Road, Wardell	Private property	Less than 10 dwellings (assumed)	Low	No
Richmond River to Coolgardie Road (10)	151.25	Thurgates Lane, Wardell	Private property	Less than 10 dwellings (assumed)	Low	No
Richmond River to Coolgardie Road (10)	152.8	Hillside Lane, Wardell	Private property	Less than 10 dwellings (assumed)	Low	No

Project section	Station (km)	Road and location	Town / village / location serviced	Population / number of properties	Traffic volume	Seasonal changes
Richmond River to Coolgardie Road (10)	152.9	Wardell Road, Wardell	Wardell	959	Medium	No
Richmond River to Coolgardie Road (10)	154.35	Lumley's Lane, Wardell	Private property	Less than 10 dwellings (assumed)	Low	No
Richmond River to Coolgardie Road (10)	157.5	Kay's Road	Private property	Less than 10 dwellings (assumed)	Low	No
Richmond River to Coolgardie Road (10)	157.5	Coolgardie Road, Wardell	Wardell	Less than 10 dwellings (assumed)	Low	No
Coolgardie Road to Ballina Bypass (11)	159.15	Laws Road, Pimlico	Private Property	Less than 10 dwellings	Low	No
Coolgardie Road to Ballina Bypass (11)	159.83	Whyte's Lane, Pimlico	Pimlico	454	Low	No
Coolgardie Road to Ballina Bypass (11)	159.8	McAndrews Lane, Pimlico	Pimlico	454	Low	No
Coolgardie Road to Ballina Bypass (11)	160	Whyte's Lane West, Pimlico	Private Property	Less than 10 dwellings	Low	No
Coolgardie Road to Ballina Bypass (11)	164.3	Pimlico Road, Pimlico	Pimlico	454	Low	No
Coolgardie Road to Ballina Bypass (11)	164.7	Smiths Drive, Ballina	Private Property	85 dwellings	Low	No

2.3 Existing highway usage and capacity

This study forecasts future traffic patterns, based on the existing traffic profile on the Pacific Highway between Woolgoolga and Ballina, identified through:

- Traffic flow and vehicle classification surveys to identify level and type of road vehicle activity
- Traffic origin/destination surveys to identify travel patterns
- Hourly traffic profiles that indicate daily peak and overnight traffic patterns
- Reference to travel time surveys for the project area[1].

A base year traffic model was developed using the SATURN traffic modelling software. This is a suite of flexible network analysis programs. It provides a platform for integration of known current traffic patterns and varying growth indicators for different zones within the study area and different vehicles classes. Traffic origin-destination surveys were used to prepare a trip matrix for the study area, which was calibrated against additional traffic counts. This provided a current base model that was growthed by identifiable regional growth factors and enhanced by inclusion of the project as an alternative to the remaining sections of the highway.

2.3.1 Current traffic

SkyHigh Pty Ltd were engaged to undertake origin-destination (O-D) trip surveys along the Pacific Highway corridor between points north of Woolgoolga and just south of Ballina. The survey locations are identified in Table 2-2, and presented in Figure 2-3.

The survey methodology included two main components:

- Twenty four hour vehicle number plate data was collected at 15 nominated sites, using a video photography technique. This survey was undertaken between 01:00 am on 8 November and 03:00 am on 9 November 2011 ensuring data overlap. The selected sites, shown in Table 2-2, were based on the existing town centres and their level of access to the Pacific Highway. The aim of this exercise was to identify the O-D trip of each recorded number plate, and then to aggregate similar O-D trips accordingly. This also yielded stopping patterns for vehicles in the townships along the route. The resulting OD trip matrix was a preliminary estimate for the O-D matrix used in the SATURN traffic model, which was then calibrated using traffic flow data
- A full week of traffic flow data (tube count) was collected along the Pacific Highway, at either side of the nominated key town centre access points. The purpose of this exercise was to corroborate the number plate survey, and identify whole-of-week traffic levels at key locations accessing the existing highway.

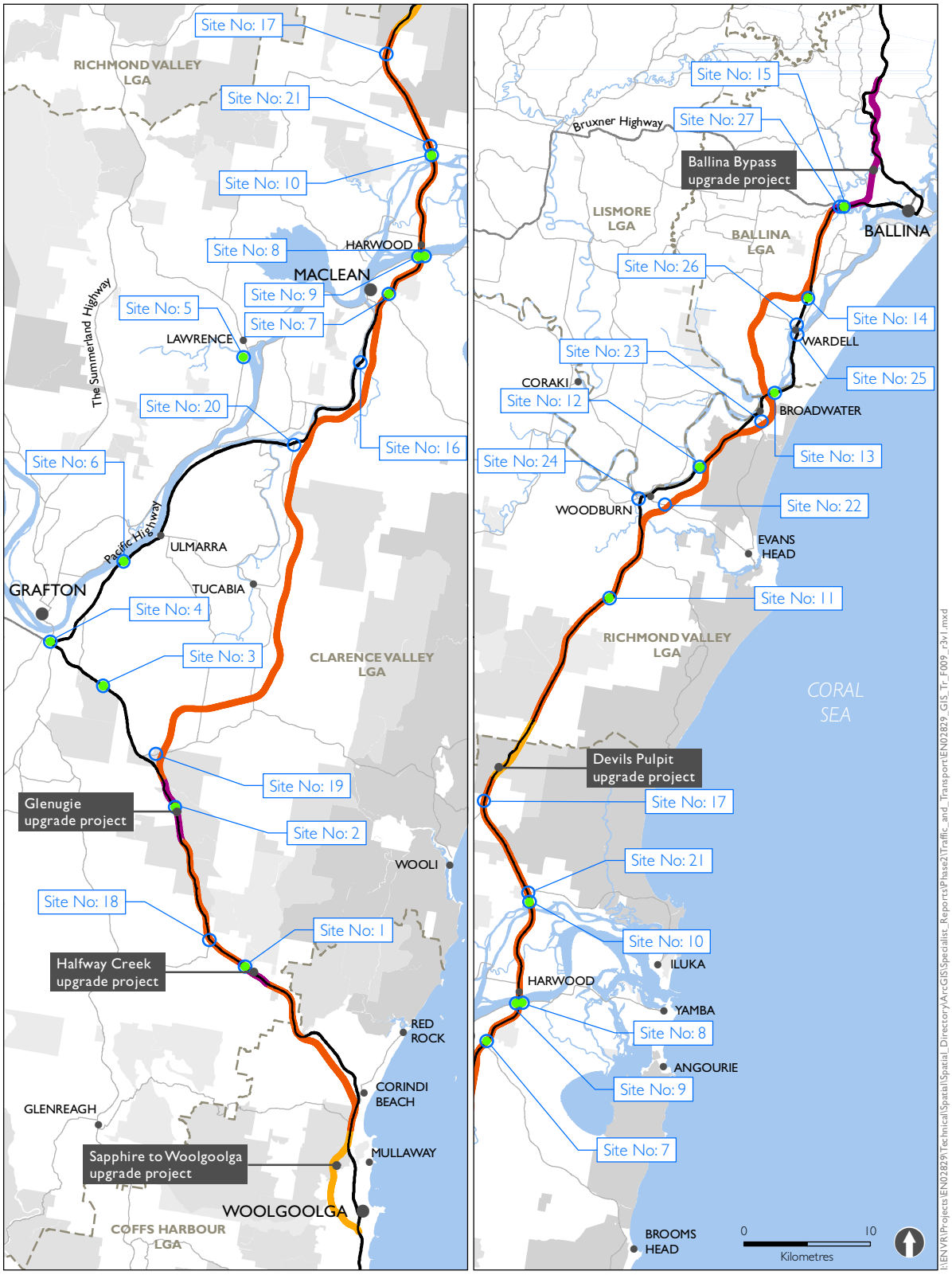
[1] Existing speed profiles were derived from measured travel speeds in the NRMA Pacific Highway Route Performance Final Report (Jiang et al., 2006).

Table 2-2 Survey locations

Site identifier	Road	Location	O-D data	Tube count
1	Pacific Highway	3.5 km south of Kungara Road, Halfway Creek	Y	Y
2	Pacific Highway	5 km south of Eight Mile Lane, Calamia	Y	Y
3	Pacific Highway	50 m south of Four Mile Lane, Bom Bom	Y	Y
4	Gwydir Highway	East of Gwydir Hwy/ Bent St/ Ryan Street roundabout, South Grafton	Y	Y
5	Grafton-Lawrence Road	South of River Bank Road, Lower Southgate	Y	Y
6	Pacific Highway	North of McLaclans Lane, Swan Creek	Y	Y
7	Pacific Highway	1.65 km north of Cameron Street, Maclean	Y	Y
8	Yamba Road	East of James Creek Rd, James Creek	Y	Y
9	Yamba Road	West of western ramp at Yamba Road/ Pacific Hwy interchange	Y	Y
10	Pacific Highway	South of Lewis Lane, Woombah	Y	Y
11	Pacific Highway	South of Turners Road, The Gap	Y	Y
12	Pacific Highway	50 m south of Rileys Hill Rd, Rileys Hill	Y	Y
13	Pacific Highway	1.35 km north of Richmond St, Broadwater	Y	Y
14	Pacific Highway	1 km south of Coolgardie Rd, Coolgardie	Y	Y
15	Pacific Highway	300 m east of Bruxner Highway, Uralba	Y	Y
16	Pacific Highway	North of Shark Creek Road, Shark Creek		Y
17	Pacific Highway	900 m north of Jacky Bulbin Road, Jacky Bulbin Flat		Y
18	Kungara Rd	50 m west of Pacific Highway, Halfway Creek		Y
19	Eight Mile Lane	50 m east of Airport Road, Glenugie		Y
20	Tucabia-Tyndale Road	200 m south of Pacific Highway, Tyndale		Y
21	Iluka Road	East of Pacific Highway, Woombah		Y
22	Evans Head Road	650 m east of Norman Street, Woodburn		Y
23	Evans Head-Broadwater Road	200 m south of Macdonald Street, Broadwater		Y
24	Coraki-Broadwater Road Bridge	West of Pacific Highway, Broadwater		Y
25	River Drive	East of Pacific Highway, Wardell		Y
26	Carlisle Street	West of Pacific Highway, Wardell		Y
27	Bruxner Highway	North of Pacific Highway, Uralba		Y

These surveys have been complemented by best available data from past studies and from RMS.

Figure 2-3 O-D data and tube counts



2.3.2 Daily traffic volumes

The surveys undertaken along the corridor provide a clear indication of average daily traffic and are presented in the following Table 2-3.

Table 2-3 Surveyed traffic volumes 2011

Section	Location	Light vehicles (average daily volume)	Heavy vehicles (average daily volume)	Total daily volume	% Heavy vehicle
1	Woolgoolga to Halfway Creek upgrade	6,538	2,133	8,671	25%
2	Halfway Creek upgrade to Glenugie upgrade	6,111	2,180	8,291	26%
3	Glenugie upgrade to Tyndale	7,377	2,178	9,555	23%
4	Tyndale to Maclean	7,327	2,151	9,478	23%
5	Maclean to Iluka Road	9,298	2,413	11,711	21%
6	Iluka interchange to Devil's Pulpit upgrade	5,149	2,008	7,157	28%
7	Devil's Pulpit upgrade to Trustums Hill	5,149	2,008	7,157	28%
8	Trustums Hill to Broadwater National Park	6,383	2,226	8,609	26%
9	Broadwater National Park to Richmond River	6,797	2,233	9,030	25%
10	Richmond River to Coolgardie Road	7,512	2,223	9,735	23%
11	Coolgardie Road to Ballina **	18,994	2,758	21,752	13%

*** Adjacent to proposed upgrade section of the project*

2.3.3 Hourly profile

Hourly profiles show traffic volumes per hour over a 24-hour period. They identify the differences between light and heavy vehicles. The hourly profile is expressed as a percentage of the corresponding total volume. Hourly profiles have been extracted for each of the eleven sections of the project. Figure 2-4 presents the corridor average[2] hourly profile for the project.

The progressive upgrading of the Pacific Highway to meet increased travel demand has provided a safer and more efficient inter-regional travel route. This has resulted in the highway becoming the favoured route for long-distance heavy vehicle trips in comparison with the New England Highway.

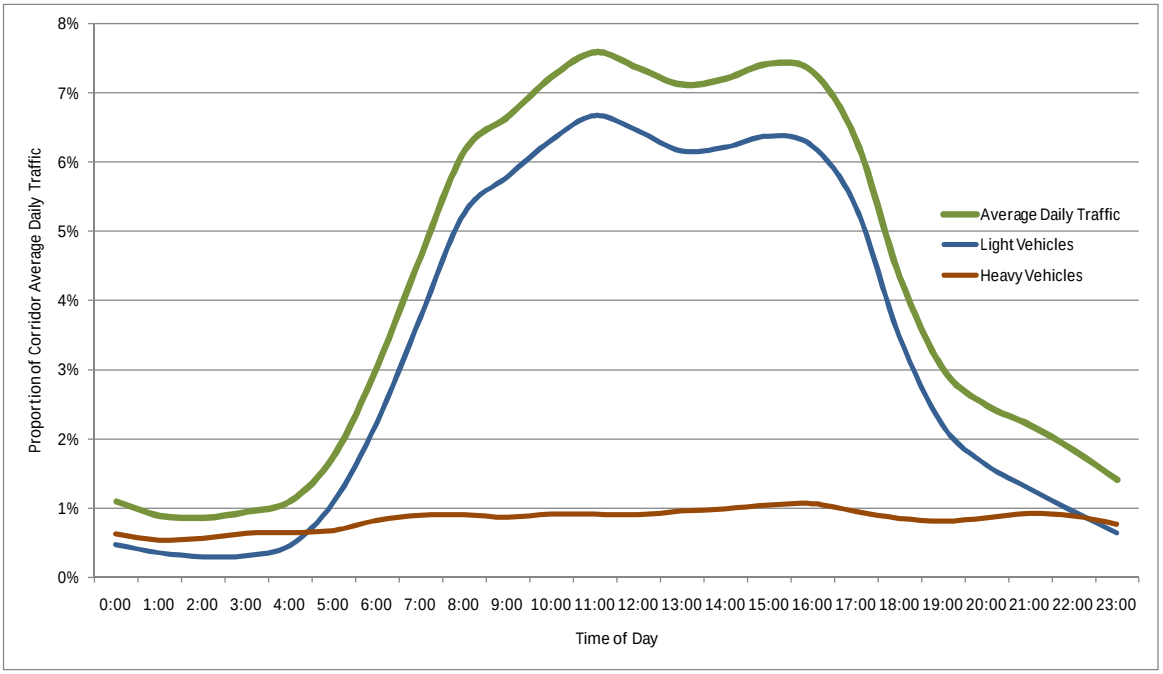
Heavy vehicles[3] make up more than 20 per cent of total daily traffic on the highway in the project area. About 50 per cent of these heavy vehicles are long distance vehicles travelling through the area.

Articulated vehicles make up around 75 per cent of heavy vehicles and 15 per cent of total traffic on the highway.

In comparison with car traffic, which peaks during the middle of the day, heavy vehicle traffic remains fairly constant throughout the day.

[2] Total of all hourly traffic volumes in each section as portion of total daily traffic.
[3] Heavy vehicles are regarded as those with a GVM of more than 12 tonnes. This includes trucks, semi-trailers, artics, B-doubles, etc.

Figure 2-4 Corridor average hourly profile



2.3.4 100th highest hourly volume

The 100th highest hourly volume (HHV) is the hourly traffic volume that is exceeded in only 99 hours of the year. It is used to represent peak demand for highway and interchange capacity, recognising that on rare occasions, traffic would exceed available capacity. This typically occurs during the summer vacation period when tourism demand reaches its peak. By designing the infrastructure to cater for these levels of demand, the majority of summer holiday traffic is accommodated, without providing capacity that would be rarely used. A future Level of Service "C" based on the 100th HHV is regarded as an acceptable performance threshold.

The best available whole-of-year RMS permanent count station data from 2004 were used to estimate the 100th HHV as presented in Table 2-4.

Table 2-4 100th highest hourly volumes

Location	100th HHV	
RMS permanent count site	Volume	Month
South of Grafton (04.002)	1,070	April
North of Maclean (04.001)	1,161	December
South of Woodburn (04.233)	1,023	October

As expected given the active tourism of the north coast, Table 2-4 shows that the 100th HHVs occurred during the school holiday periods, summer school holidays (December/ January), Easter holidays (April) and spring holidays (September/ October).

2.3.5 Daily and seasonal variations in traffic volume

Traffic volumes vary by day of week with noticeable difference between weekdays and weekend traffic volumes. Table 2-5 shows a comparison between the annual average daily traffic volume (AADT) and the annual average traffic volumes for weekdays, weekends and public holidays.

Table 2-5 Daily variations in traffic

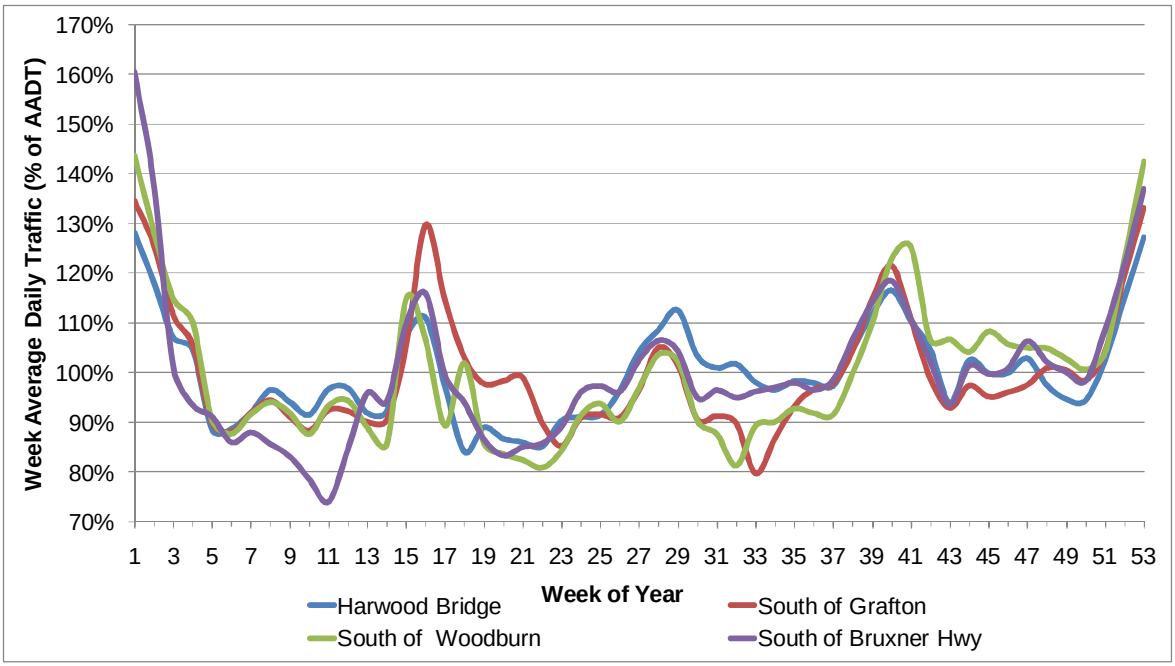
Location RMS permanent count site	% of AADT		
	Annual average weekday	Annual average weekend	Annual average public holiday
South of Grafton (04.002)	107%	84%	102%
North of Maclean (04.001)	106%	86%	108%
South of Woodburn (04.233)	108%	87%	114%
South of Ballina (04.264)	105%	84%	102%

Source: RMS Traffic Volume Data for Hunter and Northern Regions 2004

Table 2-5 shows that weekday traffic volumes are higher than the weekend. Traffic volumes on the Pacific Highway are generally lowest on the weekend and highest on public holidays.

The weekly traffic volumes from the RMS permanent count stations located at the Pacific Highway south of Grafton, north of Maclean, south of Woodburn and south of Ballina were used to estimate the seasonal variations of traffic during the year. Figure 2-5 shows the seasonal profiles of traffic at the selected locations. The three traffic count sites reveal similar seasonal fluctuation of traffic. There are peaks in traffic volume coinciding with the Christmas/ New Year period, Easter and the October school holidays, as well as a lesser peak in the June/July school holidays. The average daily traffic of the highest week during the Christmas period is significantly higher than the average for the year.

Figure 2-5 Seasonal variation of weekly traffic on the Pacific Highway



2.3.6 Highway capacity and Level of Service

The Level of Service (LoS) of a section of road varies from A (good) to F (forced flow), depending on the number of lanes, traffic volumes and composition, and the frequency of intersections and junctions. Detailed Level of Service (LoS) definitions are provided in Table 2-6.

Table 2-6 Level of Service definitions (lane capacity)

Level of service	Definition
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream in extremely high, and the general level of comfort and convenience provided is excellent.
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with level of service A.
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow would generally cause operational problems.
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream would cause breakdown.

Level of service	Definition
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.

Source: Austroads "Guide to Traffic Management Part 3: Traffic Studies and Analysis", page 28 (2009)

The capacity of the existing Pacific Highway in the project area varies between one lane and two lanes in each direction. The estimated capacity for a limiting two-lane two-way section of the existing highway is about 1,200 vehicles per hour per lane, reflecting the current condition and alignment of the highway.

The Level of Service on the Pacific Highway within the study area typically varies between B and C. However, a lower Level of Service is experienced during summer holidays and some busy weekends, resulting in congestion and traffic delays. At Harwood Bridge, peak holiday traffic volumes are close to the theoretical capacity, taking into account bridge approach conditions.

The opening of the Harwood Bridge over the Clarence River for the occasional passage of high-masted river vessels can also interrupt traffic flows. Traffic delays occur occasionally due to flooding and other incidents.

2.3.7 Traffic patterns in the project

The predominant traffic patterns in the project have been determined through the origin-destination trip surveys (see Section 2.3.1) conducted between north of Woolgoolga and just south of Ballina. These formed the basis of the SATURN traffic model described in detail in Section 3.1 and Appendix A.

A total of 29 zones, representing major towns and/or catchments, were identified. Figure 2-6 shows the locations of the zones and their connectivity to the modelled road network. The zones were aggregated into four sectors to simplify assessment and allow some comparison with previous surveys conducted in 2004. The sectors are shown in Figure 2-6.

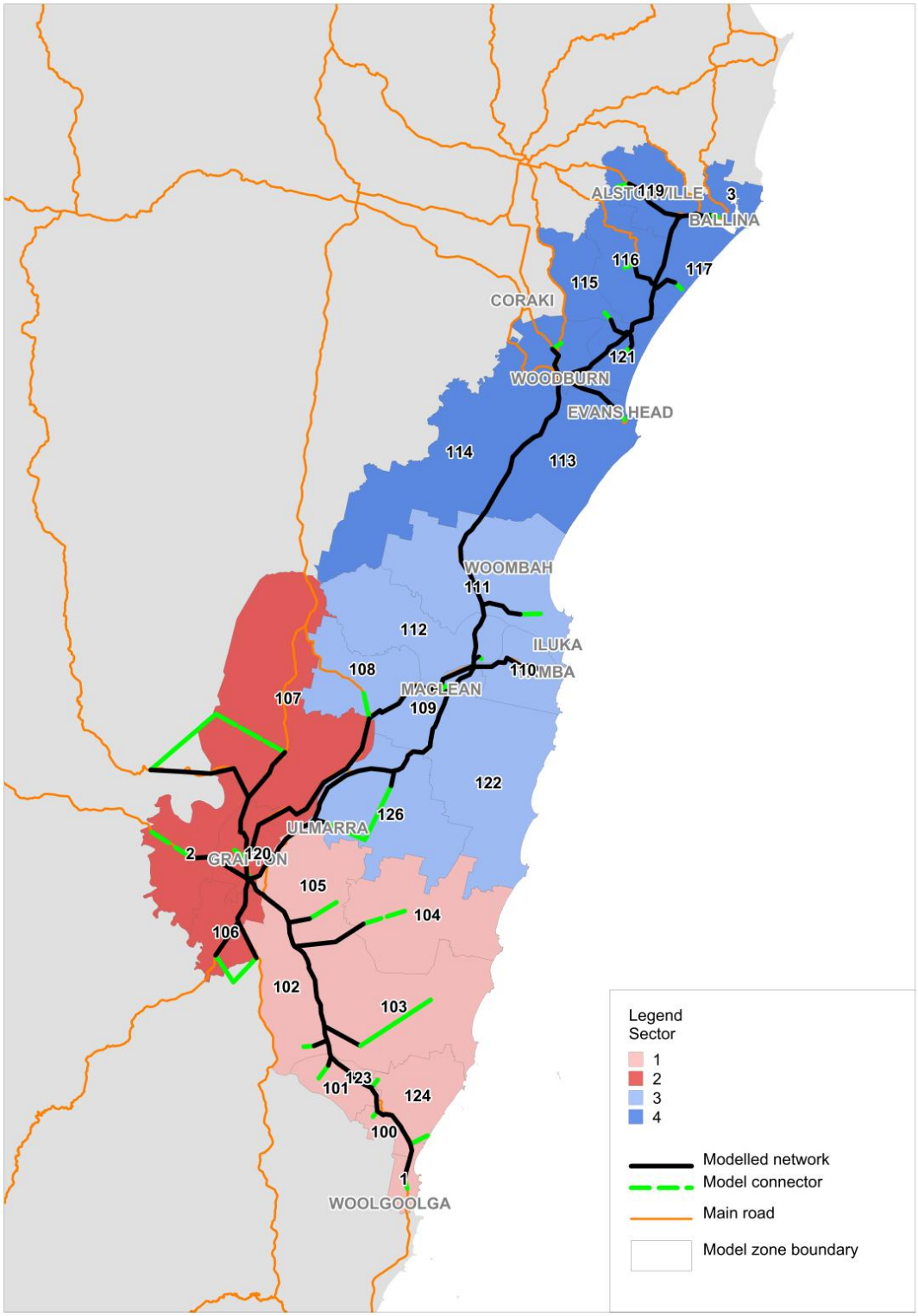
The surveys indicated a high number of short trips, a moderate amount of medium and very long trips, and relatively low numbers of long trips.

Vehicles which were observed with an origin at one end of the study area, and a matching observation at the other end of the study area, can be considered as 'through' trips.

Confirming the role of Grafton as the major regional centre in the study area, 29.5 per cent of light vehicle trips emanated from Grafton, West Grafton or South Grafton, with 28.3 per cent finishing here. Light vehicle trips along the full project accounted for only 3 per cent of trips in the corridor, with the average light vehicle trip length for the study area being 36.8km.

Heavy vehicle trips also reflected the regional importance of Grafton with 19.2 per cent of trips originating in Grafton, west Grafton or South Grafton. However, 22% of heavy vehicle trips covered the whole corridor. The average heavy vehicle trip length for the study area was 73.3km.

Figure 2-6 Modelled network and zones



Details of the trip distribution within the study area can be seen in the following Tables (Table 2-7 and Table 2-8).

Table 2-7 2011 modelled daily trips (vehicles)

Destination Origin	Pacific Highway South	Grafton	Maclean, Yamba, Harwood, Iluka	Pacific Highway North	Total
Pacific Highway South	1,633	1,850	488	1,903	5,875
Grafton	2,248	17,076	2,296	497	22,118
Maclean, Yamba, Harwood, Iluka	404	2,183	7,859	1,122	11,568
Pacific Highway North	2,219	476	944	18,588	22,227
Total	6,504	21,585	11,587	22,111	61,788

Table 2-8 2011 modelled daily trips (proportion)

Destination Origin	Pacific Highway South	Grafton	Maclean, Yamba, Harwood, Iluka	Pacific Highway North	Total
Pacific Highway South	3%	3%	1%	3%	10%
Grafton	4%	28%	4%	1%	36%
Maclean, Yamba, Harwood, Iluka	1%	4%	13%	2%	19%
Pacific Highway North	4%	1%	2%	30%	36%
Total	11%	35%	19%	36%	100%

In trips made within the area comprising Maclean, Yamba, Harwood and Iluka, there has been a large increase in the number of trips of around sixty per cent, compared to surveys carried out in 2004. These trips are effectively ‘local’ trips and indicate significant growth in recent years. Local trips (within the sector) made up 68 per cent of the total number of trips originating in Sector 3.

Similarly, the Grafton and the Pacific Highway North Sectors had 77 per cent and 84 per cent respectively of ‘local’ trips.

There were 1850 trips between the Pacific Highway South and Grafton, with a similar number of trips, 2248 in the opposite direction. This two-way pattern of trips is indicative of a significant amount of commuter trips within the region, in this case between Coffs Harbour and Grafton.

Other sector pairs show a similar trend. There were 2183 trips between Sector 3 (Maclean, Yamba, Harwood and Iluka) and Sector 2, Grafton with a corresponding 2296 trips in the opposite direction.

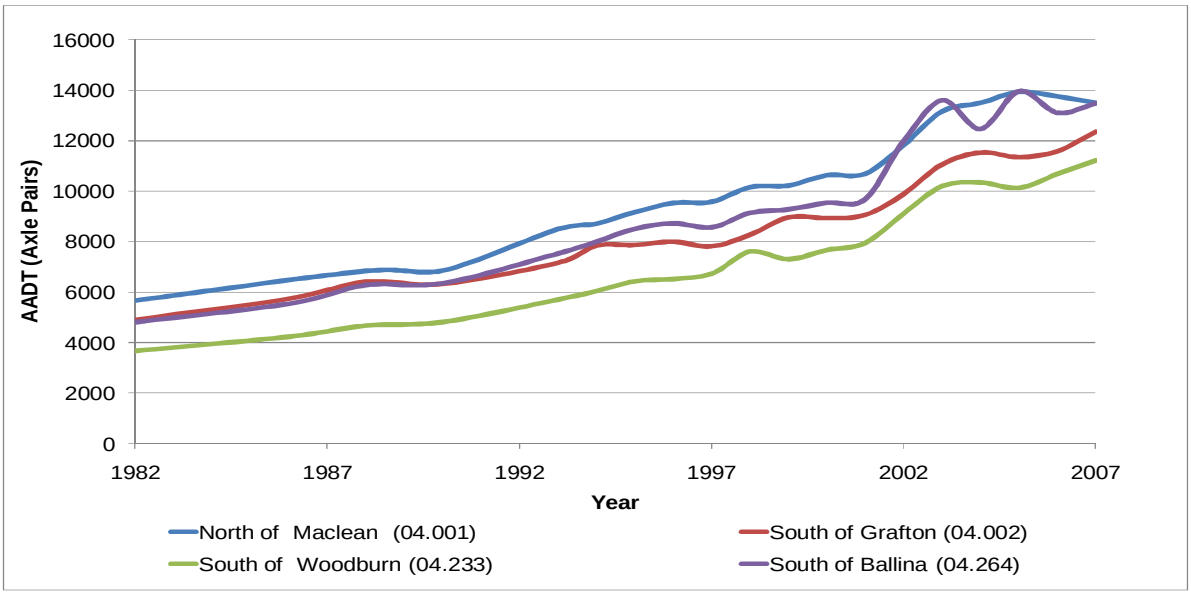
Based on the findings from the Heavy Vehicle Study (RTA, 2011a), the Grafton Bridge along the Pacific Highway section carries around 29,500 vehicles per weekday, and 5 per cent of the total number of vehicles are heavy vehicles (around 1475 per day). This study also indicated that about 97 per cent of all vehicles crossing the bridge either originated from or were destined for Grafton or South Grafton and only three per cent were through trips. Similarly, 88 per cent of all heavy vehicles have an origin and/ or destination within Grafton or South Grafton. This means that only twelve per cent of heavy vehicles are undertaking a through trip.

It is understood that RMS is investigating options to propose an additional crossing along the Clarence River at Grafton.

2.3.8 Historic traffic growth on the Pacific Highway

Figure 2-7 shows traffic growth in axle pairs between 1982 and 2007 at four Pacific Highway locations in the study area and indicates traffic has generally increased steadily over the past 25 years**.** The average linear growth rate from 1982 to 2007 is between 2.3 per cent and 2.9 per cent per annum (base year 2004), equating to an increase of about 300 to 350 vehicles per year**.**

Figure 2-7 AADTs at RMS permanent count sites on the Pacific Highway



2.4 Traffic growth

Traffic using the project is derived from a number of sources: local traffic accessing nearest villages, intra-regional traffic accessing major towns, inter-regional traffic accessing destinations within the study area, and through traffic, which may stop at facilities within the study area or proceed to destinations beyond. Future growth would reflect population changes within the study area, tourism growth for destinations within the study area, regional economic growth and regional and interregional freight growth.

2.4.1 Population growth

Many indicators of population growth are available, although not all would be representative of the area served by the project. This report uses population growth for the five local government area served by the project, as it is assumed this would provide greater accuracy and better represent future changes within the study area.

Two sources have been used to provide an indication of population growth within the model area, namely: NSW Department of Planning Department (2008; 2010) and The Australian Bureau of Statistics (ABS, 2011a; ABS, 2011b). The information gained from each of these sources is discussed below.

NSW Planning determined population projections and average annual growth rates at 5 year intervals to 2036. The data has been extracted for the five local government areas.

In March 2011, the Australian Bureau of Statistics published updated population figures for 2010. Using NSW Planning growth rates and the revised 2010 population, revised population forecasts have been generated for the local government areas. These are presented in the following table.

Table 2-9 Population growth estimates

	2010	2011*		2016*		2026*		2036*	
LGA	Population	Population	% change	Population	% change	Population	% change	Population	% change
Coffs Harbour	72,827	74,058	1.7%	80,057	8.1%	91,635	14.5%	101,724	11.0%
Clarence Valley	52,592	52,923	0.6%	54,449	2.9%	56,949	4.6%	58,593	2.9%
Richmond Valley	23,115	23,242	0.6%	23,841	2.6%	24,923	4.5%	25,707	3.1%
Ballina	42,708	43,272	1.3%	45,999	6.3%	51,470	11.9%	56,406	9.6%
Lismore	45,917	46,091	0.4%	46,974	1.9%	48,814	3.9%	50,399	3.3%

Change relative to preceding period, eg 2011 relative to 2010, 2016 relative to 2011.

The figures included in the table above have been used for the future year traffic growth within the study area.

2.4.2 Growth in tourism

In 2011 the Tourism Forecasting Committee released two sets of forecasts to provide an indication of regional tourism growth from 2010 to 2020 by state. This data provides forecasts based upon inbound visitor nights and domestic visitor nights. These two data sets have been used in combination to provide an indication of tourism growth in the study area. The table below shows the historic annual visitor nights and demonstrates a steady increase in tourism activity, shown in visitor nights.

This data has been forecast to 2020, the results are provided in Figure 2-8 relative to a series of future years which have been considered within the traffic model. No forecasts were available beyond 2020 and so these were calculated manually assuming the annual growth between 2019 and 2020 remains constant to 2036.

Table 2-10 Summary of tourist visitor nights (NSW)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2016	2020	2026	2036
Nights (M)	Reported								Forecast			
	130.5	136.5	131.2	143.5	140.4	139.7	138.3	143.6	158.5	167.1	180.6	207.7

Tourism data for the five local government areas within the project area has been considered. The number of visitor nights over a four year average period to 2007 was compared to the NSW visitor nights for the same period. The resultant proportion was applied to the future year figures to obtain visitor night forecasts. This data is provided in the following tables.

Table 2-11 Visitor nights for study area local government areas

Visitor nights by LGA (4 year average to 2007)		
LGA	**Total**	**% NSW**
Coffs Harbour	3,015,000	2.19%
Clarence Valley	1,720,000	1.25%
Richmond Valley	395,000	0.29%
Ballina	953,000	0.69%
Lismore	575,000	0.42%

Forecast visitor nights by LGA					
LGA	**2016**	**2026**		**2036**	
	Total	**Total**	**% Change**	**Total**	**% Change**
Coffs Harbour	3,049,489	3,224,628	5.7%	3,431,774	6.4%
Clarence Valley	1,659,626	1,700,416	2.5%	1,744,765	2.6%
Richmond Valley	598,040	663,720	11.0%	743,641	12.0%
Ballina	952,876	1,000,092	5.0%	1,055,400	5.5%
Lismore	597,833	643,240	7.6%	697,737	8.5%

2.4.3 Regional employment/economic growth

Mid North Coast Regional Strategy

The *Mid North Coast Regional Strategy* (Department of Planning, 2009) establishes the guiding principles for future sustainable growth of the NSW mid north coast. This is relevant to the project

as the strategy is specifically referred to in the environmental assessment requirements for land use and property.

The strategy recognises the Pacific Highway as the primary north–south corridor for both inter- and intra-regional movements. It identifies growth pressures faced by the region and the importance of safe and efficient transport connections within and between regions along the Sydney–Brisbane corridor. The project would assist by further improving traffic safety and efficiency for the mid north coast region by reducing travel times and improving accessibility in certain places.

The strategy identifies a number of challenges facing the region, two of which are particularly relevant to the project:

- Recognising the value of existing primary industries and ensuring land use planning decisions do not hinder the growth and diversification of primary production. Agriculture, and sugar cane in particular, is a vital component of the regional economy. Section 4 of the project between Tyndale and Maclean would affect areas of highly productive sugarcane land in the Clarence River Valley. For example, the project has been designed to minimise impacts on productive sugar cane land to the extent possible by following an alignment to the east of Shark Creek
- Encouraging new export industries to give the regional economy greater diversity and resilience and ensuring the jobs market offers a broader mix of employment options including high-wage high-skill positions. The Pacific Highway provides the critical link between the mid north coast producers and the major ports along the east coast. The project responds to this challenge by creating linkages. The project would also potentially reduce travel costs (of both intermediate goods and end product) by travel time savings and could increase competitiveness as a result. There is scope for the project to broaden the regional labour market through better access to jobs along and within the vicinity of the project.

The Mid North Coast Regional Strategy suggests that Clarence Valley would be required to accommodate an additional 7,100 dwellings to meet the projected demand to 2031. These sites would benefit from the project as traffic movement and accessibility would be improved. The towns are located outside the project. The project would support the strategy and assist with mitigating some of the challenges identified in the strategy.

Council initiatives

The existing land use and property context of the study area is characterised by:

- Urban uses such as commercial, residential and industrial land uses mainly focussed on major regional centres such as Coffs Harbour, Grafton, Lismore and Ballina as well as towns and villages such as Tucabia, Maclean, Townsend, Harwood, New Italy, Trustums Hill, Woodburn, Broadwater, and Wardell
- Pockets of rural residential land are also located across the study area, including near Section 3 of the project. Areas identified for future development include Clarenza, Junction Hill, West Yamba and Gulmarrad. Combined, these four major urban land release areas are expected to provide an additional 3,000 residential lots.

Overall, the project would support future development across the region through improved access across the region, to major regional centres such as Coffs Harbour and Ballina and areas outside of the region such as south east Queensland.

There are no urban release areas identified for future residential or employment land located within the project.

Land zoned for Rural (Investigation) is located outside the project near Section 5, Section 8 and Section 9. These areas are located along and adjacent to the project and could be suitable for urban development at the major interchanges. These areas currently do not contain significant levels of development.

The Maclean Urban Catchment Local Growth Management Strategy (Clarence Valley Council, 2011) was adopted by Council in August 2011. The purpose of the strategy is to provide guidance for the release of new residential and employment areas including timing and infrastructure needs to respond to the proposed growth in the area. Three growth areas have been identified and included in the strategy. These areas are identified in the Mid North Coast Regional Strategy and include:

- Townsend (proposed future employment lands)
- Gulmarrad (proposed future urban release areas)
- James Creek (proposed future urban release areas).

These sites are proposed to support Maclean as satellite towns at Townsend, Gulmarrad and James Creek. The proposed total population is 10,000 people by 2031, an increase of 5,200 people over the current population. It is anticipated the project would support future development potential in these areas by promoting access to a major transport corridor.

The Maclean Urban Catchment Local Growth Management Strategy (MUCLGS) identifies that the project would reduce the need for additional local road network upgrades to provide increased access to these areas. An additional investigation into the local road network identified that, if the Pacific Highway upgrade did not occur, development thresholds on the existing road network would be strained. The assessment confirmed that, in the long term, development as envisaged by the MUCLGS would not adversely affect the Pacific Highway network but identified a threshold of about 50 per cent of the identified 2021 development yield.

All sites are located east of Maclean and accessed by Brooms Head Road. The nearest interchange providing access to the project would be the interchange at Maclean (Goodwood Street, south).

2.4.4 Regional growth

These cited regional growth initiatives are consistent with the overall population growth projections, and have been integrated in them in developing traffic forecasts.

2.5 Freight transport growth

Both interstate and intrastate freight movement occur in the study area. Where suitable information has allowed, growth estimates have been made for both types. Typically, these are carried out by four modes of transport: road, rail, coastal shipping and air. Road and rail are the main modes used for interstate and intrastate shipments and are the most relevant to this study.

Since August 2002, B-Doubles have been permitted to use the Pacific Highway for its entire length between Hexham and the NSW/Queensland border which has led to a significant change in the profile of traffic from this time.

2.5.1 Baseline freight growth rate forecasts

Historical trend analysis for the corridor have been identified from the previous study undertaken for RMS for the upgrading of the Pacific Highway between Wells Crossing and Iluka Road (RTA, 2009a).

Table 2-12 Previous growth assumptions

Characteristic	1978-1998	1998-2004
Population	0.9%	0.9%-1.3%
Local traffic (light vehicles)	1.4%	1.7%
Through traffic (light vehicles)	2.0%	4.7%
Trucks (heavy vehicles)	-	4.0%

Average linear growth rate over the identified period

In 2009 the Bureau of Infrastructure, Transport and Regional Economics (BITRE) prepared traffic forecasts of on the national road network. This was based on econometric modelling, assuming that infrastructure enhancements are completed to meet demand.

This indicated annual heavy vehicle growth in the Sydney-Brisbane coastal corridor (Pacific Highway) of 1.39 per cent from 2005 to 2030. Of particular interest was the forecast for growth in the study area of 1.28 per cent between Coffs Harbour and Grafton, with 1.42 per cent between Grafton and Ballina. In comparison, forecast growth for the Sydney-Brisbane inland corridor was forecast as 0.52 per cent from 2005 to 2030.

2.5.2 NSW submission to Infrastructure Australia

In its submission to Infrastructure Australia in 2011, the NSW Government reviewed the work of BITRE and updated freight productivity and growth factors.

In 2004, some 11.5 million tonnes of freight (excluding coal) was moved between Sydney and Brisbane (Ernst and Young, 2006), accounting for about one third of the total east coast inter-capital freight. BITRE also estimated that freight travelling the full length of the corridor comprises 21 per cent of the non-bulk inter-capital freight and 16 per cent of all non-bulk freight carried on the national land transport corridors in mainland Australia (BTRE, 2006). It is estimated that about 76 per cent of these freight movements are undertaken by road, most using the Pacific Highway.

The 2007 Australian Government's Sydney to Brisbane Corridor Strategy (DOTARS, 2007) showed significant expected growth in traffic on the Sydney to Brisbane corridor. It indicated that interstate freight between Sydney and Brisbane would almost triple over the next 20 years[4], compared to an expected doubling of freight on most other national freight corridors. This freight growth is in

[4] Rising from around seven million tonnes to around 17 million tonnes (note this figure excludes freight moving between Melbourne and Brisbane): Meyrick and Associates based on North–South Rail Corridor Study (Ernst and Young, 2006) quoted in DOTARS (2007) pp 19.

addition to the growth in inter-corridor and intra-corridor freight and passenger movements (DOTARS, 2007).

In addition, the route bypasses four of the ten Higher Mass Limit (HML) deficient Pacific Highway bridges. A further HML deficient bridge is bypassed at Bulahdelah and the other four are in the section Port Macquarie to Urunga. When all are bypassed, the Pacific Highway would no longer be HML deficient and would provide a major HML freight route.

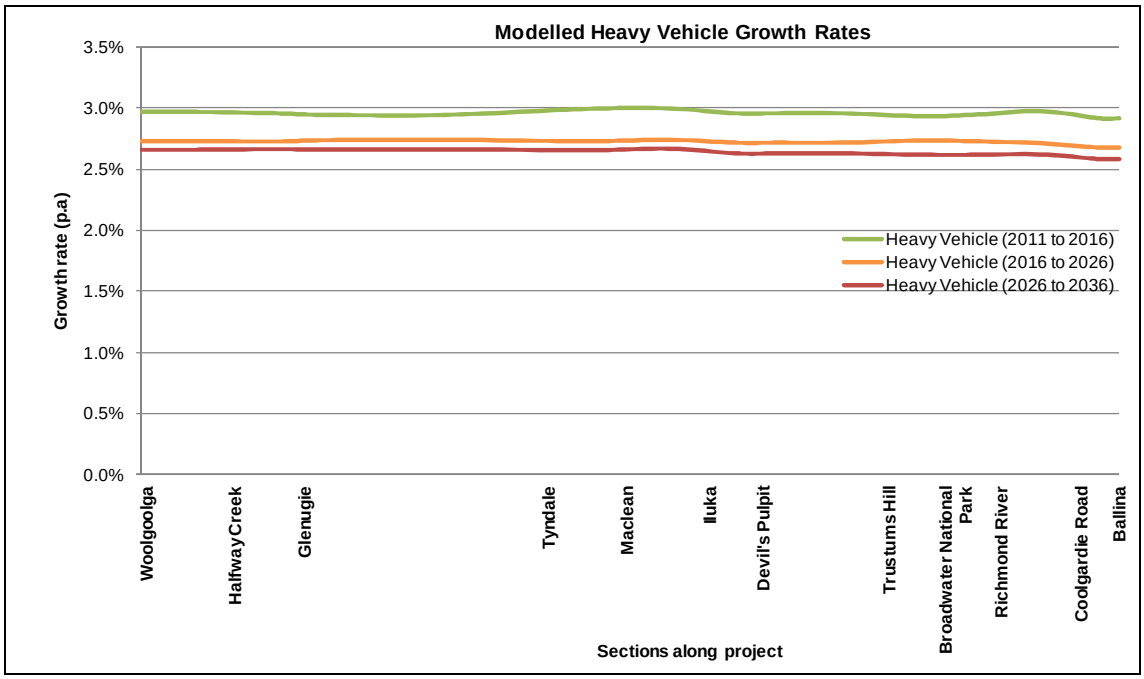
It is assumed that the updated freight productivity and growth factors used in the NSW Government submission to infrastructure Australia in 2011 incorporated the increased importance of the Pacific Highway as a Higher Mass Limit route. The conclusion of the NSW submission was that truck growth in the study corridor (expressed as compound annual growth) would grow in the following form (RTA, 2011b). This has been applied to the surveyed heavy vehicle traffic, and is presented graphically in Figure 2-8.

Table 2-13 Truck traffic growth factors

Pacific Highway	Coffs Harbour - Grafton	Grafton - Ballina
Base growth expectations	1.28	1.42
Add BITRE Productivity adjustment	3.28	3.42
2005 to 2019 (0.3%pa)	2.98	3.12
2020 (0.3%pa +0.15%)	2.83	2.97
2021 (0.3%pa +0.225%)	2.76	2.90
2022 to 2030 (0.6%pa)	2.68	2.82

Based on NSW Submission to Infrastructure Australia

Figure 2-8 Forecast heavy vehicle growth rates



2.6 Public transport

Public transport operating in the study area includes CountryLink rail and coach services, other long distance coach services, local bus services and school bus services. [5]

2.6.1 CountryLink services

CountryLink operates three daily return rail services in the study area**.** These services operate between Sydney and Grafton, Sydney and Casino and Sydney and Brisbane. Stations are located at Coffs Harbour and Grafton. Travel time between Grafton and Sydney is about 10 hours, between Casino and Sydney it is about 11.5 hours (due to interchange delays) and between Grafton and Brisbane it is about four hours.

A CountryLink coach service (operated by Sunstate Coaches) operates daily between Byron Bay and Grafton, and takes about four hours**.** The service stops in Ulmarra, Cowper, Tyndale, Maclean, Palmers Island, Yamba West, Yamba, Chatsworth Island, Woombah, Iluka, Woodburn, Evans Head, Broadwater, Wardell, Ballina West, Ballina, Lennox Head and Suffolk Park, and connects

[5] Reviewed January 2012.

with XPT services at Grafton**.** Passengers wishing to travel less than 40 kilometres are not permitted to use these services.

Another CountryLink coach service, operated by Symes Bus Service, runs between Grafton and Moree on Tuesdays, Thursdays and Saturdays, and between Moree and Grafton on Mondays, Wednesdays and Fridays. The service stops in Jackadgery, Gibraltar Range, Glen Innes, Inverell, Mount Russell turnoff, Delungra, Warialda, Gravesend and Biniguy, and connects with XPT services at Grafton. Travel time from Grafton to Moree is about five hours 15 minutes, including a half hour refreshment break at Inverell.

2.6.2 Long distance coach services

Two companies provide long-distance coach services between Sydney and Brisbane. These services stop at major centres in the vicinity of the project, enabling passengers from the region to travel within and through the region as outlined in Table 2-14.

Table 2-14 Long distance coach services

Bus operator	Service coverage	Daily frequency (both directions)
Greyhound	Brisbane / Sydney	3 Brisbane to Sydney / 3 Sydney to Brisbane
Premier Motor Service	Brisbane / Sydney	2 Brisbane to Sydney/ 2 Sydney to Brisbane

Greyhound operates three Brisbane to Sydney coach services each day along the Pacific Highway (there is also a service via the New England Highway). The stops are as follows:

- **Ballina –** Bus shelter on Tamar Street, between Cherry Street and Moon Street
- **Woodburn –** Post office (for AM departures from Brisbane, on-request only).
- **Yamba –** Bus stop, corner River Street and Coldstream Street
- **Maclean –** CountryLink bus stop, Riverland Travel (on request only)
- **South Grafton –** South Grafton Bus interchange
- **Arrawarra –** Arrawarra Beach Holiday Park, 46 Arrawarra Road, Arrawarra
- **Woolgoolga –** Opposite Raj Mahal
- **Coffs Harbour –** Urara Park, next to information centre.

There are three Sydney to Brisbane services each day**.** The stops are as follows:

- **Coffs Harbour –** Urara Park, next to information centre
- **Woolgoolga –** In front of Raj Mahal
- **Arrawarra –** Arrawarra Beach Holiday Park, 46 Arrawarra Road, Arrawarra
- **South Grafton –** South Grafton bus interchange
- **Grafton** – Pacific Highway and Duncan Lane North
- **Maclean –** CountryLink bus stop, Riverland Travel (on request only)

- **Yamba –** Bus stop, corner River Street and Coldstream Street
- **Woodburn –** opposite hotel
- **Ballina –** Bus shelter on Tamar Street, between Cherry Street and Moon Street.

Travel time between Sydney and Grafton is 10 to 12 hours, depending on stopping patterns**.** The travel time between Grafton and Brisbane is about five hours**.**

Premier Motor Service runs two services daily in each direction between Sydney and Brisbane, with a similar stopping pattern to the Greyhound services**.**

2.6.3 Local buses

There are 36 companies providing local and school only bus services in the corridor, plus two CountryLink rail connection coach services. These are summarised in Table 2-15. Many of these only provide limited services or do not actually use the Pacific Highway.

The four principal companies providing local bus services within the study area are:

1) Ryan's Bus Services- Ryan's Bus services provide seven services, Monday to Friday, to and from Coffs Harbour during school term and six services outside of school term. Two services are provided on Saturday and there is no Sunday service. Route destinations vary depending on the service. Of the weekday services, two terminate in Grafton, three terminate in Red Rock and two terminate in Woolgoolga. The two Saturday services terminate in Woolgoolga. A similar pattern of return service is also provided
2) Ballina Bus Lines - Ballina Bus Lines provide a network of routes, two of which lie within the study area. The first route is Ballina to Evans Head. This route provides one daily service Monday to Friday and no weekend services. The second route is an inner city route that occupies a section of the Pacific Highway. The West Ballina route provides four services Monday to Friday, two services on Saturday and no Sunday service
3) Busways North Coast - Busways North Coast is a local bus service that provides ten local bus routes in Grafton, eleven in Coffs Harbour. Two of these routes travel via the Pacific Highway, the Grafton-Maclean-Yamba service and the Iluka-Maclean service. The Grafton-Maclean-Yamba service operates six services Monday to Friday and four services on Saturdays and Sundays. The Iluka-Maclean service operates three services Monday to Friday, providing two Saturday services and no Sunday service
4) Lawrence Bus Service runs one return service between Grafton and Lawrence, Monday to Friday, with an additional service provided during school term time. Routes do not use the Pacific Highway.

Table 2-15 Summary of bus services in the study area

Town	Bus Operator	Service Provided by Operator			Number of Schools Located in Town					Routes provided by operator that use Pacific Highway
					Public		Private			
		Through Bus Service	Local Bus Service	Dedicated School Bus	Primary	Secondary	Primary	Secondary	Total Schools	
Coffs Harbour	Busways North Coast		✓		3	3	4	2	12	✓
	Ryan's Bus Service		✓							✓
	Sawtell Coaches		✓							✓
	Greyhound Australia	✓								✓
	Premier Motor Service	✓								✓
	MJ & CK Sweeney Pty Ltd			✓						
	RJ & PJ Beaumont Pty Ltd			✓						
	Rex & Hazel Williams			✓						
Woolgoolga	Ryan's Bus Service		✓		1	1	1	0	3	✓
	Greyhound Australia	✓								✓
	Premier Motor Service	✓								✓
Grafton	Lawrence Bus Services		✓		2	2	2	1	7	
	Singh J & B			✓						
	Busways North Coast		✓							✓
	Ballina Bus Lines		✓							✓
	Ryan's Bus Service		✓							✓
	Greyhound Australia	✓								✓
	Premier Motor Service	✓								✓
	CountryLink	✓								✓
	Albin Lorenz			✓						
	Casey's Coaches Grafton Pty Ltd			✓						
	Neil & Karyn Bohn			✓						
	Norman Kane			✓						

Town	Bus Operator	Service Provided by Operator			Number of Schools Located in Town					Routes provided by operator that use Pacific Highway
					Public		Private			
		Through Bus Service	Local Bus Service	Dedicated School Bus	Primary	Secondary	Primary	Secondary	Total Schools	
Maclean	Ballina Bus Lines		✓		2	1	1	0	4	✓
	Busways North Coast		✓							✓
	Lawrence Bus Service		✓							
	CountryLink	✓								✓
	Dianne Kingsley & Geoffrey Ward			✓						
	Greyhound Australia	✓								✓
	Premier Motor Service	✓								✓
Casino	Northern Rivers Bus Lines		✓		3	1	1	2	7	
	Eyears Bus Service Pty Ltd			✓						
	Norman Kane			✓						✓
	Douglas Bennett			✓						
	Foscars Pty Ltd			✓						
	Byview Pty Ltd			✓						
	Neville & Joan Brown			✓						
	G & J Bruce Pty Ltd			✓						
	CountryLink	✓								✓
	Sunstate Charters	✓								✓
Lismore	Ballina Bus Lines		✓		6	2	1	4	13	✓
	Gosel's Bus Company		✓							✓
	Northern Rivers Bus Lines		✓							✓
	Graeme A Waller		✓	✓						
	JI & DG Hall			✓						
	CountryLink	✓								✓
	Sunstate Charters	✓								✓
	Premier Motor Service	✓								✓
	Barbara Creighton			✓						
	DJ & GK Singh			✓						

Town	Bus Operator	Service Provided by Operator			Number of Schools Located in Town					Routes provided by operator that use Pacific Highway
					Public		Private			
		Through Bus Service	Local Bus Service	Dedicated School Bus	Primary	Secondary	Primary	Secondary	Total Schools	
Lismore	G & J Bruce Pty Ltd			✓	6	2	1	4	13	
	J & B Bus Services Pty Ltd			✓						
	Michael & Cathleen Quinn			✓						
	Peter & Helen Rayner			✓						
	Rachel Williams			✓						
	Sodhi Joga & Avjinder Singh			✓						
Ballina	Ballina Bus Lines		✓	✓	2	1	2	1	6	✓
	Blanchs Bus Company			✓						North of Ballina only
	Greyhound Australia	✓								✓
	Premier Motor Service	✓								✓

D:\@NBIF\Projects\EN02829\Technical\Traffic EIS\Technical\Bus Routes\[bus route info.c.xlsx]All Busses

Sourced: January 2012.

2.7 Pedestrians and cyclist facilities

Throughout the study area, the Pacific Highway has minimal formal pedestrian and cyclist facilities outside of major towns and regional centres.

The Coastline Cycleway is a policy initiative of the Department of Planning and Infrastructure (2011), which is co-funding (with local government) its progressive development. The objective of the cycleway is to provide a cycling route along the NSW coast, providing cycling connectivity between coastal towns. It exists as a collective of individual cycle routes. In general, the intention is to avoid major roads such as the Pacific Highway, although in the study area, for example along the coastline at Bundjalung National Park and the Bundjalung Bombing Range, there are limitations to this. Adoption of the Pacific Highway is a matter of necessity, rather than choice. A route for the cycleway has been identified by the Department in consultation with Clarence Valley Council. Within the study area, the coastline cycleway route would use the existing Pacific Highway between Wells Crossing and South Grafton, and then travel via Grafton, Lawrence and Maclean to Yamba. Elsewhere, the existing Pacific Highway provides the core alignment for the NSW coastal cycleway, as shown in Figure 2-9 to Figure 2-14.

As cyclists are general road users, cyclists are not precluded from NSW roads unless there are specific reasons. This implies that cyclist safety and amenity must be recognised in the design of the project. This falls in three broad categories:

- **Safety of the carriageway**, with adequate width for cyclists and appropriate facilities at motorway ramps
- **Cycle-specific wayfinding**, which addresses cyclist's needs for destination and distance information. Signage needs to accord with recognised practice. The Department of Planning and Infrastructure has no specific requirement to identify the Coastline Cycleway as a preferred route. The preference is to identify intermediate destinations that can be served by the Coastline Cycleway route
- **Cyclist facilities**. The Coastline Cycleway would allow cyclists to ride between townships along the coastline, with access to facilities such as fresh water. These needs would be addressed wherever possible.

Figure 2-9 NSW coastline cycleway

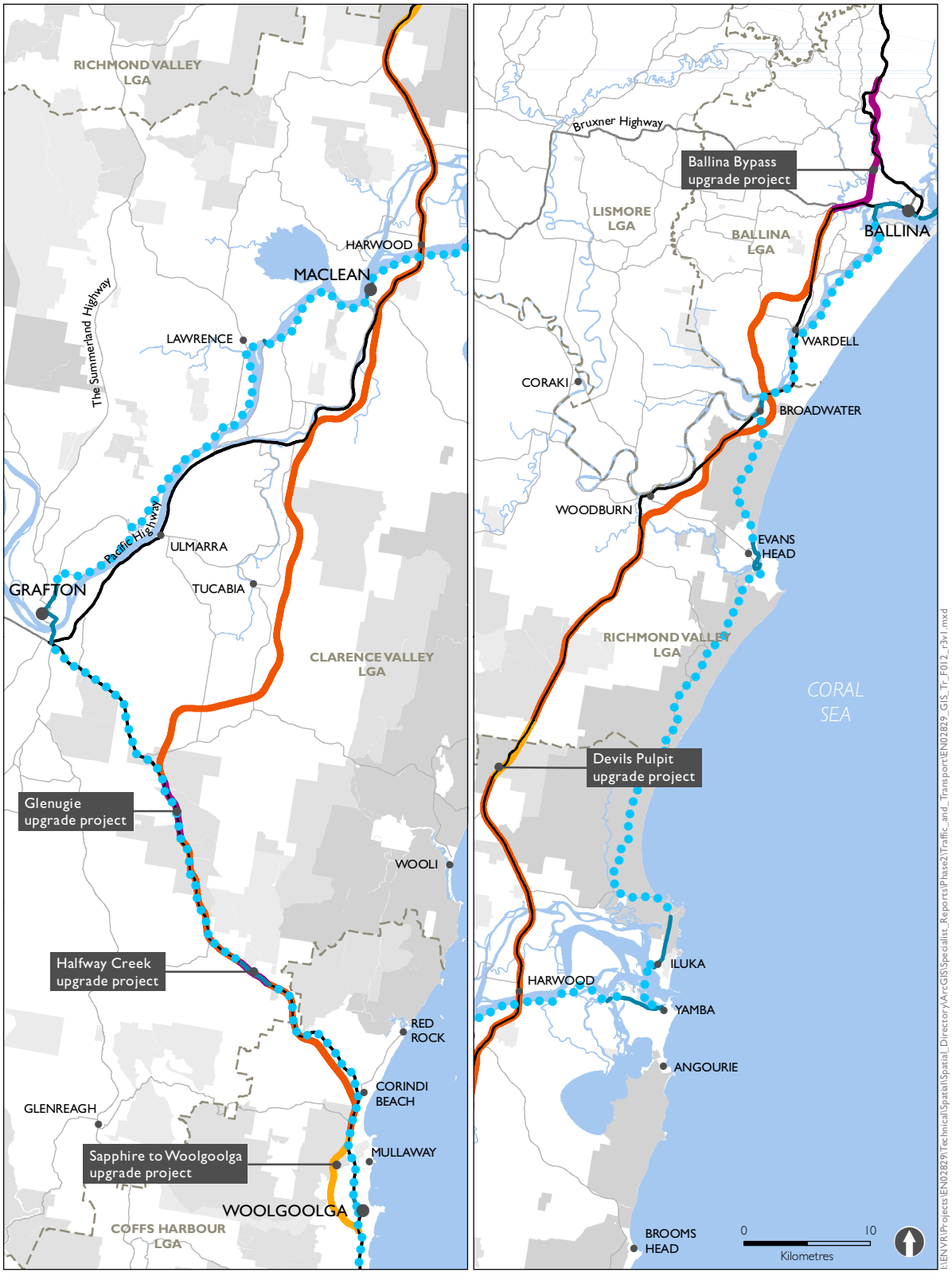


Figure 2-10 NSW coastline cycleway

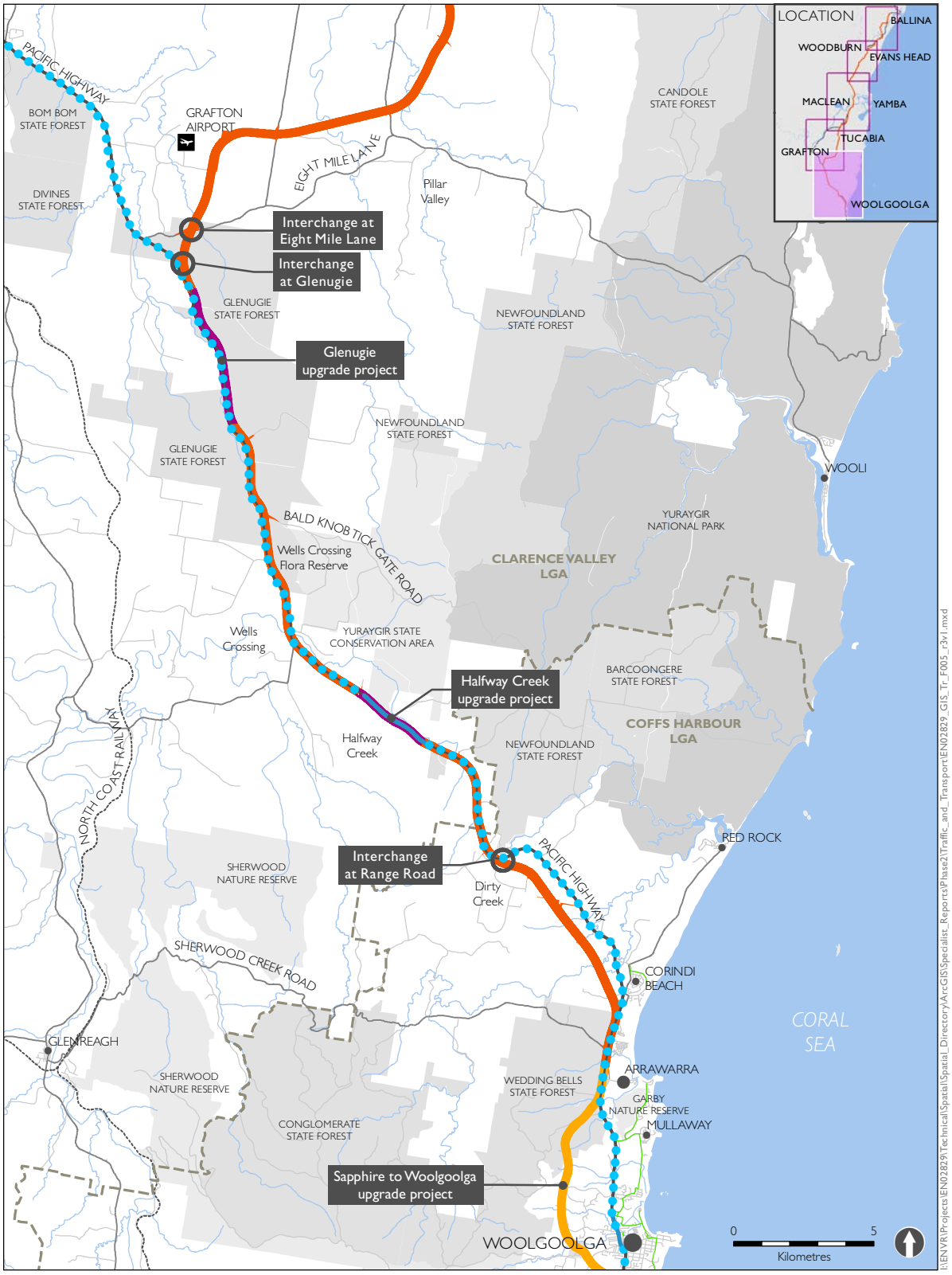


Figure 2-11 NSW coastline cycleway

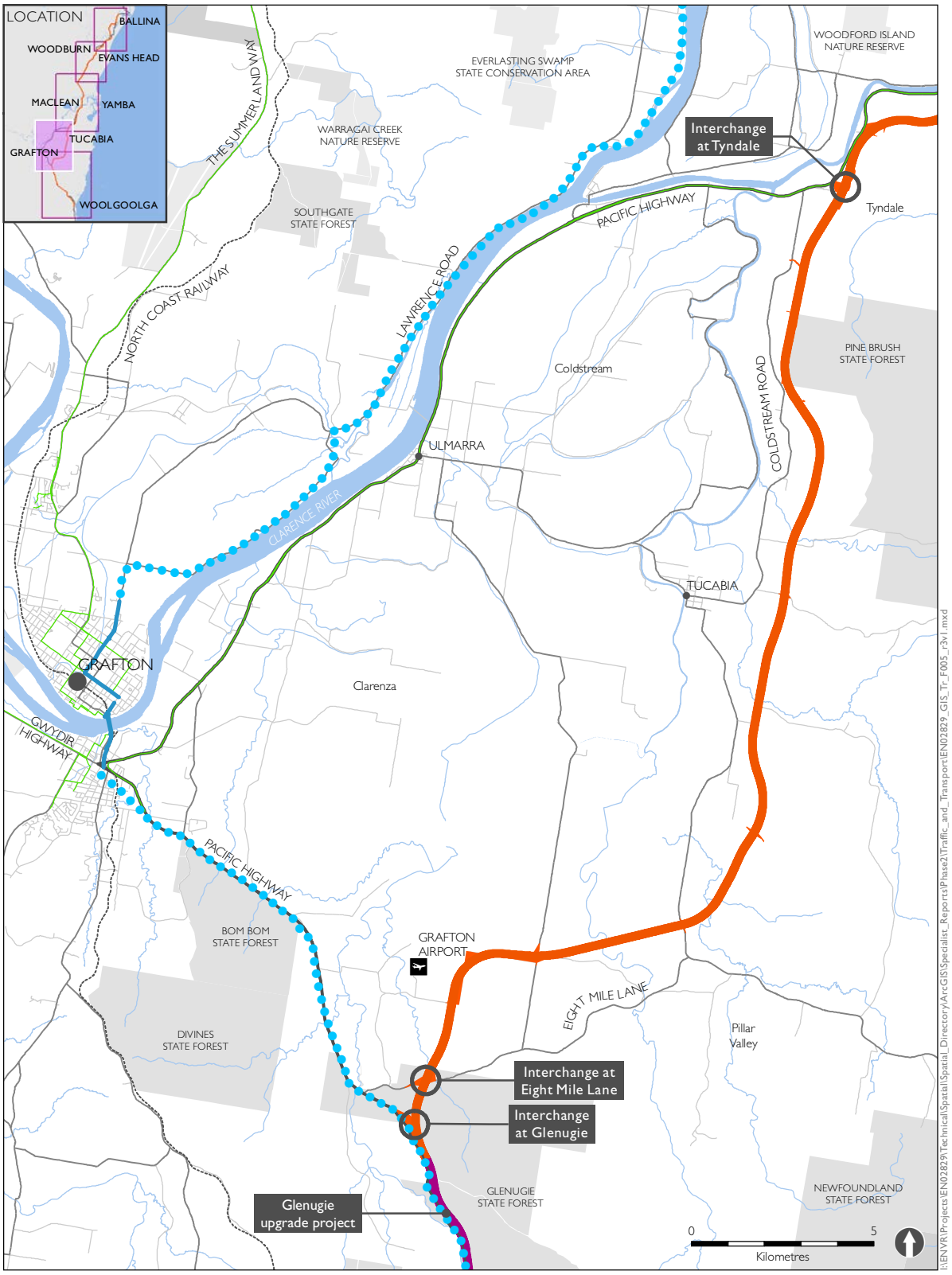


Figure 2-12 NSW coastline cycleway

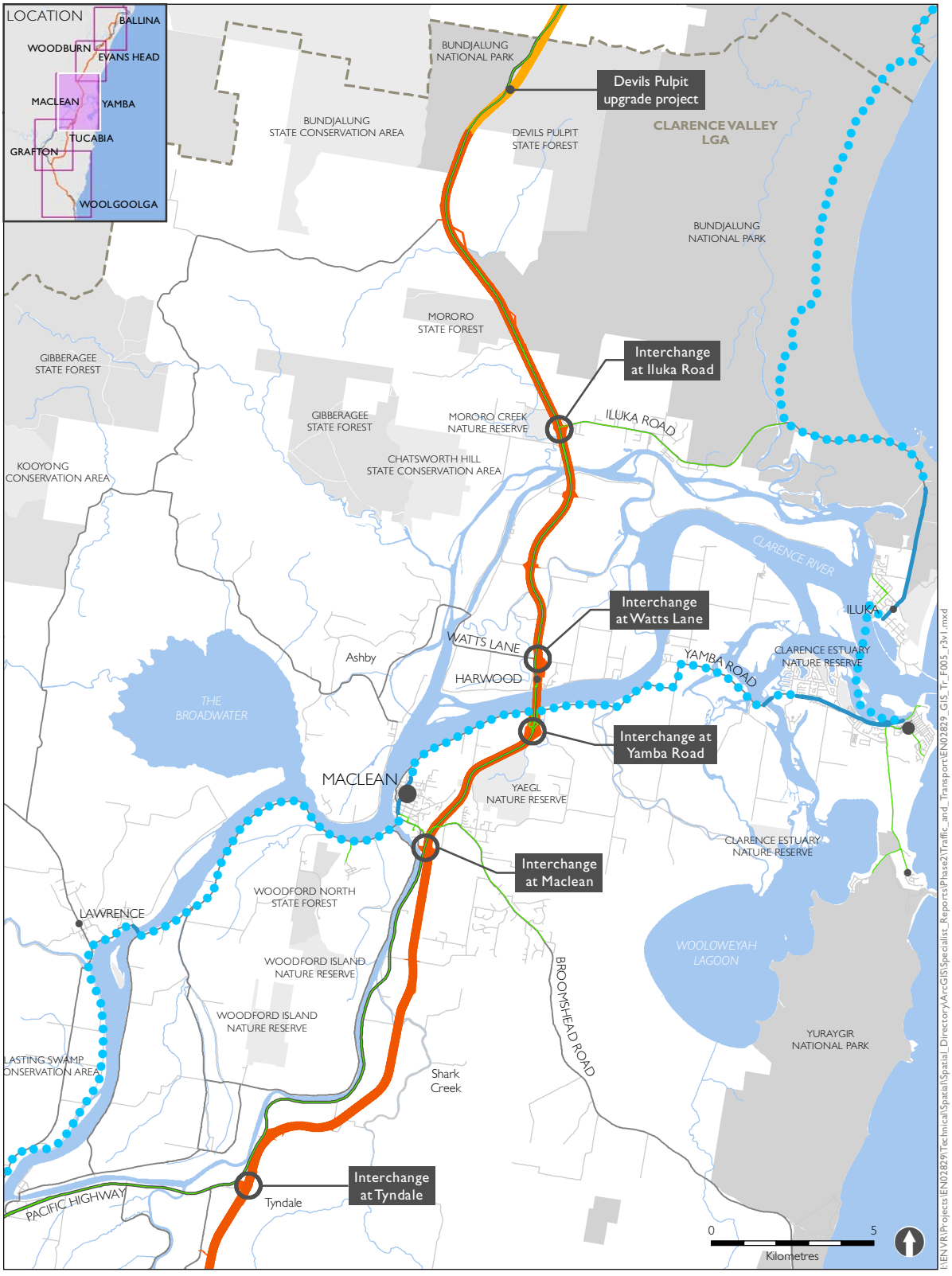


Figure 2-13 NSW coastline cycleway

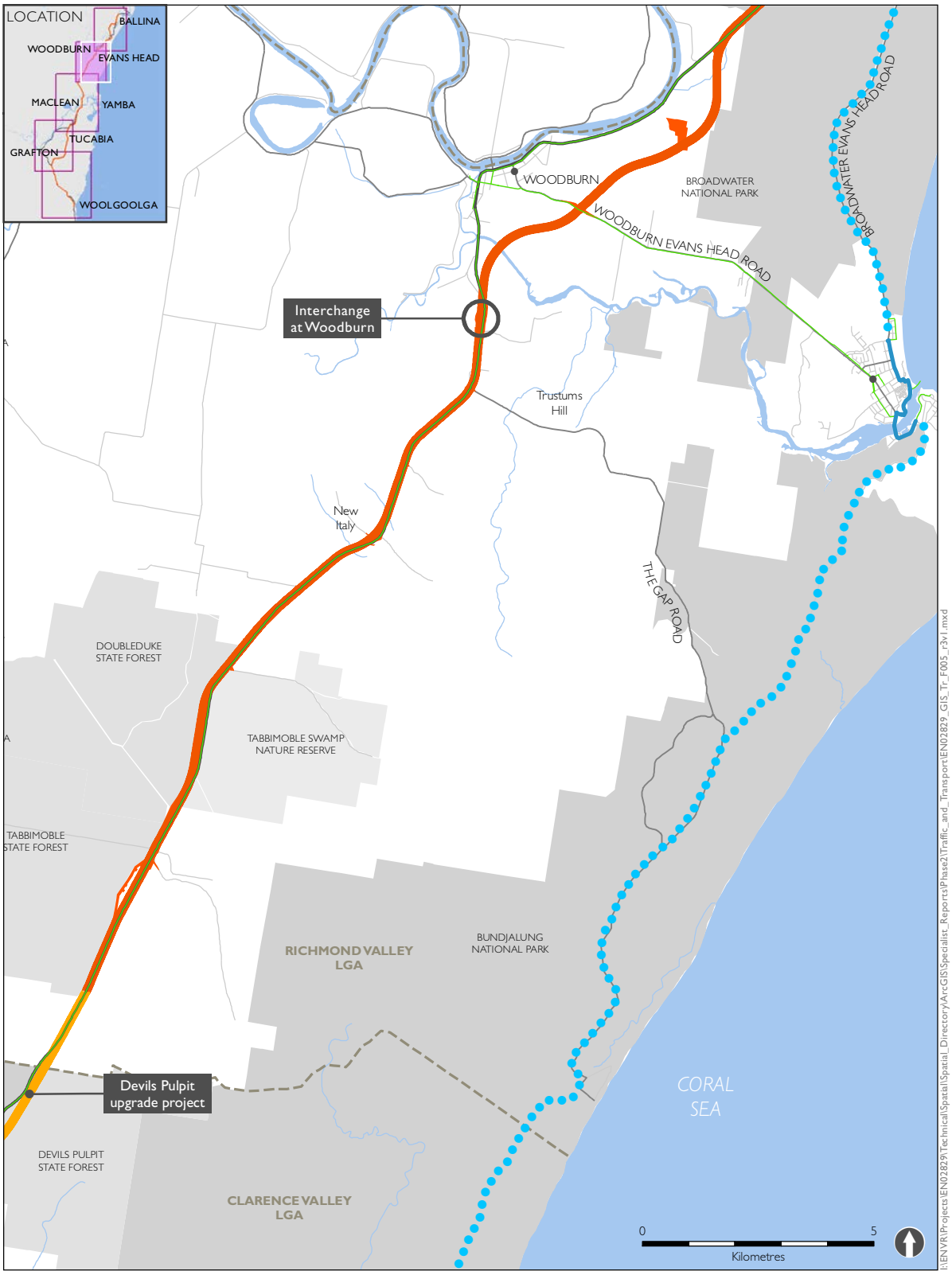
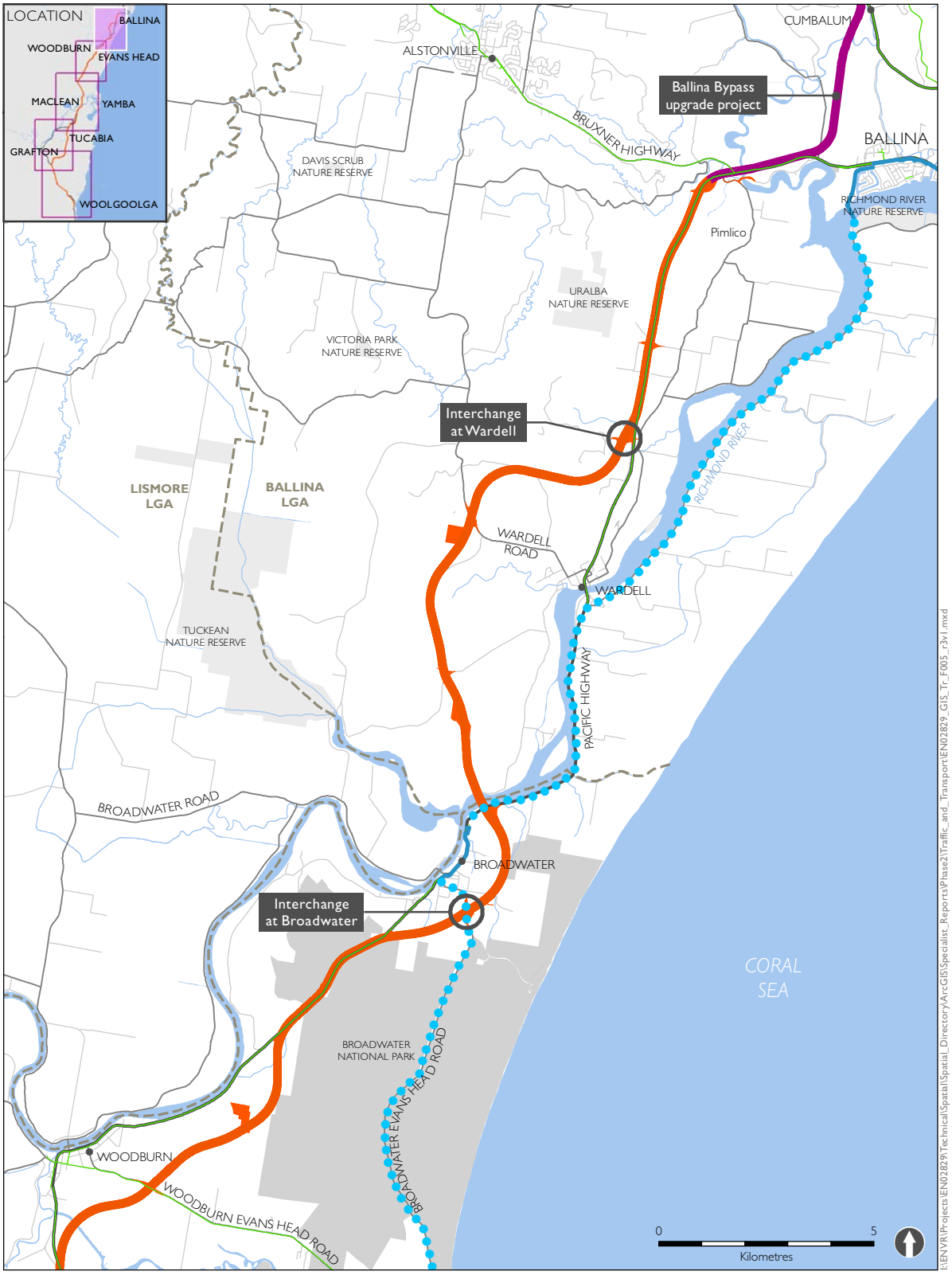


Figure 2-14 NSW coastline cycleway



2.8 Property access

Property access along the existing Pacific Highway is provided either by side road access, or direct access from the highway to adjacent properties. A number of fire trails and internal property access tracks (such as those passing through the sugar cane fields in the area around Maclean) exist throughout the area covered by the project. The majority of these are unsealed and narrow, and may carry a number of heavy vehicles during harvest season.

2.9 Regional airports

The study area is served by Clarence Valley Regional Airport at Grafton and Ballina, with other airports outside the study area at Coffs Harbour. Grafton Airport is served by Regional Express, with 18 weekly services from Sydney (via Taree), although Regional Express, Jetstar and Virgin provide 34 services weekly from Sydney to Ballina.

Road access to Grafton airport from the Pacific Highway is provided by two main routes. Access from the north is via Six Mile Lane and Aerodrome Road, and from the south via Eight Mile Lane and Aerodrome Road. The intersections of the Pacific Highway and Six Mile Lane and Eight Mile Lane are priority-controlled (give way).

2.10 Road safety

Crash data obtained for the Woolgoolga to Ballina section of the existing Pacific Highway were reviewed and based on RMS crash data for the five-year period between 2006 and 2010. One of the objectives of the Pacific Highway Upgrade Program is to reduce the high incidence of road crashes along its length.

2.10.1 Crash statistics

Crashes are recorded as fatal, injury or non-casualty (tow away). The number of crashes along the Pacific Highway over the period 2006 to 2010 is shown in Table 2-16. The data has been aggregated into the sections applicable to the project. Of the total 644 crashes along the highway, 38 per cent involved heavy vehicles. Of the total number of crashes, 29 were fatal, 255 were classified as injury crashes and 360 were non-casualty (tow away) crashes.

Table 2-16 Crash severity (2006-2010)

Section	Number of crashes Location	Length (km)	Fatal	Injury	Non-casualty (tow away)	Total
1	Woolgoolga to Halfway Creek	22.2	7	31	39	77
2	Halfway Creek upgrade to Glenugie upgrade	12.0	1	17	25	43
3	Glenugie upgrade to Tyndale	44.6	7	83	92	182
4	Tyndale to Maclean	13.5	1	12	24	37

Section	Number of crashes Location	Length (km)	Fatal	Injury	Non-casualty (tow away)	Total
5	Maclean to Iluka Road	14.0	1	19	26	46
6	Iluka Road to Devil's Pulpit upgrade	8.7	3	12	7	22
7	Devil's Pulpit upgrade to Trustums Hill	16.8	0	13	42	55
8	Trustums Hill to Broadwater National Park	11.5	1	17	28	46
9	Broadwater National Park to Richmond River	6.7	0	8	9	17
10	Richmond River to Coolgardie Road	11.8	5	22	29	56
11	Coolgardie Road to Ballina Bypass	6.6	1	7	16	24
Total			**29**	**255**	**360**	**644**

2.10.2 Crash locations

Figure 2-15 to Figure 2-19 shows the locations of the crashes that have occurred in the study area between 2006 and 2010. Figure 2-20 presents the crash density, ie the number of crashes occurring within a one kilometre section along the highway, while Figure 2-21 shows the density of casualty crashes over the same period. Figure 2-20 and Figure 2-21 indicate that a number of sections of the highway have very high crash frequency, namely:

- Range Road to Barcoongere Way, Dirty Creek (maximum 16 crashes/ per kilometre)
- Lookout Road to Eight Mile Lane, Glenugie (maximum 16 crashes/ per kilometre). This particular stretch has been improved as part of the Glenugie upgrade
- Centenary Drive and Viaduct Road, South Grafton (maximum of 21 crashes/ per kilometre).

Under the objectives of the Federal Black Spot Program (Australian Transport Council 2011), sections of road with higher than one casualty crash/per kilometre over a five year period warrant intervention. Figure 2-21 identifies the casualty crash density along the existing alignment. While all identified segments would warrant attention, Figure 2-21 indicates that there are clearly sections of the highway that are very concerning with respect to casualty crash density.

Figure 2-15 Fatal, injury and non-casualty crashes (2006 to 2010)

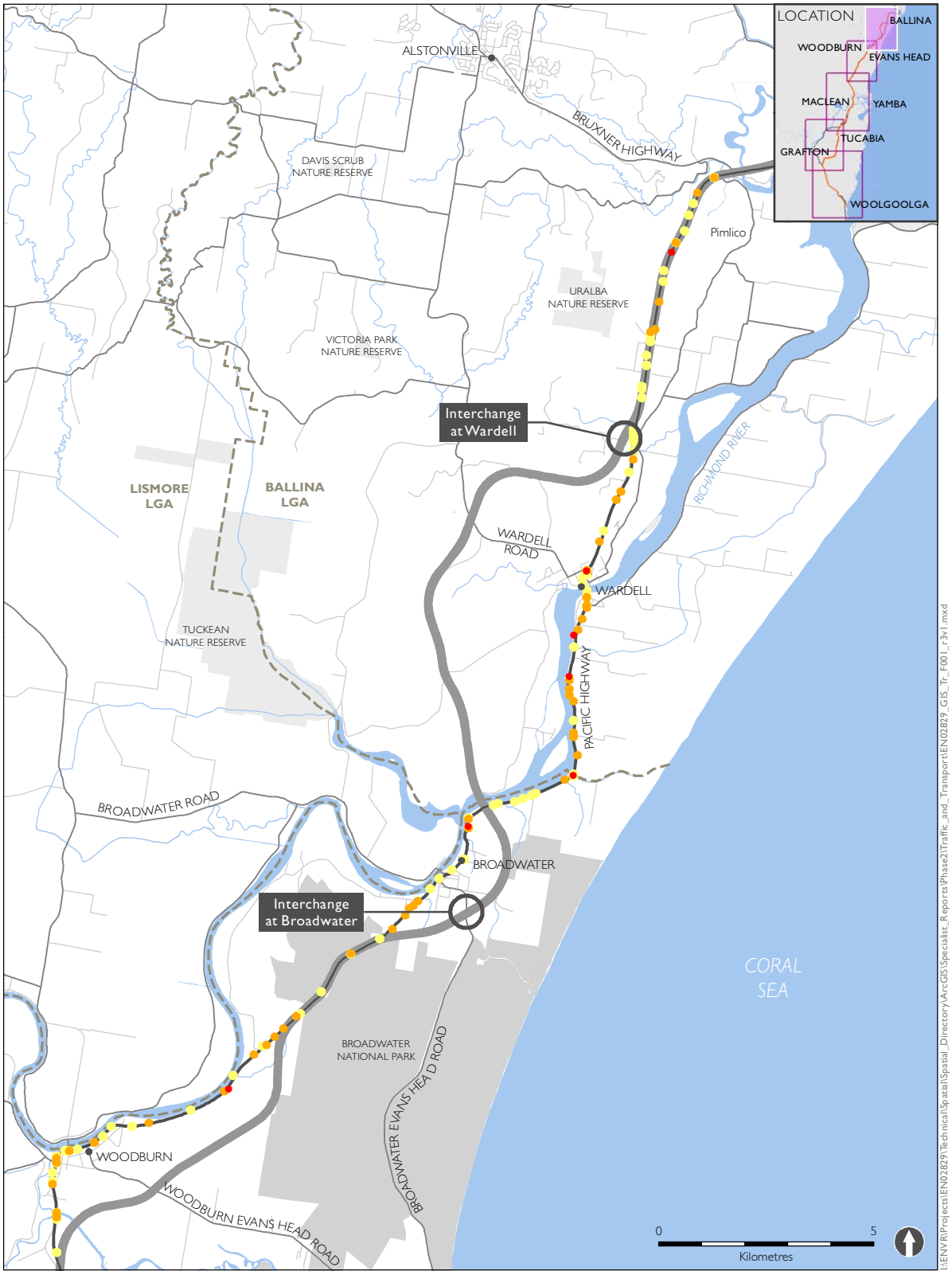


Figure 2-16 Fatal, injury and non-casualty crashes (2006 to 2010)

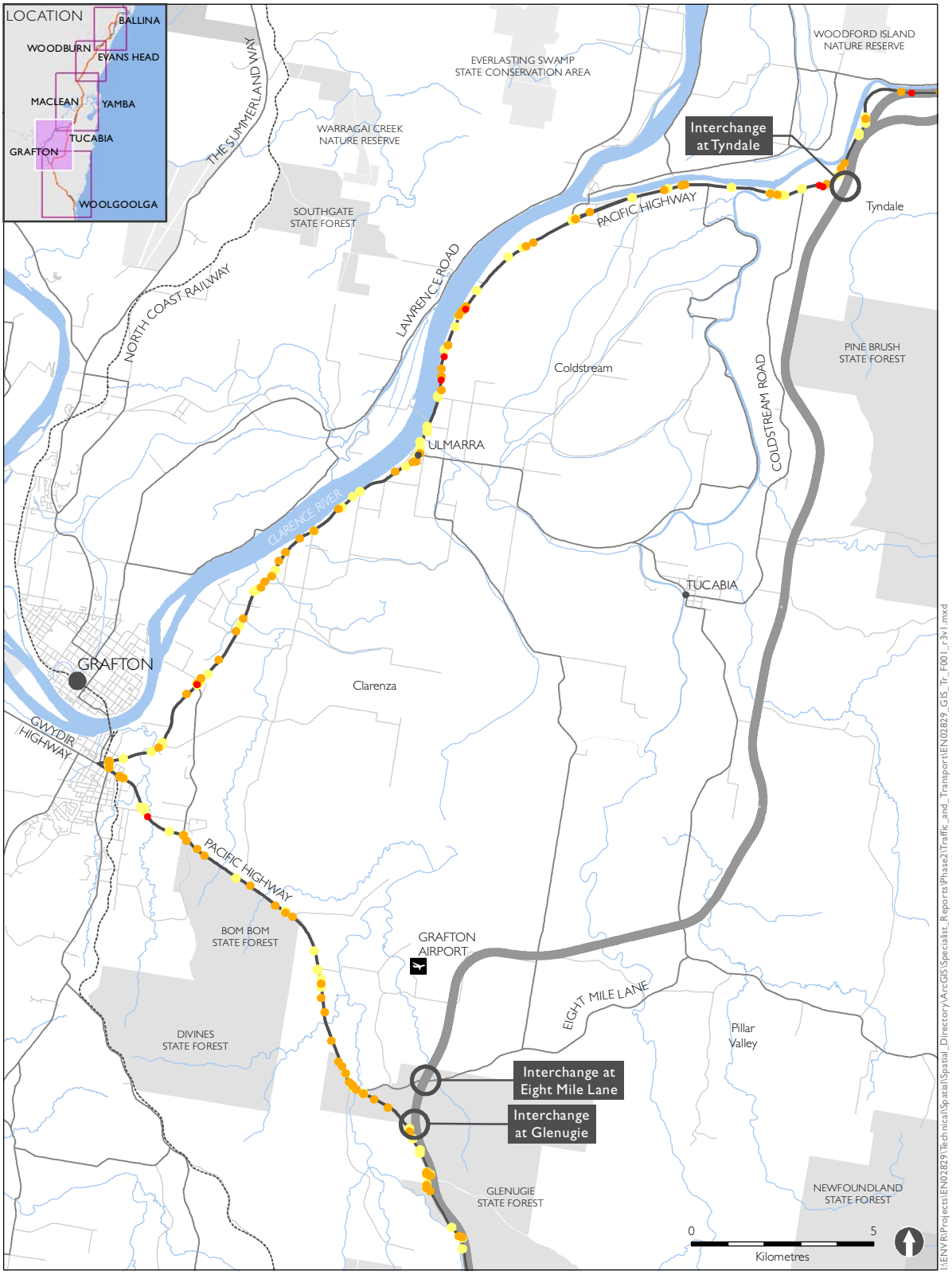


Figure 2-17 Fatal, injury and non-casualty crashes (2006 to 2010)

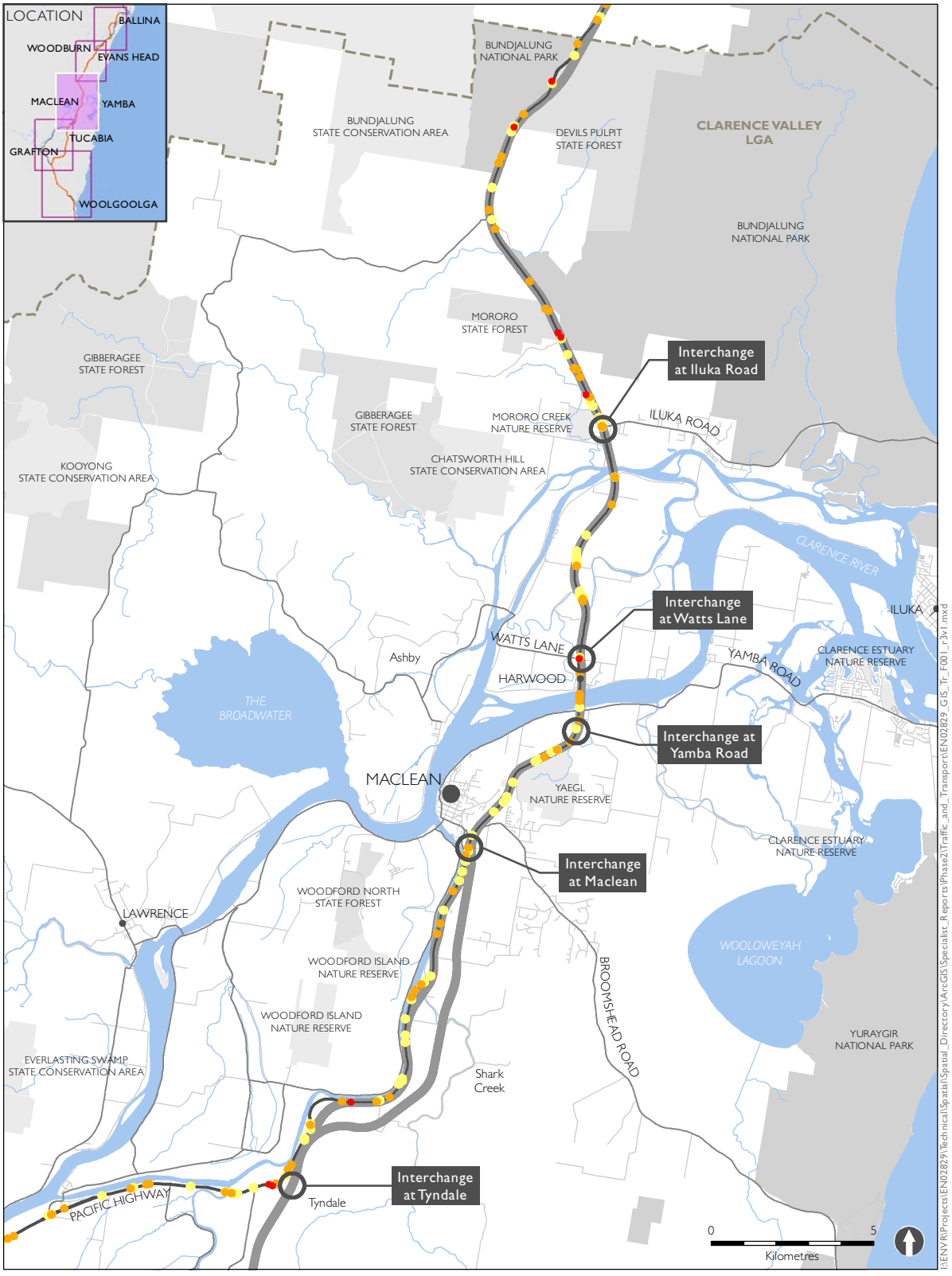


Figure 2-18 Fatal, injury and non-casualty crashes (2006 to 2010)

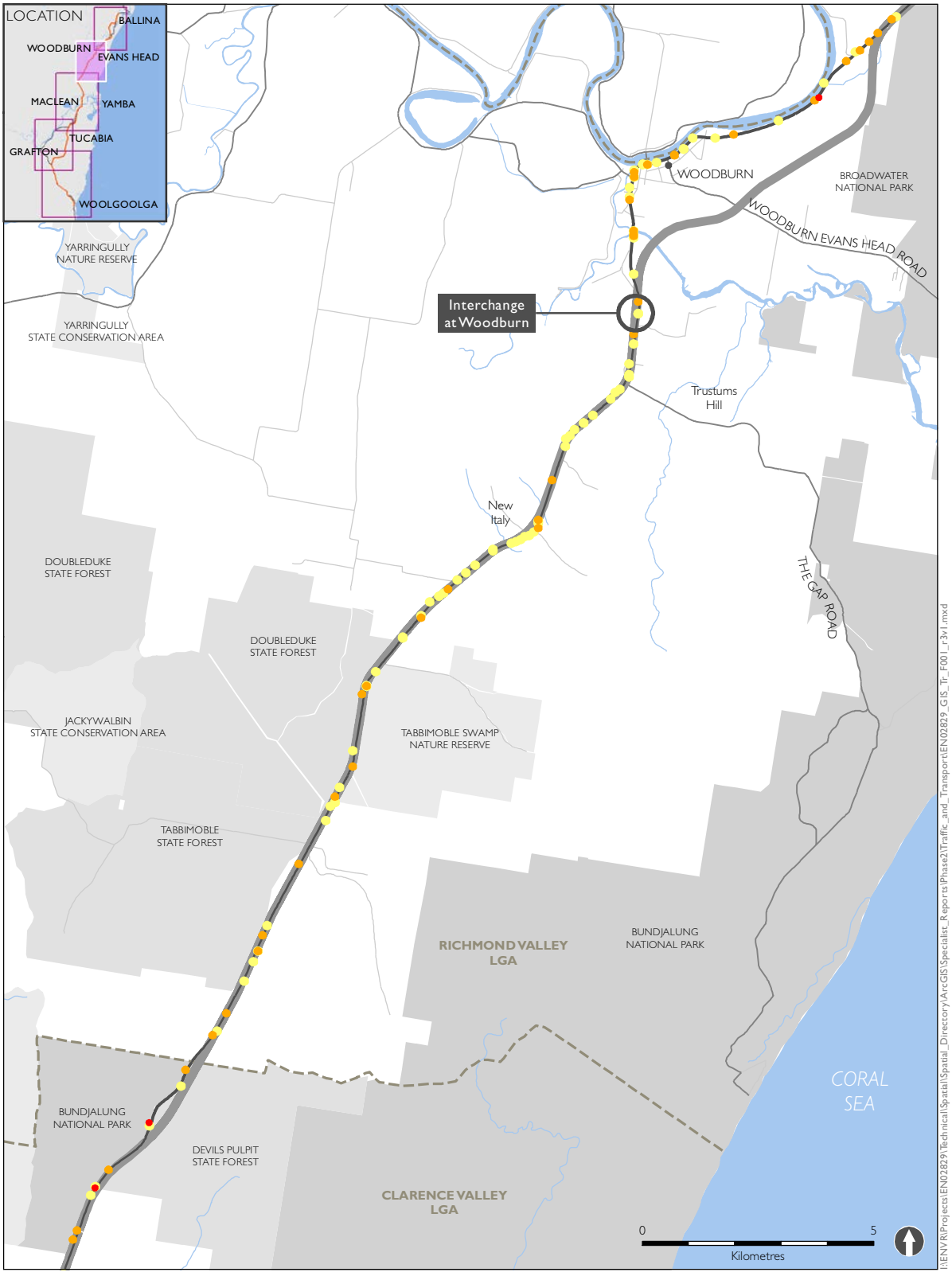


Figure 2-19 Fatal, injury and non-casualty crashes (2006 to 2010)

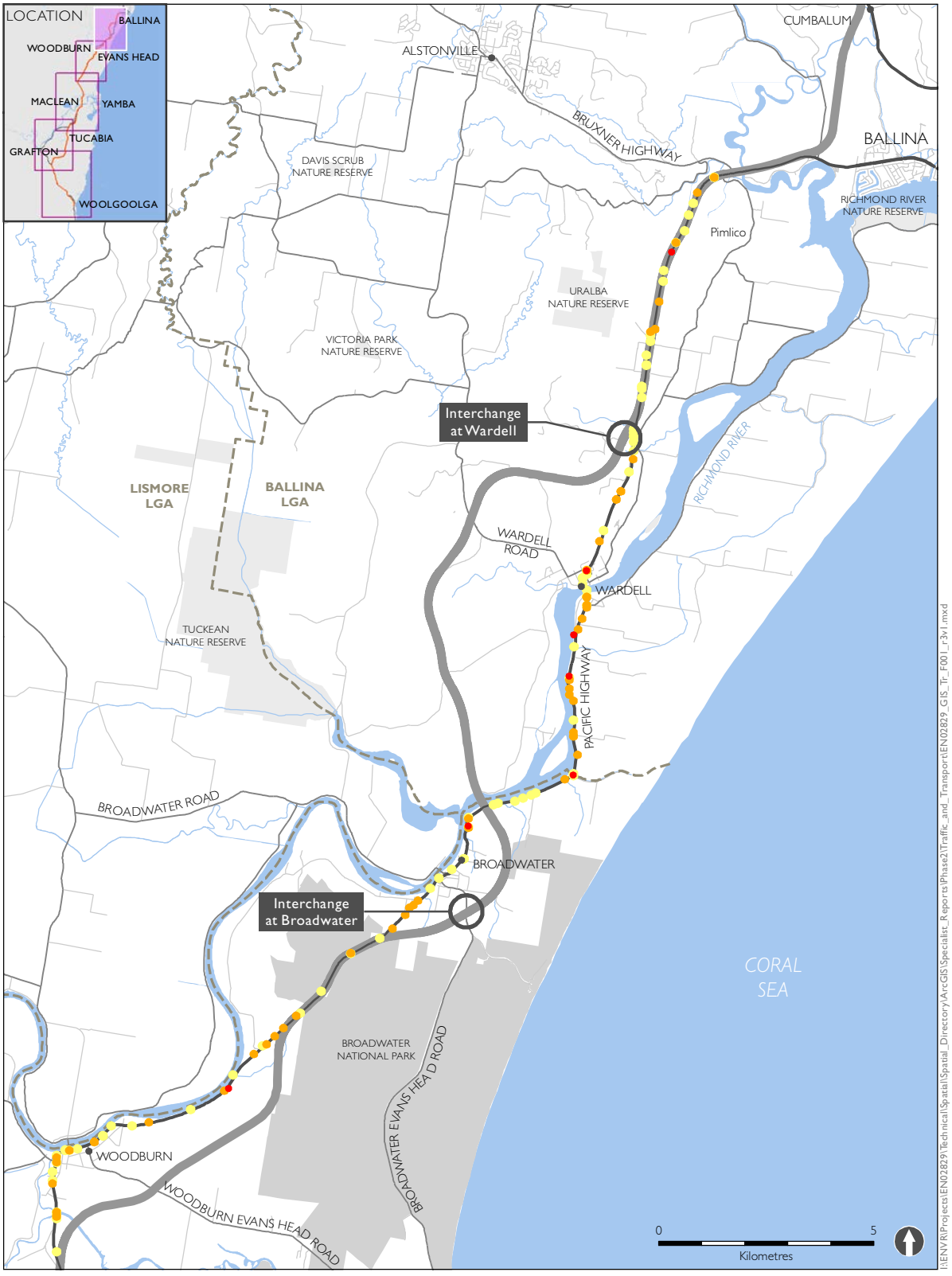


Figure 2-20 Crash density (crashes per kilometre in 2006 to 2010)

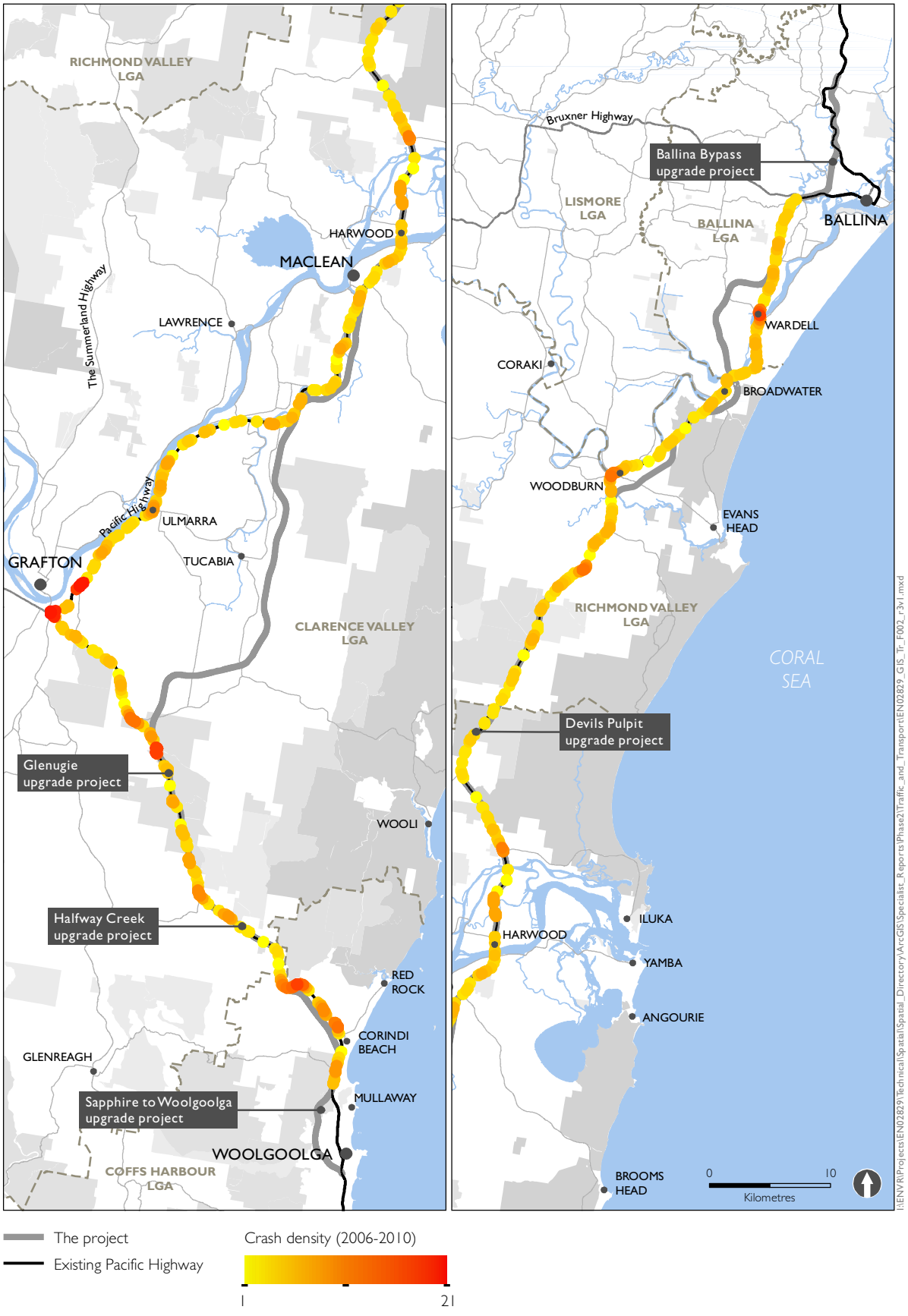
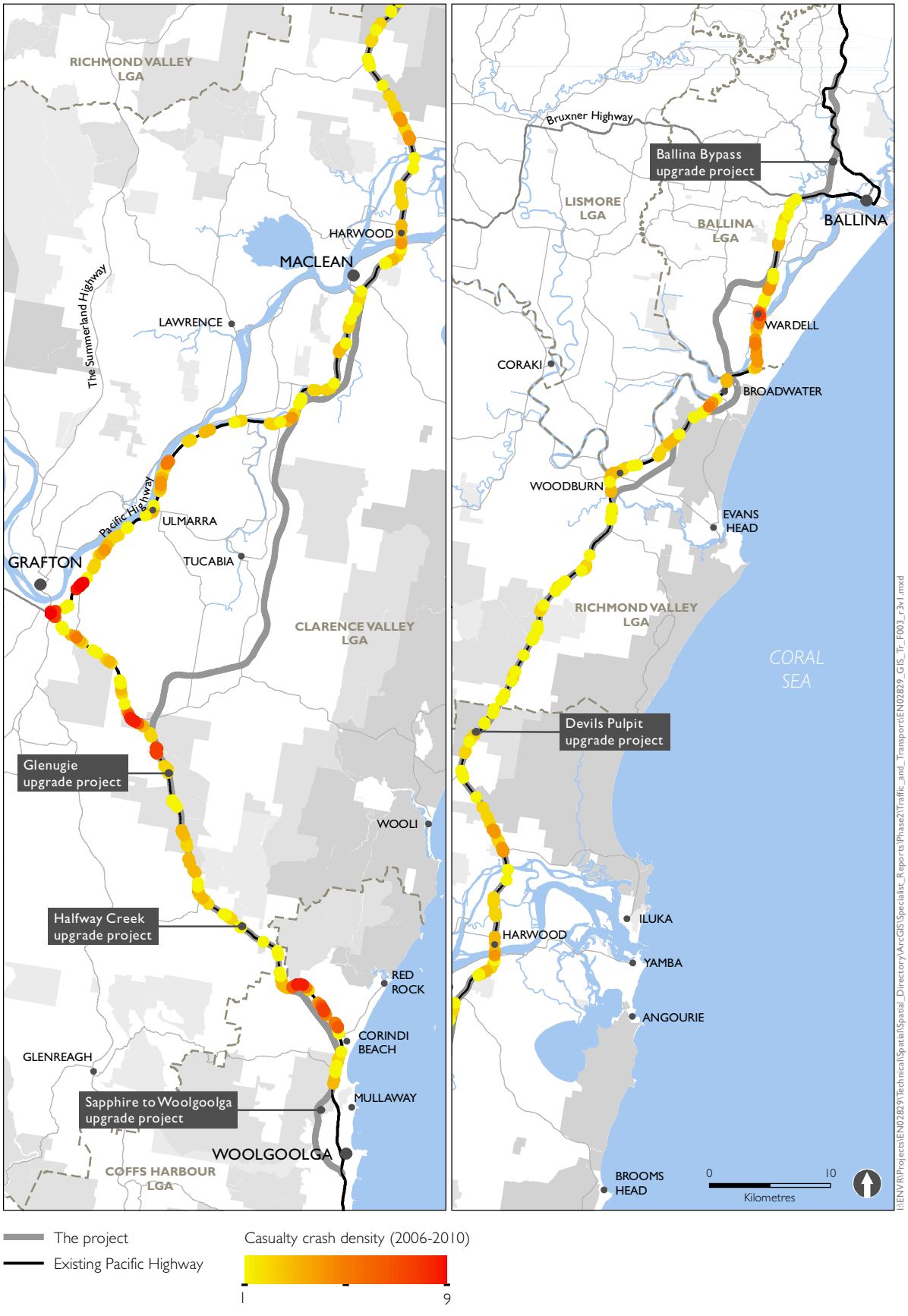


Figure 2-21 Casualty crash density (casualty crashes per kilometre in 2006 to 2010)



2.10.3 Crash rates

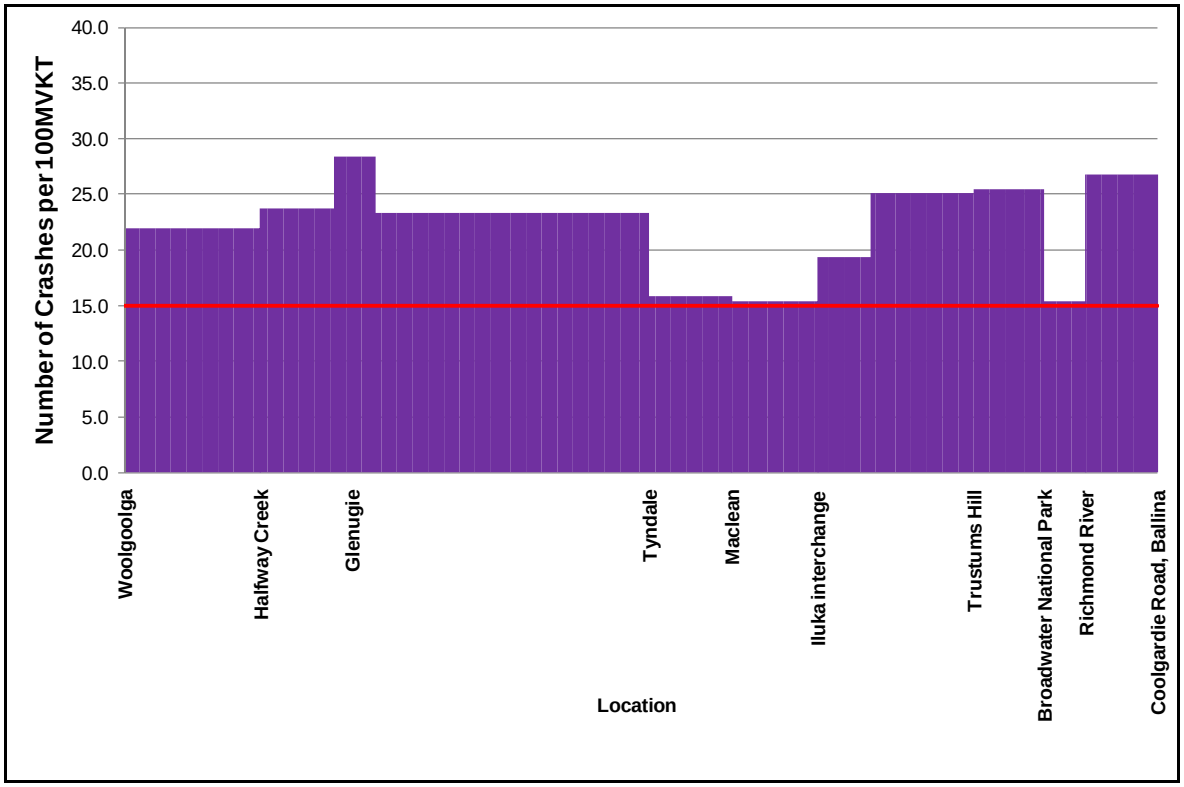
Crash rates are commonly expressed in terms of crashes per total travel, recognising that increased activity does not necessarily translate to increased crash risk. This is expressed as crashes per 100 million vehicle kilometres travelled. For the 5 years of available crash data, the crash rate has been calculated as an average over the period (total crashes divided by an estimate of total travel). One of the objectives of the Pacific Highway Upgrade Program has been to reduce the crash rate on the Pacific Highway to 15 crashes per 100 per million vehicle kilometres travelled. Table 2-17 and Figure 2-22 indicate the average crash rate for each section of the project, from which it is noted that all except the final section into Ballina exceed this targeted crash rate.

Table 2-17 Crash rates along existing Pacific Highway

Section	Location	5year average Annual Crashes per 100 MVKT
1	Woolgoolga to Halfway Creek	21.9
2	Halfway Creek upgrade to Glenugie upgrade	23.7
3	Glenugie upgrade to Tyndale	23.4
4	Tyndale to Maclean	15.8
5	Maclean to Iluka Road	15.4
6	Iluka Road to Devil's Pulpit upgrade	19.4
7	Devil's Pulpit upgrade to Trustums Hill	25.1
8	Trustums Hill to Broadwater National Park	25.5
9	Broadwater National Park to Richmond River	15.4
10	Richmond River to Coolgardie Road	26.7
11	Coolgardie Road to Ballina	9.2

When the total traffic activity and individual crash rates are aggregated, the study area is exhibiting an average crash rate of 20.7 crashes/100 per million vehicle kilometres travelled.

Figure 2-22 Estimated average crash rates along existing Pacific Highway

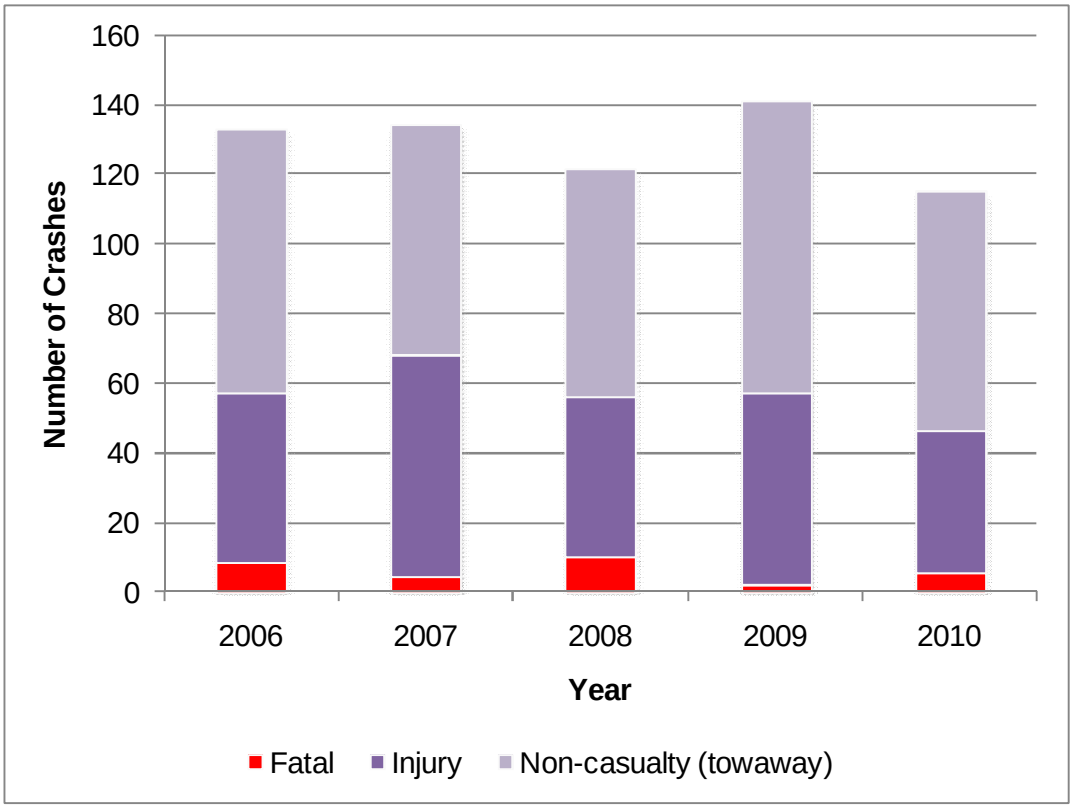


Note*: 15 crashes/100 per million vehicle kilometres travelled is the target crash rate for motorway enhancements*

2.10.4 Yearly trend

Figure 2-23 provides a summary of the number of crashes for the five year period between 2006 and 2010. The general trend in the data indicates the number of crashes has fluctuated across the year, with a maximum of 141 crashes in 2009 and a minimum of 115 crashes in 2010. Over half of all crashes recorded were identified as non-casualty crashes.

Figure 2-23 Yearly crash trend



2.10.5 Crashes by time of day

Table 2-18 shows information on the crashes by time of day. The crashes are aggregated into four different time periods, comprising peak and inter-peak periods. The day time period has the highest number of crashes per hour coinciding with the period of heaviest demand.

Table 2-18 Crashes by time of day

Time period	Number of crashes				Hours	Crashes per hour
	Fatal	Injury	Non-casualty	Total		
Night Time (6:00pm - 7:00am)	9	91	162	262	13	20
AM Peak (7:00am - 9:00am)	6	19	34	59	2	30
Day Time (9:00am - 4:00pm)	11	119	133	263	7	38
PM Peak (4:00pm-6:00pm)	3	26	31	60	2	30

2.10.6 Crashes by vehicle type

Figure 2-24 shows the proportion of crashes involving heavy vehicles fluctuated from a maximum of 41 per cent in 2006 (and 2007) to a minimum of 33 per cent in 2009. Within the five year period, the percentage of crashes involving heavy vehicles has dropped in recent years (2008 to 2010) compared to 2006 and 2007. As the percentage of heavy vehicles within the total traffic fleet using the Pacific Highway is about 25 per cent, the number of crashes involving heavy vehicles is over-represented within the overall crash rate.

Figure 2-24 Proportion of crashes involving heavy vehicles