New South Wales

RTA

Iluka Road to Woodburn

Upgrading the Pacific Highway

CONCEPT DESIGN REPORT

MARCH 2006

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Pacific Highway Upgrade
Iluka Road to Woodburn

Concept Design Report

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Glossary

AADT	Annual average daily traffic volumes
ABS	Australian Bureau of Statistics
ADT	Average daily traffic volumes
AEP	Annual exceedance probability
AHD	Australian height datum
ANZECC	Australian and New Zealand Environment Conservation Council
At-grade	At the same level; eg an intersection where two or more streams of traffic are required to cross paths when turning
B-double	A combination road vehicle consisting of a prime mover towing two semi-trailers
BCR	Benefit cost ratio
BH	Bore hole
CIS	Community information session
Class A	Divided road with at least two lanes in each direction and shoulders and some direct accesses
Class M	Divided road with at least two lanes in each direction and shoulders with no direct accesses and with flyover type interchanges
CLG	Community liaison group
CMP	Conservation Management Plan
Concept design	Initial alignment for consultation with community and other stakeholders. Concept design has been developed for the upgrade of the Pacific Highway between Iluka Road to Woodburn
CRAFTI	Comprehensive Regional Assessment Aerial Photograph Interpretation vegetation maps
dB(A)	Decibel. Unit used for 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear
DEC	Department of Environment and Conservation (comprising National Parks and Wildlife Service and Environment Protection Authority)
DNR	Department of Natural Resources
DoP	Department of Planning
Double lane divided road	Dual carriageway
DPI	Department of Primary Industries (NSW Fisheries, NSW Agriculture, NSW Forests)
DHV	Design hour volume
EEC	Endangered ecological community
EIA	Environmental impact assessment
EIS	Environmental impact statement
Endangered	Species listed as 'endangered' under the Threatened Species Conservation Act 1995
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC	*Environmental Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically sustainable development
Flyover	An overpass to enable separation of main road traffic and minor crossing traffic
FMZ	Forest Management Zones
Grade-separated	Refers to roads constructed at different levels such as flyovers, interchanges and overpasses
hr	Hour
Interchange	Any junction enabling movements between the main road and a minor road
km/h	Kilometres per hour
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan

Glossary (cont.)

LGA	Local government area
LOS	Level of Service
MLEP	Maclean Local Environmental Plan 2001
Model Provisions	*Environmental Planning and Assessment Model Provisions 1980*
Mvkt	Million vehicle kilometres travelled
NPWS	National Parks and Wildlife Service
NRMA	National Roads and Motoring Association
NSW	New South Wales
PADS	Potential archaeological deposits
pc/h	Passenger cars per hour
PFM	Planning focus meeting
pH	Value taken to represent acidity or alkalinity of an aqueous solution
PHUP	Pacific Highway Upgrade Program
PVB	Present value of benefits
PVC	Present value of costs
REP	Regional Environmental Plan
RL	Reduced level
RRLEP	*Richmond River Local Environmental Plan 1992*
RTA	Roads and Traffic Authority
Seagull	T-intersection on a divided road with deceleration and acceleration lanes in the median
SEPP 4	*State Environmental Planning Policy No. 4 – Development Without Consent and Miscellaneous and Complying Development*
SEPP 14	*State Environmental Planning Policy No. 14 – Coastal Wetlands*
Service road	Through route adjacent to Class M providing a link to access roads and local communities
Shoulder	The area beside a main road where a driver can stop in an emergency
Threatened	Species listed as 'threatened' under the *Threatened Species Conservation Act 1995*
T-intersection	Where one road meets another without crossing it, forming the shape of a letter 'T'
TSC Act	*Threatened Species Conservation Act 1995*
TSS	Total suspended solids
U-turn bay	Facility to enable one to turn and travel in the opposite direction
VOC	Vehicle operating costs
vpd	*Vehicles per day*
Vulnerable	Species listed as 'vulnerable' under the *Threatened Species Conservation Act 1995*

Executive Summary

Between Iluka Road and Woodburn, the Roads and Traffic Authority (RTA) proposes to upgrade the Pacific Highway, generally by following its existing route. This report describes the proposed concept design.

With the $2.2 billion Pacific Highway Upgrade Program in place since 1996, a total 233 km of the highway are now double-lane divided road. A further 302 km of new highway are under construction, have been approved for construction or have had a preferred upgrade route identified (refer to **Figure A**).

As of the end of March 2006, this leaves only 162 kilometres where a preferred route is still to be identified.

Route options for five projects were displayed in October – November 2005:

- F3 Freeway to Raymond Terrace.
- Oxley Highway to Kempsey.
- Woolgoolga to Wells Crossing.
- Wells Crossing to Iluka Road.
- Tintenbar to Ewingsdale.

This final group of five projects is now proceeding to the route selection phase. These five projects, along with the sections from Macksville to Urunga and Woodburn to Ballina, will provide preferred routes for a total 230 km of the highway. This will provide planning certainty for local communities and pave the way for a construction program to complete the upgrade of the Pacific Highway.

Another three projects:

- Iluka Road to Woodburn;
- Failford Road to Tritton Road; and
- Herons Creek to Stills Road;

involve upgrading the highway along the existing alignment. Concept plans are currently being prepared, and the upgrading of the highway to dual carriageway in these locations is being discussed with adjacent communities.

The Iluka Road to Woodburn upgrade is proceeding to concept design display in March 2006.

Beyond 2006

The Roads and Traffic Authority (RTA) is planning in the long term to provide a high standard road, described as a motorway or 'Class M'. A key feature of a motorway involves the separation of local and through or long distance traffic, refer to **Figure B**. This means that alongside the motorway, which is designed for a speed of 110 km/h, there will be a lower speed alternative local road. Local traffic can get onto the motorway at regular grade-separated interchanges.

Iluka Road to Woodburn

The Iluka Road to Woodburn Project comprises approximately 35 km of the existing Pacific Highway, from the Iluka Road turnoff to the junction of the Pacific Highway and Tuckombil Road at Trustums Hill, approximately 2 km south of Woodburn. The aim of the project is to upgrade the highway to a high-standard dual carriageway facility. The plans discussed in this report would be built in two separate

stages, firstly to a 'Class A' or arterial standard, and in the longer term, to a 'Class M' or Motorway standard (the two are described below).

The study area predominantly follows the existing Pacific Highway alignment and is confined to a band approximately 1.5 km wide.

Road design and upgrade strategies

Design standards for the PHUP require a four lane divided highway, capable for future upgrade to a motorway-standard road. The design will allow for future growth in Pacific Highway traffic, based on projections of traffic volumes for 20 years from the date of opening (taken as being 2016).

The proposed upgrade strategy being considered for Iluka Road to Woodburn is initially for a 'Class A' highway with two lanes in each direction, limited access and at-grade intersections. The speed limit would be signposted at 100 km/h but may be increased to 110 km/h.

Grade-separated or flyover-type interchanges would be located at both the Iluka Road intersection and at Woodburn. The interchanges are being planned as part of the adjoining Pacific Highway upgrade projects for Wells Crossing to Iluka Road and Woodburn to Ballina, which form part of project planning south and north of the Iluka Road to Woodburn highway upgrade, respectively.

The RTA is also planning for a possible future upgrade to a 'Class M' or motorway standard road, with two lanes in each direction, but with the capability of being upgraded to three lanes in each direction when warranted. A Class M road would have 110 km/h posted speed, controlled access, and grade-separated or flyover-type interchange access. Under a future Class M arrangement local traffic would be diverted to a parallel service road, having two lanes and with a posted speed limit of less than 100 km/h.

At the present time, there is no timeframe proposed for implementing a Class M strategy for the proposal. However, planning is important at this stage of the project so that it can be achieved with minimal disruption to highway operation, without having to reconstruct large sections of new highway, without major environmental impact and without further disruption or uncertainty for private landowners. Potential property and land use issues for the Class M strategy are considered in this report.

Development of the proposed concept design

The route development process has involved the following steps:

- Review of existing data.
- Site visits – road and aerial inspections of the study area.
- Preliminary ecological, heritage, traffic, geotechnical and other investigations including field studies.
- Community involvement activities to identify community interests, issues and concerns.
- A risk assessment workshop.
- Identification of a possible highway upgrade route.
- Development and refinement of the proposed route concept design.
- Preparation of the Concept Design Report.
- Commencement of detailed survey of the proposed concept design route.
- The concept design display provides the community with an opportunity to comment on the proposed concept design.
- Community groups and individuals have been kept informed of the project to date through:
- Community information session (CIS) held in Woodburn at the commencement of the study in December 2004.
- CIS held in New Italy to provide a project update and identify opportunities and constraints in March 2005.

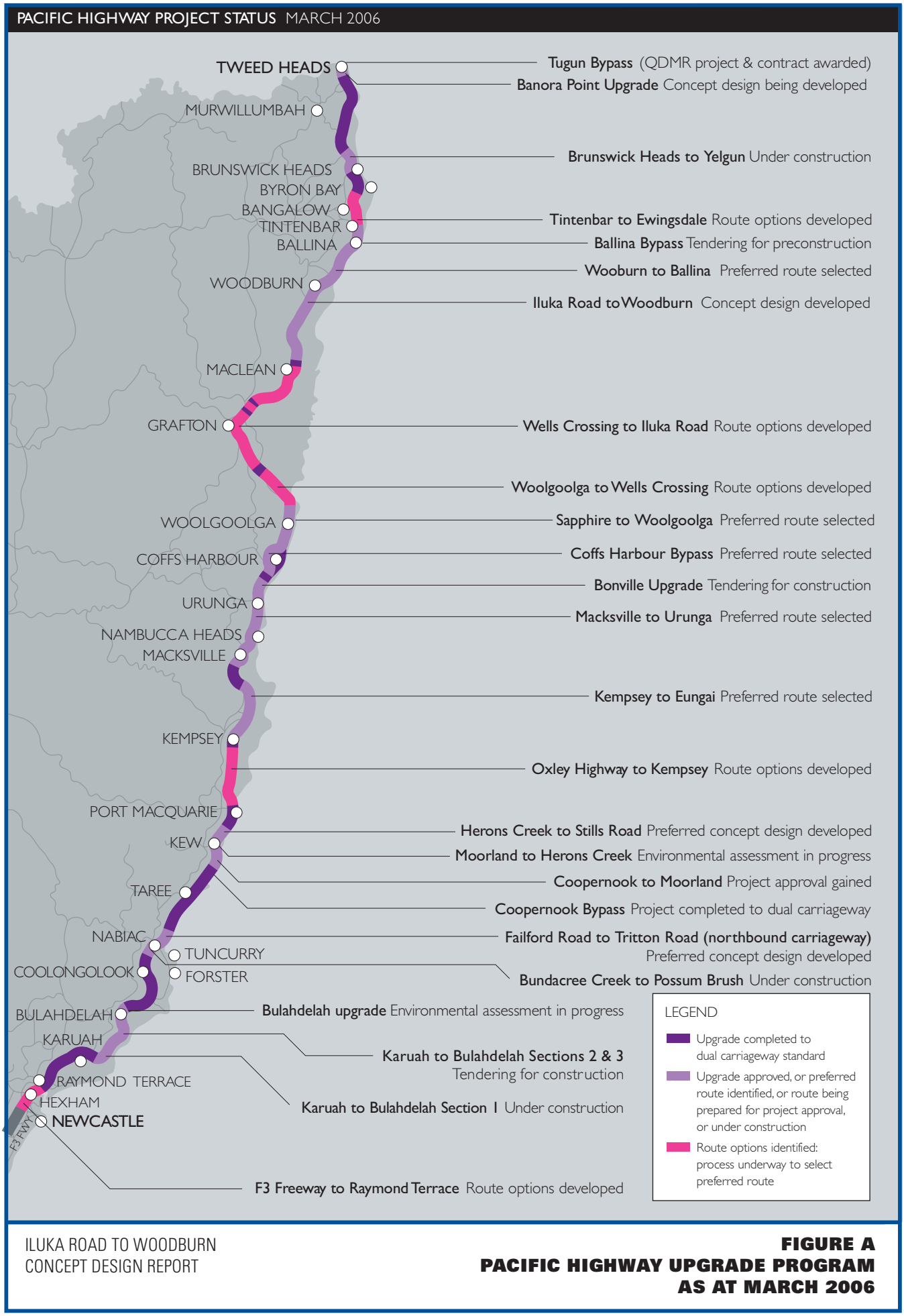

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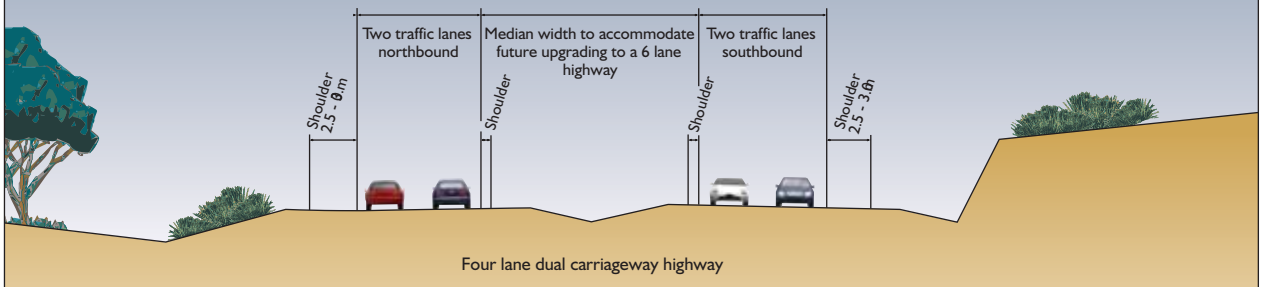
FIGURE A
PACIFIC HIGHWAY UPGRADE PROGRAM
AS AT MARCH 2006

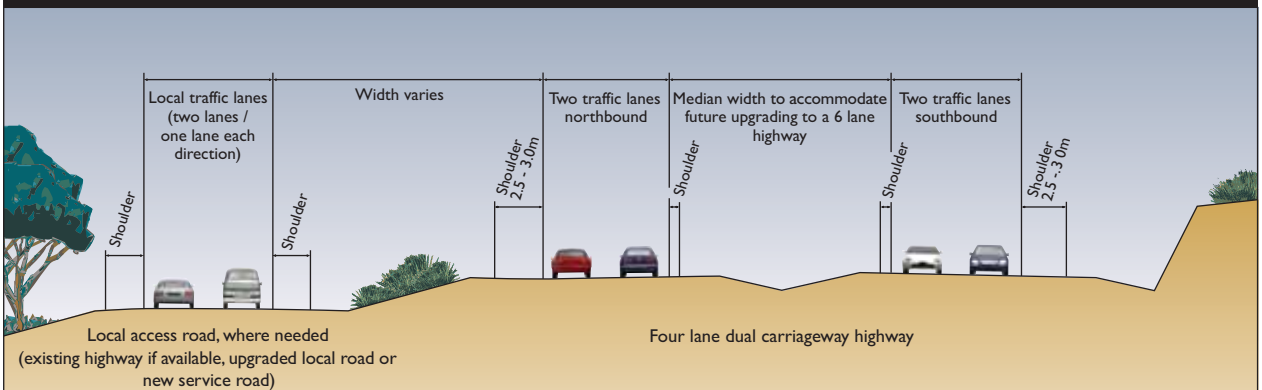
TYPICAL CROSS SECTION SHOWING AN UPGRADE, DUAL CARRIAGEWAY HIGHWAY



This cross section shows a typical arrangement of the Pacific Highway.
The final arrangement may vary as conditions change, for example, local topography.

A new carriageway is to be constructed along side the existing highway for much of this project. Which side of the existing highway the new carriageway will be built on may vary from location to location depending on environmental, engineering or other constraints.

TYPICAL CROSS SECTION SHOWING THE NEW MOTORWAY WITH A LOCAL ACCESS ROAD RUNNING PARALLEL



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- Distribution of community updates in November 2004, February 2005, October 2005 and December 2005.
- Public notice advertising and media coverage (print and electronic) informing the community of key aspects of the project and opportunities for involvement.
- Submissions and comments via letters, a free call community information line and e-mail.
- A project website to host project information, project updates and records of CIS meetings.
- A planning focus meeting (PFM) with representatives of State government agencies, Clarence Valley Council and Richmond Valley Council.
- Meetings/briefings with local councils and State government agencies.
- Meetings and site visits with individual residents and property owners.

At the first CIS meeting, nominations were invited from the community for the formation of a community liaison group (CLG). However, the study area's population is small and dispersed and it was considered that all interested community members could be directly engaged with through the continuation of the CISs. As such a CLG was not formed for this project.

Area characteristics

The study area is shown in **Figure C**.

Traffic and transport issues

The proposed upgrade of the Pacific Highway between Iluka Road and Woodburn is needed to improve road safety and to reduce travel times. Upgrading the Pacific Highway will reduce travel times, bringing benefits for all road users including local and long distance travellers, and freight transport operators.

Future travel demand in the corridor is unlikely to be served by rail transport. It is therefore important that the road system be upgraded to ensure that there is capacity to safely meet future demand.

The existing Pacific Highway through the study area is primarily a two-lane road with occasional overtaking lanes. The existing alignment in some sections does not meet current design standards for the upgrading of the highway, in terms of curves and gradients. However, much of the route has a good alignment and has been designed with curves and gradients that are suitable for upgrading by duplicating the existing carriageway, either on the east or the west side of the existing highway.

The current crash rate on the Pacific Highway between Iluka Road and Woodburn is approximately 30 crashes per 100 million vehicle kilometres travelled (Mvkt). The crash rate is predicted to decrease to 28 crashes per 100Mvkt once a wire rope median scheme (currently being installed) has been fully implemented. The proposed highway upgrade will reduce this crash rate further, and is predicted to achieve a crash rate of 23 crashes per 100Mvkt.

Within the study area, the highway currently passes through semi-rural residential areas, cane farms and the New Italy historical settlement. Characteristics of the existing highway are:

- A high proportion of long distance traffic, especially heavy vehicles, which have been increasing substantially over the past five years (approximately 90% of existing traffic between Iluka Road and Woodburn is through traffic).
- Predominantly single carriageway with limited overtaking opportunities and potential for head-on collisions.
- Vehicles cannot travel at a consistent speed.
- A number of residences along the highway in close proximity to the road edge.
- Vehicles can enter or exit the highway at numerous access points, including local roads and private properties, which increases the potential for conflicts with high speed through traffic.

There is a need to provide a higher and consistent standard of road to better serve existing and future road users. The upgrading of this section of the highway forms an essential part of the overall upgrade of the highway between Hexham and the Queensland border.

Concept design

The existing highway route is mostly of a good standard. Therefore, a route concept based on duplication of the existing highway with short sections of new highway where the existing alignment is sub-standard has been used, rather than multiple route options. The largest section of proposed new highway is a 3 km deviation adjacent to the Devils Pulpit State Forest. The RTA has already acquired a corridor of land to the east of the existing highway for this purpose. There would be additional minor land acquisition in certain areas, where the corridor is either too narrow to accommodate the second carriageway, or where realignment for curve straightening is required.

The route concept was developed through a process that involved an assessment of transportation issues, and the opportunities and constraints to new road development within the study area. Key environmental and land use constraints include:

- Rural residential communities.
- Agricultural land, in particular the sugar cane farms at the southern end of the study area.
- Areas of environmental sensitivity including State Forests, nature reserves and the Bundjalung National Park.
- The New Italy village and Museum Complex, which is of local historical, social and cultural significance.
- Locally and regionally significant flora and fauna, some of which have been identified as threatened or endangered.
- Flood prone land along the highway route.

Another important issue is the need to link the project with other Pacific Highway Upgrade projects to the south (Iluka Road to Wells Crossing) and north (Woodburn to Ballina). The Iluka Road to Woodburn project would tie into the Wells Crossing to Iluka Road project at Iluka Road and would tie into the preferred option being considered for the Woodburn to Ballina project, in the vicinity of the junction of the Pacific Highway and Tuckombil Road at Trustums Hill, approximately 2 km south of Woodburn.

In developing the proposed concept design, the project team sought to avoid significant constraints while identifying a feasible highway upgrade option that could be developed to meet the project objectives. The PHUP has a set of broad objectives for the whole of the highway from Hexham to the Queensland border. From the PHUP objectives, the RTA derived a set of more specific objectives to guide the development of the Iluka Road to Woodburn project. The PHUP objectives and the Iluka Road to Woodburn project objectives are listed in **Table A**.

The project team has also developed a set of assessment criteria to measure the performance of the proposed concept design against the PHUP and project objectives. The assessment criteria, and the evaluation of the proposed concept design against the objectives, are also set out in **Table A**.

The proposed concept design was then assessed against the PHUP and project objectives, to determine whether it remained feasible. The proposed concept design is illustrated in **Figure D-1 to D-5**.

Assessment of the proposed concept design

The proposed concept design was assessed against a wide range of social, biophysical, economic, traffic and transport factors. The proposed concept design and assessment criteria will be further refined after the public display period. Results of investigations undertaken to date, in developing the proposed concept design, are summarised in the **Table A** below.

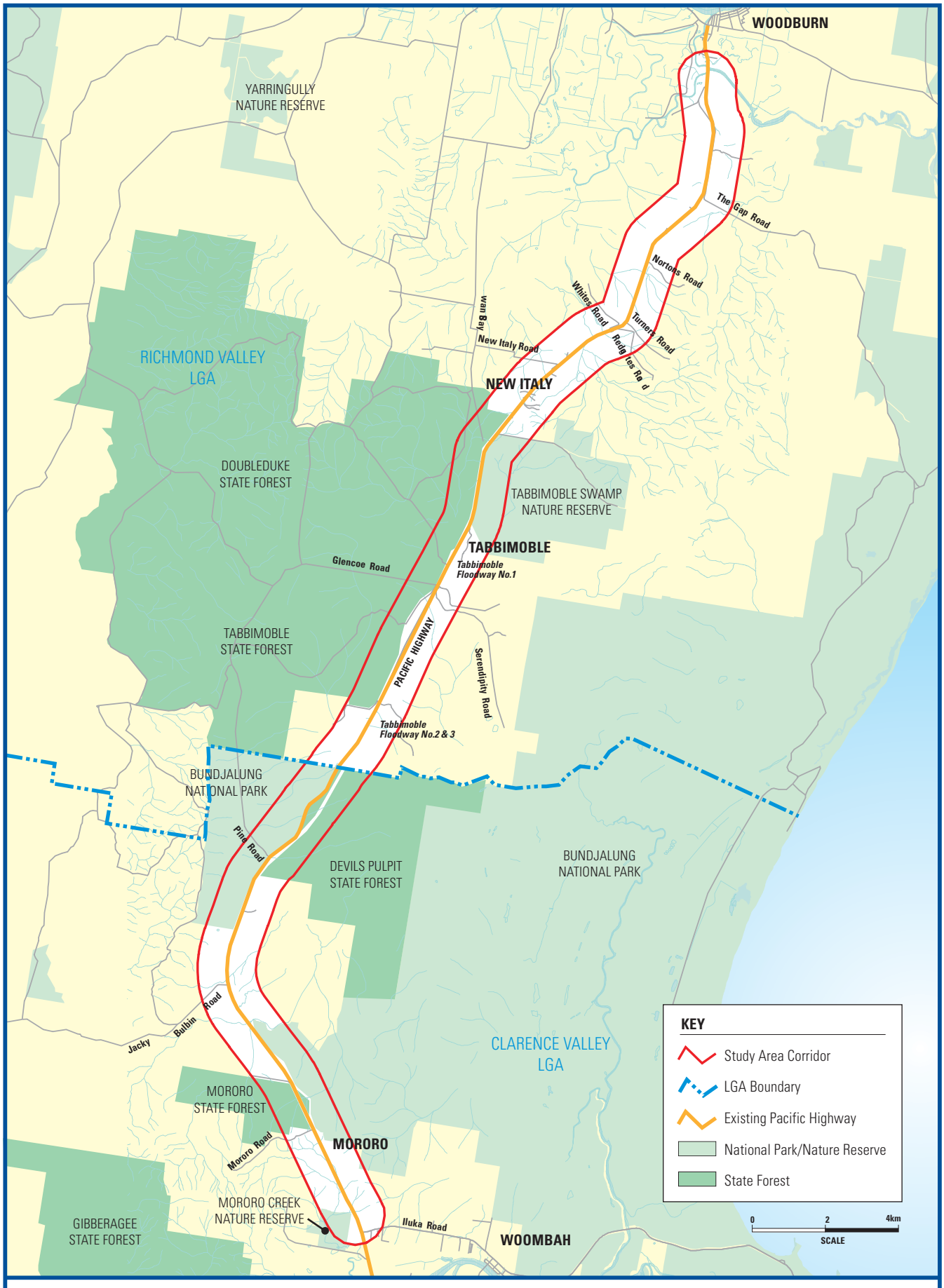

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FIGURE C
STUDY AREA

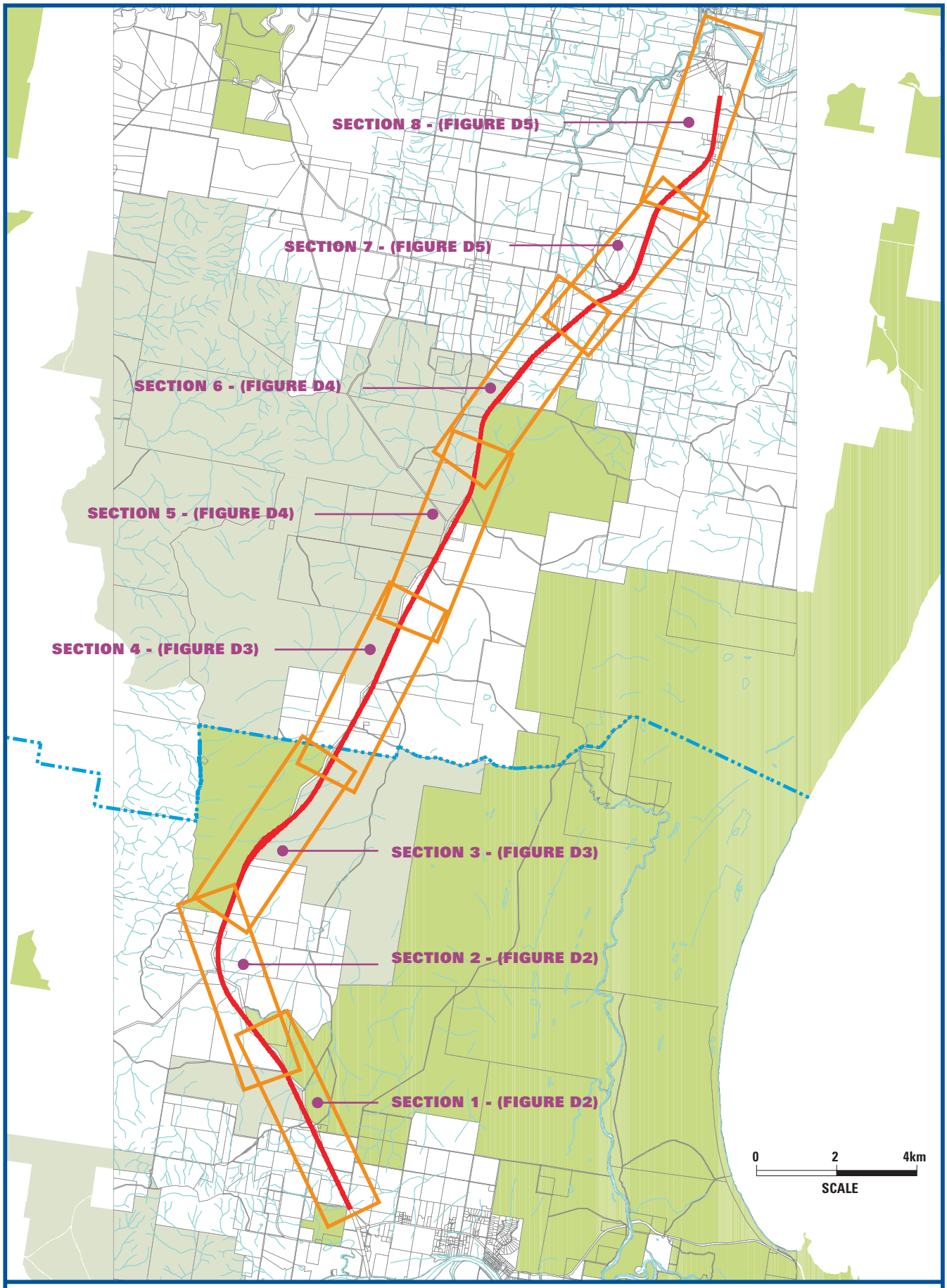

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FIGURE D1
PROPOSED CONCEPT DESIGN SECTIONS MAP

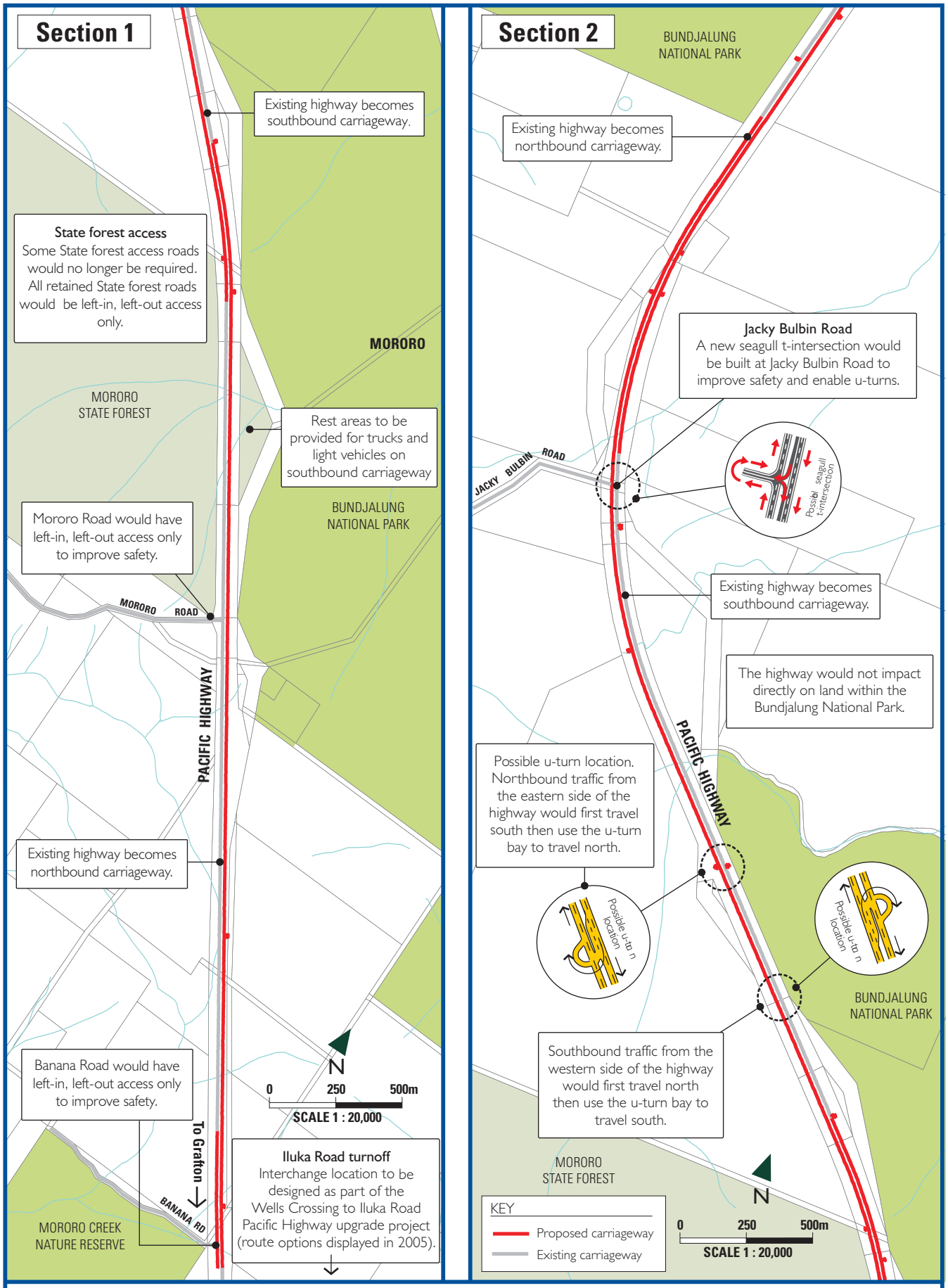

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FIGURE D2
PROPOSED CONCEPT DESIGN

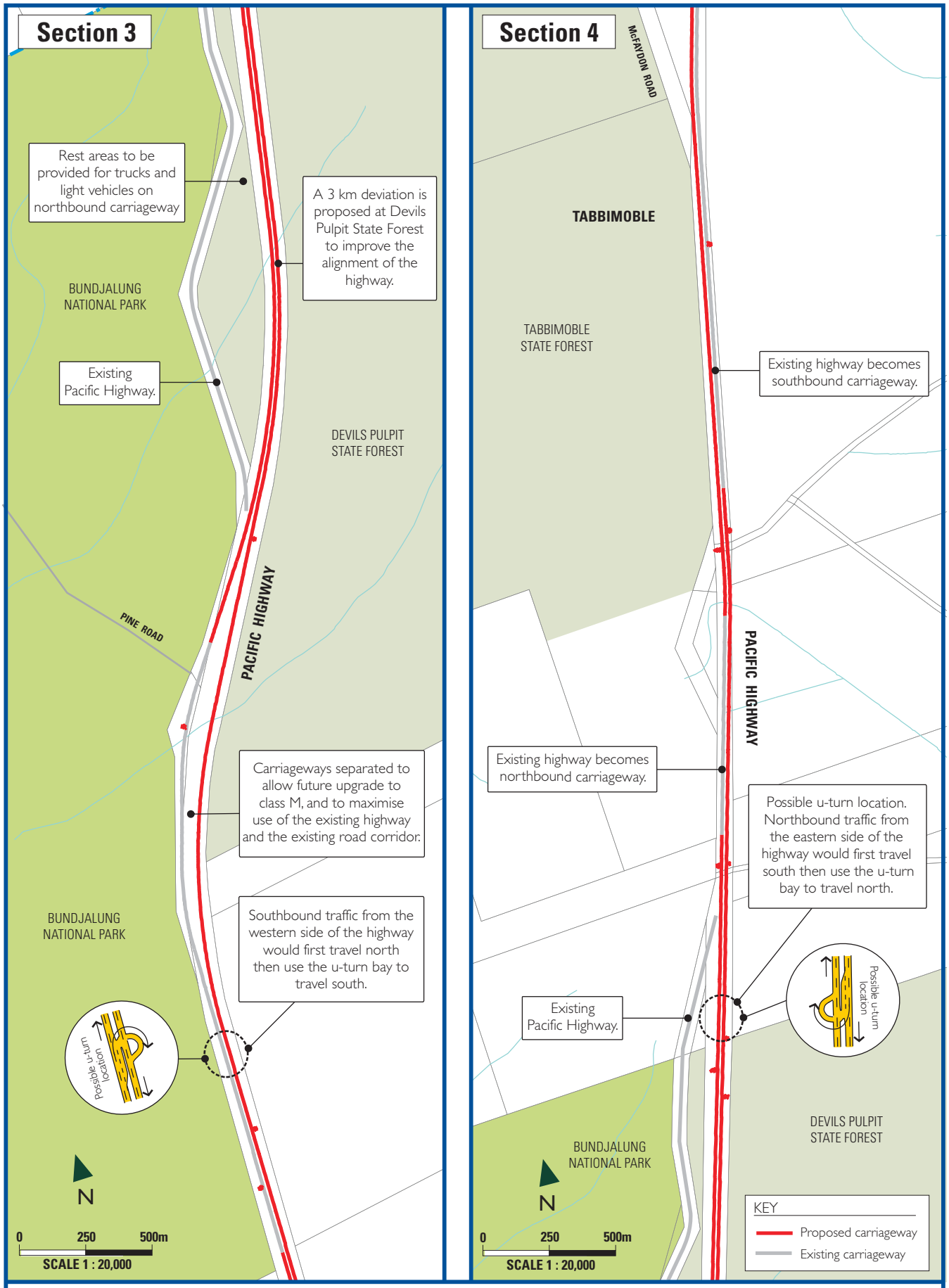

FIGURE D3
PROPOSED CONCEPT DESIGN

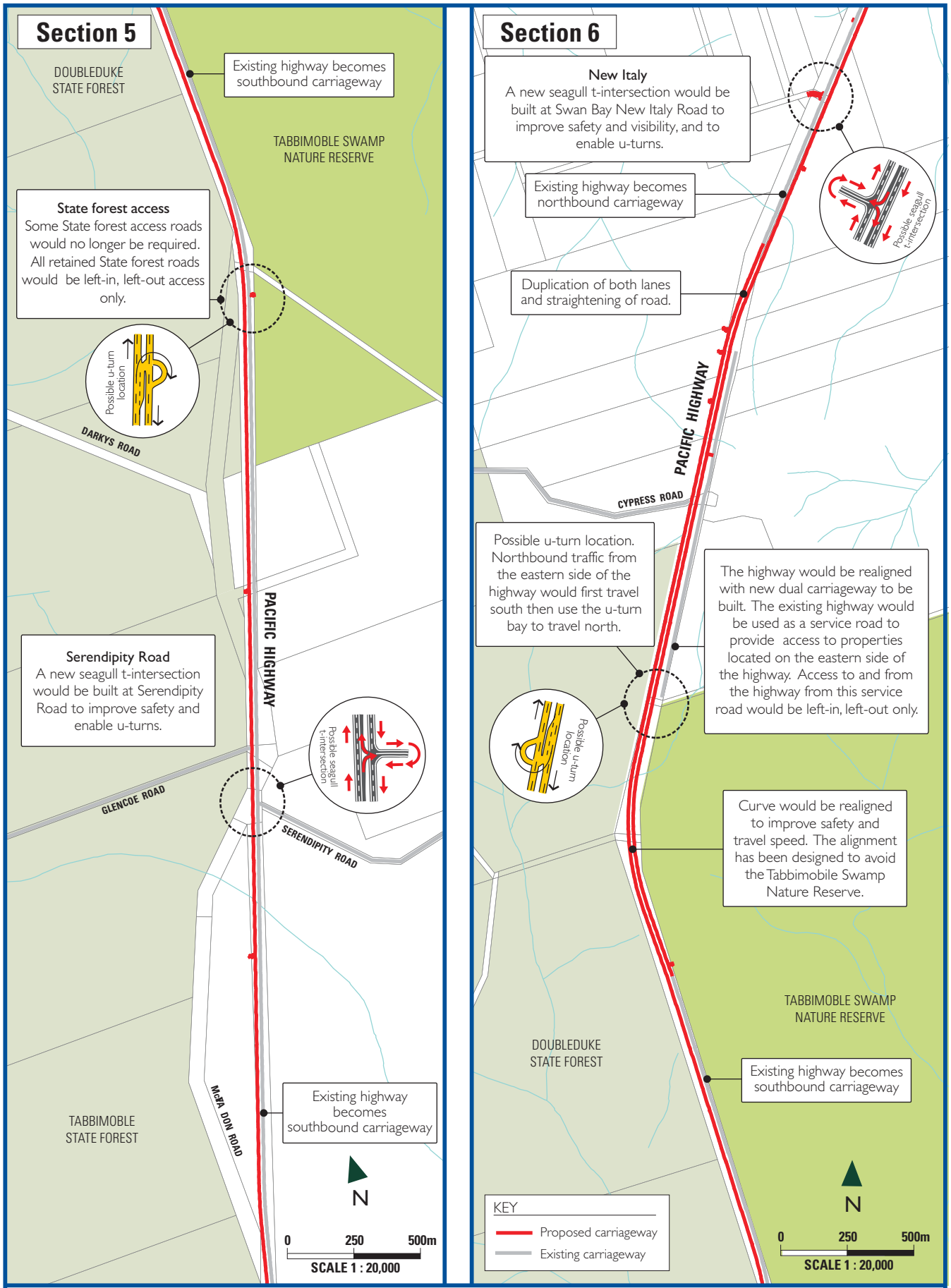

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FIGURE D4
PROPOSED CONCEPT DESIGN

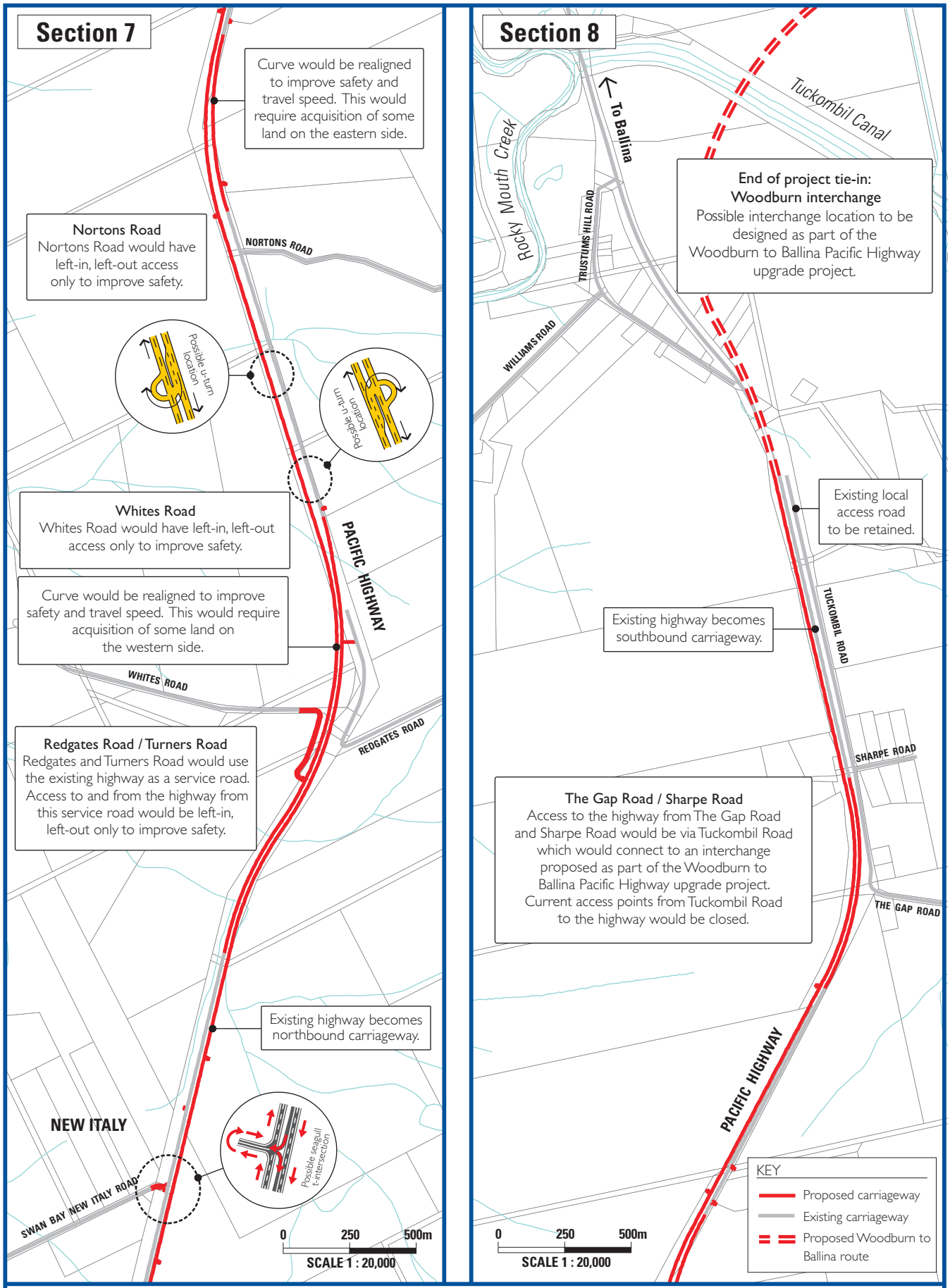

FIGURE D5
PROPOSED CONCEPT DESIGN

Table A Evaluation of the proposed concept design against the objectives and assessment criteria

PHUP objectives	**Assessment criteria – a*chieved in proposed concept design (Y/N)***	**Y/N**
Significantly reduce road crashes and serious injuries	**Improvement in road safety**	
	▪ Comply with design and engineering safety standards.	**Y**
	▪ Retain existing rest areas.	**N/A***
	▪ Optimise number of direct access points onto highway.	**Y**
	▪ Optimise number of at-grade intersections.	**Y**
	▪ Provide emergency stopping bays.	**Y**
	Design to bypass sections of road with poor existing horizontal alignment	
	▪ Replace existing sections of sub-standard highway with new road that meets current RTA design standards.	**Y**
	Design to make allowance for future upgrade to Class M	
	▪ Identify locations for potential future interchanges, service roads, etc.	**Y**
	Identify property acquisition requirements for Class M corridor, including service roads	
	▪ Total Class M corridor requirements identified.	**Y**
	Provision of rest areas and truck parking bays at intervals as required by RTA design guidelines	
	▪ Retain or relocate existing rest areas and truck parking bays – in accordance RTA design guidelines.	**Y**
Reduce travel times and delay	**Minimise length of upgraded highway and travel times**	
	▪ Minimise route option length.	**Y**
	▪ Minimise travel time.	**Y**
	▪ Minimise vehicle operating costs.	**Y**
	Improve the reliability of travel times on the highway	
	▪ Achieve appropriate Level of Service.	**Y**
	▪ Ensure capacity to accommodate seasonal traffic variations.	**Y**
	Ensure upgrade is flood-proof for the 1:100 year flood	
	▪ Design for 1:100 year flood (subject to hydrology and hydraulics report).	**Y**
	Minimise disruption to traffic during construction	
	▪ Optimise length of highway under construction at one time.	**Y**
	▪ Maximise off-line construction where possible within corridor.	**Y**
	▪ Minimise cross-over points for new second carriageway.	**Y**
	▪ Utilise available RTA-owned 'controlled access road' land adjacent Devils Pulpit State Forest.	**Y**
	▪ Design to current RTA design standards within available RTA corridor/land assets.	**Y**
	Deliver travel benefits as soon as possible	
	▪ Ability to stage project works.	**Y**
	Optimise highway alignment and geometry	
	▪ Enable trucks and B-doubles to travel safely at maximum legal speed limit.	**Y**
Develop route that involves the community and considers their interest	**Achieve community acceptance of the selected route**	
	▪ Maintain community support for preferred option.	**Y**
	▪ Minimise severance across highway corridor.	**Y**
	▪ Minimise impacts on areas of cultural or archaeological significance.	**Y**
	▪ Minimise impact to native flora and fauna.	**Y**
	▪ Minimise businesses affected by potential acquisition.	**Y**
	▪ Minimise length of highway in visually sensitive (or medium-high visual quality) areas.	**Y**
	▪ Minimise number of properties that will experience noise that could require mitigation.	**Y**

* *Existing rest areas will be replaced with new high-standard rest areas catering for all road users, with one rest area for each direction of travel*

Cont.

PHUP objectives	**Assessment criteria – *achieved in proposed concept design (Y/N)***	**Y/N**
	Improve/maintain existing traffic and access	
	▪ Improve local traffic circulation, safety, separation from highway traffic.	**Y**
	▪ Improve vehicle, cyclist and pedestrian facilities.	**Y**
	▪ Maintain/improve availability of safe access across the highway corridor for all residents.	**Y**
	▪ Direct access points and intersections onto the highway will be formalised to Class A standard.	**Y**
	▪ Traffic surveys and forecasts for future performance at key intersections indicate that the performance of intersections would be good with the proposed upgrade.	**Y**
	Minimise property impacts	
	▪ Retain private property access on and off the highway.	**Y**
	▪ Minimise property acquisition and displacement impacts.	**Y**
	▪ Minimise number of sensitive land uses that may be subject to construction dust and other air quality impacts.	**Y**
	▪ Minimise impacts of altered flood flows.	**Y**
A route that supports economic development	**Maintain access to and from the highway for businesses and producers**	
	▪ Minimise distance from local producers to nearest highway access or interchange.	**Y**
	▪ Optimise highway to meet RTA flood requirements.	**Y**
	▪ Maintain access to Bundjalung National Park.	**Y**
	Provide access to New Italy for north and south-bound traffic on highway	
	▪ Minimise direct property impacts.	**Y**
	▪ Retain Driver Reviver facility.	**Y**
	Minimise impacts on high quality agricultural land and existing agricultural enterprises and resources	
	▪ Minimise number of properties with greater than 10% of land acquired by the preferred option.	**Y**
	▪ Minimise number of agricultural enterprises that will experience reduction in primary production.	**Y**
	▪ Minimise length of route encroaching on State Forests.	**Y**
Manage the upgrading in accordance with ecologically sustainable development principles	**Conserve biological diversity and ecological integrity**	
	▪ Minimise impact on threatened species and habitats.	**Y**
	▪ Minimise impact on endangered ecological communities (EEC).	**Y**
	▪ Mitigate against risk identified for loss of, or disturbance to flora and fauna, including threatened species during construction and operation.	**Y**
	Eliminate the threat of serious or irreversible environmental damage	
	▪ Minimise the area of high and moderate conservation value land affected.	**Y**
	▪ Develop a comprehensive Environmental Management Plan (for the construction phase).	**Y**
	▪ Minimise use of energy and non-renewable resources.	**Y**
	▪ Maintain or improve water movement across the highway corridor.	**Y**
	▪ Minimise disturbance of potential acid sulphate soils.	**Y**
	▪ Minimise potential for elevated total suspended solids levels in watercourses from construction.	**Y**
	▪ Minimise the risk of water quality impacts in small creeks draining to sensitive SEPP 14 wetlands.	
	Eliminate encroachment or direct impact on National Parks and wildlife estate	**Y**
	▪ National Parks and wildlife estate lands preserved with no encroachment.	
	Improve air quality and reduce greenhouse emissions	
	▪ Minimise travel distance, travel time and delays.	**Y**
	▪ Ensure atmospheric carbon monoxide concentrations would be well below Department of Environment and Conservation criteria.	**Y**

Cont.

PHUP objectives	**Assessment criteria – a*chieved in proposed concept design (Y/N)***	**Y/N**
Provide best value for money	**Design to make allowance for future upgrade to Class M**	
	▪ Locations identified for potential future interchanges, service roads.	**Y**
	▪ Total Class M corridor requirements identified.	**Y**
	Minimise impacts on existing utility infrastructure	
	▪ Minimise cost of public utility adjustments.	**Y**
	▪ Maximise use of existing road infrastructure.	**Y**
	Maximise economic benefits to offset costs	
	▪ Minimise construction cost.	**Y**
	▪ Minimise operation cost.	**Y**
	▪ Deliver earlier economic benefits.	**Y**
	▪ Maximise benefit/cost ratio for the preferred option.	**Y**
	▪ Optimise benefit/cost ratio of construction staging options.	**Y**
	▪ Maximise compatibility of the preferred option with broader long term land use and development strategies.	**Y**

Source: Connell Wagner, 2006.

Next steps

The project is being developed in a way that is both ecologically sustainable and achieves the best overall outcome for the whole community. The RTA recognises the importance of achieving a balance between social, ecological, engineering and cost factors while continuing to provide for future transport needs. Most importantly, dual carriageway roads and fewer highway connections will result in a safer road environment.

Community response to the proposal is an important part of the route development process. The concept design will be on display for approximately four weeks. Community feedback will be integrated into the refinement of the proposed concept design and the approval of a preferred route.

Community consultation will continue. Updates in the local media, newsletters, meetings with individuals and groups, and the project website will continue to keep the community informed and assist community input.

Following the concept design display, the key stages in the process leading to the opening of the completed road include:

- *Publication of Community Update* – The preferred route will be confirmed following consultation with the community and input.
- *Refined Concept Design* – The proposed concept design will be refined taking into consideration all relevant constraints and design guidelines. This stage of the project provides the opportunity to refine the design to optimise the alignment and to minimise environmental and other impacts.
- *Environmental Impact Assessment (EIA)* – An EIA will be undertaken to identify environmental constraints and potential impacts associated with the project. During the EIA appropriate mitigation and ameliorative measures will be developed to minimise the environmental impacts of the construction and operation phases of the project.
- *Value Engineering Workshop* – A value engineering workshop involving members of the study team will be conducted to provide a critical evaluation of the preferred route concept design. The value engineering study will incorporate a risk management workshop, the aim of which is to optimise the project design and provide a risk assessment of the preferred route.
- *Determination and Approval* – Following the EIA and depending upon the statutory planning approval process to be adopted (which is subject to further consideration), the project will either be determined by the RTA or the Department of Planning, and approved by the Minister for Planning.
- *Construction* – If project approval is obtained, construction may commence.

1. Introduction

1.1 The Pacific Highway Upgrade Program

Between Iluka Road and Woodburn, the Roads and Traffic Authority (RTA) proposes to upgrade the Pacific Highway, generally by following its existing route. This report describes the proposed concept design.

With the $2.2 billion Pacific Highway Upgrade Program in place since 1996, a total 233 km of the highway are now double-lane divided road. A further 302 km of new highway are under construction, have been approved for construction or have had a preferred upgrade route identified (refer to **Figure A**).

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- Wells Crossing to Iluka Road.
- Tintenbar to Ewingsdale.

This final group of five projects is now proceeding to the route selection phase. These five projects, along with the sections from Macksville to Urunga and Woodburn to Ballina, will provide preferred routes for a total 230 km of the highway. This will provide planning certainty for local communities and pave the way for a construction program to complete the upgrade of the Pacific Highway.

Another three projects:

- Iluka Road to Woodburn;
- Failford Road to Tritton Road; and
- Herons Creek to Stills Road;

Involve upgrading the highway along the existing alignment. Concept plans are currently being prepared, and the upgrading of the highway to dual carriageway in these locations is being discussed with adjacent communities.

The Iluka Road to Woodburn upgrade is proceeding to concept design display in March 2006.

For the 10 years to June 2006 the New South Wales (NSW) government will have contributed $1.66 billion and the Federal government will have contributed $660 million to the PHUP.

The main objective of the PHUP is to upgrade the Pacific Highway to a high-standard dual carriageway road for its full length between Sydney and Brisbane. An upgraded Pacific Highway will reduce travel times, and improve road safety through the removal of the remaining accident black spots. To this end the highway has been broken into discrete sections, each of which represents a separate project within the overall PHUP. As shown in **Figure A**, there are some 26 individual projects currently in progress, which means that they are either:

- in planning;
- awaiting State government approval;
- approved and awaiting construction; or
- under construction.

A number of projects are already complete. The State government's aim is to have all projects planned and preferred routes identified by the end of June 2006 and for construction to continue according to priority, subject to availability of funding.

1.2 The Iluka Road to Woodburn project

As part of the PHUP, the Roads and Traffic Authority (RTA) proposes to upgrade a 35 km section of the Pacific Highway between the Iluka Road turnoff and Woodburn on the North Coast of NSW (see **Figure 1.1**). The RTA has engaged Connell Wagner to undertake route option investigations and concept design development for this project, and environmental impact assessment (EIA) of the eventual preferred route.

1.3 The study area

The Iluka Road to Woodburn Project comprises approximately 35 km of the existing Pacific Highway, from the Iluka Road turnoff to the junction of the Pacific Highway and Tuckombil Road at Trustums Hill, approximately 2 km south of Woodburn. The study area, as shown in Figure C, predominantly follows the existing Pacific Highway alignment in a band approximately 1.5 km wide and centred on the existing Pacific Highway corridor.

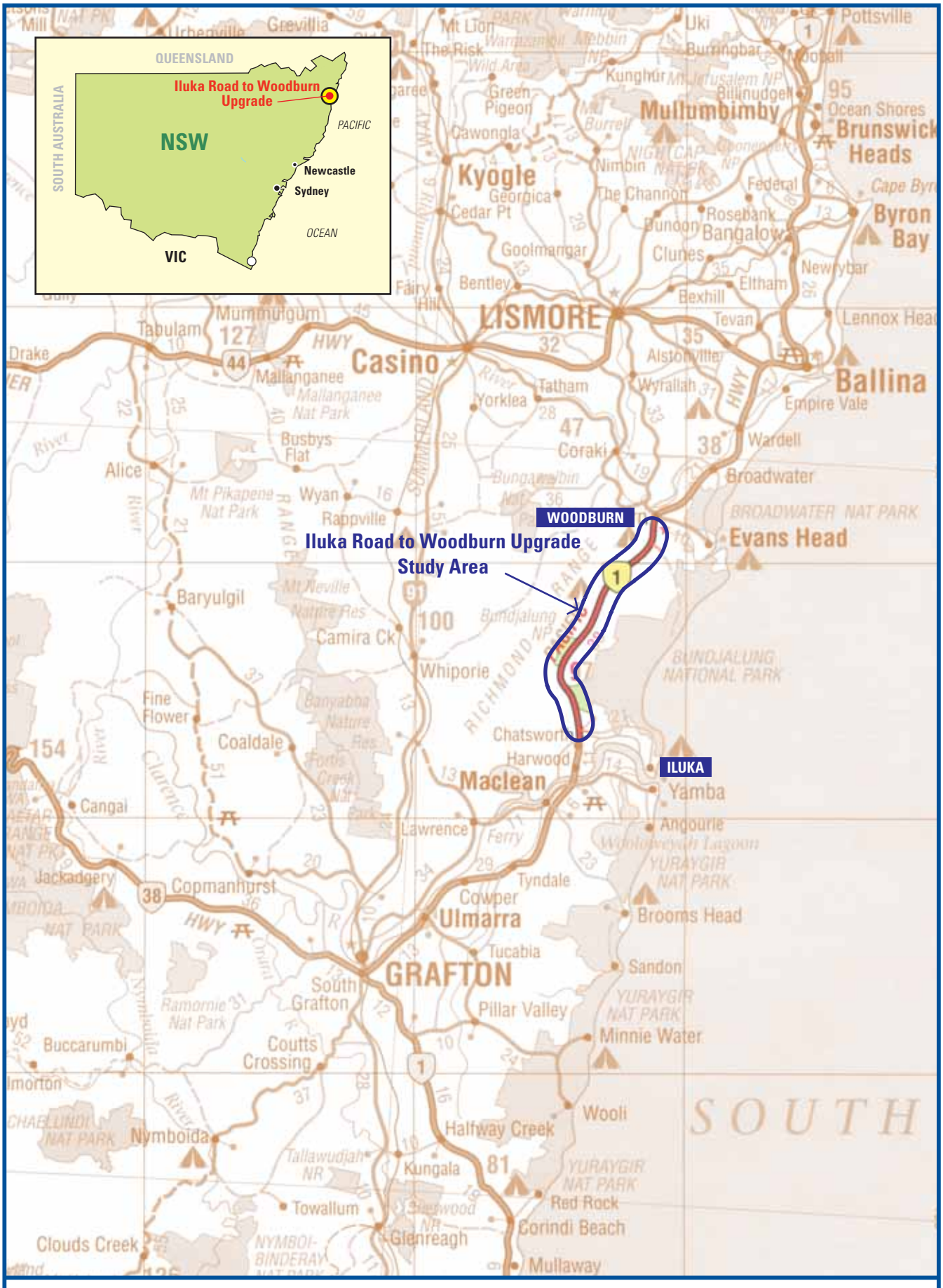
The southern end of the project will be co-ordinated with the development of the adjacent Pacific Highway upgrade project for Wells Crossing to Iluka Road, while the northern end will be co-ordinated with the concurrent Woodburn to Ballina upgrade project.

The existing highway route is mostly of a good standard. Therefore, a route concept based on duplication of the existing highway with short sections of new highway where the existing alignment is sub-standard has been used, rather than multiple route options. The largest section of proposed new highway is a 3 km deviation adjacent to the Devils Pulpit State Forest. The RTA has already acquired a corridor of land to the east of the existing highway for this purpose. There would be additional minor land acquisition in certain areas, where the corridor is either too narrow to accommodate the second carriageway, or where realignment for curve straightening is required.

1.4 The study process

Development of a proposed concept design for the Pacific Highway between Iluka Road and Woodburn has involved a comprehensive and multi-disciplinary study process. The process is designed to continue throughout all stages of route development, until the project has been approved for construction. The key components of the study process to date are as follows:

- *Project familiarisation* – collecting and reviewing available information, project team orientation and appraisal of the study area, preliminary risk assessment, initial discussions with councils, local communities and other stakeholders.
- *Project objectives and assessment criteria* – establishing the project's aims and objectives, and key criteria by which to evaluate options for their achievement of project aims and objectives.
- *Detailed investigations* – investigating the key technical and biophysical characteristics of the study area including geotechnical, traffic and transport, ecology, heritage, archaeology, land use, planning and zoning, socio-economic, water quality, hydrology, acoustic and survey.
- *Constraints* – identifying potential opportunities and constraints to development of an upgraded Pacific Highway through the technical and biophysical investigations.
- *Route concept refinement and development* – commencing the highway design process, to refine the route for upgrading and duplication of the existing highway. This component of the study also looked at the possibility of defining route options outside the existing highway corridor.
- *Community and stakeholder input* – informing local communities that the project is under way and inviting participation, through open forums and the use of various media and communication channels. Invitations were sent to government agency stakeholders for



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 1.1
STUDY AREA
NORTH COAST REGIONAL CONTEXT

- attendance at the first planning focus meeting (PFM), to identify issues of relevance and to open dialogue with those agencies.
- *Route concept assessment* – assessing the proposed route concept design against project objectives and specific criteria including the potential impacts on the environment and local communities.
- *Concept design display* – displaying the concept for community participation and feedback. This process includes public meetings, information boards displayed in public locations and the distribution of project information sheets. It is anticipated that feedback from the community will help to further refine the project.

Once a route concept design has been approved as the preferred route, the key stages in the process leading to the opening of the completed road include:

- *Value Engineering Workshop* – a value engineering workshop will be undertaken during detailed concept design stage. A value engineering workshop, involving key members of the study team, will be conducted to provide a critical evaluation of the concept design. The value engineering workshop will incorporate a risk management workshop, the aim of which is to optimise the project design and provide a risk assessment of the concept design.
- *Refined Concept Design* – a detailed concept and engineering design will be developed, based on the approved proposed concept design, and taking into consideration all relevant constraints and design guidelines. This stage of the project provides the opportunity to refine the design to optimise the alignment and to minimise environmental impacts.
- *Environmental Impact Assessment (EIA)* – following development of the detailed concept and engineering design, a comprehensive EIA will be undertaken to fully identify all environmental constraints and potential impacts associated with the project. During the EIA appropriate mitigation and ameliorative measures will be developed to minimise the environmental impacts of the design, construction and operation phases of the project as far as practicable.
- *Determination and Approval* – following completion of the EIA and depending upon the statutory planning approvals process to be followed, either:
  a) a project application will be lodged with the Department of Planning (DoP), for determination and an approval decision by the Minister for Planning; or
  b) the project will be determined by the RTA.
- *Construction* – if project approval is obtained and funding available then construction may commence.

1.5 Purpose of this report

The overall purpose of this report is:

- To provide an overview of the development of the Iluka Road to Woodburn project to the proposed concept design phase.
- To place the Iluka Road to Woodburn project in the overall context of the PHUP.

This report demonstrates how the project is integral to the achievement of a much broader strategic transport planning objective.

It outlines the study process that has been undertaken to date and, with the aid of maps, photographs and diagrams, describes the study area and its biophysical and socio-economic attributes. It documents the key findings of all the studies undertaken to date and identifies opportunities and constraints for input to route concept development. The report then describes the process that led to the development of the proposed concept design, and gives a preliminary assessment of the proposed concept design in terms of its likely environmental and socio-economic impacts.

The Concept Design Report also discusses the study processes that will follow the concept design phase of the project. In this regard the report seeks to map the way forward, and to provide a platform from which the more detailed concept and engineering design development activities may be provided.

1.6 Report structure

The Concept Design Report has been structured so as to best reflect the study process, and to place the project in the context of the overall PHUP. The report follows the structure briefly outlined below:

- Chapter 1 - Introduction.
- Chapter 2 – Strategic transportation and planning context of the project, within the overall PHUP and government strategic transport planning.
- Chapter 3 - Description of the study area and its biophysical and socio-economic characteristics.
- Chapter 4 - Discussion of the project objectives and the guiding principles for development of the highway upgrade design.
- Chapter 5 - The process of and approach to route selection and community involvement.
- Chapter 6 - Development of the proposed concept design.
- Chapter 7 - Evaluation of the proposed concept design.
- Chapter 8 - Cost estimates.
- Chapter 9 - Description of the proposed concept design, conclusions and recommendations and the process from here.

2. Strategic transport and planning context

2.1 Transport planning context

The Pacific Highway is a State highway within NSW and therefore falls under NSW government financial responsibility. Joint funding between the State and Federal governments occurs on some projects. The NSW and Commonwealth governments have various transport initiatives in relation to the staged upgrade of the Pacific Highway within NSW.

2.1.1 Commonwealth government policy initiatives

Prior to 1996 the Pacific Highway formed part of the Commonwealth government's National Highway network. In 1996, the Commonwealth declared the Pacific Highway a Road of National Importance because of its poor safety record, and in acknowledgment that neither the Federal or State governments by themselves had the capacity to meet the costs of the upgrading program within a reasonable timeframe.

In June 2004 the Commonwealth government released its new national transport plan called AusLink. The AusLink National Network is based on national, regional and urban transport corridors, links to ports and airports, and intermodal connections between road and rail. It incorporates the former National Highway system and many Roads of National Importance. The objectives of the plan are to provide transport benefits for businesses, local communities, exporters and farmers. In addition, environmental benefits will accrue from reduced congestion, pollution and more efficient transport.

The Pacific Highway between Newcastle and Brisbane forms part of the Australian Government's AusLink National Network.

The Federal Government committed funding under the AusLink program for the period from 2004 to 2008. On 23 December 2005, the State and Federal governments signed a memorandum of understanding (MoU), which recognises the Pacific Highway Upgrading Program as a critical economic transport infrastructure project. The overall aim of the MoU is to accelerate the upgrade of the Pacific Highway. It commits both governments to the creation of a working party to jointly explore options for funding arrangements, works priorities and other aspects of the PHUP, including the possible development of a North Coast Motorway.

2.1.2 The Pacific Highway Upgrade Program

The PHUP commenced in 1996-97 following the signing of a memorandum of understanding between the Commonwealth government and the NSW and Queensland governments.

The PHUP is now in its last year of the original 10 year joint State - Federal funding agreement. In the 10 years to June 2006 the NSW government will have contributed $1.66 billion, and the Federal government will have contributed $660 million. For the next three years, the Federal government will match the State government contribution of $160 million per year. The State government is negotiating with the Federal government to reach agreement on an overall funding package to accelerate completion of the upgrade of the Pacific Highway.

Since 1996, a total 233 km of new double-lane divided road have been built. A further 302 km of new highway are under construction, have been approved for construction, or have had a preferred route identified.

2.1.3 NSW government policy initiatives

The Pacific Highway is a major interstate and regional route connecting Sydney to Brisbane along the NSW coastline. The Main Northern Railway and New England Highway are the main alternative land transport links to the northern parts of NSW and between NSW and Queensland.

The Pacific Highway Office of the RTA is coordinating implementation of the joint Federal and NSW Government Pacific Highway Upgrade Program. The ten year program has dedicated funding of $2.2 billion making it the largest civil construction project undertaken in the past 40 years. $1.6 billion of this total funding for the original program has been committed by the NSW Government.

The objectives of the Pacific Highway Upgrade Program are discussed in **Chapter 4**. They relate to road safety, transport efficiency, economic development, community interests, ecologically sustainable development and value for money.

The progressive upgrading of the Pacific Highway to meet increased travel demand and provide a safer, more efficient travel route, has contributed to the continued development of the communities and towns along the highway. The highway has also become the preferred route for long-distance heavy vehicles compared with the New England Highway.

2.2 General traffic characteristics

2.2.1 Regional road network

The Pacific Highway is a primary arterial road and the main transport corridor servicing the east coast of NSW. The highway forms part of the AusLink National Network, connecting Sydney with Brisbane over more than 900 km of roadway. It caters for interstate travel between NSW and Queensland, as well as intra-state, regional and local users. Through NSW, the Pacific Highway is approximately 700 km in length.

On a regional level, this section of the Pacific Highway provides limited access to the coast between Iluka and Evans Head, via a small number of minor roads leading into Bundjalung National Park. East of the highway, there are scattered rural settlements between Iluka and Evans Head. West of the highway, secondary roads serve a local rather than regional purpose, which is reflected by low traffic volumes. Jacky Bulbin Road provides an alternative (mostly unsealed) route to Tullymorgan and the Summerland Way between Grafton and Casino. Swan Bay New Italy Road provides an alternative route, also on unsealed roads, between New Italy and Woodburn.

2.2.2 Existing traffic conditions

Traffic classification counts were undertaken from 29 February 2005 to 6 March 2005 for seven continuous days in two locations representing both the northern (north of The Gap Road) and southern (north of Iluka Road) ends of the study area. **Table 2.1** shows the weekday and 7-day Average Daily Traffic volumes (ADT) and Average Daily Heavy Traffic volumes derived from the results of the surveys. **Table 2.1** also shows the Annual Average Daily Traffic volumes (AADT) which have been estimated by adjusting the 7-day ADT figures to take account of seasonal variations in traffic volumes.

Table 2.1 Existing traffic volumes – 2005

Location along Pacific Highway	Annual Average Daily Traffic Volume – (AADT) (veh/day)	Average Daily Traffic Volume – (ADT) (veh/day)		Average Daily Heavy Traffic Volume (veh/day)*	
		7-day Average	Weekday Average	7-day Average	Weekday Average
North of Iluka Road	7840	***6939***	***7052***	***1560 (22%)***	1833 (26%)
North of The Gap Road	8080	7151	7210	1580 (22%)	1847 (26%)

* Note: heavy vehicle volume as proportion of ADT is shown in brackets
Source: Connell Wagner, 2005.

In addition to the counts and classification of through traffic on the highway, surveys of three intersections were undertaken for a 12 hour period (7.00am to 7.00pm) on a typical weekday to

identify peak hour traffic volumes. The surveys were carried out at the following key intersections:

– Pacific Highway/Jacky Bulbin Road.
– Pacific Highway/Swan Bay New Italy Road.
– Pacific Highway/The Gap Road.

Table 2.2 shows the traffic volumes along each of the side roads for the AM and PM peaks and for the 12 hour survey period. The low volumes illustrate how these roads generally serve local traffic, and are not used as through routes.

Table 2.2 Traffic volumes along side roads for 12hr period

Side Road	Traffic Volumes (Two Way)		
	AM Peak (veh/hr)	PM Peak (veh/hr)	Traffic Volumes for 12 hour period from 7.00am to 7.00pm
Jacky Bulbin Road	***19***	16	236
Swan Bay New Italy Road*	24	32	245
The Gap Road	18	16	117

***** includes traffic volumes recorded at car park access road to the rest area
Source: Connell Wagner, 2005.

From **Table 2.2**, it is evident that the traffic volumes generated from the side roads are low and would not be expected to result in any significant delays at intersections based on the current volumes of traffic travelling along the Pacific Highway.

The results of the traffic counts and analysis indicate that more than 90% (see **Table 2.3**) of the traffic travelling within the study area is through traffic (ie. it does not have an origin or destination within the study area).

Table 2.3 Through and local traffic comparisons

Location	ADT	Local	%	Through	%
North of Iluka Road	6939	***387****	6	6552*	***94***
North of The Gap Road	7151	599*	8	***6552****	92

Source: Connell Wagner, 2005.
** Note: as origin-destination surveys were not carried out, these figures are estimates based on ADT (average daily traffic) volumes derived from traffic survey results.*

2.2.3 Level of Service

Existing highway performance is measured in terms of the Level of Service (LOS) provided to motorists. LOS is defined in the *Highway Capacity Manual (Transportation Research Board 2000)* as 'a qualitative measure describing the operational conditions within the traffic stream, based on service measures such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience'. The LOS criteria were adopted for a 'Class I' two-lane highway, which represents those two lane highways on which motorists expect to travel at relatively high speeds. The percent time-spent-following and the average travel speed for a Class I highway are used to determine the LOS, which is expressed as a range from A (best) to F (worst), as follows:

LOS A describes the highest quality of traffic service for a highway, where motorists are able to travel at their desired speeds. The highest quality usually results in average speeds of 90 km/h or more on two-lane highways. A maximum flow rate of 490 passenger cars per hour (pc/h) total in both directions may be achieved with base conditions.

LOS B characterises traffic flow with speeds of 80 km/h or slightly higher on level terrain. Service flow rates of 780 pc/h total in both directions can be achieved under base conditions.

LOS C describes further increases in flow, resulting in noticeable increases in platoon formation, platoon size, and frequency of passing impediments. The average speed still exceeds 70 km/h on level terrain, and a service flow rate of up to 1,190 pc/h total in both directions can be accommodated.

LOS D describes unstable flow conditions. The two opposing traffic streams operate separately at higher traffic volumes and passing becomes extremely difficult. Speeds of 60 km/h can still be maintained under base conditions, with a maximum service flow rate of 1,830 pc/h total in both directions.

LOS E characterises unstable traffic flow. Even under base conditions, speeds may drop below 60 km/h. Passing is virtually impossible at LOS E and platooning becomes intense. The highest volume attainable is generally 3,200 pc/h total in both directions.

LOS F represents heavily congested flow with traffic demand exceeding capacity. Volumes are lower than capacity and speeds are highly variable.

The performance of the existing Pacific Highway was assessed for the 'design hour volume' (DHV) which is the 100th highest hourly traffic volume recorded on the highway, based on the RTA's traffic data over a full year. The DHV is the volume of traffic that the highway is designed to accommodate, and represents a cost effective balance between the standard of the highway and the volume of traffic it is designed to carry.

Based on an analysis of the hourly traffic volumes at the RTA permanent count station at Tick Gate (for the year 2004), the following information was obtained:

– DHV – 13% of AADT.
– Percentage of heavy vehicles in the DHV – 5%.
– Percentage of recreational vehicles in the DHV – 50% (the DHV corresponds with the summer holiday period, therefore it is assumed that 50% of this traffic is holiday/ recreational traffic.
– Directional split for the DHV – 40: 60 (northbound:southbound).
– Terrain – level.
– Free flow speed – 100 km/h.

The DHV for the midblock sections of the existing highway within the study area was estimated as 1050 vehicles per hour.

Assessment of the existing Pacific Highway performance between Iluka Road and Woodburn incorporated the current program of wire rope safety improvements being implemented by the RTA. The results showed that the existing highway and the three intersections referred to in **Table 2.2**, provide an overall good LOS (LOS B).

It is anticipated that LOS A could be achieved with the provision of dual carriageway at this section the Pacific Highway. LOS A describes the highest quality of traffic service, when motorists are able to travel at their desired speed. The passing frequency required to maintain the desired speed has not reached a demanding level, so that passing demand is well below passing capacity, and platoons of three or more vehicles are rare. Drivers are delayed no more than 35% of their travel time by slow-moving vehicles.

2.2.4 Accident statistics

An historical crash analysis has been undertaken for the five year period from July 1999 to June 2004 between Iluka Road and Tuckombil Canal. The results of the crash analysis can be summarised as follows:

– A total of 117 crashes occurred, including 12 fatal crashes and 48 injury crashes.

- A total of 18 fatalities and 97 injuries were reported during the analysis period.
- The majority of the fatal crashes (75% of the fatal crashes) were head-on crashes.
- A total of 18 crashes were reported as speed-related crashes and 26 crashes were reported as fatigue-related crashes.
- A total of 43 crashes involved heavy vehicles.

The wire rope fences currently being installed in the median of the highway would be expected to reduce the number of head-on crashes within the study area and this measure would also reduce the number of fatal crashes and fatalities.

The following crash rates per 100 million vehicle kilometres travelled (Mvkt) have been calculated for the crashes that were reported between July 1999 and June 2004 within the study area:

- Fatal crashes – 3 per 100 Mvkt;
- Injury crashes – 12 per 100 Mvkt; and
- Total crashes – 30 per 100 Mvkt.

The RTA's Economic Analysis Manual (EAM) contains typical crash reductions based on before-and-after studies undertaken by the RTA to test the effectiveness of implementing various alternative road upgrade treatments. The following crash reductions are predicted:

- Since most of the existing fatal crashes are head-on crashes, the majority of fatal crashes would be expected to be eliminated with the completion of the duplicated highway.
- The reduction in run-off road crashes would be small since the EAM indicates that only 10% of the run-off road crashes would be eliminated by duplicating the highway.
- The EAM indicates that a 30% reduction in rear–end crashes can be expected with the duplication of the highway.
- Based on the current proposal for rest-area provision it is assumed that fatigue-related crashes would continue to occur at the same rate as existing.

One of the project objectives for the proposal is to reduce the crash rate to 15 crashes per 100 Mvkt over the project length. Using the EAM methodology, for a base case with the recently installed wire rope medians, the current crash rate is reduced from 30 to 28 crashes per 100 Mvkt. Using the same methodology, a further reduction to 23 crashes per 100Mvkt is predicted to occur for the Class A upgrade proposal as a result of duplicating the highway.

2.2.5 Future traffic / travel demand

The AADT volume along the highway is predicted to be 10,600 vehicle movements in 2016, and 15,190 vehicle movements in 2036 (20 years after opening). Of these total volumes, heavy vehicle movements make up approximately 2,060 per day (19.4%) in 2016 and 2,960 (19.5%) in 2036. Both the total and heavy vehicle traffic movements are therefore predicted to increase by approximately 88% in 2036 compared to existing traffic levels.

2.2.6 Local road network

Within the study area, the Pacific Highway serves a small, dispersed population that is mainly concentrated in the following locations:

- Jacky Bulbin Road, 30 km south of Woodburn, west side of Pacific Highway;
- Serendipity Road, 18 km south of Woodburn, east side of Pacific Highway;
- Swan Bay New Italy Road, 11 km south of Woodburn, west side of the Pacific Highway;
- Whites Road (west side) and Turners Road (east side), 8.5 km south of Woodburn;
- Tuckombil Road and The Gap Road, 3-5 km south of Woodburn, east side of the Pacific Highway; and

– Trustums Road and Williams Road, 2 km south of Woodburn, west side of the Pacific Highway.

Other local roads within the study area serve the extensive areas of State Forest, National Park and nature reserve situated on both sides of the highway.

2.2.7 Pedestrians and cyclists

The existing movements of cyclists and pedestrians within the study area are minimal and pedestrian facilities are limited. This reflects the rural character of the study area and the fact that there are no major settlements.

2.2.8 Public transport

The study area is not well served by public transport. The main North Coast Railway lies more than 20 km to the west. There is one private bus company, Kirklands, operating a local service along the Pacific Highway. The service operates once in the morning and once in the afternoon and although not confined solely to schoolchildren, is primarily a school service.

Bus and coach services operate frequently along the Pacific Highway between Sydney and Brisbane, through established operators such as Murrays, Greyhound, Kirklands, CountryLink, McCafferty's and Premier. Maclean and Woodburn are the nearest towns providing regular intra- and interstate bus services through the larger coach operators. CountryLink offers a connecting service between Woodburn and Grafton railway station, where passengers can join the Sydney XPT rail service. Coach services also link the study area with Ballina Airport.

The closest airports offering scheduled services to major centres are at Grafton (56 km south of the study area) and Ballina (40 km north of the study area). Grafton airport offers only limited services, because of its close proximity to the larger hub of Coffs Harbour. Ballina airport has become a sub-regional hub, serving Lismore and Byron Bay, and now caters for over 120,000 passenger movements per year.

2.3 Planning context

2.3.1 Regional planning context

North Coast Regional Environmental Plan

The North Coast Regional Environmental Plan (REP) established a regional framework for the development of the NSW North Coast Region. The REP is currently under review, and the DoP has recently released the draft Far North Coast Regional Strategy. The strategy, which is on public display until May 10 2006, will guide local planning in the six local government areas of Ballina, Byron, Kyogle, Lismore, Richmond Valley and Tweed. It represents the NSW government's 25-year plan for land use, population growth, economic development, infrastructure and service delivery, and protection of the natural environment. The draft Strategy identifies the PHUP as a planning priority for the region.

2.3.2 Local planning context

The study area for the Iluka Road to Woodburn section of the Pacific Highway is located within two local government areas (LGAs), Richmond Valley and Clarence Valley. Local planning and land use are governed in these LGAs by the *Richmond River Local Environmental Plan 1992* (RRLEP) and the *Maclean Local Environmental Plan 2001* (MLEP).

The two Local Environmental Plans (LEPs) are statutory planning instruments, which require any development proposal to demonstrate consistency with overall strategic objectives, and with zoning objectives and development controls, in order to be regarded as 'permissible'. Permissibility relates to whether or not council consent is required in order for a development to proceed.

Zoning and permissibility

Land use zones in the study corridor under MLEP 2001 are illustrated in **Figure 2.1**, while the zones under RRLEP 1992 are illustrated in **Figures 2.2a** and **2.2b**. It must be noted that Clarence Valley and Richmond Valley Councils were formed through the amalgamation of smaller Councils and adjustment of LGA boundaries. The location of the boundary between the two LGAs has resulted in a small portion of Clarence Valley (between Jacky Bulbin Road and Tabbimoble Floodway No. 3) falling within the area administered under the RRLEP. This situation came about because MLEP 2001 was gazetted prior to the formation of Clarence Valley Council. Clarence Valley Council has recently exhibited a draft amending LEP which, when gazetted, will make the zone boundaries consistent with the LGA boundaries.

The Pacific Highway generally assumes the zoning of the land through which it passes, with the exception of the Arterial Road zone under the Maclean LEP 2001 (Clarence Valley) as shown in **Figure 2.1**. Within the study corridor in the Richmond and Clarence Valleys, the land use zones mean that a road such as the Pacific Highway is determined to be either:

– permissible with the consent of the council,
– permissible without development consent, or
– prohibited.

Where roads are permissible with development consent, the provisions of clause 11C of State Environmental Planning Policy No. 4 – Development Without Consent and Miscellaneous Exempt and Complying Development (SEPP 4) apply, in respect of the development being for a 'classified road'. Therefore, where the zoning controls would otherwise require council's consent, the proposed Pacific Highway upgrade between Iluka Road and Woodburn is permissible without development consent in both the Richmond Valley and Clarence Valley LGAs.

Where roads are permissible without development consent, the proponent (in this case, the RTA) is required under NSW legislation to 'self-assess' the project in terms of environmental and other impacts (see **section 2.3.3** below).

Where roads are prohibited in a particular zone, a planning instrument may adopt 'savings' provisions by which certain types of essential development become permissible without consent. However, there is no such statutory mechanism in either the Richmond River Local Environmental Plan or the Maclean Local Environmental Plan, applying to road construction that involves the "widening, realignment or relocation" of a road.

Of the land use zones through which the proposed concept design is likely to pass, the project is prohibited in the 1(d) Rural (Investigation) zone and the 1(f) Forests zone under the Richmond River LEP 1992. In the circumstances therefore, the RTA may be required to rely on other statutory mechanisms whereby the prohibition might be removed. In any event, the project will not be able to proceed unless the RTA has undertaken a detailed and comprehensive environmental assessment. The precise statutory mechanism, and the statutory planning approvals process by which the project is to be assessed, are currently under investigation by the RTA and the project team, in consultation with the NSW Department of Planning.

Forest management zones

Forests NSW (Department of Primary Industries) manages its forest estates under a system of Forest Management Zones (FMZ) based on whether an area of State Forest is designated for timber production, conservation, recreation, visual or ecological buffer zones, or drainage corridors. While the FMZ has implications for ownership, acquisition and the use of the land, these zonings do not affect the planning permissibility discussed above. FMZs and the implications of the proposed concept design for State Forest lands is discussed below **in section 7.4.1.**

2.3.3 Approvals under the Environmental Planning and Assessment Act 1979

If the project is determined to be development that is permissible without development consent, the proposed Pacific Highway upgrade would be assessed under Part 5 of *the Environmental Planning and Assessment Act 1979* (EP&A Act). The RTA is the proponent and also the determining authority, in accordance with Section 110A of the Act.

2.3.4 Changes to the Environmental Planning and Assessment Act 1979

The NSW Parliament passed *the Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005 No 43* on 16 June 2005. This amendment came into force on 1 August 2005.

The amendment introduces a new Part 3A to the EP&A Act to cover the assessment of 'major projects'. This type of development was previously assessed under Part 4 and/or Part 5 of the EP&A Act.

2.3.5 Application of Part 3A of the EP&A Act to the Iluka Road to Woodburn project

By an order gazetted on 29 July 2005, the Minister for Planning declared that Part 3A applies to all projects for which the proponent is also the determining authority and which otherwise would have required an Environmental Impact Statement (EIS) to be obtained under Part 5.

Within the meaning of Part 5 of the EP&A Act, the RTA is both the proponent and the determining authority for the Iluka Road to Woodburn Project. However, the RTA has not yet determined whether an EIS under Part 5 of the Act would be required for this Project, and will not make that decision until a preferred route is selected. It is therefore too early to say whether Part 3A would apply to this project. If Part 3A does not apply, the project would be subject to environmental assessment by way of a Review of Environmental Factors prepared in accordance with Part 5 of the EP&A Act.

2.3.6 Ecologically sustainable development

This project is being undertaken in consideration of sustainability principles, which are included in both NSW and Commonwealth legislation.

The *NSW Environmental Planning and Assessment Regulation 2000* incorporates the following ecologically sustainable development (ESD) principles:

- **Precautionary principle:** comparison of feasible options, corridors with the least amount of ecological impacts including SEPP 14 wetlands.
- **Intergenerational equity:** comparison of feasible options to maintain environmental attributes both now and in the future.
- **Conservation of biological diversity:** identification of sensitive ecological areas including for example the Tabbimoble Swamp Nature Reserve.
- **Improved valuation and pricing of environmental resources:** opportunities to achieve specific design responses to reduce adverse impacts on areas of high conservation value and improvements to environmental amenity through the management of traffic noise.

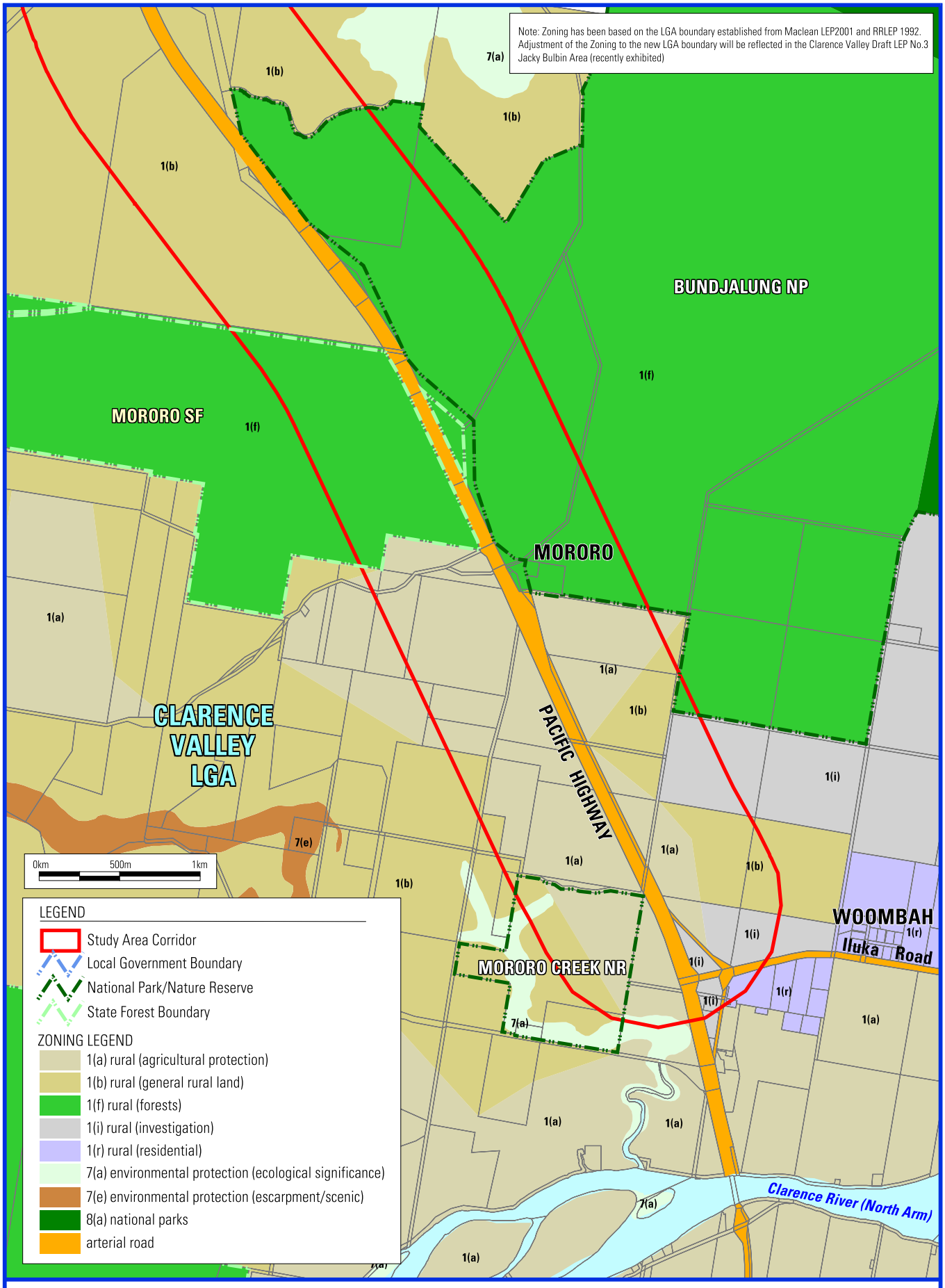


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FIGURE 2.1
MACLEAN LEP 2001
ZONING MAP

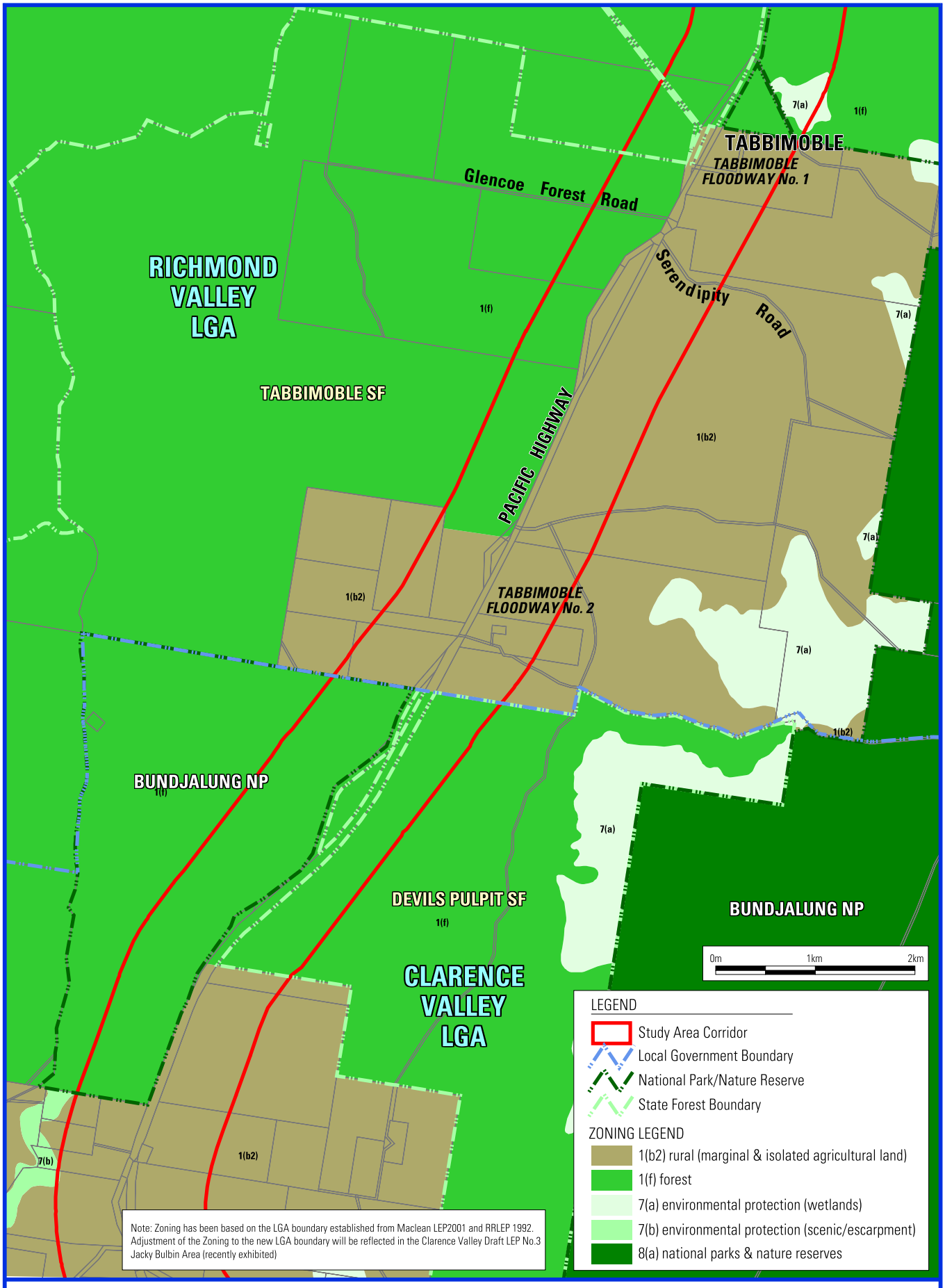

FIGURE 2.2a
RICHMOND RIVER LEP 1992
ZONING MAP

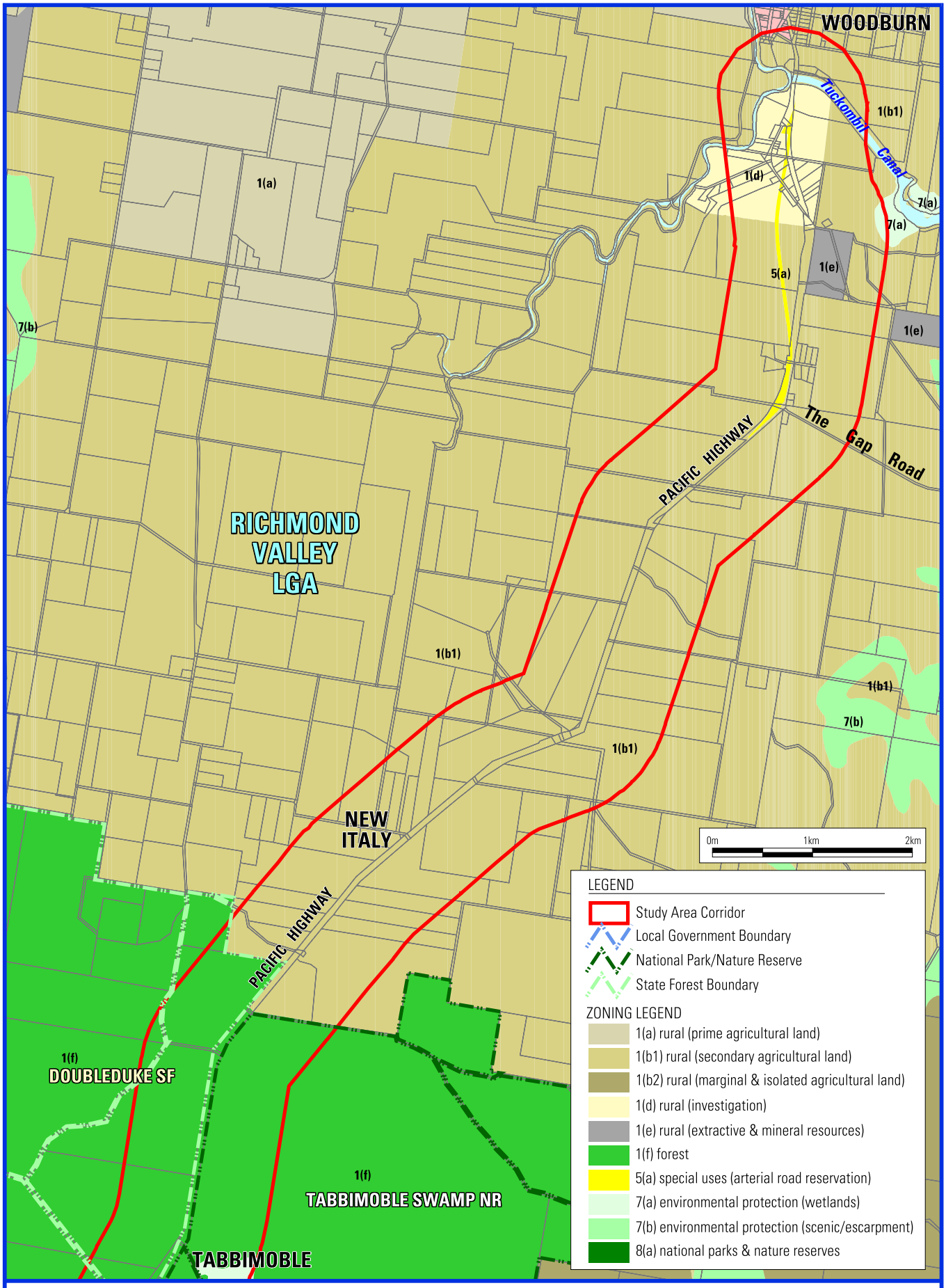

FIGURE 2.2b
RICHMOND RIVER LEP 1992
ZONING MAP

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Section 3A incorporates ESD principles which are similar to NSW ESD principles but with an additional principle:

> 'Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations'.

The outcomes of incorporating ESD in project development will be:

– effective transport networks and economic and social linkages for future generations;
– maintenance of biological diversity; and
– avoidance, minimisation and mitigation of environmental, social and economic impacts.

2.3.7 Project need

The 'do minimum' option infers no substantial change. Minor improvements could be undertaken along the Pacific Highway under the 'do minimum' option to eliminate black spots, improve line marking, construct safety features such as median safety barriers, and provide better overtaking opportunities.

The consequences of the 'do minimum' option for Iluka Road to Woodburn would not mean substantial improvements in terms of traffic congestion, travel times or general LOS. However, as discussed in **section 2.2.4**, this section of the Pacific Highway has a poor accident record, including fatalities. Any increase in traffic volumes, regardless of the effect on overall highway capacity, is likely to result in an increased frequency of accidents, particularly as driving conditions are improved elsewhere. Many of the accidents including head on collisions are attributed to fatigue, and only a change in the type and function of the highway can address this issue.

Therefore, the 'do minimum' option is not considered to be a viable alternative to upgrading the highway to a dual carriageway.

Highway safety is a major concern of residents in the study area and of the wider community. Local residents must rely on the Pacific Highway for local trips, which can conflict with through traffic. In particular, residents perceive the high volumes of truck traffic, especially at night, as being a considerable risk to safety. Access on and off the Pacific Highway into minor roads or to private properties often requires turn movements in unsafe situations such as on curves or crests, where sight distances can be inadequate.

In addition, the overall traffic noise level and the frequency of night-time noise 'events' such as use of engine compression brakes, which are already major sources of concern to many residents along the route, would increase.

3. Characteristics of the study area

3.1 Overview of the study area

3.1.1 Regional context

The Iluka Road to Woodburn study area covers 35 km of mostly low-lying rural land between the Clarence and Richmond Rivers, as shown in Figure C. The study area is bounded generally by the Iluka Road turnoff with the Pacific Highway in the south, and Tuckombil Road to the north. The study area ends approximately 2 km south of Woodburn, and as a consequence the Iluka Road to Woodburn project does not pass through any urban or built-up areas.

Approximately half of the study area lies within each of the adjoining LGAs of Clarence Valley and Richmond Valley. Land use is dominated by a small number of major (public) land uses including Bundjalung National Park, the Mororo Creek and Tabbimoble Swamp Nature Reserves, and the Mororo, Devils Pulpit Tabbimoble and Doubleduke State Forests. In the south, private land holdings comprise mostly sugar cane farms interspersed with pockets of grazing land. In the north, there is a greater concentration of rural residential development and numerous small to medium rural holdings. Between New Italy and Woodburn in particular, there is an apparent trend towards smaller rural residential holdings and rural subdivision.

As illustrated in **Figure 3.1**, there are established residential communities at:

Serendipity Road – the residents of Serendipity occupy a substantial area of land between the Pacific Highway and Bundjalung National Park, which is registered under a system of Community Title. There are approximately 12 households at Serendipity, which is the limit of development on the land under the existing development consent.

New Italy – the New Italy community traces its origins to a group of Italian immigrants who settled in the area in the 1880s. While the original settlement has all but disappeared, the locality retains a strong connection to the past and to its Italian heritage through a small but active community and the presence of the New Italy Museum and cultural centre adjacent to the Pacific Highway. Swan Bay New Italy Road provides an alternative (low-standard) access between New Italy and Woodburn. New Italy comprises approximately 20 dwellings on medium sized rural allotments.

Whites Road, Redgates Road, Turners Road – Whites Road comprises a cluster of approximately 10 small rural residential holdings in a confined area of mostly cleared land west of the highway. Turners and Redgates Roads provide access to scattered private properties east of the highway.

The Gap Road, Sharpe Road, Tuckombil Road – The Gap Road is one of the only sealed roads of any length in the study area, and connects the highway with the beaches and camping areas within Bundjalung National Park. Sharpe Road is a recent subdivision of small (1 hectare) rural residential allotments adjacent to the eastern side of the highway immediately to the north of The Gap Road. Tuckombil Road is a residual section of the former Pacific Highway, which is now a local road and which has begun to attract new rural residential development close to Woodburn. It comprises approximately 10 dwellings.

Trustums Hill, Williams Road - Trustums Hill has been identified by Richmond Valley Council as a suitable location to accommodate some future growth in Woodburn's residential population. Existing development at Trustums Hill is focused around the old Pacific Highway, which is now a local road (Trustums Road). It comprises approximately 15 dwellings.

The remainder of the study corridor comprises scattered single residences only. There are no other 'communities' or any concentrations of settlement, that are serviced by roads within the study area although the towns and villages of Woodburn, Evans Head, Woombah and Iluka are located just outside the study area.

3.2 Biophysical characteristics

3.2.1 Key biophysical environmental characteristics

Much of the original native forest on the Clarence and Richmond River floodplains was removed for timber in the 19th century and replaced by agriculture. Remnant native forest still exists in the Tabbimoble Swamp Nature Reserve, while there are also large areas of State Forest dedicated to timber production. Adjoining the study area to the east are broad coastal heath and wetland areas of Bundjalung National Park. Wetlands mapped *under State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14) cover a wide area east of the highway and drain into the Esk River, which itself drains into the Clarence River upstream from Iluka.

3.2.2 Topography, geology and soils

A preliminary geotechnical investigation of the study area has been undertaken, including sample boreholes at nine locations along the route. The following section of the report presents the findings of the geotechnical investigation and provides a summary of the physical geography of the study area, such as the topography, geology and soils.

Topography

The study area generally comprises low hills, undulating rises, broad valleys, alluvial plains, backswamps and drainage depressions. **Figures 3.2** and **3.3** show the topography and relief of the study area, grouped into two terrain units:

- 'Elevated areas' greater than 10 m above sea level and covering approximately the southern two-thirds of the study area, characterised by undulating rises and low hills rising to approximately 40 m above sea level.
- 'Lowland areas' less than 10 m above sea level and characterised by alluvial floodplains, including backswamps.

Drainage channels typically flow from west to east into the lowland area.

Geology

The majority of the study area is comprised of quartz sandstone and shale, with thin interbeds of finer sediments and minor coal. Sedimentary structures are dominant, as might be expected on a low-lying alluvial floodplain of relatively young geological age.

Existing drainage paths such as Tuckombil Canal and Tabbimoble Creek, and the low lying swamp areas typically exhibit gravel, sand, silt and clay in varying layering and depths and are likely to be potentially compressible. The northern end of the study area near Woodburn is covered by estuarine alluvial plain deposits and typically comprises mud overlain by sand, silt, clay and gravel.

Quarries are generally located on Kangaroo Creek Sandstones or Quartz Sandstones (see **Figure 3.4**). Extensive sand mining has occurred within Broadwater and Bundjalung National Parks, but is no longer carried out.

The geology of the study area is shown in **Figure 3.5**.

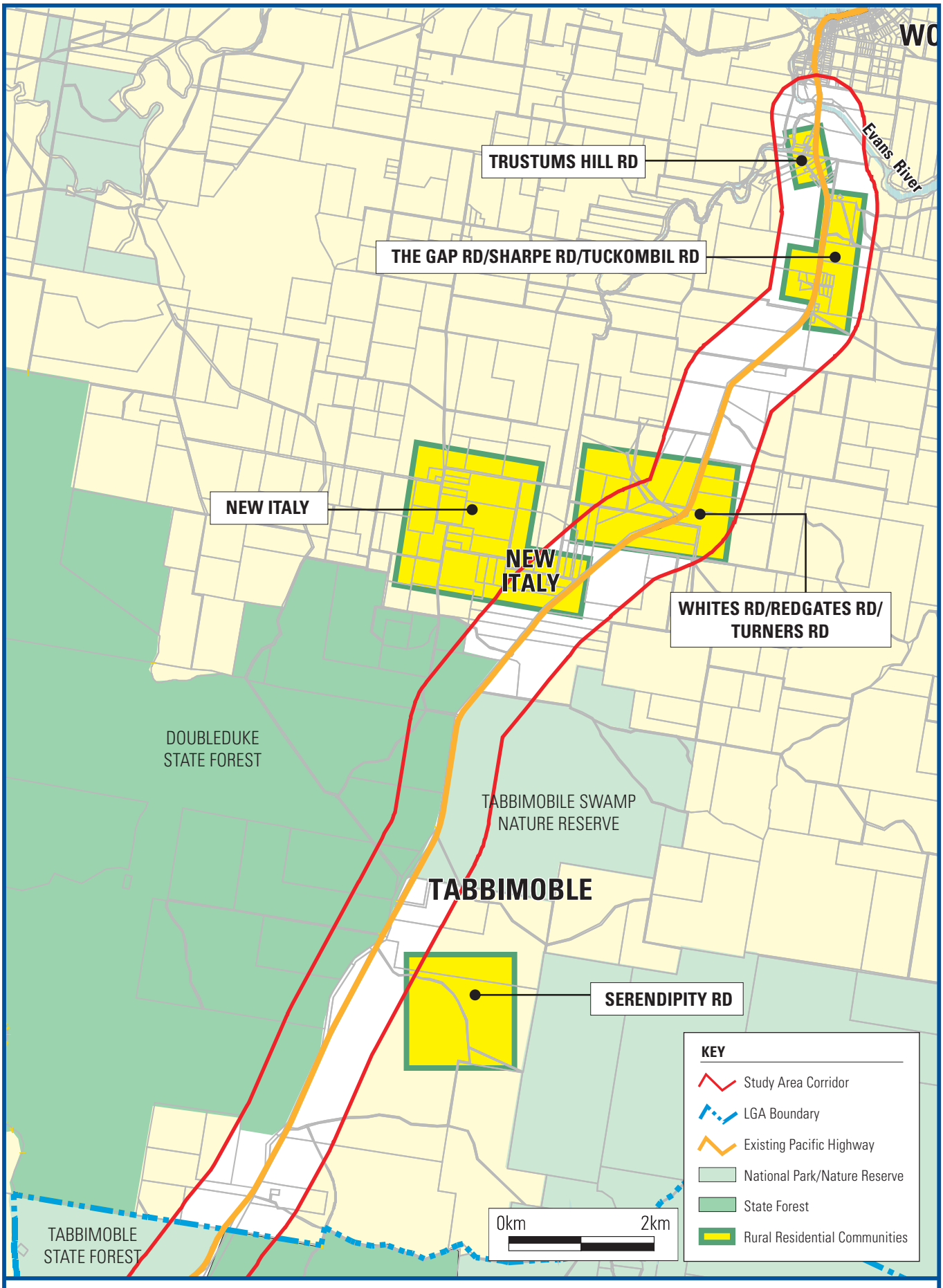

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FIGURE 3.1
RURAL RESIDENTIAL COMMUNITIES

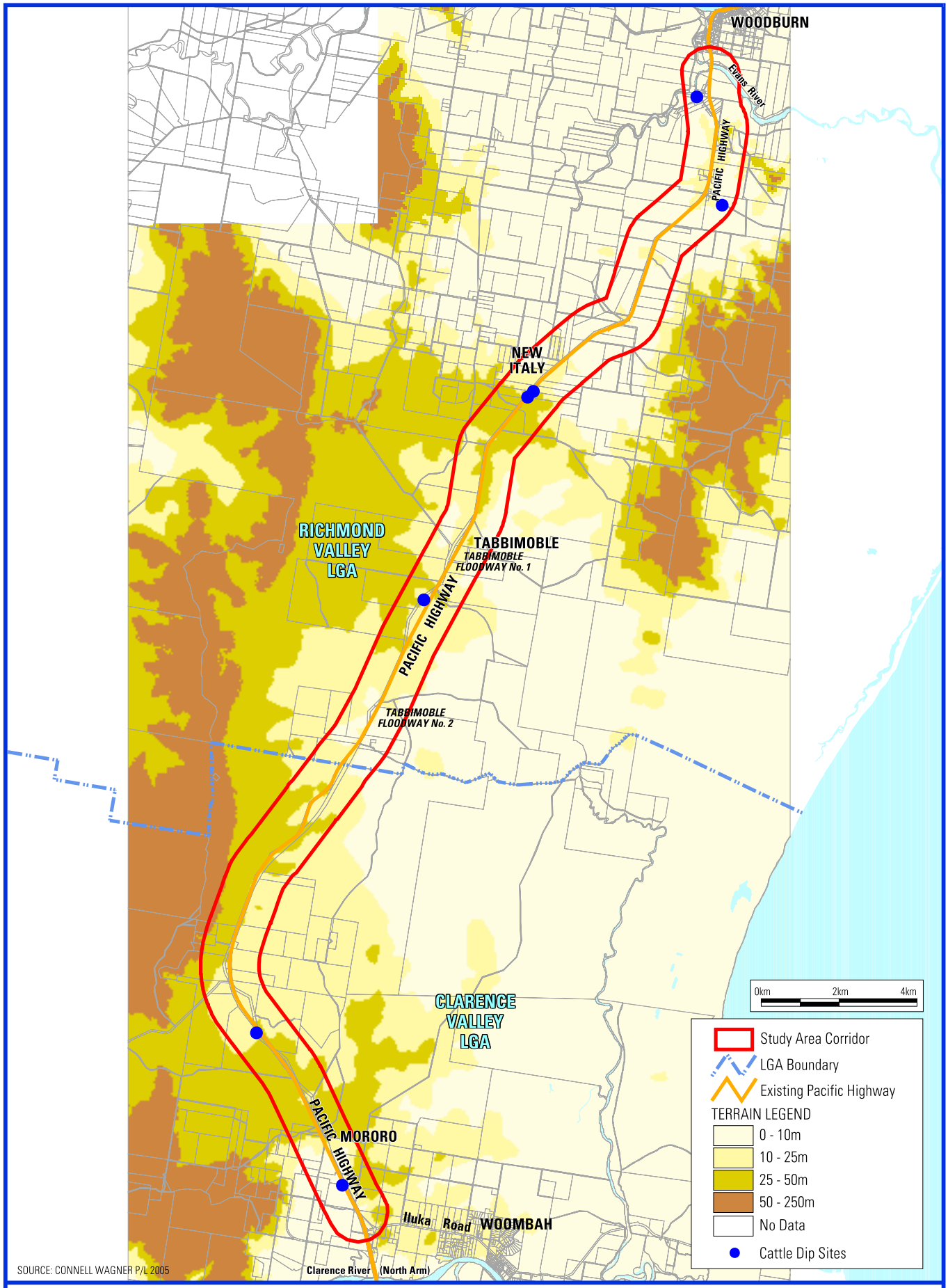

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FIGURE 3.2
TOPOGRAPHY MAP

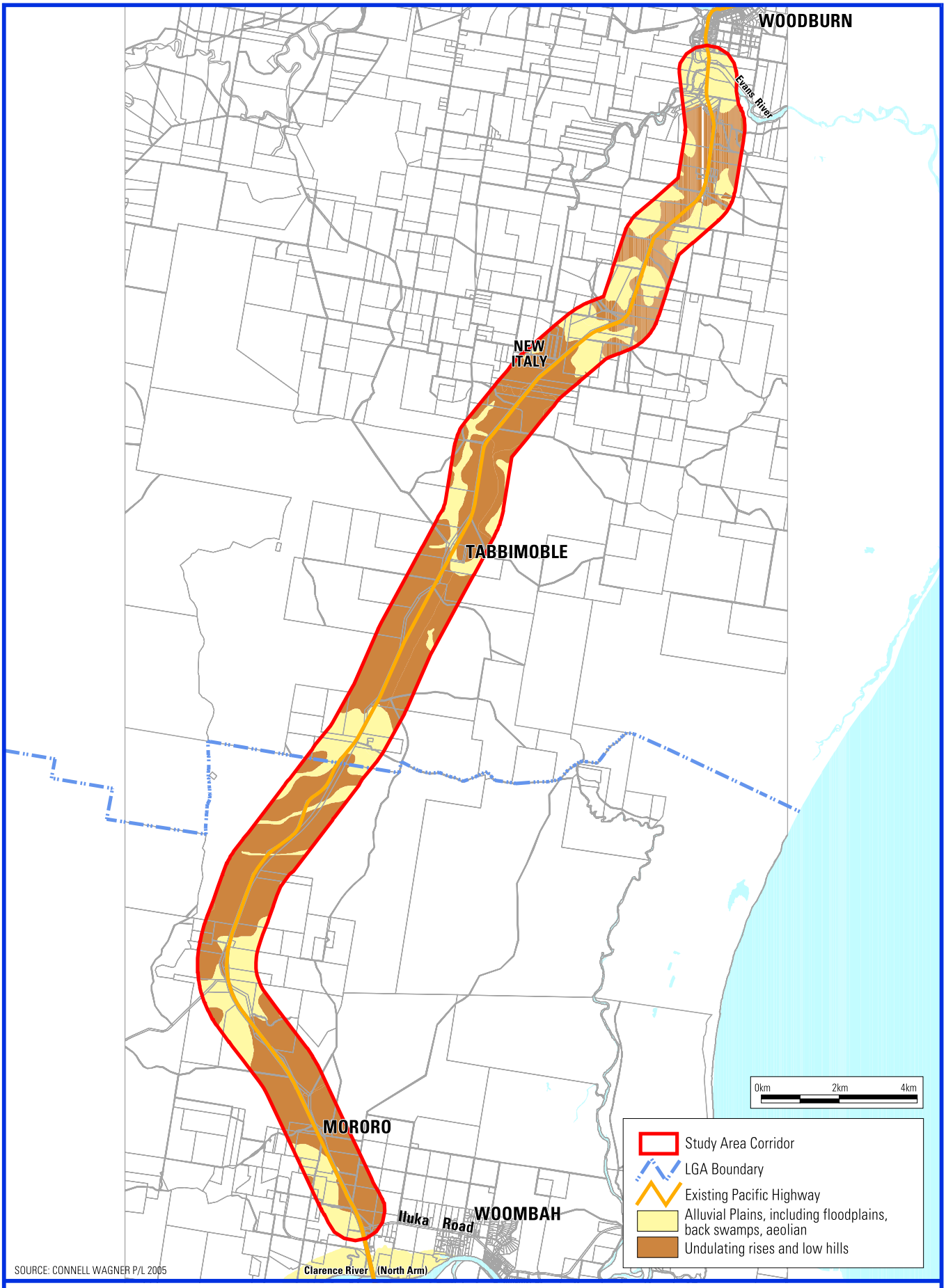

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FIGURE 3.3
TERRAIN MAP

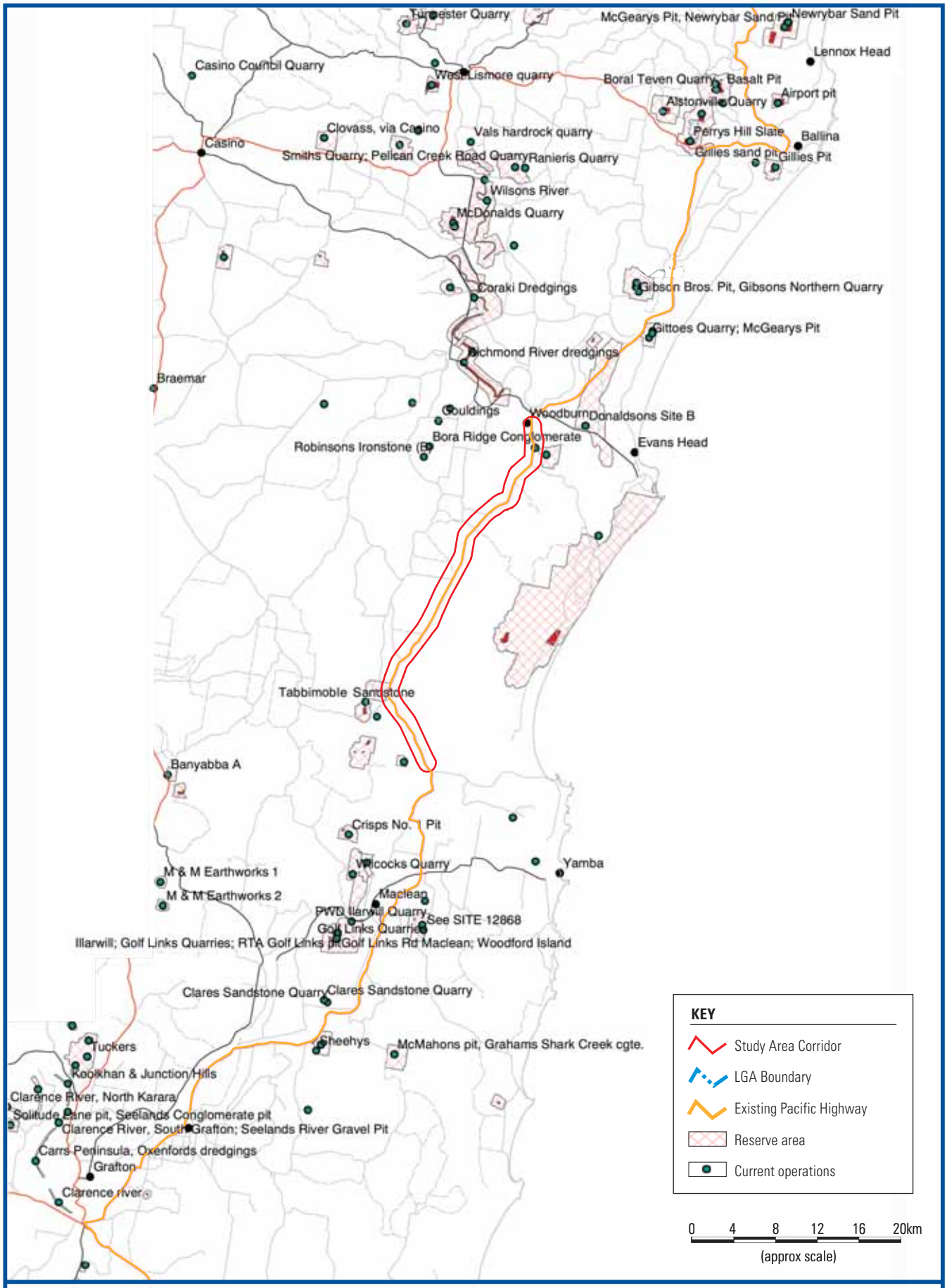

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FIGURE 3.4
QUARRIES AND MINING CLAIMS

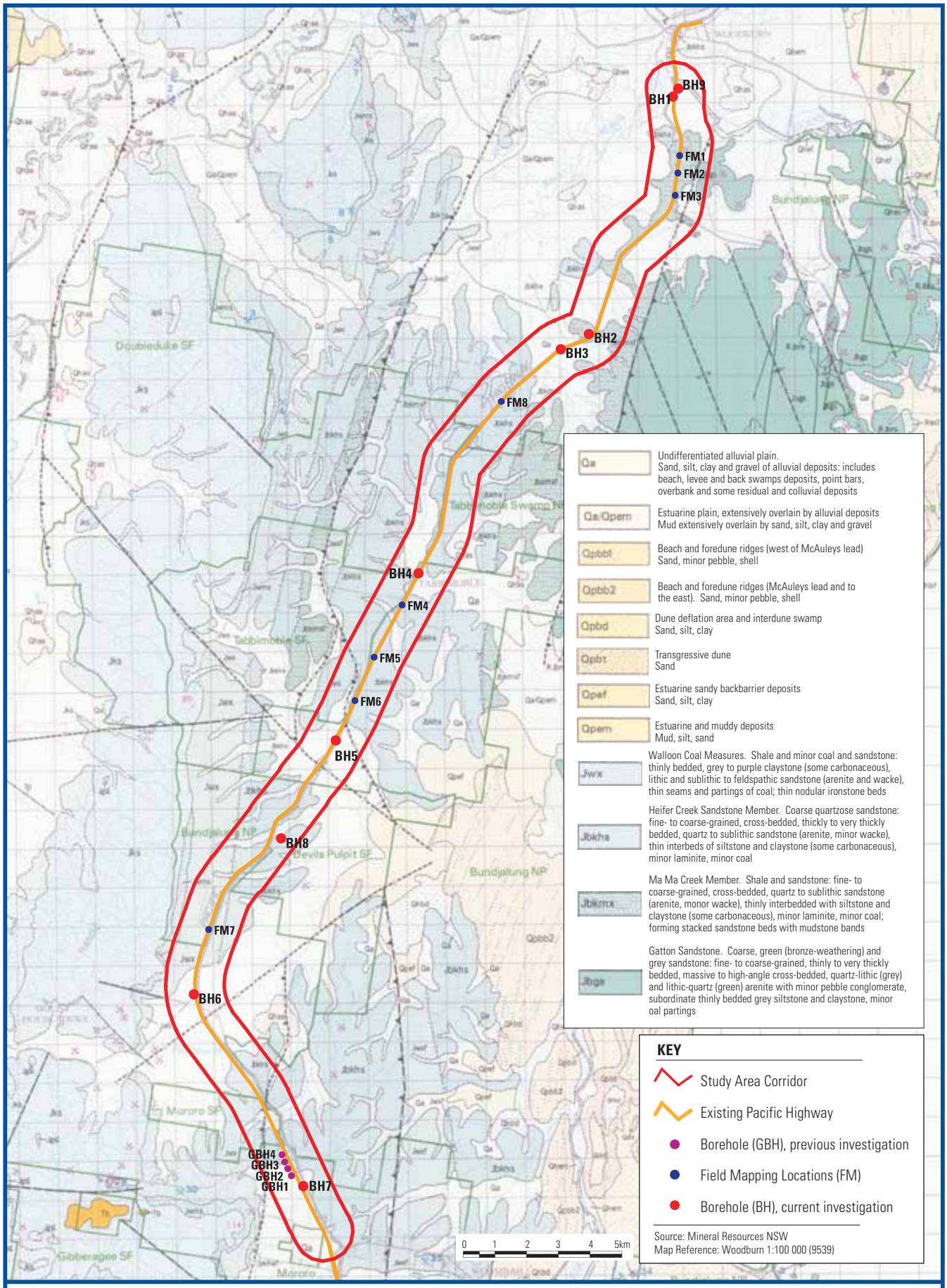

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FIGURE 3.5
GEOLOGY MAP

Blank

Soils

The predominance of alluvial soils reflects the low-lying and estuarine nature of the study area. The Richmond and Clarence River floodplains exhibit thick alluvial soils, while the Tabbimoble lowlands, the stagnant alluvial plains and drainage depressions give rise to thick, waterlogged soils.

All of the alluvial soils display poor foundation properties, due to their waterlogged nature. The less waterlogged alluvial soils display high shrink-swell characteristics, which also diminishes their foundation properties.

On higher ground and in undulating lands, more stable soils are characterised by broad drainage depressions and broad crests. These landscapes are erosional and the soils are highly erodible, especially on cleared or steeper slopes.

The alluvial soils at the northern and southern ends of the study area have been identified by the Department of Natural Resources (DNR) as being potential acid sulphate soils (**see Figure 3.6**). The Iluka sand sheets at the southern end of the study area have a high water table and represent a lower risk of acid generation, while the northern end of the study area has a fluctuating water table and represents a generally higher risk of acid generation.

Geotechnical investigations

Preliminary geotechnical investigations were conducted in April and May 2005. The work involved inspection of topography, drainage features, floodplains and backswamps, and sub-surface investigations at nine selected locations. Boreholes were excavated into areas of rock and the deeper alluvial soils, to check the suitability for cut materials, and also to identify presence of any potential soft soil and acid sulphate soils. The information was also used to further characterise sub-surface geology and terrain mapping. Geotechnical investigation locations are illustrated in **Figure 3.7**.

Inspection and mapping of cuttings along the existing highway was also conducted to gather information on slopes adopted and their condition.

Investigation results

The elevated and lowland terrain types were defined as ‘Alluvial plains including floodplains, backswamps and aeolian deposits’ (lowland areas) and ‘undulating rises and low hills’ (elevated areas). The extent of each terrain unit is presented in **Figure 3.3**.

Alluvial plains including floodplains, backswamps and aeolian deposits

The alluvial plains are generally flat (slopes less than 1%), and are identified as being at elevations of:

- Reduced Level (RL) 4m and RL8m Australian Height Datum (AHD) (northern section; Richmond River, Tuckombil Canal floodplain).
- RL5m – RL10m AHD (Tabbimoble Floodways).
- RL25m AHD (Tabbimoble Creek).

Two main types of alluvial soils were encountered, although all exhibited deep soil profiles with shallow groundwater. Backswamp areas are typically soft, and during periods of high rainfall often become waterlogged and boggy, and are slow to drain.

Other deep alluvial soils are mostly stiff silty clays, with occasional sand or gravel layers overlying weathered sandstone or shale bedrock. The depth of alluvium varies as follows:

- Richmond River/Tuckombil Canal floodplain – up to 10 m deep.
- Tabbimoble Floodways – up to 16 m deep.

Bedrock was not encountered in any of the borehole samples taken. From the available data, sandstone is likely to be present below 8-10 m depth in the Richmond River floodplain. In the Tabbimoble Floodways, sandstone and shale are expected below a depth of 17 m. The weathering and strength of bedrock is unknown, and the depth to rock in the Clarence River floodplain is also unknown.

Undulating rises and low hills

The higher ground through the study area is characterised by weathered soils underlain by bedrock of extremely weathered, low strength sandstone/siltstone. The terrain rises between 8 m AHD and 40 m AHD, with slopes in the range from two to 10%. Existing Pacific Highway cuttings exhibit cut faces of typically 20 to 60%, and are showing signs of erosion and fretting.

Soils were found to be stiff to hard silty or sandy clays, between 2 m and 6 m deep. Bedrock was encountered in one borehole only (BH8). However, rock was mapped at eight existing Pacific Highway cuttings. Based on these inspections and other available data, the underlying bedrock comprises extremely weathered and low strength sandstone/siltstone.

Potential acid sulphate soils were found in two boreholes (BH 1 and 2) located in Richmond River Alluvial plain at the northern end of the study area. Acid sulphate soils were not found in other locations. Further investigations are recommended to identify the extent of potential acid sulphate soils in the study area where excavations are required for road construction. These investigations will be undertaken during the detailed geotechnical study for the proposed concept design.

3.2.3 Hydrology and hydraulics

The Pacific Highway between Iluka Road and Woodburn crosses several floodplains and numerous waterways, and consequently this length of the highway experiences flood inundation from time to time. A detailed hydrologic and hydraulic analysis of the flooding behaviour and drainage patterns of the study area was in progress at the time of preparing this report. While findings and conclusions are not available for inclusion in this report, the following discussion describes the known drainage characteristics of the study area and the parameters of the study now under way.

For the purposes of the hydrologic study, the study area has been divided into the following portions (from north to south):

– Richmond River floodplain;
– Tabbimoble Creek and Floodways; and
– Clarence River floodplain;

The northern section of the project crosses the Richmond River floodplain, which consists of a relatively complex network of creeks and waterways (including Richmond River, Rocky Mouth Creek, Swampy Creek and Tuckombil Canal) and exhibits a highly two-dimensional nature (ie the network of streams extends upstream as well as across a wide catchment). Historically, the highway has been inundated for extended periods at the crossings in the area north of New Italy. This suggests that the downstream system (likely Rocky Mouth Creek or Richmond River) may have been at capacity, preventing local catchment runoff from escaping.

The Tabbimoble Creek and Floodway crossings also exhibit a two dimensional nature, flowing from west to east and discharging beneath the highway to a large low-lying area behind the coastline. The southern section of the project crosses numerous small, ephemeral creeks within the Clarence River floodplain, also exhibiting a highly two-dimensional nature.

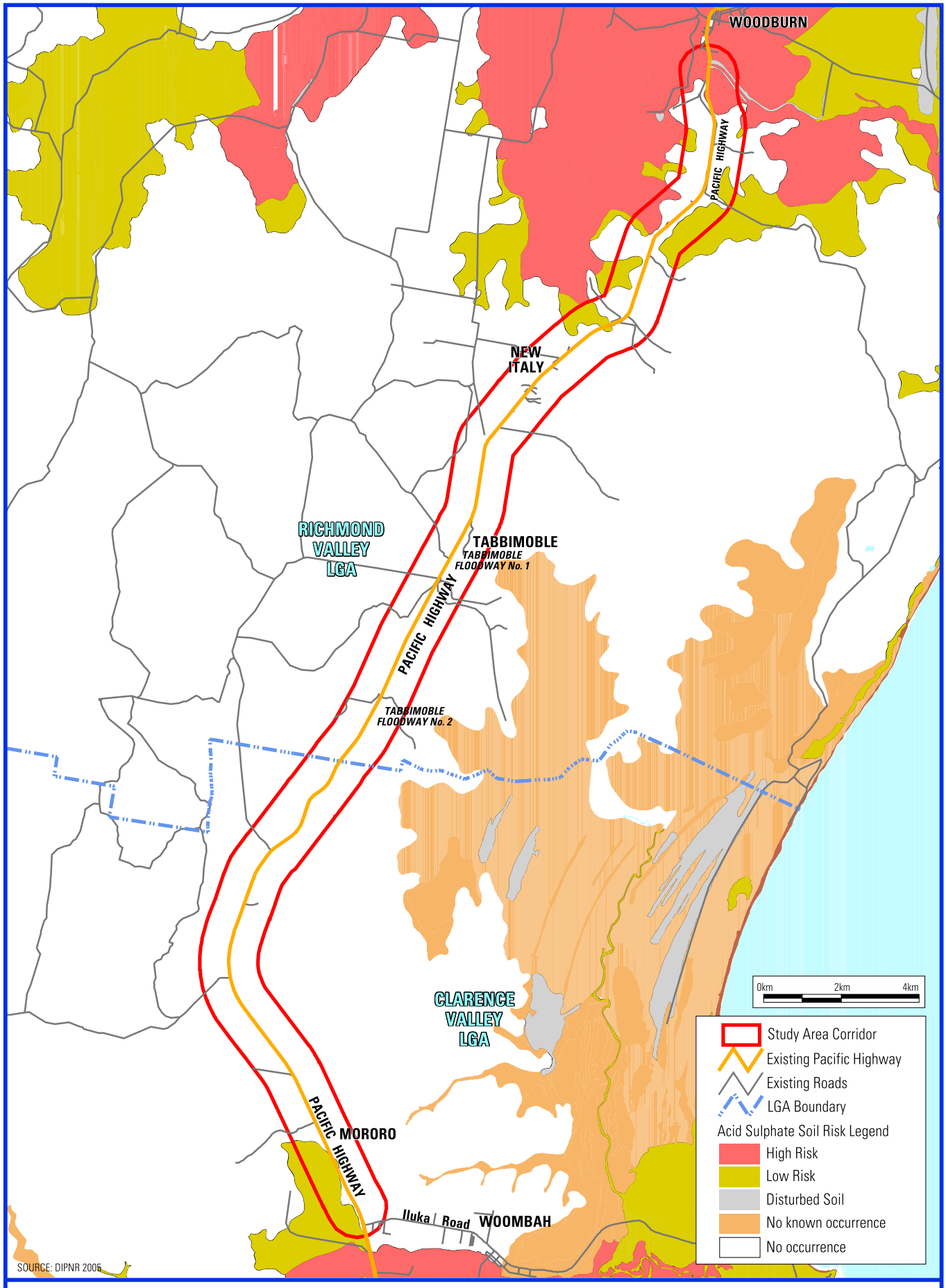

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FIGURE 3.6
ACID SULPHATE SOIL RISK MAP

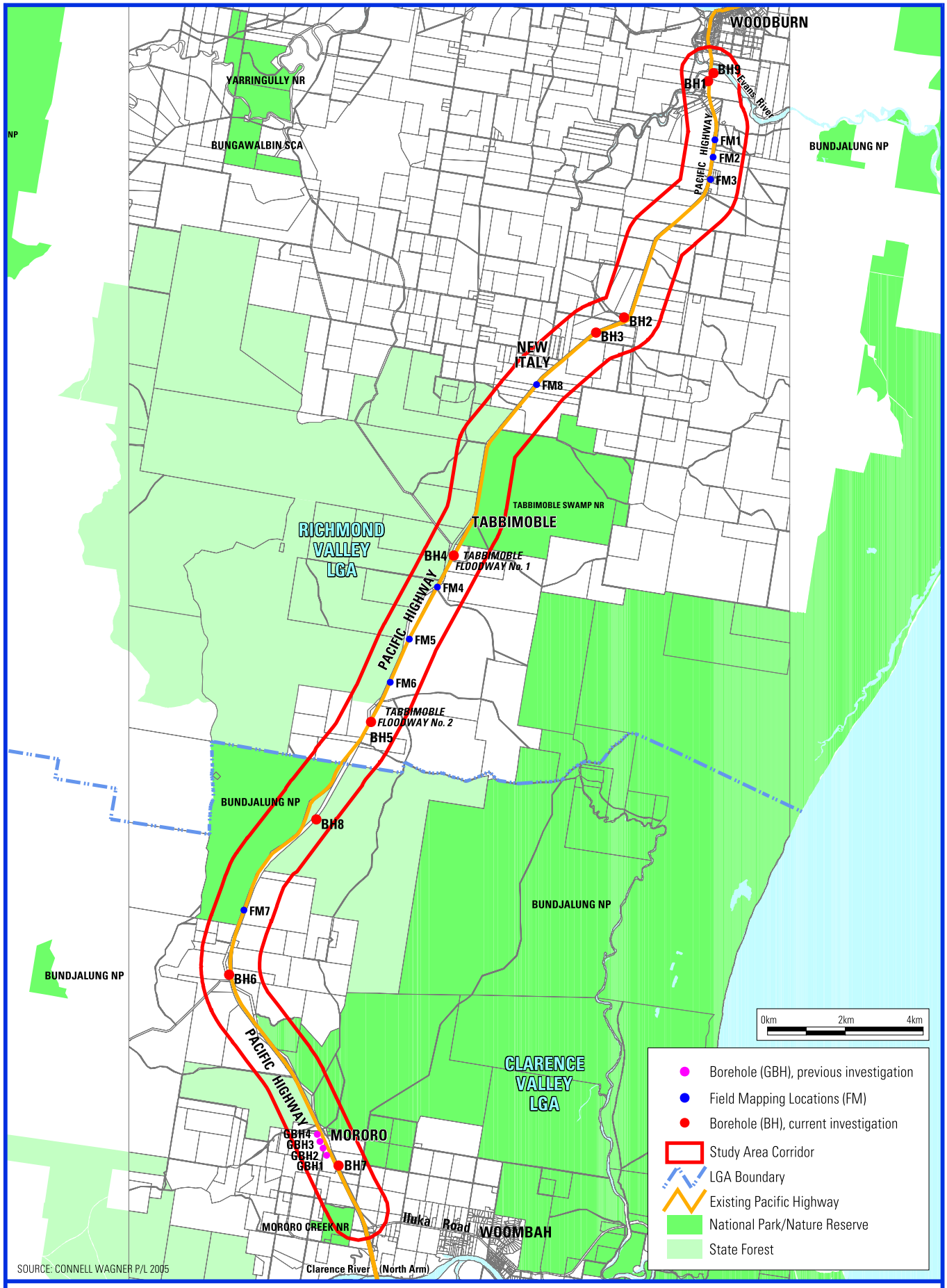

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FIGURE 3.7
GEOTECHNICAL TEST LOCATIONS

Hydrologic analysis

Analysis carried out to date has consisted of:

– Development and verification of hydrologic models for each existing crossing, using design rainfall parameters and existing catchment information. Verification of the models aims to provide confidence in their ability to predict 'event' discharges, and was carried out in a process adopted to cover the absence of detailed historical observations and records; and
– Calculation of peak design event discharge predictions for each crossing, for a range of design event magnitudes.

Hydraulic analysis

Detailed hydraulic models will be prepared for pre and post-development conditions. These models will be used to:

– Predict existing extents, depths and durations of inundation in the vicinity of the highway;
– Identify flood affected structures across the floodplains;
– Design upgraded creek crossings so that the highway can achieve the required flood immunity; and
– Quantify any hydraulic impacts associated with the project – with particular attention to flood affected properties.

Detailed development of the hydraulic models can commence when the detailed survey of the proposed concept design corridor has been completed. The hydrologic and hydraulic study will then proceed, to provide a detailed description of how flood waters behave in the study area, and to what extent this will influence the design of the proposed Pacific Highway upgrade.

3.2.4 Water quality

Background

The surface water catchments between Iluka Road and Woodburn are typically freshwater and small (mostly 1st to 3rd order streams). Many are ephemeral and flow only after heavy or prolonged rainfall. The catchments in the south of the study area flow south to the Clarence River system, while the northern catchments flow north to the Evans River system, which is part of the Richmond River catchment. Because of the relatively low lying and undulating nature of the route many small creeks towards the centre of the route do not flow to either the Clarence or Evans River catchments, but discharge to adjacent coastal swamps and SEPP 14 wetlands (see **Figure 3.8**). At the northern end of the study area Rocky Mouth Creek and Tuckombil Canal join immediately upstream of the existing highway and eventually form the Evans River. Both Rocky Mouth Creek and the Tuckombil Canal are subject to tidal influences.

The catchments of most of the creeks in the study area are predominantly vegetated with undisturbed native vegetation held in several National Parks and State Forests. However, some of the small creeks at the southern end of the route drain areas of agricultural land (primarily sugar cane), while others along the route have small patches of cleared paddocks and/or scattered rural residences in their catchments.

Objectives

A baseline water quality assessment was undertaken to provide information on the quality of surface and groundwater along the existing Pacific Highway route. Accordingly, the water quality assessment was undertaken to provide as much information on as many creeks as possible, taking into consideration likely water quality constraints associated with the route. The key aims were to:

– characterise the existing quality of surface and ground waters along the route;
– identify potential sources of ground and surface water contamination;
– characterise the likely sensitivity of receiving waters along the route; and
– identify suitable locations for repeat water quality monitoring during the concept design phase.

Review of existing data

A review of existing water quality data was undertaken and relevant government and non-government agencies were approached regarding available background information. However, it is apparent that the smaller freshwater watercourses in the study area are very poorly studied, and as a consequence there is an absence of adequate baseline physico-chemical water quality data for the small freshwater creeks throughout the study area.

Limited water quality data were obtained for monitoring locations in Rocky Mouth Creek and Tuckombil Canal at the northern end of the study area. The data were obtained from water quality monitoring undertaken by Richmond Valley Council as part of the Evans River Estuary Management Plan between December 1999 and August 2001. The monitoring locations (RVC1 and RVC2) are shown in **Figure 3.9c**.

From the sampling and analysis results, it is evident that both Rocky Mouth Creek and Tuckombil Canal have highly variable water quality and are both subject to acidic influxes from acid sulphate soils in the catchment. Both watercourses have a history of fish kills, and are subject to tidal influence. Turbidity and dissolved oxygen results fluctuate widely.

Existing groundwater quality data obtained from a groundwater monitoring bore installed by Clarence Valley Council at Mororo landfill (bore location CVC1 is shown in **Figure 3.9a**) show that groundwater quality is also highly variable. In terms of dissolved oxygen, electrical conductivity, alkalinity, and bromine, ammonia and nitrate results, the data were consistent with the Australian and New Zealand Environment Conservation Council (ANZECC, 2000) water quality guideline trigger levels for slightly to moderately disturbed ecosystems.

Water quality monitoring

Water quality sampling was undertaken at 14 surface water and three groundwater monitoring locations distributed along either side of the existing highway route. The monitoring locations are detailed in **Figures 3.9a - c**. The monitoring locations were selected to be representative of the study area, catchment characteristics and potential water quality constraints, including:

– tributaries of the Evans and Clarence Rivers (SW1, SW2, SW14);
– smaller creeks and channels draining the coastal floodplain (SW3-SW13);
– groundwater locations representative of the study area (GW1-GW3);
– tributaries of coastal swamps and SEPP 14 Wetlands to the east of the proposed alignment (SW3, SW4, SW6-9);
– areas of potential acid sulphate soil or actual acid sulphate soil (SW12-SW14);
– agricultural land uses, in particular sugar cane fields at the southern end of the study area (SW1-SW2);
– a known cattle dip site (SW7-SW9); and
– rural residences and associated rural roads (SW10).

The water samples were collected on 5 and 6 September 2005, following approximately 25 mm of rainfall in the previous week at Ballina (the closest location with reliable and easily accessible rainfall data). Annual rainfall for the region is slightly lower (100-200 mm) than the long term annual average. Consequently, water quality monitoring was hampered both by prevailing meteorological/climatic conditions and by the ephemeral nature of many of the creeks in the study area. Only seven water samples were obtained from the original 14 proposed monitoring

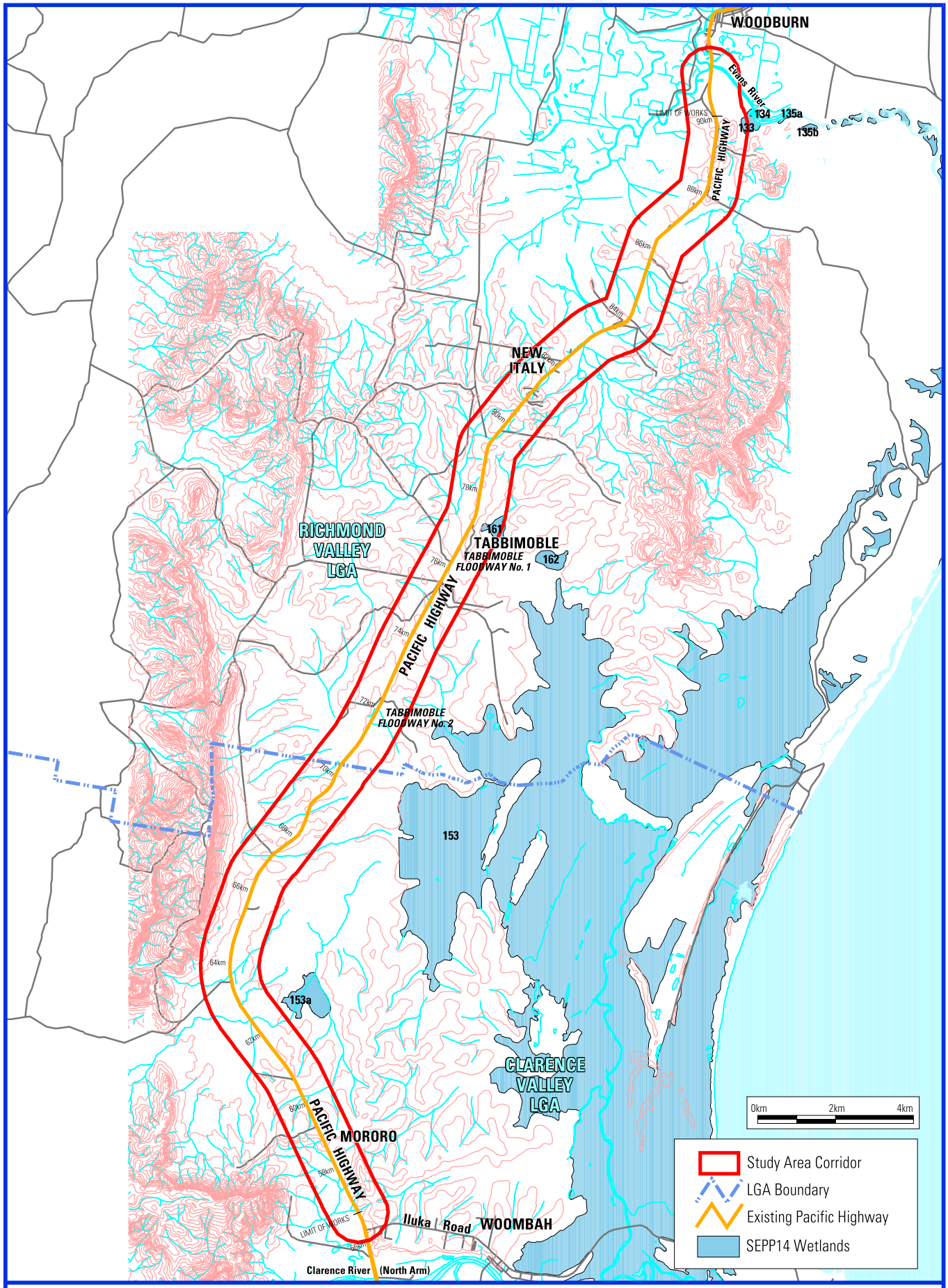

FIGURE 3.8
SEPP14 WETLANDS

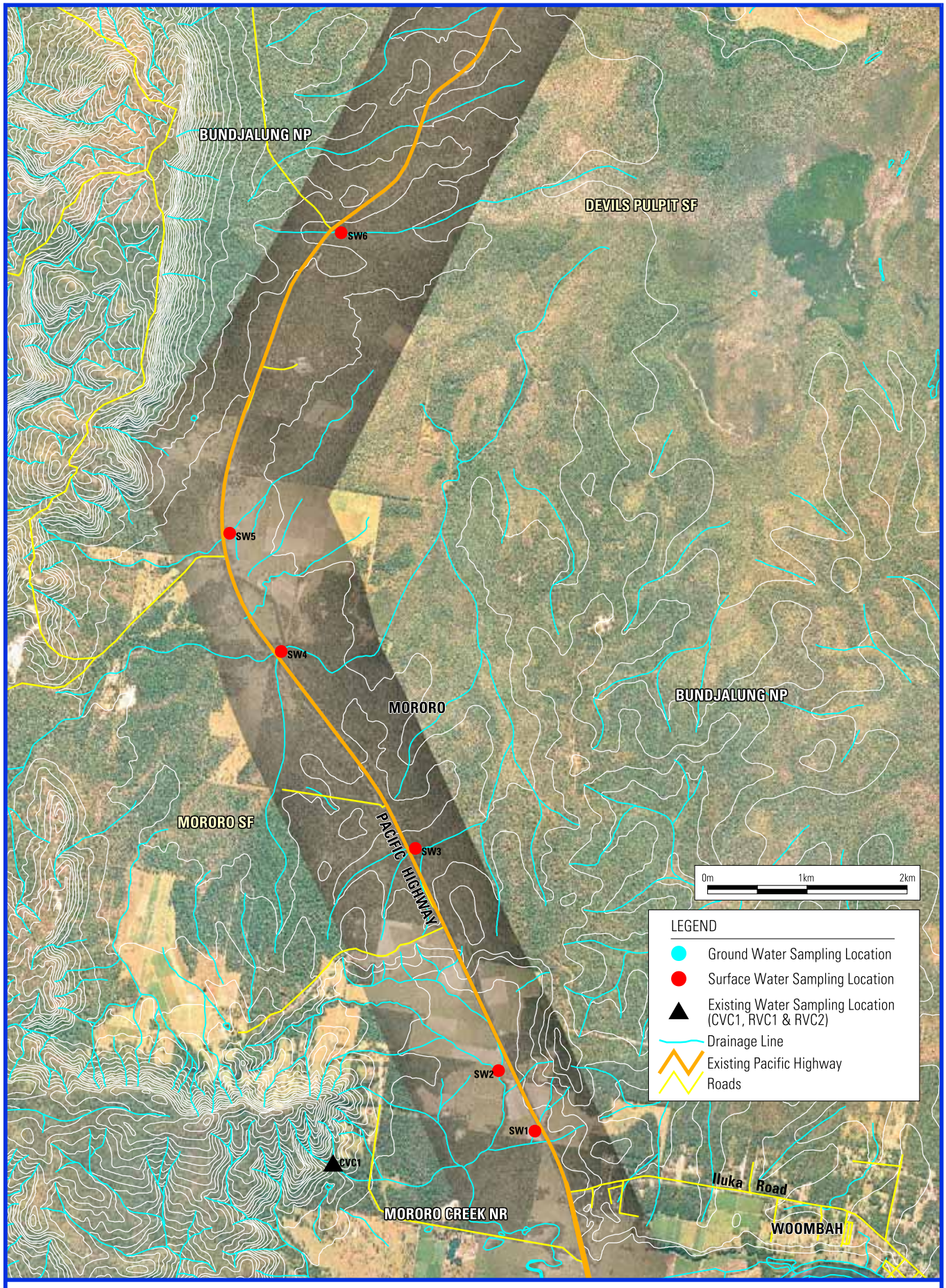

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FIGURE 3.9a
WATER QUALITY MONITORING LOCATIONS

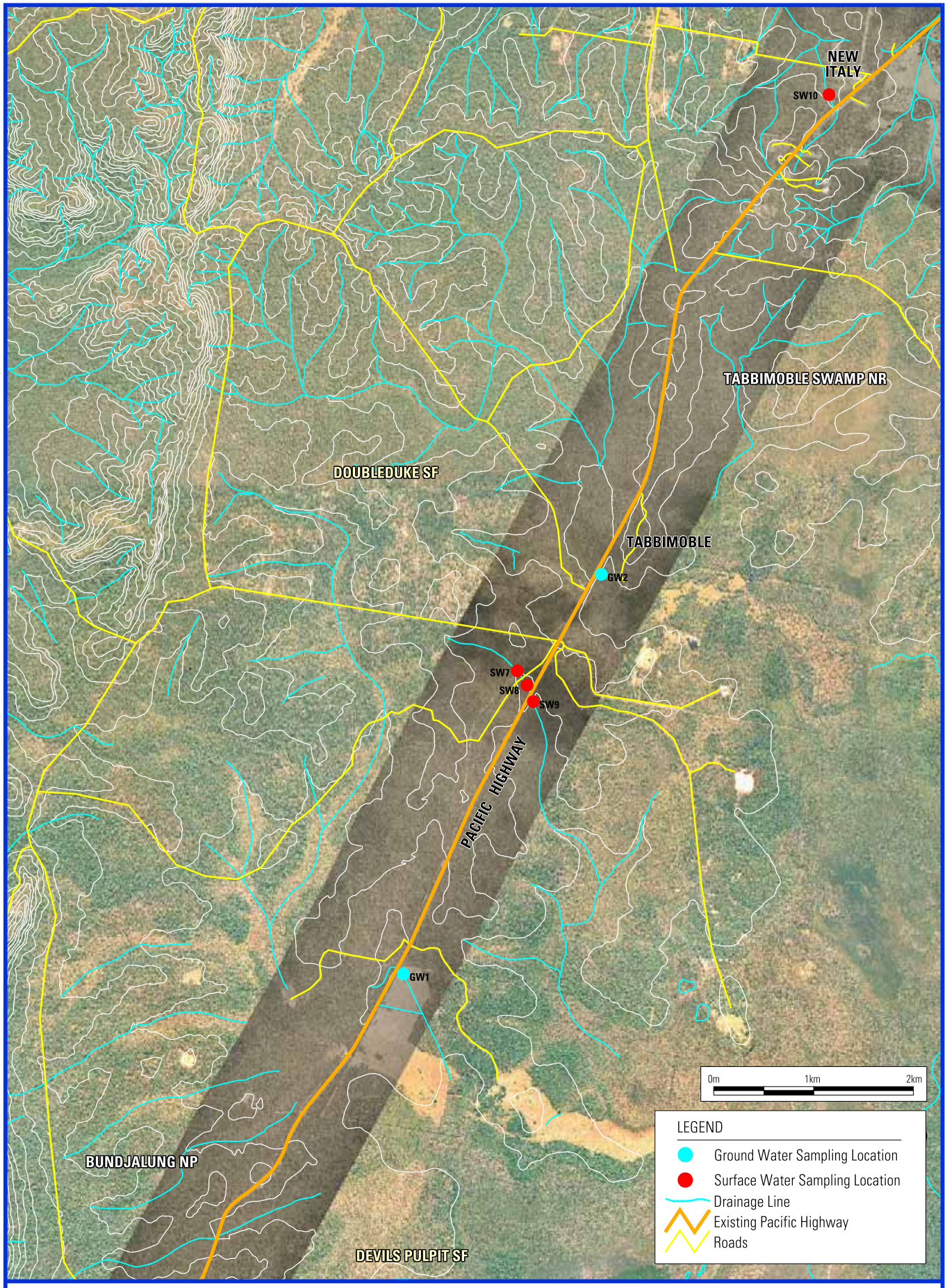

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FIGURE 3.9b
WATER QUALITY
MONITORING LOCATIONS

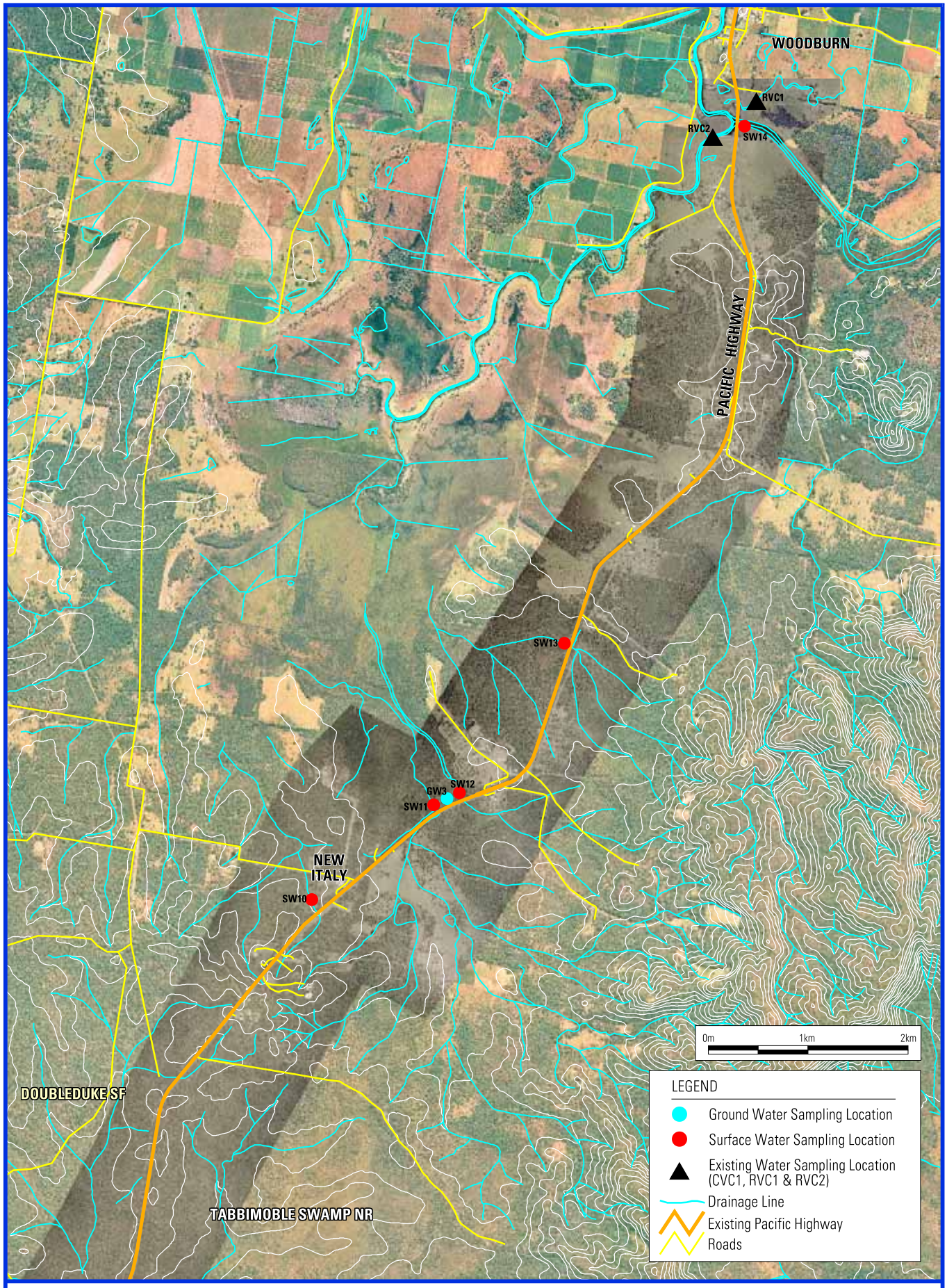

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FIGURE 3.9c
WATER QUALITY MONITORING LOCATIONS

locations. Similarly, only one groundwater sample was obtained from the three proposed locations due to the depth of the water table in the area.

Sampling and analysis showed that water quality of most of the surveyed creeks does not comply with the relevant ANZECC (2000) water quality guideline trigger values for pH, dissolved oxygen and total nitrogen.

The observed low levels of dissolved oxygen and high levels of total nitrogen may be influenced by the low flows observed during the drought conditions in September 2005, which may limit entrainment of oxygen and result in stagnation and the concentration of nutrients. It was evident that monitoring locations SW4 and SW10 had very low flows and were less than 1m wide, while locations SW5, SW11, SW12 and SW13 were larger bodies of water with no visible current.

The low pH levels observed at most locations do not generally appear, from a review of DIPNR's *Acid Sulphate Soils Risk Maps of Coastal NSW*, to be related to acid sulphate soil risks, which generally are only present at the northern extremity of the study area. However, the low pH observed at SW12 may be related to the presence of a small area of low risk acid sulphate soils located immediately upstream of the sample location.

Monitoring locations SW10 and SW14 had elevated electrical conductivity results that substantially exceeded the relevant ANZECC (2000) range. In the case of SW14 it is apparent that the result was related to tidal influence. In contrast, the elevated electrical conductivity at SW10 may be related to natural catchment processes (although this may be unlikely given that similar adjacent catchments did not display similar results), but may also be related to human activities in the catchment, including the presence of rural residences and minor roads.

All creeks exhibited low levels of total suspended solids (TSS), indicating that catchment activities and processes are not contributing substantial quantities of particulate material to the creeks under low flow conditions at the time of sampling. However, TSS levels may be elevated under higher flow conditions.

3.2.5 Ecology

An ecological assessment has been carried out on the flora and fauna of the study area. This included vegetation sampling, classification and mapping in order to ascertain the extent and types of flora and habitat. Surveys were conducted to ascertain the extent and type of fauna within the study area. In addition to visual surveys, call playback tests, traps and ultrasonic detection were used.

The Iluka Road to Woodburn study area is characterised by extensive tracts of native vegetation exhibiting high biodiversity including a range of threatened flora and fauna species and endangered ecological communities (EECs). Flora and fauna surveys were undertaken along the study corridor over a period of 15 days between March and July 2005. The results are summarised below.

Vegetation

Five broad vegetation types occur in the study area:

- Dry Open Forest.
- Swamp Sclerophyll Forest.
- Floodplain Forest.
- Wet Heath/Sedgeland.
- Freshwater Swamp.

These five vegetation types cover 14 vegetation associations, four of which fall under the definition of an EEC listed under the *NSW Threatened Species Conservation Act 1995* (TSC Act). The four EECs concerned, which are illustrated in **Figures 3.10a** and **b**, are:

- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Subtropical coastal floodplain forest of the NSW North Coast bioregion; and
- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

A substantial percentage of the survey corridor is vegetated with either Swamp Sclerophyll Forest or Subtropical Coastal Floodplain Forest. Nearly all the recorded threatened plant species and regionally significant plant species occur in these EECs.

The dominant vegetation types within the study area are Dry Open Forest and Swamp Sclerophyll Forest. These two vegetation types account for 47% and 12% respectively, of the native vegetation within the study area and nine of the 14 vegetation associations.

Threatened flora species

An assessment of the likelihood of threatened species occurring in the study area was based on:

- interrogation of Department of Environment and Conservation's (DEC's) Atlas of NSW Wildlife for a 20 km radius search area;
- review of previous studies;
- review of the habitat preferences of threatened species resulting from the database search; and
- interpretation of Comprehensive Regional Assessment Aerial Photograph Interpretation (CRAFTI) vegetation maps.

The vegetation surveys undertaken were conducted in compliance with the 'precautionary principle' whereby the presence of suitable habitat was used as an indicator of the possible presence of a species in the study area. The assessment drew a distinction between those threatened species that were likely to occur in the study area (by virtue of presence of suitable habitat) and those that were unlikely to occur. Those species that are considered likely to occur are therefore assessed as though they have been recorded.

Six species of flora listed as threatened under the TSC Act were recorded in the study area, as shown in **Figures 3.11a** and **b**. Three of these were endangered:

- Small-leaved Paperbark *(Melaleuca irbyana).*
- Fern *(Lindsaea incisa).*
- Sedge *(Cyperus aquatilis).*

Three of these were vulnerable:

- Orchid *(Oberonia titania).*
- Spiny Desmodium *(Desmodium acanthocladum).*
- Swamp Mint Brush *(Prostanthera palustris).*

Two of these species were also listed under the Commonwealth EPBC Act as vulnerable *(Desmodium acanthocladum and Prostanthera palustris).*

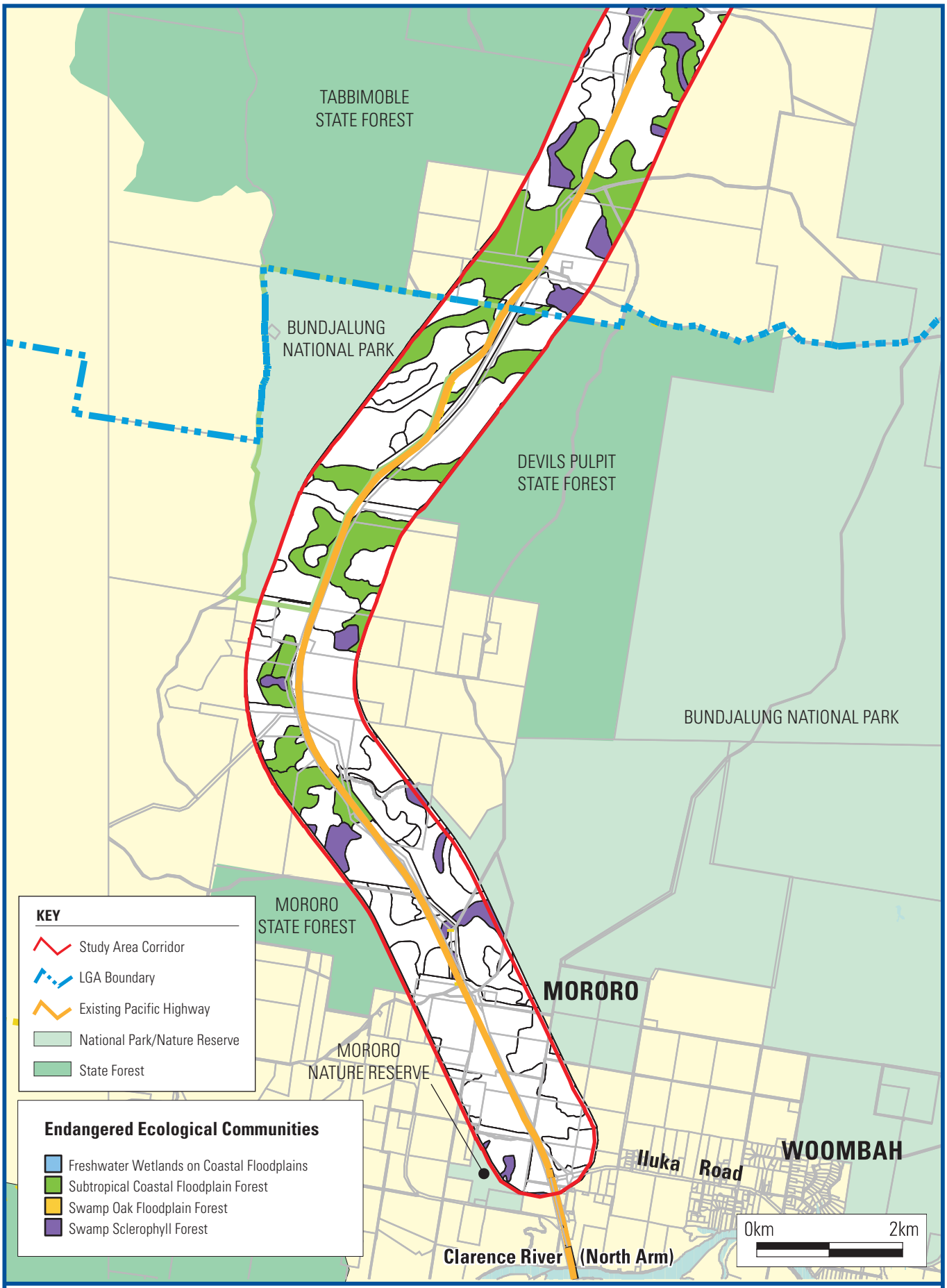

FIGURE 3.10a
ENDANGERED ECOLOGICAL COMMUNITIES

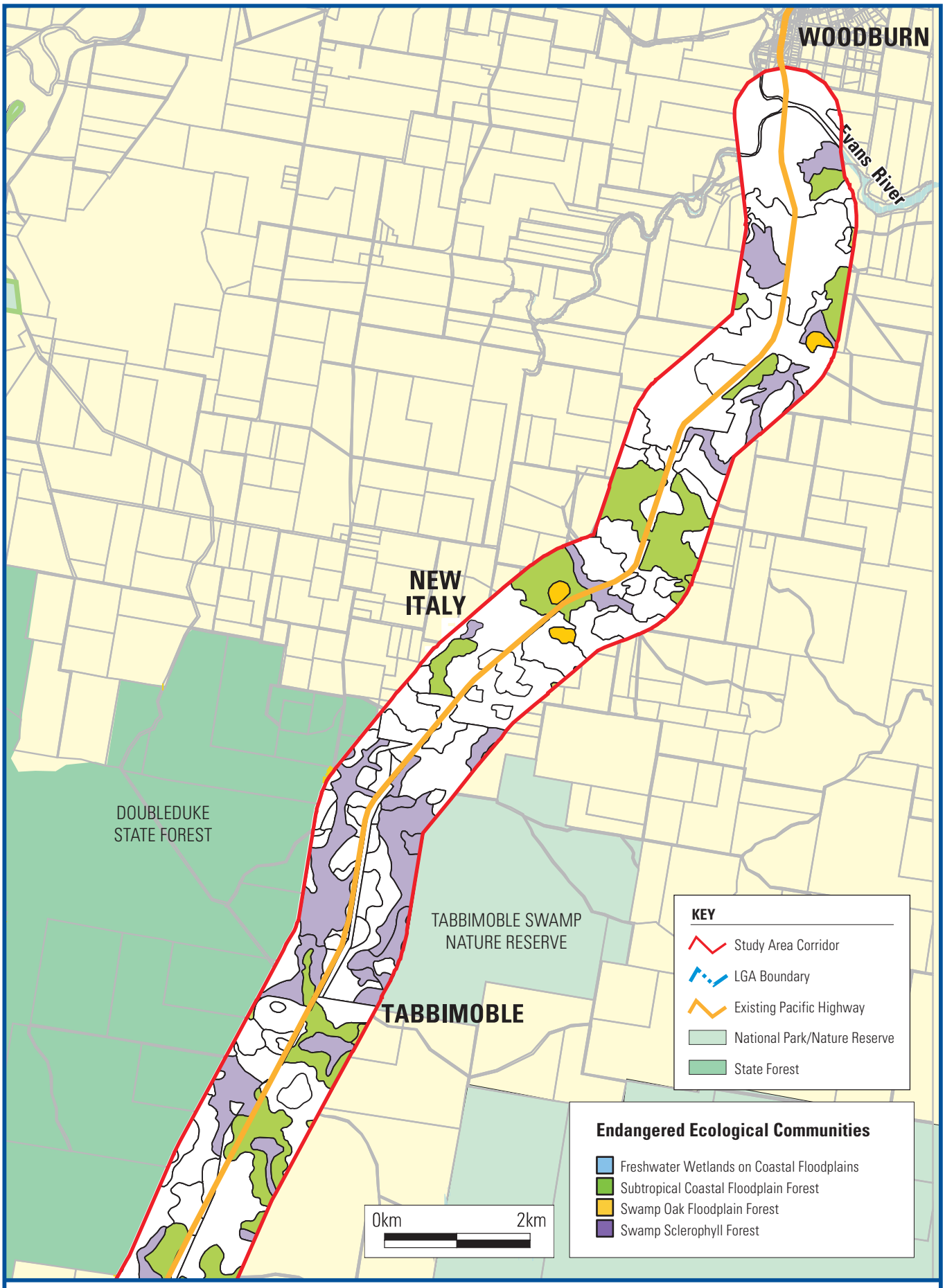

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FIGURE 3.10b
ENDANGERED ECOLOGICAL COMMUNITIES

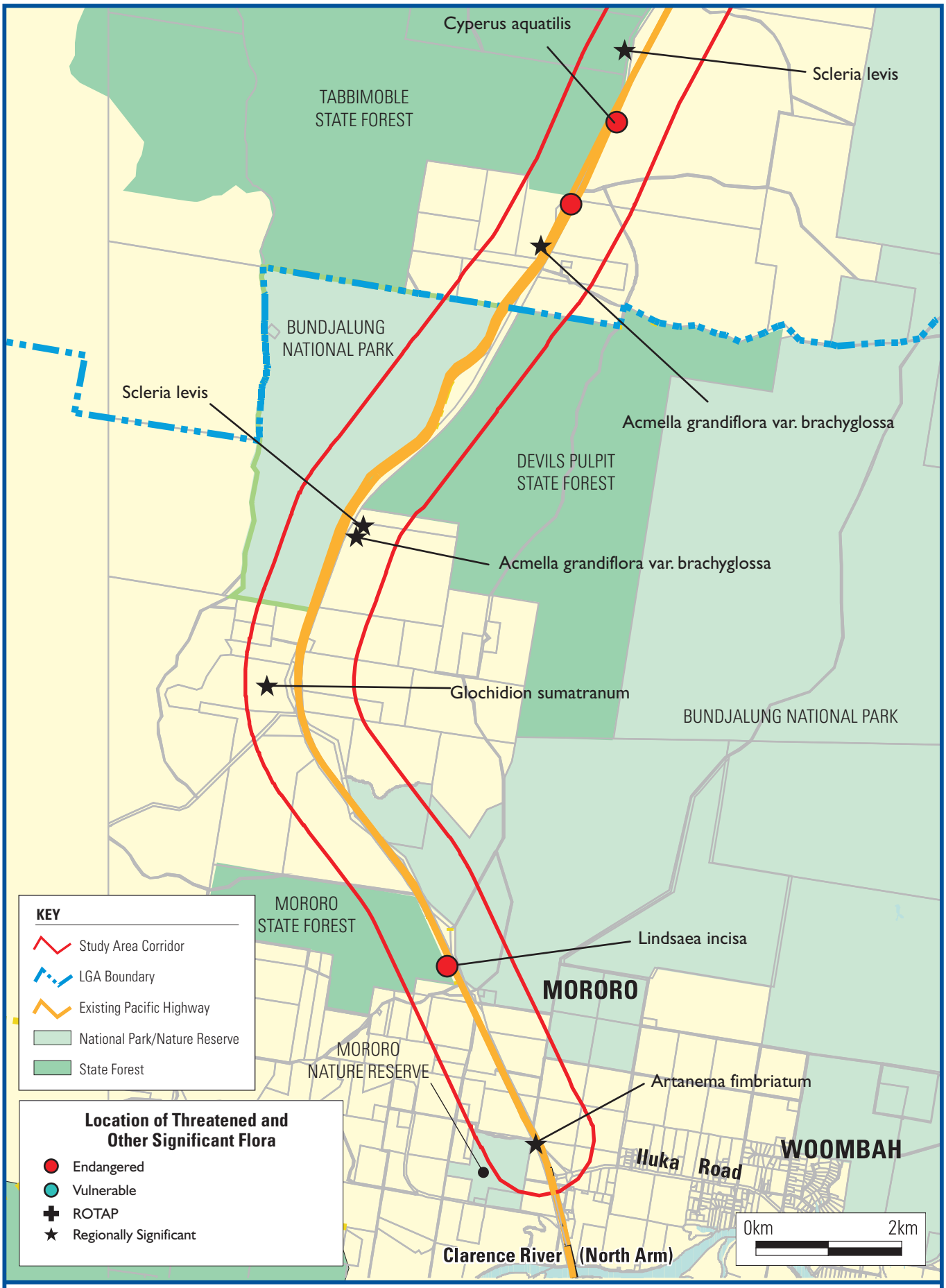

FIGURE 3.11a
LOCATIONS OF THREATENED AND OTHER SIGNIFICANT FLORA

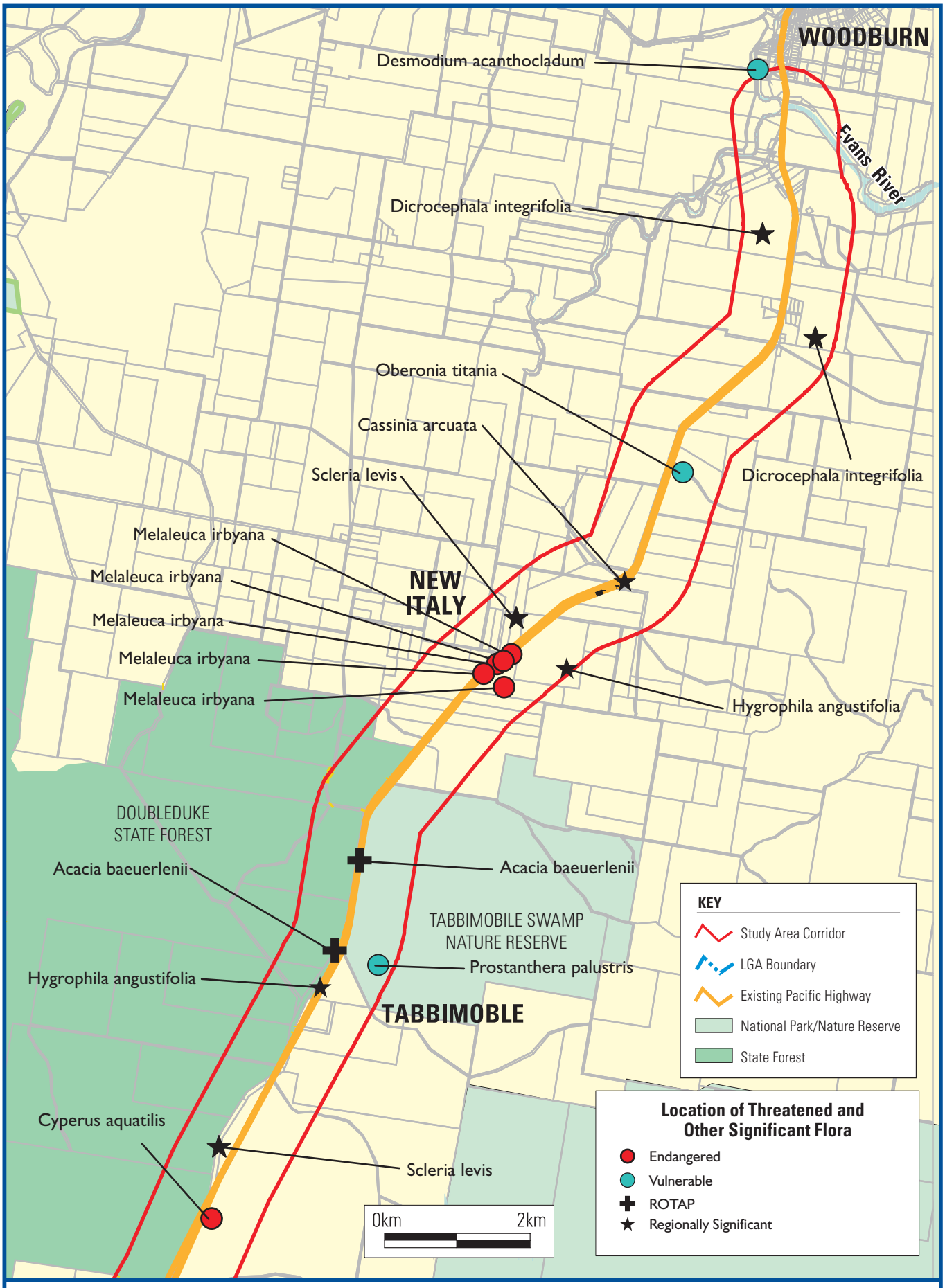

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FIGURE 3.11b
LOCATIONS OF THREATENED AND OTHER SIGNIFICANT FLORA

The following 18 species, which are listed as threatened species under the TSC Act, are potentially present in the study area on the basis of species habitat requirements, but were not recorded during the field surveys. They are therefore considered, for the purpose of this report, as likely to occur in the study area (see **Table 3.1**).

Table 3.1 Threatened flora species likely to occur in the study area

Common name	Botanical name
	Drynaria rigidula
Square-stemmed Spike-rush	*Eleocharis tetraquetra*
Slaty Red Gum	*Eucalytpus glaucina*
Square-fruited Ironbark	*Eucalyptus tetrapleura*
Sweet Myrtle, Small-leaved Myrtle	*Gossia fragrantissima*
	Grammitis stenophylla
Mason's grevillea	*Grevillea masonii*
	Haloragis exaltata ssp. Velutina
	Hibbertia marginata
	Lindsaea fraseri
	Melichrus sp. 'Gibberagee'
	Oldenlandia galioides
Knotweed	*Persicaria elatior*
Lesser Swamp Orchid	*Phaius australis*
Endangered Swamp Orchid	*Phaius tankervilliae*
	Phyllanthus microcladus
	Polygala linariifolia
	Rutidosis heterogama

Source: Connell Wagner, 2005.

Several other conservation significant species were recorded, including 5 species identified by the Department of Environment and Conservation (DEC) and the Royal Botanic Gardens Sydney (National Herbarium) as threatened or potentially threatened species; one Rare or Threatened Australian Plant species; and several other regionally uncommon species. These species are listed below and mapped on **Figures 3.11a** and **b**.

– Sedge *(Scleria levis).*
– Herb *(Hygrophila angustifolia)*.
– Grass *(Vetiveria filipes).*
– Herb *(Dicrocephala integrifolia*).
– Herb *(Artanema fimbriatum. Cyperus bowmannii).*
– Grasstree *(Xanthorrhoea latifolia subsp. maxima)*.

The endangered species *Melaleuca irbyana* (Small-leaved Paperbark) has probably the highest level of botanical constraint on the proposal. In NSW this species is restricted to the Grafton and Casino districts, where it is known from approximately nine populations. The population in the study area is the most easterly recorded. The only other area where the species occurs is between Ipswich and Toowoomba west of Brisbane.

Melaleuca irbyana occurs at New Italy on either side of the existing highway and some was probably cleared from the present road footprint many years ago. Further field work would be required at the detailed design stage to better define the extent and distribution of this species.
The small ground fern *Lindsaea incisa*, also an endangered species under the TSC Act, has a similar level of botanical constraint on the proposal. This species is currently known from a total of only seven other locations in NSW. The population at the southern end of the corridor in Mororo State Forest, approximately 3 km north of the Iluka turn-off, is located about 40m from the existing highway in swamp sclerophyll forest (protected ecological community).

Cyperus aquatilis, which is also listed as endangered under the TSC Act, is a small sedge or grass-like plant with an annual life cycle. *Cyperus aquatilis* was recorded on the eastern and western sides of the Pacific Highway at Tabbimoble. A further targeted survey was carried out in late summer (February 2006) to determine how widespread the species is in the Tabbimoble area and to develop management options to conserve it in relation to the proposed highway upgrade.

The other three recorded threatened species, *Desmodium acanthocladum, Oberonia titania* and *Prostanthera palustris*, are unlikely to be impacted by the highway upgrade due to their location, but would be subject to further investigation during the refinement of the concept design.

Terrestrial fauna

Sixteen threatened fauna species listed under the TSC Act were recorded in the study area during field investigations undertaken for this assessment:

– Brown Treecreeper *(Cormobates picumnus)*.
– Glossy Black-Cockatoo *(Calyptorhynchus lathami*).
– Grey-crowned Babbler *(Pomatostomus temporalis).*
– Masked Owl *(Tyto novaehollandiae).*
– Powerful Owl *(Ninox strenua).*
– Brush-tailed Phascogale *(Phascogale tapoatafa*).
– Squirrel Glider *(Petaurus norfolcensis*).
– Yellow-bellied Glider *(Petaurus australis*).
– East Coast Freetail Bat *(Mormopterus norfolkensis)*.
– Grey-headed Flying-Fox *(Pteropus poliocephalus)*.
– Hoary Wattled Bat *(Chalinolobus nigrogriseus)*.
– Large-footed Myotis (*Myotis adversus).*
– Little Bent-wing Bat (*Miniopterus australis*).
– Common Bent-wing Bat (*Miniopterus schreibersii*).
– Northern Long-eared Bat (*Nyctophilus bifax*).
– Eastern Cave Bat (*Vespadelus troughtoni*).

Of these species, the Marbled Frogmouth (*Podargus ocellatus*) is also listed under the EPBC Act. In addition to these threatened species, two migratory species listed under the EPBC Act were recorded in the study area. Interrogation of DEC's *Atlas of NSW Wildlife*, together with the presence of suitable habitat within the study area, indicate that additional threatened species are likely to occur. Species clearly exhibiting preferences for habitats not represented in the study area were eliminated from the target species list, thereby focusing field studies and impact assessments on the remaining threatened species. Threatened species for which there were no database records, but which were considered likely to occur (on the basis of habitat suitability) were also targeted. Threatened species that were found to be 'likely' to occur in the study area by virtue of habitat suitability were treated as if they had been recorded. These species are listed in **Table 3.2** below.

Table 3.2 Threatened fauna species likely to occur in the study area

Common name	Scientific name
Green Thighed Frog	*Litoria brevipalmata*
Wallum Sedge Frog	*Litoria olongburensis*
Stuttering Frog	*Mixophyes balbus*
Fleay's Barred Frog	*Mixophyes fleayi*
Giant Barred Frog	*Mixophyes iteratus*
White-crowned Snake	*Cacophis harriettae*
Pale Headed Snake	*Hoplocephalus bitorquatus*
Stephen's Banded Snake	*Hoplocephalus stephensii*
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii*

Common name	Scientific name
Emu	*Dromaius novaehollandiae* (NSW North Coast Bioregion and Port Stephens LGA Population)
Red Goshawk	*Erythrotriorchis radiatus*
Black-breasted Buzzard	*Hamirostra melanosternon*
Swift Parrot	*Lathamus discolor*
Square-tailed Kite	*Lophoictinia isura*
Hooded Robin Hooded Robin (southeastern subspecies)	*Melanodryas cucullata* *Melanodryas cucullata cucullata*
Osprey	*Pandion haliaetus*
Regent Honeyeater	*Xanthomyza phrygia*
Barking Owl	*Ninox connivens*
Masked Owl	*Tyto novaehollandiae*
Rufous Bettong	*Aepyprymnus rufescens*
Eastern Pygmy-possum	*Cercartetus nanus*
Spotted-tailed Quoll Spotted-tailed Quoll (SE Mainland Population)	*Dasyurus maculatus* *Dasyurus maculatus maculatus*
Long-nosed Potoroo Long-nosed Potoroo (SE Mainland Population)	*Potorous tridactylus* *Potorous tridactylus tridactylus*
Koala	*Phascolarctos cinereus*
Common Planigale	*Planigale maculata*
Large-eared Pied Bat	*Chalinolobus dwyeri*
Golden-tipped Bat	*Kerivoula papuensis*
Black Flying-Fox	*Pteropus alecto*
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*
Greater Broad-nosed Bat	*Scoteanax rueppellii*
Common Blossom-bat	*Syconycteris australis*
Migratory species under EPBC Act:	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*
White-throated Needletail	*Hirundapus caudacutus*

Source: Connell Wagner, 2005.

The diverse range of habitat types is reflected in the high number and diversity of threatened fauna recorded throughout the study area. Threatened fauna species recorded include three cave-roosting bat species, three hollow-roosting bat species, three hollow-dependent mammal species, and seven bird (including four hollow-dependent) species.

Hollow-bearing trees provide essential nesting/roosting/shelter habitat for many of these species. Most of the hollow-bearing trees observed during the fauna surveys were located in the dominant habitat type (Dry Open Forest) which is distributed along the length of the highway corridor. Additional important habitat for some of these species includes culverts and bridges (providing roosts for cave-dwelling bats) and winter-flowering species (providing foraging resources for gliders). These habitats are also distributed throughout the length of the highway corridor.

Key habitats and corridors identified by the DEC as occurring within, or in the vicinity of, the study area include:

– Broadwater-Tabbimoble Regional Corridor, which links Bundjalung National Park and Tabbimobile Swamp Nature Reserve.
– Devils Pulpit Subregional Corridor, which links Bundjalung National Park and Tabbimoble Creek.
– Mororo–Bundjalung Regional Corridor, which links the Mororo Corridor and Bundjalung National Park.
– Bundjalung-Tabbimoble Regional Corridor, which serves as a link between Bundjalung National Park and the Pacific Highway.

Aquatic habitats

The study area contains several creeks and drainage lines, with intact native vegetation, providing shelter, foraging, breeding habitat for frogs including potential habitat for threatened frogs such as the Giant Barred Frog. These habitats are also used as foraging areas by various threatened bat species.

Culverts crossing the creeklines and drainage lines are also likely to be used as roost sites for cave-dwelling bats, including the threatened *Myotis adversus* (Large-footed Myotis) and *Miniopterus australis* (Little Bent-wing Bat), which were captured in traps located at culvert entrances.

Freshwater wetland habitat within the study area provides suitable habitat for a number of threatened species listed under the TSC Act, particularly threatened wetland birds and frogs.

Watercourses within the study area, such as creeklines and a river at the northern end, provide potential habitat for fish, including the threatened Eastern Freshwater Cod listed as endangered under the NSW Fisheries Management Act 1994. The species is associated with the Clarence and Richmond river systems in north-eastern NSW. The Clarence River is situated near the southern end of the study area, while the Richmond River occurs near the northern end of the study area.

The habitat requirements of the Eastern Freshwater Cod are poorly known, but probably resemble related species (NSW Fisheries 1999). Cod are typically found in clear flowing rivers with rocky substrate and large amounts of in-stream cover. Recent research observations have indicated that eastern cod are typically associated with deeper parts of the river near cover, especially around rocky islands and large boulders in fast-flowing water.

Main ecological characteristics

The main aspects of ecological sensitivity associated with the proposed concept design have been identified as:

– the population of *Melaleuca irbyana* near New Italy;
– individual threatened plants distributed throughout the study area;
– locations with a high density of hollow-bearing trees;
– the EECs;
– forested habitats associated with threatened species records;
– culverts and bridges which are likely roosts for cave-dwelling bats; and
– creeks and drainage lines.

Potential impacts of the proposed concept design on flora and fauna species and habitats are discussed in **section 7.3.4** and **7.3.5** of this report.

3.2.6 Climate and air quality

The study area is heavily influenced by coastal weather patterns. The overall climate is warm to sub-tropical, with high annual rainfall. The wettest seasons are summer and autumn, while there is a pronounced dry season between July and December.

Mean annual rainfall figures for the study area range from approximately 1600 mm along the coast, to approximately 1000 mm at Casino. The most intense summer rain events, which can exceed 500 mm, are usually associated with the influence of tropical cyclone systems. Similarly, heavy winter rainfall events are usually associated with intense offshore low pressure systems.

Information on local air quality is limited. Rural areas with low population density do not generate airborne pollutants in sufficient concentrations to present a risk to the environment or to human health. Air quality monitoring is therefore not routinely carried out in these areas.
Based on studies carried out for other Pacific Highway upgrade projects, it is anticipated that airborne pollutants generated by this project will meet DEC criteria.

3.3 Land use

3.3.1 Existing land use

The predominant land use through the study area is retained natural forest either currently uncleared or partially cleared for pasture. Most private properties along the route are used for small scale beef cattle and horse raising on generally unimproved pasture of clearings within this natural forest. The retained forest on private land is in addition to extensive areas of State Forest, National Parks and nature reserves that border the highway in this area. Sugar cane growing is confined to the area near Iluka Road.

Previous highway upgrading works have left a number of small land blocks along the highway. The prior upgrades have also left clusters of residential blocks with frontage to the original highway alignment. Most residential areas are primarily located off the highway on minor access roads. However, a number of residences have direct highway frontages.

The only commercial centre in the study corridor is at New Italy, comprising a heritage museum and related small-scale tourist facilities.

The current land use of properties with frontage to the existing highway is summarised **in Table 3.3**, noting that there may be more than one activity per property. There are 181 individual allotments of land fronting the Pacific Highway. Some holdings however comprise more than one allotment. Therefore, the number of individual 'properties' or holdings fronting the highway is less than 181.

Table 3.3 Current land use activity: numbers of properties engaged in the activity

Land Use Activity*	No of Properties
Natural forest on private land	80
Pasture	55
Sugar cane	17
Commercial	5
Residential or rural living	48
State Forest, National Park, nature reserve, canal	20
Prior highway upgrade remnants	31
Total	**181**

* Each property may have more than one activity.
Source: Connell Wagner, 2005.

Land uses along the highway corridor are generally consistent with the zones established under the MLEP (Clarence Valley) and the RRLEP (Richmond Valley).

3.3.2 Potential future land use

Upgrading the highway presents few options for development of new land use strategies. There is minimal residential development along the route with vast areas conserved as State Forest or National Park. Both Clarence Valley Council in the south and Richmond Valley Council in the north advised in July 2005 that there were no development applications pending with regard to any properties within the defined corridor.

3.3.3 Agricultural lands assessment

Most of the land fronting the highway, which could be directly impacted by highway upgrading, has low agricultural capability and current use is dominated by forestry or forest dominant reserves. The special class lands near Iluka Road reflect the occurrence of land suitable for sugar cane on selected pockets there, while that at the Woodburn end reflects the presence of the Richmond River alluvial flood plain. While sugar could be grown on some of the land being used for pasture, industry economics are also a determining factor. Part of this land is already occupied by residential development near Woodburn.

The highway corridor passes through an area of relatively low agricultural productivity, a consequence of low fertility soils, poor drainage and a concentration on ecological and cultural conservation and forestry. Given the focus of recent *Native Vegetation Act 2003* legislation on limiting new clearing, there appears to be little scope for substantially changing the agricultural productivity along the highway corridor. Apart from sugar cane production in the southern sectors, crop production potential for properties affected by the highway upgrading appears very small.

3.3.4 Agricultural capability

The sugar cane farms towards the south of the study area, and the Richmond River floodplain just south of Woodburn, are on land which has limited agricultural capability for diverse long term or permanent cropping. Soils within the study area are generally of moderate to low fertility (see **section 3.2.2**) and most of the land along the corridor is suitable for grazing but not for cultivation and is not well suited to pasture improvement. The better agricultural land is found on the well drained lower slopes where there are extensive areas of swamp forest. The State Forests, nature reserves and Bundjalung National Park occupy most of this land within the study area.

3.4 Recreation and tourism

Tourism and recreation facilities within the study area include Bundjalung National Park, Tabbimoble Swamp Nature Reserve and New Italy. Higher traffic flows along the highway coincide with holiday periods being predominantly January, April and October. These higher flows reflect the use of the highway to reach tourism destinations on either side of the study area including the coastal towns of Iluka and Evans Head, and other destinations between Sydney and Queensland.

The New Italy Museum Complex is a small tourist attraction that is well patronised because of its location on the highway, relying mostly on passing trade rather than destination visits. It is estimated that the New Italy Museum Complex would have approximately 60,000 visitors annually.

A Driver Reviver facility operates at New Italy during holiday periods. The Driver Reviver caters for approximately 30,000 visitors annually (Richmond Valley Council *pers comm*, 2005).

3.5 Public utilities

Four service organisations own or operate utility services on or near the highway corridor. These are Country Energy, which distributes electricity to rural areas within NSW, Telstra, which provides telecommunications locally and nationally, and Clarence Valley and Richmond Valley Councils. Plant belonging to Telstra and Country Energy generally follows the existing highway alignment. Telstra's plant, including the fibre optic cable, is located entirely underground, while Country Energy's power distribution network consists primarily of overhead wires.

3.6 Acoustic environment

3.6.1 Existing noise environment

For the purpose of establishing ambient noise levels, measurements were conducted at six reference locations along the study route from Tuesday 1 March 2005 to Tuesday 8 March 2005. The monitoring locations are shown in **Figures 3.12a** and **b**. The results, detailed in **Table 3.4**, showed that daytime noise levels were 1-2dB(A) higher than night-time levels.

The small difference between day-time and night-time traffic noise levels reflects the fact that night-time traffic, although lower in terms of total number of vehicles, has a higher proportion of heavy vehicles, which generally emit higher noise levels than light vehicles.

Table 3.4 Façade road traffic noise levels

Noise Measurement Location (Refer Figures 3.12a and b)	Distance to Pacific Highway	Façade Road Traffic Noise Level	
		dB(A) (day)	dB(A) (night)
R1: 8 Old Pacific Highway Woombah	120m	59	58
R2: 6530 Pacific Highway Tabbimoble[1]	***65m***	62	61
R3: Lot 1/796808 Pacific Highway Tabbimoble[1]	45m	63	62
R4: 7680 Pacific Highway Tabbimoble	45m	65	64
R5: Lot 15/5861 Pacific Highway Tabbimoble	65m	64	62
R6: 32 Trustums Hill Road Woodburn	55m	62	61

Note 1: Measurements at locations R2 and R3 were in free-field (free of reflective objects). To account for noise reflection from the buildings, a façade correction of 2.5dB(A) was added to the measurement results.
Source: Connell Wagner, 2005.

Classified traffic counts were conducted on the Pacific Highway at the southern and northern ends of the study route during the noise monitoring period. Results of the traffic counts showed that:

- traffic volumes throughout the study area were similar;
- the average daytime (15-hour) traffic volumes and proportions of heavy vehicles were in the order of 6,000 vehicles per day (vpd) and 20% respectively;
- the average night-time (9-hour) traffic volumes and proportions of heavy vehicles were in the order of 1,000vpd and 60% respectively; and
- the average traffic speed was approximately 110 km/h.

3.7 Planning and settlement patterns

The study area does not include any towns and as a result there is no demographic data specific to the immediate area along the Pacific Highway. Most data provided in this section has been obtained from the Australian Bureau of Statistics (ABS, 2001) census for the broader community within the Clarence Valley and Richmond Valley LGAs.

Further information has been provided by local Councils and through discussions with community members.

3.7.1 Demographic profile

The current population of Woodburn is approximately 550 people. The population of the rural area between Woodburn and the Richmond Valley/Clarence Valley LGA boundary is approximately 200. Richmond Valley's population grew by 2.5% between 1991 and 2001 (ABS census data, 2001). The overall trend is consistent with population growth throughout the North Coast of NSW, one of the fastest growing regions in NSW.

Richmond Valley Council expects Woodburn's population to grow to 700 over the next 20 years, and the rural area between Woodburn and the LGA boundary to 500 over the same period.

New Italy, which is located between Woodburn and Iluka, is a heritage museum and small-scale tourist facility devoted to the history of the area, which was first settled by Italian migrants in 1882. New Italy's resident population is located mostly west of the Pacific Highway on medium sized rural allotments, and would not be directly affected by the proposed highway upgrade.

The population of the southern end of the study area (within Clarence Valley LGA) is likely to remain relatively static over the next 20 years as growth of the area is restricted by the large areas of land occupied by National Parks, nature reserves, State Forests and cane farms. Clarence Valley Council has advised that there is little likelihood of any change to existing land use strategies or strategic planning policy, in respect of land within the study area, in the foreseeable future.

The towns of Iluka and Woombah have a combined population of approximately 2,750, which increases considerably during the summer holiday period.

3.7.2 Age profile

The north coast region of NSW is ageing more rapidly than the State as a whole. There are more aged people and young people in Richmond Valley than in the rest of the State (Richmond Valley Social Plan 2001). Further, the number of aged people in Richmond Valley increased by 19% between 1991 and 2001, with the largest concentrations of aged people being in Coraki, Evans Head and Casino.

The former Maclean LGA (now part of Clarence Valley) also accommodates a median age (44 years) higher than the State average (34 years). The former Maclean LGA accommodates 26.5% of people over the age of 55 which is higher than the state proportion of 21%. Iluka is considered to accommodate a notably higher aged population than other areas in the former Maclean Shire.

3.7.3 Housing

The study area comprises predominantly dispersed low density semi-rural to small rural holdings with smaller residential blocks of land at Trustum's Hill and along Williams Road. Single dwellings are the main style of housing within the study area and there are few scattered caravans and cabins.

The Richmond Valley Council State of the Environment Report 2004 indicates that there are three areas within the LGA available for immediate rural residential development. These are Fairy Hill, Swan Bay and North Casino, none of which is within the study area. Further discussion with Richmond Valley Council has indicated that there are no known future release or development areas in the region in closer proximity to the study area. However, this appears contrary to the population growth predictions for the rural area south of Woodburn, as mentioned above. Trustum's Hill is a potential future development area and there has been recent subdivision (to create seven one-hectare rural residential allotments) at Sharpe Road, which is a short distance south of Woodburn as shown in **Figure 3.1**.

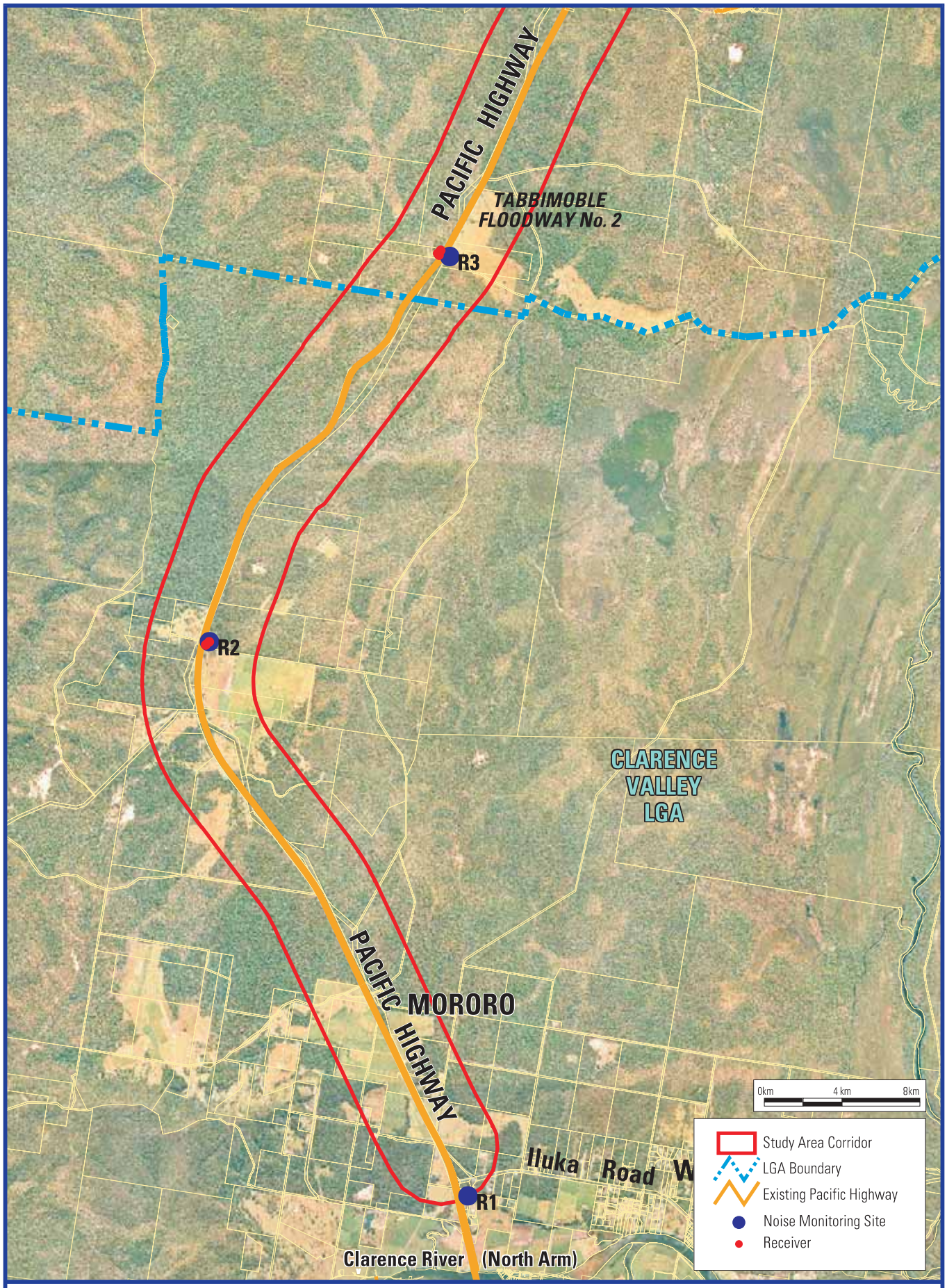

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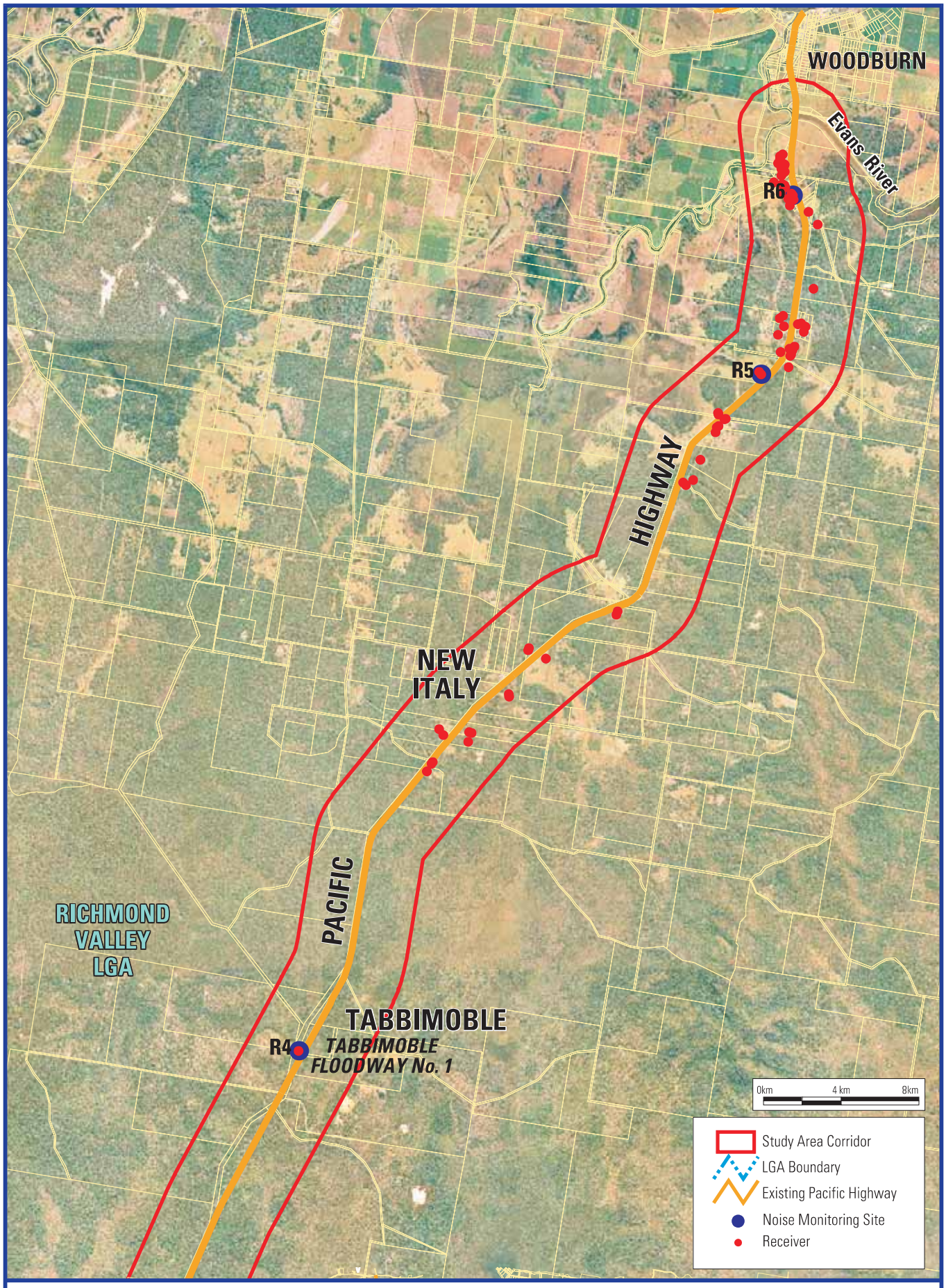
FIGURE 3.12a
NOISE MONITORING LOCATIONS AND DWELLINGS LOCATED WITHIN 300m OF THE EXISTING/PROPOSED ROAD ALIGNMENT



ILUKA ROAD TO WOODBURN
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FIGURE 3.12b
NOISE MONITORING LOCATIONS AND DWELLINGS LOCATED WITHIN 300m OF THE EXISTING/PROPOSED ROAD ALIGNMENT

Housing at the southern end of the highway corridor, in the Clarence Valley LGA, consists of very low density rural properties. The future development of this area is restricted by surrounding National Parks, nature reserves, State Forests and cane farms.

3.7.4 Employment

There are numerous sugar cane farms, cattle grazing farms and horse rearing businesses within the study area providing employment for the local community. Within the wider region the areas of employment include mainly manufacturing, agriculture, forestry, fishing, retail trade, and health and community services.

Clarence Valley and Richmond Valley are typical of many rural areas in that unemployment is high for both males and females, particularly in the 15-24 year age group. Youth unemployment rates are close to double the rates for the overall population. Full time work is predominantly the domain of males, while part time work is conversely the domain of females.

3.8 Indigenous heritage

3.8.1 Local Aboriginal Land Councils

The southern part of the study area between Iluka Road and Tabbimoble Creek lies within the territory administered by the Yaegl Local Aboriginal Land Council (LALC), and within the area of interest to the Ulgundahi Elders group.

The area north from Tabbimoble Creek to New Italy lies within the boundaries of the Bogal LALC, while the area from New Italy to the northern limit of the project area at Tuckombil Canal is shared by the Bogal, Jali and Ngulingah LALCs. This sharing arrangement has arisen due to the high spiritual and archaeological significance of the Evans Head/Goanna Headland locality to Bandjalang people from a wide geographical area.

3.8.2 Native title claims

A search of the Register of native title claims, the Register of Indigenous Land Use Agreements, the National Native Title Register and the Applications Summary was undertaken for the Richmond Valley and Clarence Valley LGAs on 4 May 2005. Advice provided by the National Native Title Tribunal indicates that at the time of the search there were two entries relevant to the study area. Both have been accepted for native title registration and are currently in mediation.

The first of these (NC96/16) has been lodged by Lawrence Wilson on behalf of the Bandjalang dialect group (the Bandjalang Aboriginal Corporation). It relates to five separate land parcels east and north-east of the existing highway reserve between Iluka Road and Woodburn. One of these land parcels (designated 'Area B') lies immediately east of the Pacific Highway Reserve in the vicinity of New Italy.

The second entry (NC98/19) has also been lodged by Lawrence Wilson on behalf of the Bandjalang people. The application relates to a 3,315 km^2 area comprising all claimable land south from Broadwater Headland to Woody Bluff, inland to Naughtons Gap and Busbys Flat. This application encompasses all of the Iluka Road to Woodburn study area.

The above native title claims generally do not affect the proposed Pacific Highway upgrade, as the claims do not apply to freehold lands, or to lands lawfully owned and occupied. On acquisition of any land required for the construction of the project however, the RTA would have to extinguish the relevant native title claims (if any) prior to acquiring the land.

3.8.3 DEC Aboriginal Heritage Register

Twelve Aboriginal sites have been registered to date on the DEC Aboriginal Heritage Information Management System within a 5 km radius of the study area. However, none of the DEC registered sites fall within the study area itself.

3.8.4 Other Aboriginal heritage registers

Searches of the relevant Commonwealth and State government heritage lists maintained by the Department of Environment and Heritage, and the NSW Heritage Register, revealed no listed Aboriginal sites within either the Richmond Valley or Clarence Valley LGAs. Four Indigenous places are registered on the National Estate database, all in the Richmond Valley Shire. These are located at Casino, Evans Head and Bora Ridge, a minimum of 10 km from the study area.

3.8.5 Unregistered Aboriginal sites

A field study was conducted on 31 May, 1-3 June and 11 August 2005 to identify previously unrecorded sites. The field survey was attended by representatives of the local Indigenous communities and was focussed on landforms with high archaeological potential located within a 60 m wide strip centred on the existing highway. Four archaeological areas, comprising one low-density scatter of stone artefacts and three isolated artefact finds, were recorded during the field survey, in the general vicinity of the location shown on **Figure 3.13**.

Owing to their limited size, level of disturbance and lack of further research potential, two of the isolated artefact finds (IR2W-1 and IR2W-3) are assessed as having low scientific significance in the local context. Aboriginal field representatives assisting with the survey advised that, if collected, these artefacts would be of educational value to the Aboriginal community.

The recorded artefact scatter (IR2W-2) and additional isolated stone artefact site (IR2W-4) are also small and disturbed. However, both sites have the potential to be larger and to contain subsurface potential archaeological deposits (PADs) on adjacent ridge crests. The scientific and cultural significance of these two sites could only be reliably assessed on the basis of the results of a sub-surface investigation of the associated PADs (subject to DEC approval).

The survey included the finding of a scarred tree in the vicinity of New Italy which has been verified as being of high significance to local Indigenous women. At the request of the LALC, the precise location of the scarred tree has not been mapped or included in the survey results. However, the study team through its Indigenous heritage consultant, has been able to verify that the tree is a sufficient distance from the existing highway to ensure that it would not be affected by any of the works required for the proposed Pacific Highway upgrade.

3.9 European heritage

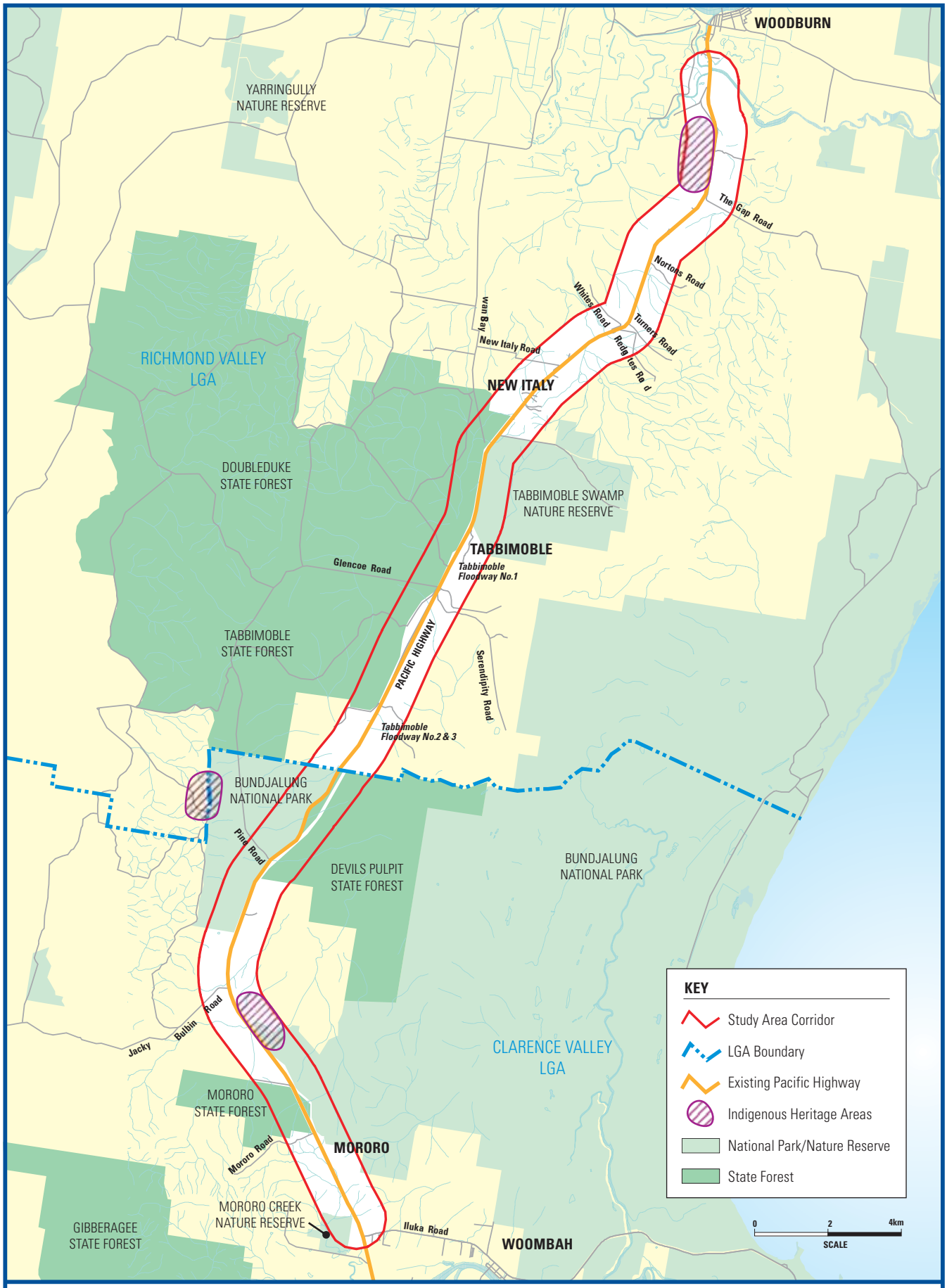
3.9.1 Identified heritage items

There is little published historical information relating directly to the Iluka Road to Woodburn area, however, it is known and understood that the area around the Richmond and Clarence Rivers was settled mainly during the mid-nineteenth century, by timber getters and dairy farmers, followed closely by sugar cane growers. Fishing has also long been a staple of the local economy, and accounts for the development of coastal towns such as Iluka.

The existing landscapes within the study area are largely the product of early timber harvesting and dairy farming. Land was extensively cleared of timber, and much of the existing forest cover is natural regrowth.

Searches of the RRLEP, the MLEP and the NSW Heritage Office State Heritage Inventory for local and state significant heritage items have identified the following heritage items/places within the general project area:

– New Italy Settlement; and
– Vineyard Haven, New Italy.



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 3.13
INDIGENOUS HERITAGE AREAS

The RTA has also been consulted with regard to its corporate register under Section 170 of the *Heritage Act 1977*, and other internal heritage inventories. The RTA has advised that there are no items within the study area, on the Section 170 register or any other RTA inventory, that are likely to be affected by the proposed highway upgrade.

A description and statement of significance for each of the sites/items identified is provided below and the location of each heritage item relative to the proposed highway upgrade is illustrated in **Figure 3.14**. During the preliminary European heritage assessment, no other 'relics' (within the meaning of that term as defined in Section 4 of the *Heritage Act 1977*) were identified in the vicinity of the existing Pacific Highway. However, a more detailed search for and assessment of 'relics' of European settlement will be undertaken during the environmental impact assessment phase of the project.

3.9.2 New Italy Settlement

The New Italy Settlement landscape is of State significance as evidence of a settlement built through the tenacity, forbearance and technical skills (especially horticultural and architectural) of a group of settlers. Although few original structures or relics have survived, the New Italy Museum Complex, located at the junction of the Pacific Highway and Swan Bay New Italy Road, preserves a link to the archaeological and cultural heritage of the locality. Items of heritage significance identified as part of the Museum Complex include:

– an obelisk of concrete and Italian marble (reputedly located on the site of the former mud brick house);
– a covered, above ground well;
– statuary and 'pioneer and his dog' monuments;
– a post and rail fence considered to be of original materials; and
– more recent pavilion, restaurant, hall, display hall and Aboriginal art gallery buildings.

Artefacts/items associated with the school site (located some 2 km north west of the Museum Complex) are considered part of the much larger New Italy landscape which contains wells, fruit plantings and archaeological evidence of churches, domestic buildings and artefacts, shops and cellars. The New Italy Settlement covers an area of 485.62 hectares (1200 acres) and represents an unusual phase of settlement in NSW. It is the only known settlement of its type in NSW. The physical condition of the site is considered fair to good and the archaeological potential of the school site together with the surrounding New Italy landscape is high.

No specific information has been found regarding an identified curtilage for the New Italy Settlement site, however for the purposes of this report, it has been assumed that the original 1880's settlement boundary forms the curtilage of the site. The approximate 1880's boundary is defined by the NSW Heritage Office State Heritage Inventory and is reproduced approximately in **Figure 3.14**.

3.9.3 Vineyard Haven, New Italy Settlement

'Vineyard Haven', although within the area defined as the New Italy Settlement, is listed as a separate item of State heritage significance under the *NSW Heritage Act, 1977*. Vineyard Haven occupies the property originally taken up by the French Palis Brothers, and then the Italian Giovanni Guarischi, and contributes to the State significant New Italy Settlement Landscape. It contains remnants of the landscape encountered by the settlers and evidence of their domestic and work practices. These relics and archaeological items include a dam site, a timber lined well, a mound, vines, vine contours on the landscape, former water trenches and other archaeological evidence of settlement.

This property is situated on the corner of Swan Bay New Italy Road and Forest Road, approximately 1.5 km to the west of the Pacific Highway. For the purposes of this report, the site boundary as identified by the NSW Heritage Office State Heritage Inventory has been adopted and is reproduced approximately in **Figure 3.14**.

3.10 Visual amenity

The Clarence Valley and Richmond Valley regions in northern NSW are existing natural and cultural environments whose beauty and unique assets are attractive for both local residents and visitors.

The presence of the mountains, the great rivers that meander across the coastal plain, the eucalypt forests broken up by meadows and pasture lands and the small settlements and interspersed farmsteads are constant features along the highway. Variation is in the main provided by vegetation and the agricultural land use.

The overarching urban design vision for the Pacific Highway upgrade is outlined in the RTA's Pacific Highway urban design framework (March 2005):

'a sweeping, vegetated highway, providing panoramic views to the Great Dividing Range and rivers, forests, farmlands and coastline of the Pacific Ocean. Sensitively designed to fit into the landscape and be unobtrusive. Characterised by simple, attractive road infrastructure.'

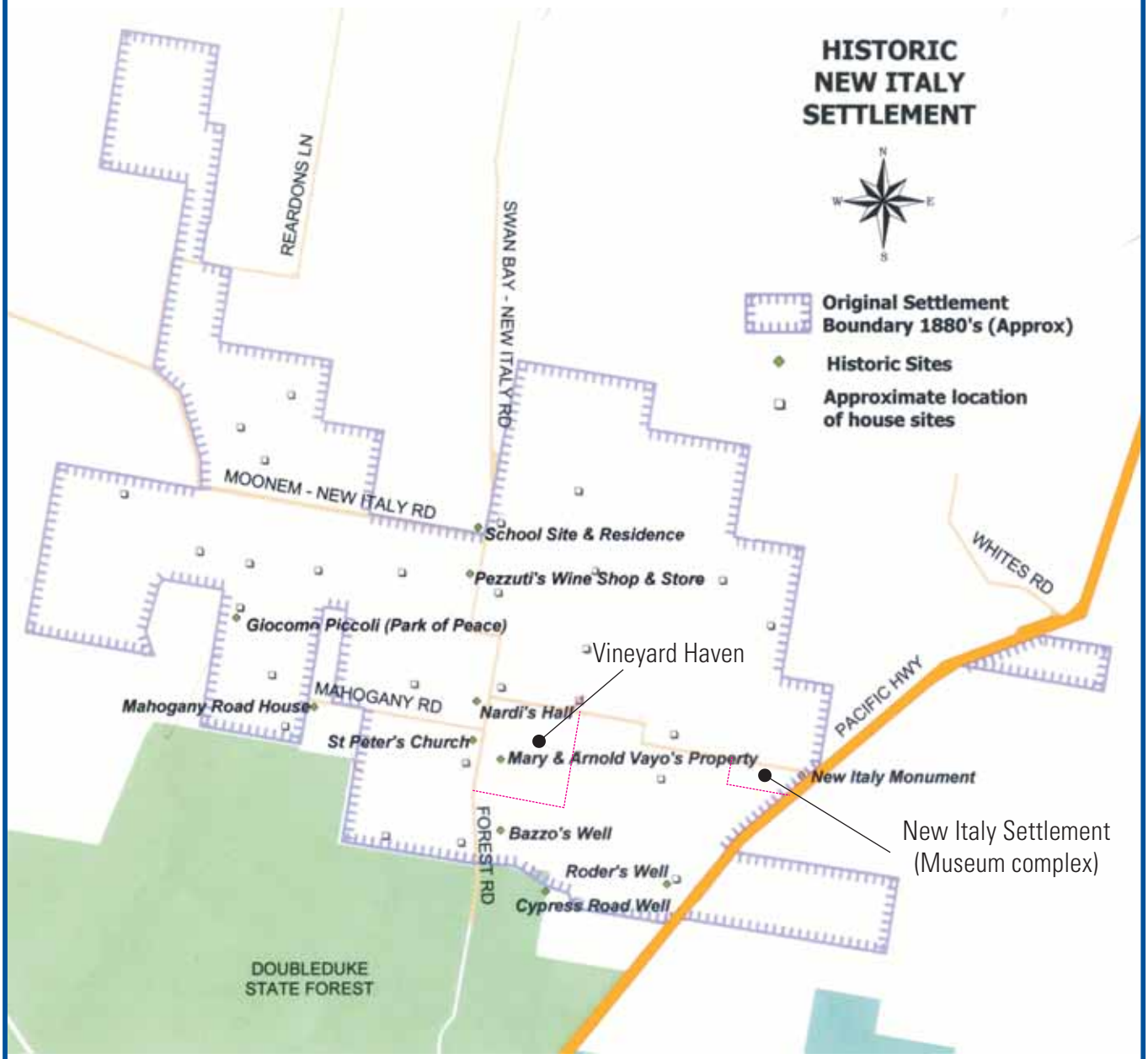
3.10.1 Existing important characteristics

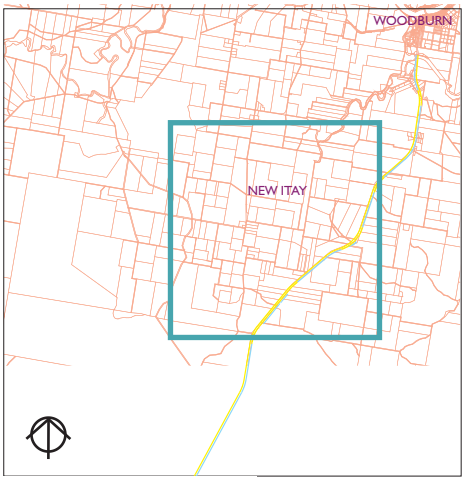
Important natural and built features of the study area include:

- Chatsworth Hill;
- Mororo Creek and Nature Reserve;
- Mount Doubleduke;
- Tabbimoble Creek;
- Tabbimoble Floodways;
- State Forests/National Parks (Mororo, Devils Pulpit, Doubleduke, Bundjalung);
- Tabbimoble Swamp Nature Reserve;
- New Italy community; and
- Tuckombil Canal.

Generally, the landscape in the study area comprises floodplains cut by a variety of rivers and creeks. Mountain ranges form the backdrops for views along the highway through the study area, the significant ones being Chatsworth Hill to the south and Mount Doubleduke and Richmond Range to the west. Sugar cane fields are predominant at the southern end around the drainage lines of Mororo Creek. Extensive dense forests of eucalypt and melaleuca line the highway for considerable lengths.

New Italy provides regional cultural landscape interest. Though close to the existing road corridor, the New Italy Museum Complex is in a pleasant garden courtyard setting, of a scale that is welcoming and restful for travellers. An earth embankment next to the road edge combined with a stand of significant existing eucalypts, and the separation between the rest area and the highway itself, provide an essential green foil to the roadway, an effective acoustic screen, and a pleasant entrance to the New Italy Museum Complex. It is considered an important urban design and landscape objective to use the Pacific Highway upgrade project as an opportunity to enhance the visual and landscape amenity of the New Italy Museum Complex.





Original Settlement
Boundary 1880's (Approx)
Historic Sites
Approximate location
of house sites

FIGURE 3.14
EUROPEAN HERITAGE

4. Project need, objectives and design principles

4.1 Need for the project

The need to upgrade the Pacific Highway between Iluka Road and Woodburn has been evaluated in the context of the overall Pacific Highway. The highway is a major inter-state transport infrastructure facility that not only forms the primary Sydney - Brisbane surface transport link, but also serves as the backbone for a significant and growing coastal residential and recreational population.

The project is required to meet the NSW and Commonwealth governments' overall objective of fully upgrading the Pacific Highway to a four-lane divided highway standard. It will provide additional capacity in an area with continued traffic growth, and will join other completed and planned projects to form a continuous high-standard road, better able to meet the demands placed on it.

The project is also an essential component of the wider regional network, and the need for it is based on a number of issues, including:

- Road safety – including the need to reduce the number of road traffic accidents through safer design;
- Population growth, urban expansion, commercial development, tourism and employment growth on the NSW north coast and in southern Queensland; and
- Freight transport demand and service patterns.

It is expected that traffic volumes on the Pacific Highway will continue to increase due to:

- Population increases in the North Coast region;
- Traffic diverted from other routes as the Pacific Highway is improved; and
- Traffic generated by improved travel times and reduced travel costs.

4.1.1 Pacific Highway Upgrade Program objectives

The RTA's overall objectives for the PHUP are to:

- significantly reduce road accidents and injuries;
- reduce travel times;
- reduce freight transport costs;
- develop a route that involves the community and considers their interests;
- provide a route that supports economic development;
- manage the upgrading of the route in accordance with ESD principles; and
- provide the best value for money.

4.1.2 The 'base case' – 'do minimum'

Within the context and overall scope of the PHUP, it is useful to compare the proposed highway upgrade with the 'base case' or 'do minimum' scenario. The 'do minimum' option infers no substantial change. Minor improvements could be undertaken along the Pacific Highway under a 'do minimum' scenario to eliminate black spots, improve line marking, construct safety features such as median safety barriers (currently being installed along the route), and provide better overtaking opportunities.

The consequences of the 'do minimum' option for Iluka Road to Woodburn would not mean substantial improvements in terms of traffic congestion, travel times or general LOS. However, as discussed in section 2.2, this section of the Pacific Highway has a poor accident record, including fatalities. Any increase in traffic volumes, regardless of the effect on overall highway capacity, is likely to result in an increased frequency of accidents, particularly as driving conditions are improved elsewhere. Many of the accidents including head on collisions are attributed to fatigue, and only a change in the type and function of the highway can address this issue.

Highway safety is a major concern of residents in the study area and to the wider community. Local residents must rely on the Pacific Highway for local trips, which can conflict with through traffic. In particular, residents perceive the high volumes of truck traffic, especially at night, as being a considerable risk to safety. Access on and off the Pacific Highway into minor roads or to private properties often requires turn movements in unsafe situations such as on curves or crests, where sight distances can be inadequate, or where shoulder width or conditions are sub-standard (eg potholed, gravelled, etc). It is anticipated that these conditions would improve with the highway upgrade as conflicts associated with slower moving heavy traffic on single carriageway highways are reduced ie fatigue and high risk overtaking manoeuvres.

In addition, the overall traffic noise level and the frequency of night-time noise 'events' such as use of engine compression brakes, which are already major sources of concern to many residents along the route, would increase under a 'do minimum' option.

These conditions are a result of the function and geometric design of the existing highway and would be substantially improved with the proposed concept design as the following would be eliminated:

– Overtaking manoeuvres in opposing flow traffic lanes – linked to head on collisions.
– Tight curves in road – linked to loss of control or head on collisions.
– Crests in roads – linked to nose to tail and head on collisions.
– Reduced visibility from side roads – linked to side impact collisions.
– Steep grades – linked to increased noise or compression breaking.
– Single lane flow – platooning of traffic caused by differential speed and low opportunities to overtake.

4.1.3 Project objectives

Objectives for the Iluka Road to Woodburn project have been derived to guide its development and to address the needs and issues identified at this stage of the project. These objectives have been developed from the PHUP objectives.

The project objectives form the basis of a range of performance measures. The performance measures will be elaborated upon as more detailed investigations and assessments occur through each stage of project development.

The project objectives were discussed with members of the community (at the CISs (Community Information Sessions) held on 14 December 2004 and 8 March 2005) and key government agencies (at the PFM held on 14 December 2004).

The project objectives arising from the community and agency consultation process, as derived from the PHUP objectives, are:

Significantly reduce road accidents and injuries:
– Develop a dual carriageway road with a route target crash rate of a maximum 15 crashes per 100 MVK over the project length.
– Minimise the number of access points onto the highway for 'Class A' Freeway sections.
– Retain or replace existing rest areas within the study area.

Reduce travel times:

- A concept design for a 110 km/h design speed for the vertical alignment and 110 km/h design speed for the horizontal alignment.
- A route that can be upgraded to Class M or Motorway standard in the future (as applicable), with controlled access only via grade-separated interchanges, and a parallel service road network for local traffic.
- Provide a route that maximises the reduction in travel time for Pacific Highway traffic.
- Provide intersections designed to at least a LOS C, 20 years after opening for the 100th Highest Hourly Volume.
- Minimise user delay from incidence and road closure on the highway including from flooding.
- Reduce delays from holiday congestion.
- Minimise disruption and delay during construction

Reduce freight transport costs:

- Provide a route which reduces the overall freight transport cost for trucks using the highway.
- A route that meets or exceeds B-double requirements.

Develop a route that involves the community and considers their interests:

- Develop a project that meets the objectives of the Community Involvement Plan.
- Minimise the physical and traffic impacts of the route such as traffic noise levels, intrusion, community severance and access patterns.
- Minimises the physical impacts on heritage (Indigenous and European) sites.
- Provide transport developments which are complementary with land use.
- Maintain access to affected properties and land during construction.
- Upgrade and improve the existing highway where it is retained as part of the Project.

Provide a route that supports economic development:

- Maintain accessibility for local industries to regional and interstate markets.
- Maintain access to local and regional centres of economic importance.
- Minimise the impacts on business/service facilities dependent on Pacific Highway traffic.

Manage the upgrading of the route in accordance with principles of ecologically sustainable development (ESD):

- Provide a flood immunity on at least one carriageway between 1% AEP (annual exceedance probability) (target) and 20% AEP (absolute minimum).
- Minimises the effects on sensitive habitats.
- Minimise the effects on native vegetation.
- A route that minimises impacts on National Parks.
- A route which satisfies the principles of ESD.

Provide the best value for money:

- Minimise the Whole of Life Costs of the project.
- Maximise the use of the existing road reserve for duplicated sections of the project where possible.
- Benefit cost ratio (BCR) of greater of 2.
- Expenditure supports NSW State government and Clarence Valley/Richmond Valley Council development policies.

4.2 Design principles and standards

4.2.1 Urban design principles

The urban design principles for the proposed upgrade are derived from:

- PHUP goals;
- Iluka Road to Woodburn project objectives; and
- The RTA's Pacific Highway urban design framework (March 2005); Pacific Highway Development Framework (2004), Beyond the Pavement 2004 Update (Urban and Regional Design Practice Notes); and Bridge Aesthetics – Design Guidelines to improve the appearance of bridges in NSW (2003).

4.2.2 Highway design standards

The design of the Iluka Road to Woodburn upgrade of the Pacific Highway is being carried out according to Upgrading the Pacific Highway – Upgrading Program Beyond 2006: Design Guidelines (2005), prepared by the RTA's Pacific Highway Office. The project will also comply with Austroads standards (various dates) and the RTA's Road Design Guide (1989). Key standards applying to this project are summarised below in **Table 4.1**. The typical cross section for the proposed highway upgrade is shown in **Figure B**.

Table 4.1 Road design standards

Feature	Class A dual carriageway	Intersecting and other roads
Design speed	Generally 110 km/h except vertical alignment may be reduced to 100 km/h at certain locations based on cost effective advantages and approved by the Pacific Highway Office.	80 and 60 km/h dependent on function.
Cross section	Dual carriageway with two 3.5 m wide lanes, 2.5 m nearside shoulder and 0.5 m offside shoulder, median width 12 m where appropriate given geotechnical and land use constraints. Minimum 10 m clearzone from edge of running lane plus additional reserve on one or both sides to enable service road to be provided under a Class M scenario.	Two lane single carriageway with typically 3.5 m lanes and 2 m shoulders dependent on road function.
Flood immunity	One carriageway positioned above the 1 in 100 year flood level (desirable) or the 1 in 20 year flood level (minimum) across the flood plain.	No change to existing conditions.
Intersections	No grade-separated interchanges for this project (Class A). At-grade 'Seagull' type T-intersections at key local roads.	At grade T-intersections with some turning lanes.
Access	Left-in, left out for all existing access roads and private properties not serviced by 'Seagull' type T-intersection (Class A).	Unrestricted.
Overhead clearances	5.3 m.	Varies dependent on function.
Fill/batter	1 vertical : 3 horizontal – 1 vertical : 2 horizontal	1 vertical : 3 horizontal – 1 vertical : 2 horizontal
Cuttings	1 vertical : 2 horizontal	1 vertical : 2 horizontal

Source: RTA, various publications.

5. Approach to route selection and community involvement

5.1 Study area established

The identification of a preferred route for the Pacific Highway between Iluka Road and Woodburn, as for all Pacific Highway upgrade projects, is a key element in State and national transport strategy.

Road corridor options for the Iluka Road to Woodburn project are limited to an upgrade of the existing highway alignment along the study area corridor, to either the east or west of the existing alignment. Therefore, this project focuses upon duplicating the existing highway to create a second carriageway, with improvements to the existing alignment in order to make it safer. It was identified early on by the RTA that duplication of the existing carriageway or full reconstruction near the existing alignment would be less intrusive to the environment and communities not adjacent to the existing road. The study area was limited to approximately 1 km either side of the current Pacific Highway. The route selection process has comprised of the key stages as detailed below and indicated in **Figure 5.1**.

5.2 Review and familiarisation with the study area

The route investigation commenced with collection and review of available information (including photographic resources) about the study area and site visits, in order for the project team to become familiar with the locality. This phase of the project also included making initial contact with local residents and businesses, and preliminary investigations of local geography, topography, climate, demographics and land use. This phase of the project was critical in establishing an understanding of the study area and establishing the information database on which further studies and investigations could build. Relevant reports were obtained that have been compiled to aid land policy or management in the study area. These included the master plans of the two councils administering all the land affected by the project.

5.3 Investigate strategic options

5.3.1 Examination of the existing highway corridor

The RTA's brief required the study team to investigate opportunities to upgrade the highway through duplication of the existing lanes where feasible. Therefore, a key component of the route selection process has been examination of the existing highway corridor to assess its condition in terms of horizontal and vertical alignment, existing bridges and drainage structures, and pavement condition.

Through this assessment, the study team has identified those sections of the existing highway that could meet or do not meet the RTA's highway design standards. This has provided some direction for the road design, by indicating where the existing highway can be used for the duplication, and where it will be necessary to construct a new section or sections of four-lane highway. Further, in assessing the condition of pavements, embankments, cuttings, bridges and other structures, this assessment provides valuable input to the estimation of project costs.

5.3.2 Options outside the study area

During the concept design development process and in response to questions from the community, the study team considered the feasibility of investigating possible highway upgrade options outside the study area as depicted in **Figure C**. Early in the process, it was decided that route selection would not extend outside the study area, for the following reasons:

– With the exception of short sections having sub-standard alignment, the existing Pacific Highway generally follows a route that is capable of being upgraded and/or duplicated to satisfy the RTA's minimum requirements for travel speeds, sight distance and flood immunity without significant impact on private land or State Forest.

- Alternative routes outside the study area would achieve little in terms of travel time saving or other benefits, and would incur very high property acquisition costs.
- An alternative route outside the study area is likely to have a significant impact on the biophysical environment.
- Alternative routes outside the study area are not likely to exhibit any substantial biophysical, socio-economic or engineering advantages when compared with possible routes inside the study area, which utilise the existing highway route where possible.

5.3.3 Why no route options?

As discussed above, the route selection process has focussed on a proposed route within the study area. As the work has progressed, it has become evident that the upgrading and/or duplication of the highway can feasibly be achieved through the utilisation of substantial proportions of the existing road, and building two new lanes on either the east or west side. In many locations, the existing road corridor has ample width to accommodate the second carriageway, side by side with the existing highway, within existing RTA road property boundaries.

By keeping to a potential route alignment that maximises the use of the existing road corridor, the proposed highway upgrade could be achieved with minimal impact on private property and the environment, and at considerable cost saving when compared with a new route.

5.3.4 Class A and Class M

The RTA's brief for the Iluka Road to Woodburn Pacific Highway upgrade specified the requirement to prepare a concept design for a Class A road that is capable of being upgraded in the future to a Class M road.

Class A refers to an arterial style four-lane divided highway (dual carriageway) that incorporates some limited direct access on and off the highway to local roads and private property. This may include intersections where right turn movements are permissible through the provision of deceleration lanes, merging lanes and vehicle refuge zones between the two opposing traffic streams. Under a Class A scenario, local traffic and through traffic would continue to share the highway.

Class M refers to a motorway-standard road, where access is restricted to grade-separated (flyover-type) interchanges, and there is no direct access on or off the highway to local roads or private property. If warranted by future traffic growth, the Class M upgrade may include widening to six lanes (three in each direction). Under a Class M scenario, local traffic would be diverted to a parallel service road, normally having two lanes and with a posted speed limit less than 100 km/h.

The proposed upgrade of the Pacific Highway between Iluka Road and Woodburn is being approached as a Class A upgrade. However, in carrying out the investigations for the project, the study team has also considered how the proposed concept design might be upgraded to Class M, and what this would entail in terms of the wider road footprint and associated property impacts.

It is not possible to anticipate when the Iluka Road to Woodburn section of the Pacific Highway might be upgraded to Class M. At the present time, there is no proposal to implement a Class M strategy for this section of the highway. However, planning is important at this stage of the project so that in the event of a possible future Class M upgrade it can be achieved with minimal disruption to highway operation. The planning and design for the Class A concept seeks to minimise the need for further reconstruction of large sections of new highway, should the Class M strategy be implemented. The Class M strategy could therefore be implemented without major environmental impact and without further disruption or uncertainty for private landowners.

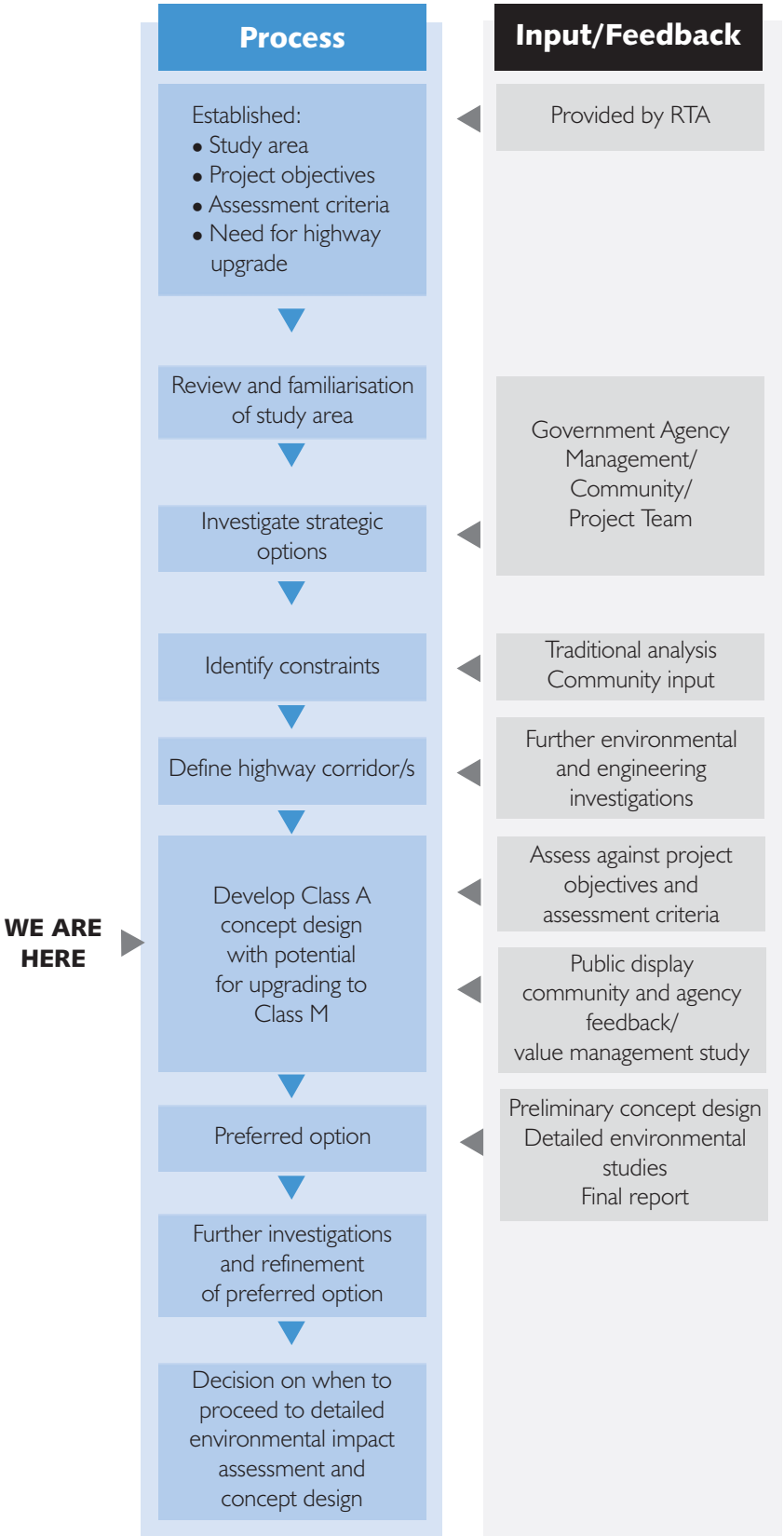


FIGURE 5.1
METHODOLOGY FOR DEVELOPMENT AND ASSESSMENT OF ROUTE

The Class M strategy includes a possible grade-separated interchange at New Italy, when warranted. An interchange at New Italy would further improve safety at this location, and would also help to support and promote the cultural heritage values and economic viability of the New Italy Museum complex. Interchanges are also proposed south of Tuckombil Canal and at Iluka Road (as part of the Woodburn to Ballina and Wells Crossing to Iluka Road projects, respectively). To complement the grade separated interchanges, the Class M strategy would require construction of a 33 km parallel local service road to provide access to communities along the route. The possible Class M concept layout is described in further detail in **section 6.5** of this report.

5.4 Identify constraints

The selection of a possible route corridor has been limited due to the physical constraints of the study area. These principally are:

- The locations of residences in proximity to the existing highway.
- Vast areas of State Forest and National Park on either side of the existing Pacific Highway.
- Extensive SEPP 14 wetland between the existing road and coast.
- The Richmond River floodplain, which covers the northern half of the study area.
- Undulating hills on the western side of the existing Pacific Highway at the southern end, and on the eastern side at the northern end.

5.5 Define preferred highway corridor

There are no large communities along the existing route that would normally prompt a consideration of a by-pass or alternate route. The existing road corridor for much of its length will accommodate a second carriageway either to the east or west of the existing and enable the provision of a service road under a Class M arrangement.

Duplication of the existing highway would require strip land acquisition from approximately 36 individual properties adjacent to the existing highway. These properties have a number of land uses that range from pasture, farming or State Forest to homesteads or houses on large blocks. It is considered that acquisition of narrow strips of land is preferable to major property severance, which is often a consequence of development of a new highway route.

5.6 Develop concept design

The proposed concept design has been developed over a 12-month period with input from the Community, numerous technical reports and investigations. The full approach to development of the concept design is described in Chapter 6.

5.7 Approach to community involvement

The approach to consultation has been to actively involve the community in each phase of the project. A Community Involvement Plan was developed and implemented based on the principles of transparency, inclusiveness and responsibility. The following specific objectives were developed to guide the consultation strategies and mechanisms:

- Ensure all stakeholders have the opportunity to participate equitably in the study process;
- Develop a better understanding of community views to assist the RTA to make informed decisions;
- Develop trust between the RTA and the community;
- Maintain transparency in all processes and decision-making;
- Communicate information to all stakeholders; and
- Provide mechanisms for stakeholder views to be incorporated into the project development process.

The key activities undertaken which were designed to keep stakeholders informed and able to provide input into the project, consisted of:

Information -

- Preparing and distributing information about the investigation and assessment process via information releases including updates, display advertising and via a project specific Internet site. This activity commenced in November 2004, with information updated regularly throughout the route investigation and concept design phases.

Community Information Sessions (CIS) -

- Open, structured community forum sessions providing a range of opportunities for exchange of information, where study team members provide information and answer questions. The CISs included presentations, display material and community input. There have been two to date, in December 2004 and March 2005.

Feedback -

- Providing stakeholders with a range of means to obtain information or make submissions, such as a telephone information line with direct contact to the RTA Project Manager and the project Community Liaison Co-ordinator, project website and email address, and project mail address. These have also been available since November 2004.

At the first CIS meeting, nominations were invited from the community for the formation of a community liaison group (CLG), a small representative group of local residents that would meet regularly throughout the project to discuss community issues, and act as a conduit for information flows between the community and the study team.

The response to the call for CLG nominations was not representative of the study area's overall population. Six nominations only were received, all of which were from residents living between New Italy and Woodburn. Although the study team sought to generate nominations from residents of the southern half of the study area (in particular from the Serendipity community and the Mororo sugar cane farmers), none was forthcoming.

It was considered that all interested community members could be directly engaged through the continuation of the CISs. As such a CLG was not formed for this project. It was considered that the CLG's aims could be achieved equally well through the open CIS forums, which to date have attracted a broad cross section of the local community, in numbers that remain manageable and productive. The CIS, being an open forum, is non-exclusive and does not require that delegates make a long-term commitment to membership of a smaller group.

Two CISs have been held to date, the first (December 14 2004, at Woodburn) to introduce the community to the project and the second (8 March 2005, at New Italy) to discuss route option planning. Further CISs will be held at strategic stages during the project planning, design and approval process.

The process for community involvement allows for a range of feedback mechanisms and provides an opportunity for community input to each major stage of the project.

5.7.1 Government and other stakeholder involvement

The relevant Commonwealth, State and local government agency representatives, utility providers, regional and local interest groups and other stakeholders were identified and consulted at project commencement and at various stages during the investigation.

The government agency representatives and other stakeholders were invited to attend a PFM on 14 December 2004. The PFM was attended by representatives from:

- Department of Infrastructure, Planning and Natural Resources (DIPNR) (including representatives of both the newly established Department of Planning (DoP) and Department of Natural Resources (DNR));
- Department of Environment and Conservation (DEC);
- Department of Primary Industries (DPI);
- Richmond Valley Council;
- Clarence Valley Council; and
- National Roads and Motoring Association (NRMA).

Government agencies and other stakeholders that were invited to the PFM, but did not attend included:

- Department of Transport and Regional Services;
- Department of State and Regional Development;
- Ministry of Transport;
- Grafton Rural Lands Protection Board;
- Casino Rural Lands Protection Board; and
- Tweed Lismore Rural Lands Protection Board.

Further consultation will continue with other stakeholder and government agencies as project planning progresses. Value engineering will be undertaken prior to the project approval stage. A value engineering workshop involving key members of the study team will be conducted to provide a critical evaluation of the proposed concept design. In this regard, the value engineering stage represents an important phase of refining the concept design.

The value engineering study will incorporate a risk management workshop, the aim of which is to optimise the project design and provide a risk assessment of the route concept.

5.7.2 Community and stakeholder input to route development

The input provided by community members in the study area has been invaluable for providing local information on key constraints. Such input has included information on:

- Access along the highway and from feeder roads for business, emergency services, school buses and residents;
- The access needs of residents within the study area, including school bus routes, pick-up and set-down locations, and turning requirements;
- The local economy and local socio-economic influences;
- Flooding within the study area;
- The cultural and social importance of the New Italy Museum Complex and rest area; and
- Biophysical features of the study area, including local flora and fauna.

All community contact and submissions (through the 1800 telephone information line, email, fax, and other correspondence) have been and will continue to be recorded and responded to on an ongoing basis.

Other stakeholders, including government agencies, have provided useful information from the beginning of the project investigation and liaison will continue as appropriate. The information provided by these stakeholders includes:

- specific planning assistance, bore searches, soil landscape maps provided by DIPNR;
- threatened fish species lists and fish habitat mapping DPI (NSW Fisheries);
- heritage information and geographic information systems (GIS) mapping of agricultural lands from DPI (NSW Agriculture);
- National Park information, Aboriginal heritage data and flora and fauna data including threatened species from DEC;
- local utilities mapping and flood information from Clarence Valley Council;
- strategic plan for Woodburn and rural areas from Richmond Valley Council; and
- specific information on sugar cane farms from the Cane Growers Association.

Discussions have begun and a meeting has been held with DPI to discuss State Forest access onto the highway. The DPI (NSW Forests) requires maintenance of direct access into the Mororo, Devils Pulpit, Tabbimoble and Doubleduke State Forests, and this has been considered in route option planning and design. At the time of preparing this report, State Forest access raises no significant issues or constraints to highway planning adjacent to these areas of forestry estate.

5.7.3 Community issues, community values

The following is a summary of the issues identified to date and communicated to the project team by the community:

- Physical impacts on private property, and impacts on property values;
- Access to and from private property, access onto the highway, and accessibility to Woodburn and other centres of population;
- Safety, conflict between local and through traffic, school bus safety and impacts of increasing truck traffic;
- Provision and location of intersections and highway interchanges;
- Impacts of the project on New Italy museum, café and driver reviver;
- Road noise and noise mitigation;
- Flooding and flood mitigation;
- Environmental impacts and biodiversity conservation; and
- Impacts on land use (eg. agriculture).

5.7.4 Project issues

A wide range of technical, social, economic and biophysical issues influence the process of route selection. These issues, identified through the stakeholder consultation process and through project familiarisation, have been grouped into the following broad categories:

- Social issues;
- Statutory and strategic planning considerations;
- Land use and zoning issues;
- Heritage;
- Urban design, landscape and visual considerations;
- Ecology and biodiversity;
- Flooding and drainage;
- Noise;
- Climate and air quality;
- Geotechnical considerations;
- Traffic and road safety;
- Engineering considerations; and
- Project costs and value for money.

5.7.5 Identification and investigation of key biophysical, socio-economic and engineering issues, risks and constraints

During the project familiarisation phase, the study team commenced the detailed bio-physical, socio-economic, engineering and technical investigations required as key inputs to the route selection and development process. These investigations have included:

- Ecological study and field survey (flora and fauna);
- Preliminary geotechnical investigation;
- Water quality sampling and analysis;
- Indigenous and European cultural heritage and archaeological assessment and field survey;
- Property and land use assessment;
- Statutory planning and zoning investigations;
- Urban design and landscaping;
- Traffic and transport study;
- Utilities and services investigation;
- Hydrological and hydraulic study (ongoing);
- Detailed survey (ongoing); and
- Acoustic study.

5.7.6 Analysis of local access needs and patterns

From site investigations and discussions with the community and stakeholders, it has emerged that access is one of the major project issues to be addressed. The proposed highway upgrade must ensure that private properties, State Forests, National Parks and nature reserves retain suitable access to and from the highway, without compromising road safety or highway operation.

A large number of properties front the Pacific Highway between Iluka Road and Woodburn, most of which have a single driveway entrance from the highway. Others are accessed via secondary or minor rural roads. A number of the existing private access points are in unsafe locations, or do not have sufficient acceleration/deceleration facilities outside the main traffic lane. Very few are located so as to allow safe right turn movements in or out.

A key stage in the planning process therefore has been an assessment of access needs for all private and public properties, and development of a strategy to ensure that access needs are safely met without compromising other important highway design standards.

6. Concept design development

This section provides an overview of the existing conditions of the highway and the improvements required to meet a Class A standard. It outlines construction issues affecting the design development and presents an overall concept with these issues and requirements in consideration. It also provides a preliminary indication of a possible design layout for a Class M scenario.

6.1 Approach to concept design development

As discussed in **Chapter 5**, it was identified at an early stage in the Iluka Road to Woodburn project that a limited study area would meet the objectives of the highway upgrade. With many other Pacific Highway upgrade projects, many options need to be investigated to identify the best solution for road users, communities and the environment while meeting the functional project objectives. In the case of the Iluka Road to Woodburn upgrade however, the existing road passes through no built-up areas. The surrounding areas provide limited scope for reasonable improvement in alignment without detrimental effect to the environment, visual intrusion on the landscape or significant impact on private property. An alternative route would not necessarily deliver any substantial travel time savings.

The main criteria to consider in the design were thus the functional requirements of the proposed highway, the amount of additional land required to construct the second carriageway and minor realignments, environmental impacts and property impacts. Given the relatively low traffic volumes and limited urban development (but clear need to improve safety), the concept design proposed is for a Class A arterial style four lane divided highway, with a limited number of T-intersections providing direct access on and off the highway. 'Seagull' type T-intersections, with appropriate deceleration lanes, merge lanes and vehicle refuge zones between the opposing main traffic lanes, would be provided to facilitate right turn movements into and out of secondary local roads.

For access to private property, State Forests, National Parks and nature reserves, left-in left-out turn facilities would be provided in order to maintain continued access to and from the highway. To facilitate safe travel to and from private properties in both directions, and to permit safe access across the highway for local traffic, U-turn bays would be provided at regular intervals in both directions (see **section 6.2.5** below).

The corridor runs through several State Forests, and adjacent to nature reserves and a National Park. To minimise impact on these areas, a key design objective is the duplication of the carriageway as close to the existing alignment as possible, subject to RTA design requirements.

Another key of the design is to avoid any resumption or acquisition of land within nature reserves or Bundjalung National Park. However, it may be necessary to acquire narrow strips of land from the edge of State Forest properties, and a number of private properties. Potential impacts on private property are discussed in **Chapter 7**.

6.2 Overview of existing conditions and proposed improvements

Substantial lengths of the Pacific Highway between Iluka Road and Woodburn have already been constructed to a 110 km/h design speed. This potentially facilitates straightforward duplication of the highway on its current alignment, either to the east or west of the existing carriageway. However, there remain a number of locations where the existing alignment is of a relatively poor standard and duplication would not be feasible. These locations are shown in **Figure 6.1**, and described below.

6.2.1 Near Pine Road for 5 km/Devils Pulpit State Forest

There are five consecutive horizontal curves in the existing alignment that cannot accommodate a 110 km/h design, and which also vary vertically (see **Figure 6.2c**). It would be difficult to realign the highway while maintaining traffic flow over this length, as most of the existing carriageway would have to be broken up for construction. In anticipation of a future deviation, the RTA had previously acquired a 3 km corridor of land through the Devils Pulpit State Forest

to the east of the Pine Road bends. The proposed route concept therefore incorporates a new section of four-lane highway within this corridor. This has the benefit of moving the main carriageways further away from Bundjalung National Park (situated to the west), while improving the overall highway alignment by eliminating five curves in the road and a number of crests and dips.

6.2.2 Cypress Road

Cypress Road adjoins a straight section of existing highway that has an acceptable gradient (see **Figure 6.2d**), however, new construction is required because of:

- The need to avoid encroachment into Tabbimoble Swamp Nature Reserve;
- The need to avoid undesirable reverse curves in the new road alignment (ie S-shaped curves); and
- The need to realign with the existing highway at New Italy, which is tightly constrained by land use and heritage issues, on both sides of the highway.

6.2.3 Whites Road

The existing curve adjacent to Whites Road has too small a radius for the required design speed of 110 km/h (see **Figure 6.2e**). A 1.1 km length of new four-lane road would therefore be required to increase the curve radius and meet the RTA's design standards. The new section of road would be located up to a maximum 100 m west of the existing two-lane highway. It is also anticipated that it can be constructed in a cutting, reducing the level of the road significantly, thus reducing the visual and acoustic impact on the surrounding area. It is anticipated that the redundant piece of existing highway would then be used to provide controlled local access for Redgates Road and Turners Road.

6.2.4 Road geometry - vertical alignment

New Italy

The existing Swan Bay New Italy Road intersection (see **Figure 6.2d**) is one of the busier intersections in the study area and has poor visibility to the south. The current intersection is close to the adjacent New Italy Museum Complex buildings, and duplication of the existing traffic lanes would not facilitate an improved intersection with better visibility. It has been identified that four new traffic lanes would need to be constructed in a deeper cutting on a new vertical alignment, (though similar horizontal alignment as the existing roadway). A 'Seagull' type T-intersection would be constructed to provide safe movements to and from the Pacific Highway. The design for the new T-intersection includes an improved vertical alignment, flattening the highway gradient to the north and south of the Swan Bay New Italy Road turnoff, to improve visibility in both directions and maximise safety.

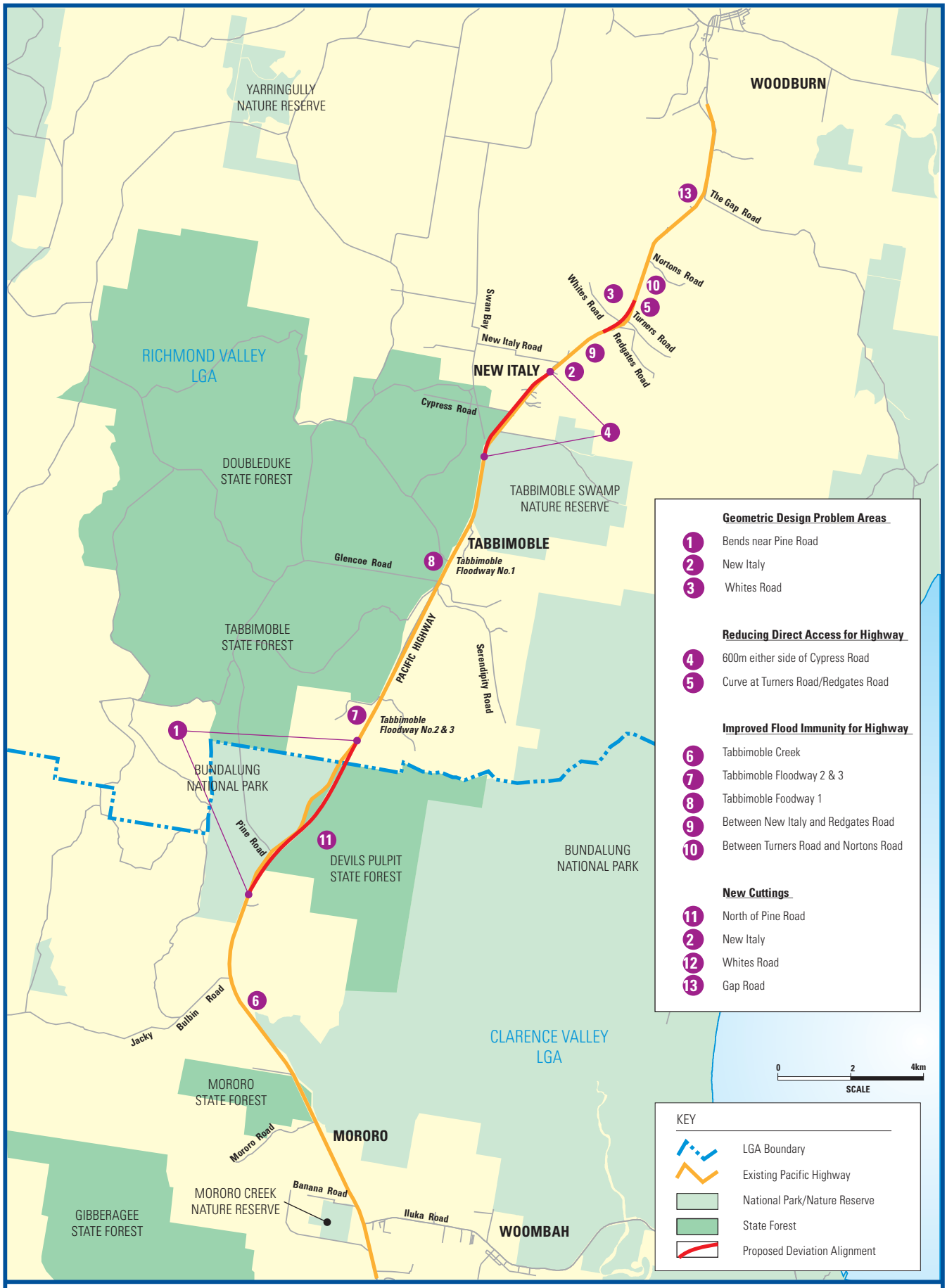
6.2.5 Other opportunities for improvement

Aside from the areas discussed above, there are few locations where the existing highway alignment and gradient are unsuitable for straightforward duplication adjacent to the existing highway. Other opportunities for possible improvements are listed below and illustrated in **Figure 6.1**.

Reducing the number of direct access points

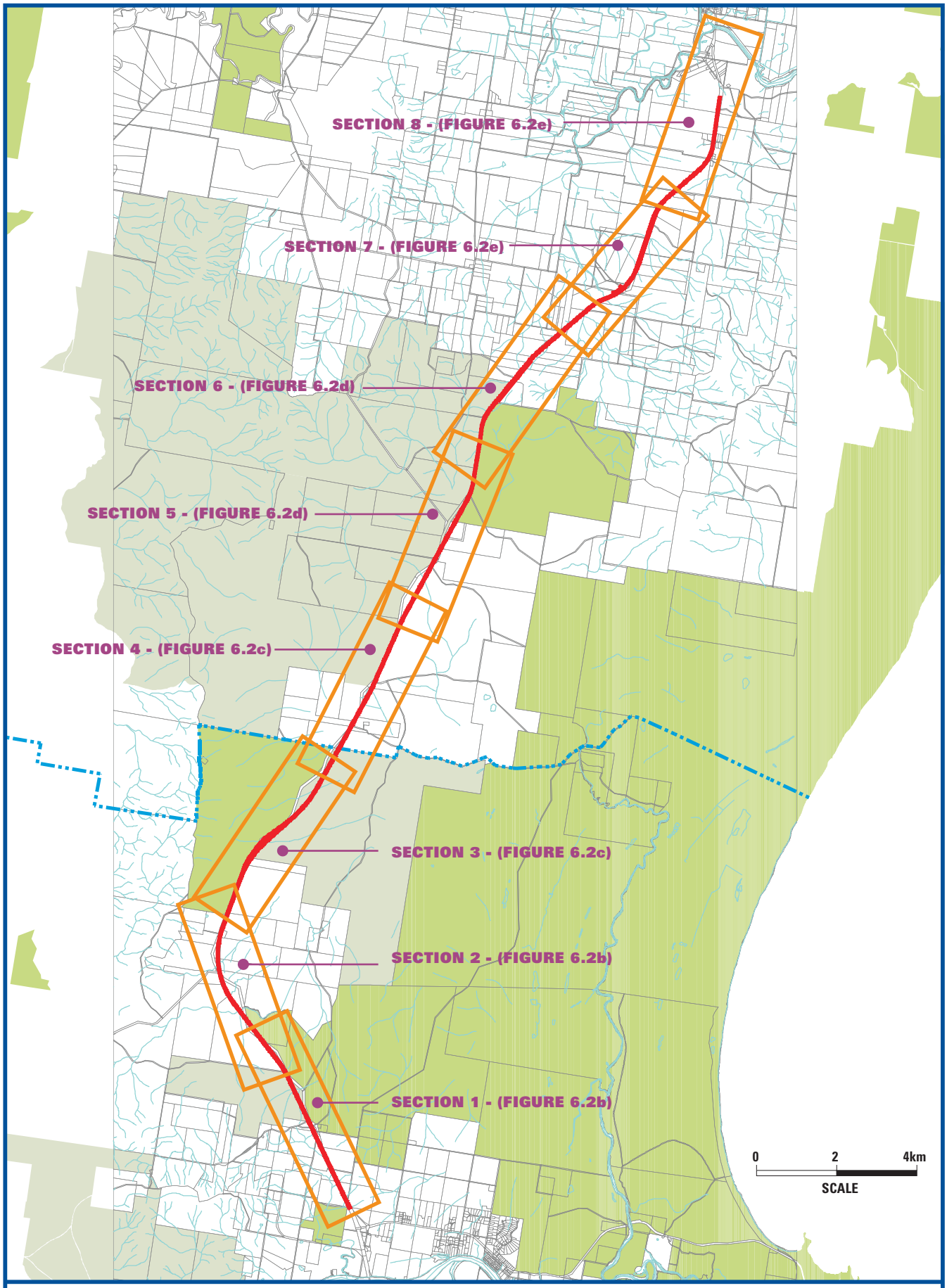
There are two locations where direct access points to the highway can be rationalised by using parallel service roads, either newly constructed or created through the use of residual sections of the existing highway, where new sections of four-lane highway are proposed. The sites include:

- 600 m either side of Cypress Road; and
- The curve at Turners/Redgates Road



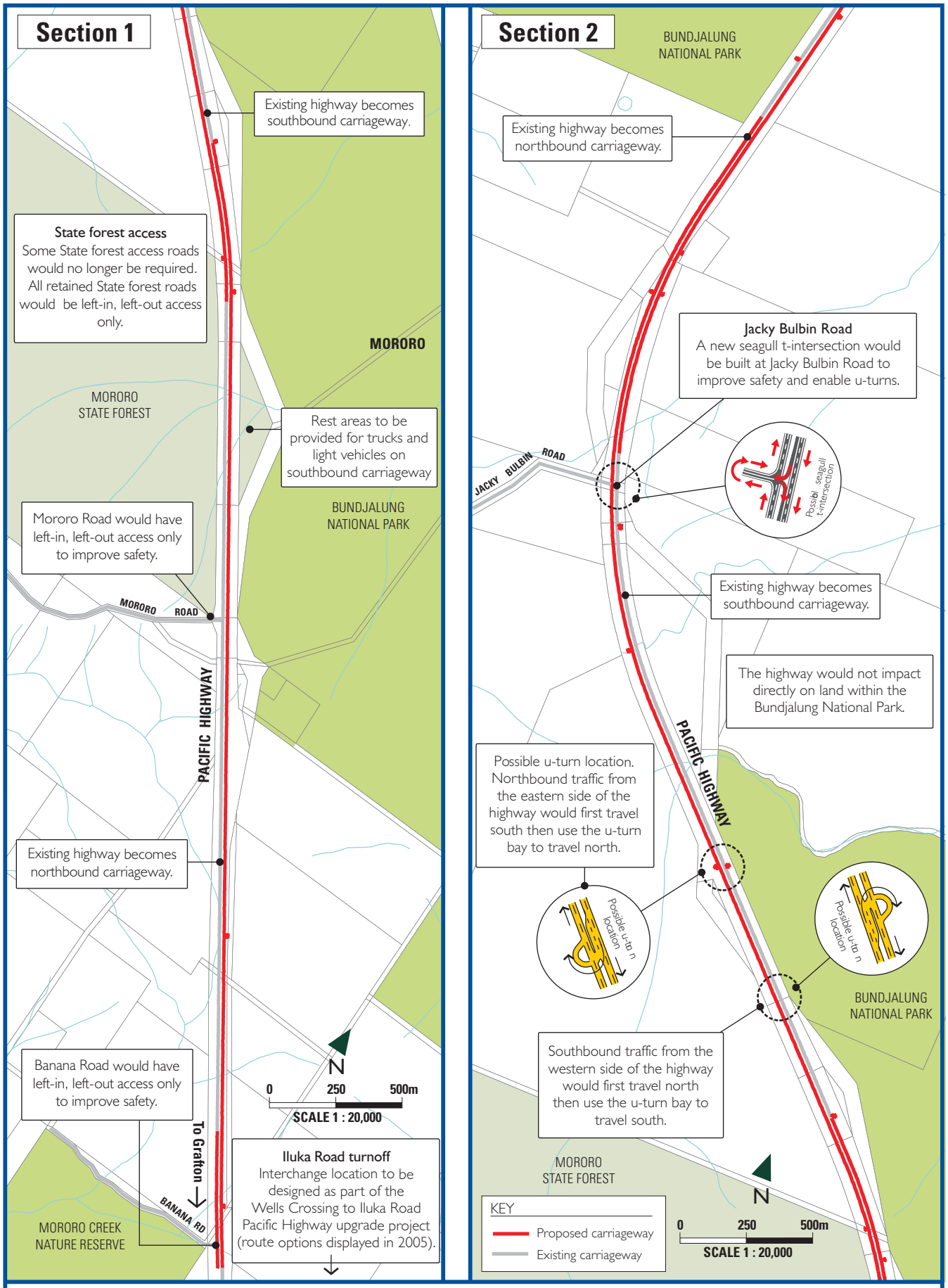
ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 6.1
EXISTING PACIFIC HIGHWAY
OPPORTUNITIES FOR IMPROVEMENT



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 6.2a
PROPOSED CONCEPT DESIGN SECTIONS MAP



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 6.2b
PROPOSED CONCEPT DESIGN

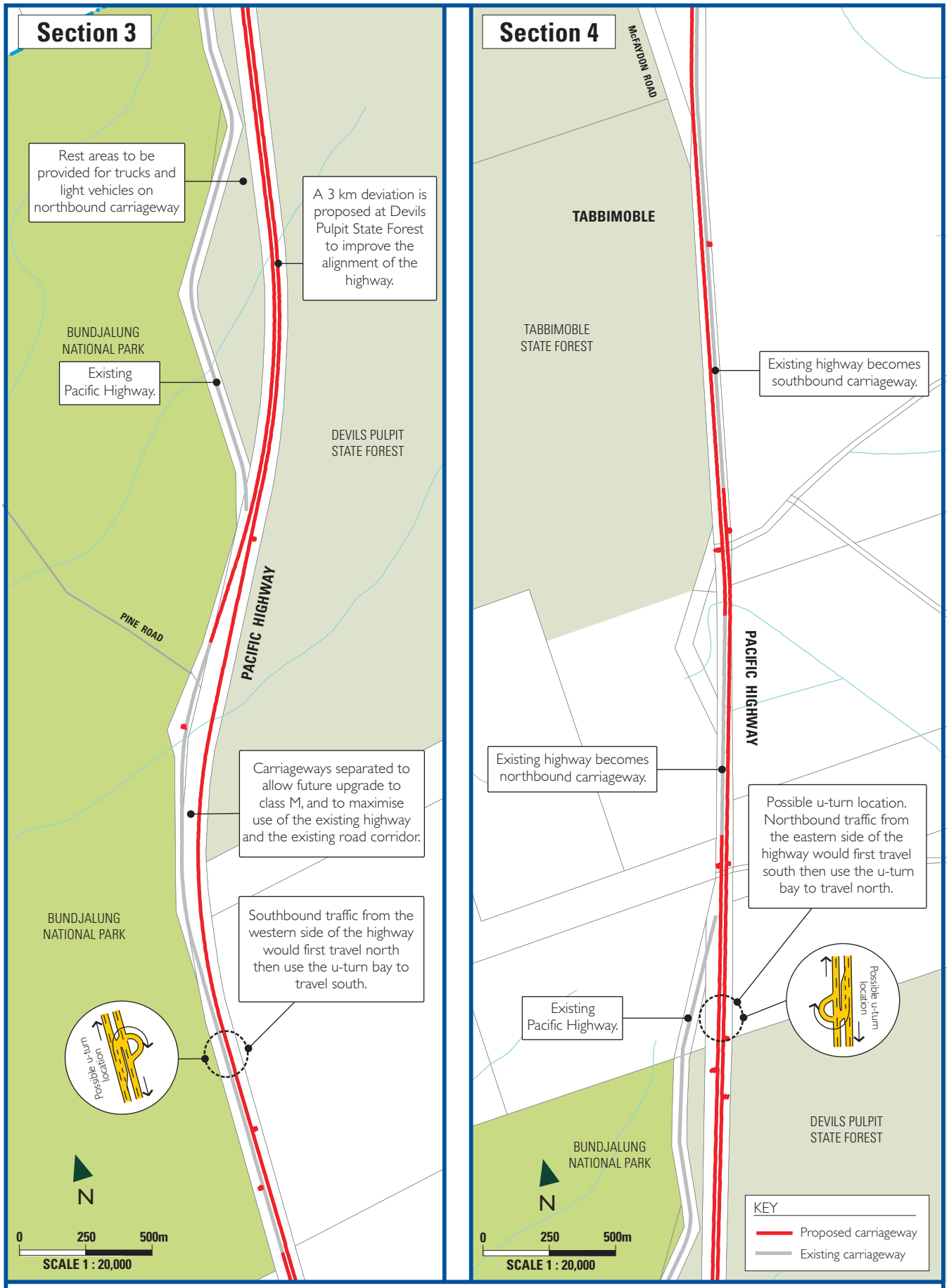


FIGURE 6.2c
PROPOSED CONCEPT DESIGN

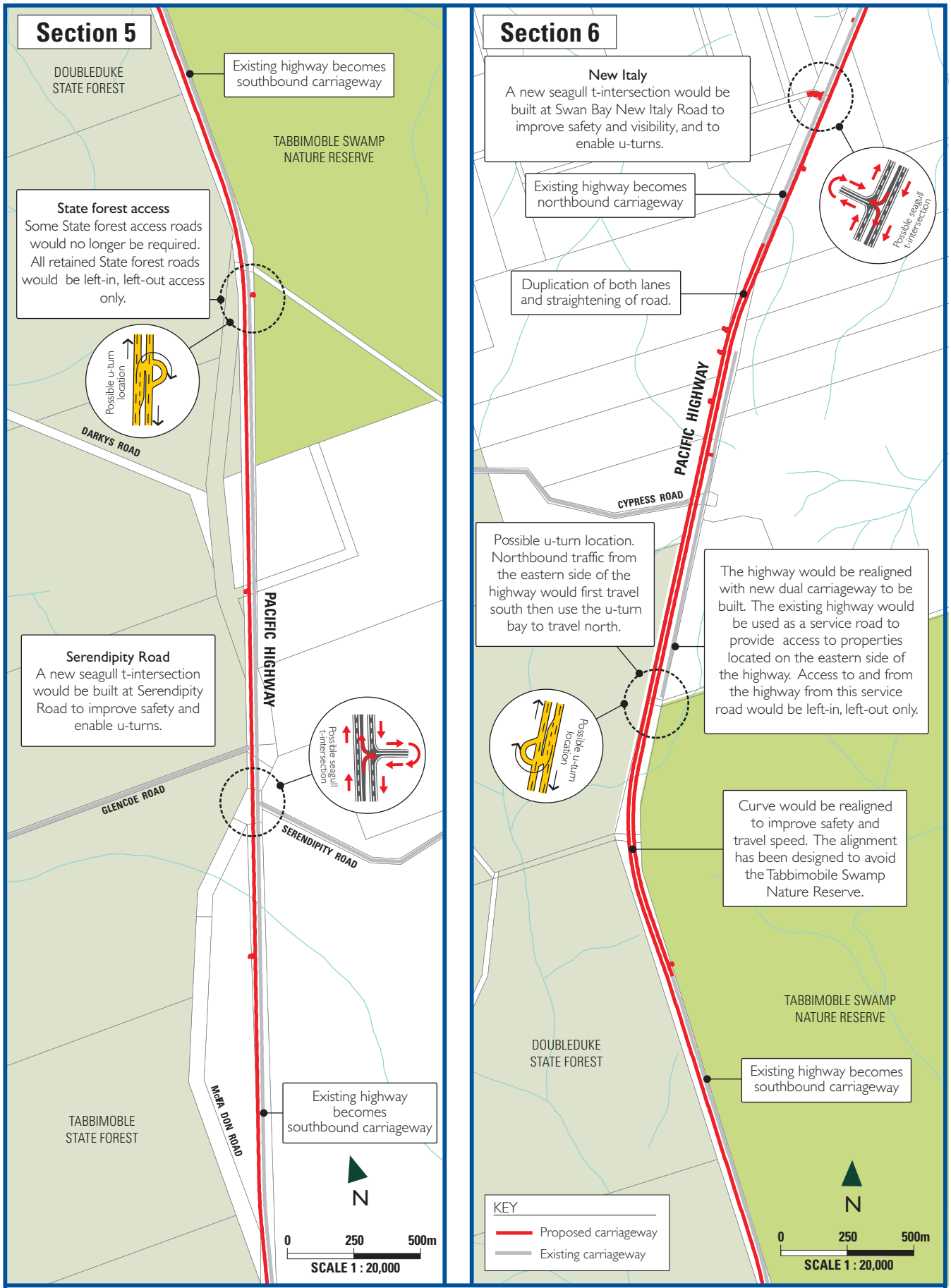


FIGURE 6.2d
PROPOSED CONCEPT DESIGN

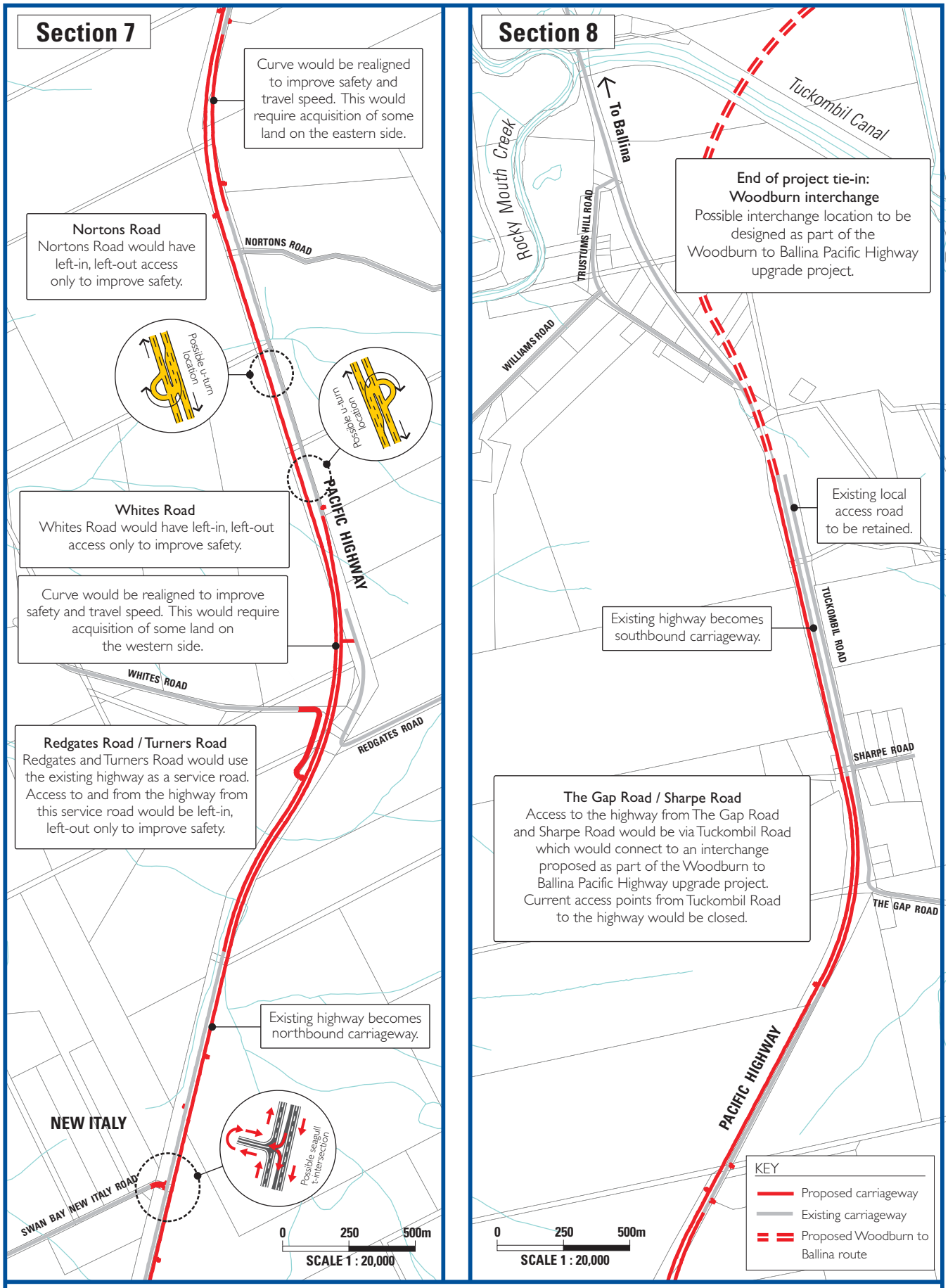


FIGURE 6.2e
PROPOSED CONCEPT DESIGN

Improving flood immunity

The RTA's Pacific Highway design standards require that, if feasible, at least one carriageway should be constructed at or above the 1-in-100 year flood level. If this is not feasible, the design standards require a minimum flood immunity of the 1-in-20 year flood level. The following key locations have been identified (see **Figure 6.1**) as being flood-prone and requiring road levels to be raised:

- Tabbimoble Creek.
- Tabbimoble Floodways 2 and 3.
- Tabbimoble Floodway 1.
- New Italy to Redgates Road.
- Turners Road to Nortons Road.

Accesses

Access onto and off the upgraded highway for private properties and minor local roads would be achieved through provision of left-in and left-out turning facilities, coupled with a small number of strategically placed U-turn facilities (see **Figure 6.3**). Motorists wishing to turn right onto the highway from minor roads and private properties would be required to first turn left, and then travel to the nearest U-turn facility before continuing their journey in the desired direction. It is anticipated that the delay and the extra distance travelled would be off-set by overall reduced journey times, reduced delays and improved safety through eliminating right-turn movements.

A vehicle intending to make a U-turn would move into the right hand lane to access a turning lane for deceleration adjacent to the median. The vehicle would then stop in the median, which would provide safe refuge and good sight distance along the opposite carriageway. When safe to do so, the turning vehicle would proceed across both lanes of the opposite carriageway and into a safe turning bay built into the left side shoulder. When safe, the turning vehicle would enter the main traffic lane from the left side, via a separate acceleration lane.

The maximum distance from a side road or private property entrance to the nearest U-turn bay would be approximately 5 km, though typically the diversion would be much less than this. Some traffic may therefore need to travel this distance to the north before making a U-turn to travel south, or vice versa. The U-turn bays would be designed to cater for all vehicles using the highway including B-Double semi-trailers.

Three intersections have been identified as requiring direct access onto the highway in each direction. The higher standard of intersection is considered justified by the relatively higher numbers of turning movements. 'Seagull' type T-intersections with protected turning lanes are proposed in these cases which are Jacky Bulbin Road, Serendipity Road and Swan Bay New Italy Road. Intersection layouts are illustrated schematically in **Figure 6.3**.

The traffic volumes on these side roads however do not justify the provision of high-standard grade-separated intersections (flyover type).

6.3 Construction issues and road user management

6.3.1 Road user delay management

Widening or duplication of an existing carriageway poses greater construction and road user management challenges than deviation or green field construction. The highway must be kept open to traffic throughout construction, often in circumstances where space is limited and temporary diversions necessary. The potential for conflict between highway traffic and construction traffic is high, and delays may be frequent. Under these conditions, phased construction must be implemented to reduce delay to road users, while maintaining high levels of safety for motorists, residents and the construction workforce.

6.3.2 Earthworks, cut and fill

Earthworks could pose a significant construction issue for this project, with the cut and fill balance having a potentially significant impact on project cost. Large sections of the proposed concept design are flood prone, where the upgraded highway would have to be constructed on embankment at a slightly higher level than the existing carriageway. A majority of suitable fill material would be gained from proposed new cuttings and from the short deviation sections of the project, thus reducing the amount of imported material required.

The proposed concept design incorporates substantial cutting at the following locations, to achieve a suitable road profile and, of equal importance, to reduce the amount of imported fill material required:

– Devils Pulpit deviation;
– Whites Road;
– New Italy; and
– The Gap Road.

At this stage it is estimated that up to one quarter of the required fill material may have to be sourced off-site. Potential external sources of fill have not yet been identified. However, in order to raise road pavement levels by (a hypothetical) 600 mm across all flood-prone areas (eg Tabbimoble and the floodway 1 km north of New Italy), approximately 500,000 cubic metres of fill material would be required in addition to that obtained from the cutting locations listed above.

It must be noted however, that until the detailed hydrology and hydraulic studies are complete, flood levels cannot be accurately predicted. Until this data is available, the desired road pavement levels for flood immunity cannot be determined. Therefore, the 600 mm referred to above is hypothetical only, and does not represent the findings of any technical studies undertaken for this project.

6.4 Description of the proposed concept design

Given the considerations outlined in this chapter, the issues raised by the community and government stakeholders, and the constraints identified through the detailed studies documented in **Chapter 3**, a proposed concept design has been developed that responds to the issues and constraints. The main features of the proposed concept design are listed below:

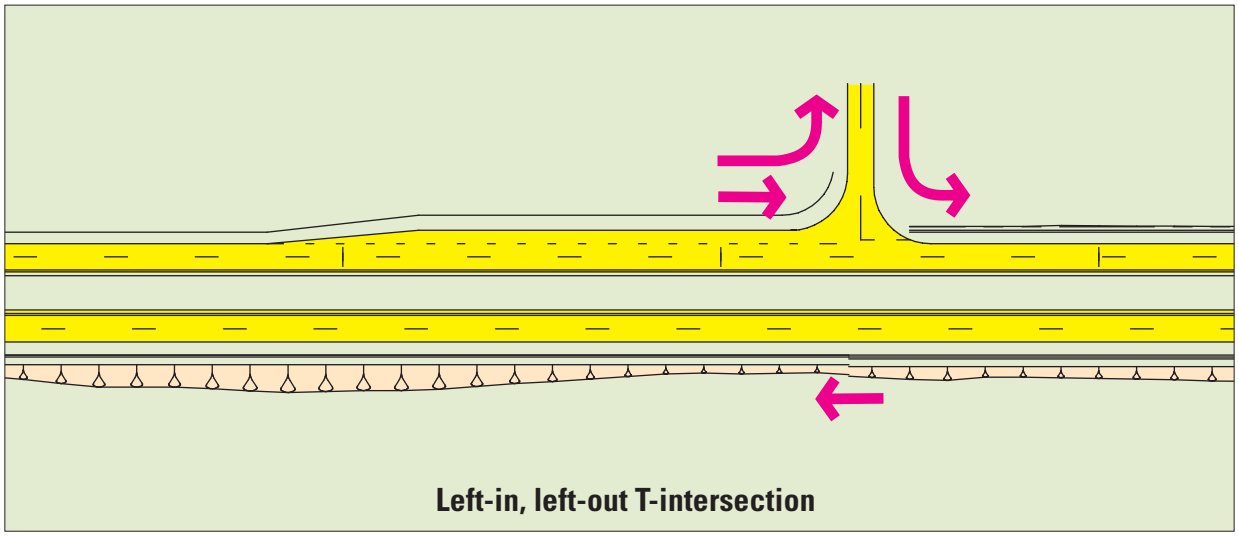
The proposed concept design is presented in **Figure 6.2a** to **6.2e**.

6.4.1 Typical cross-section

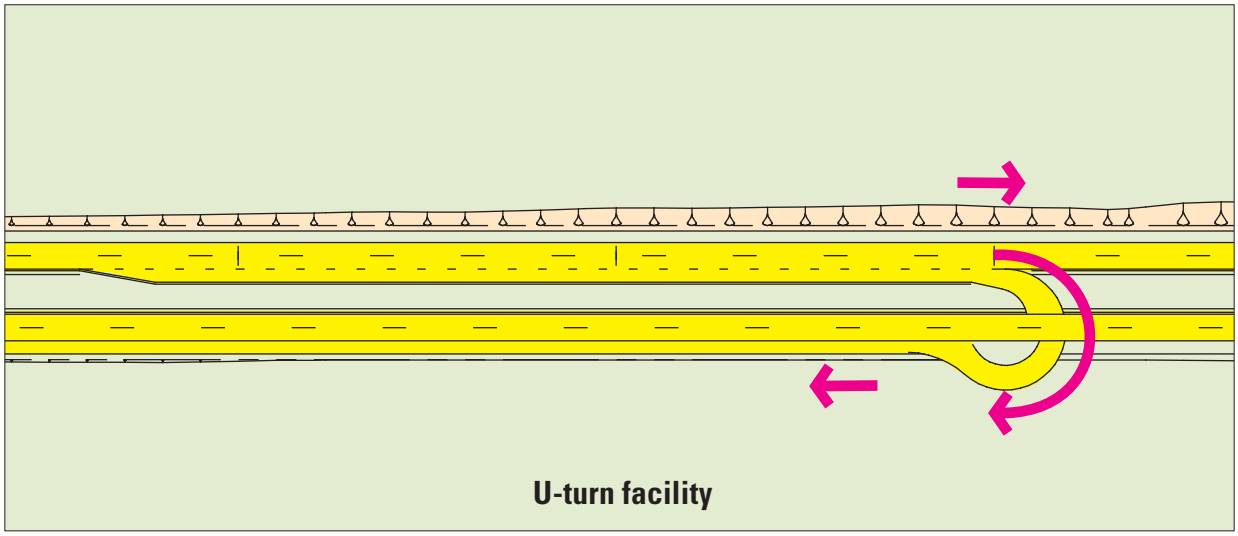
The typical cross-section (see **Figure 6.4**) of the proposed concept design consists of the following:

– Minimum 10 m verge.
– Minimum 3 m shoulder.
– Minimum 2 x 3.5 m traffic lanes.
– Minimum 0.5 m shoulder.
– Minimum 11 m central median reserve.
– Minimum 0.5 m shoulder.
– Minimum 2 x 3.5 m traffic lanes.
– Minimum 3 m shoulder.
– Minimum 10 m verge.

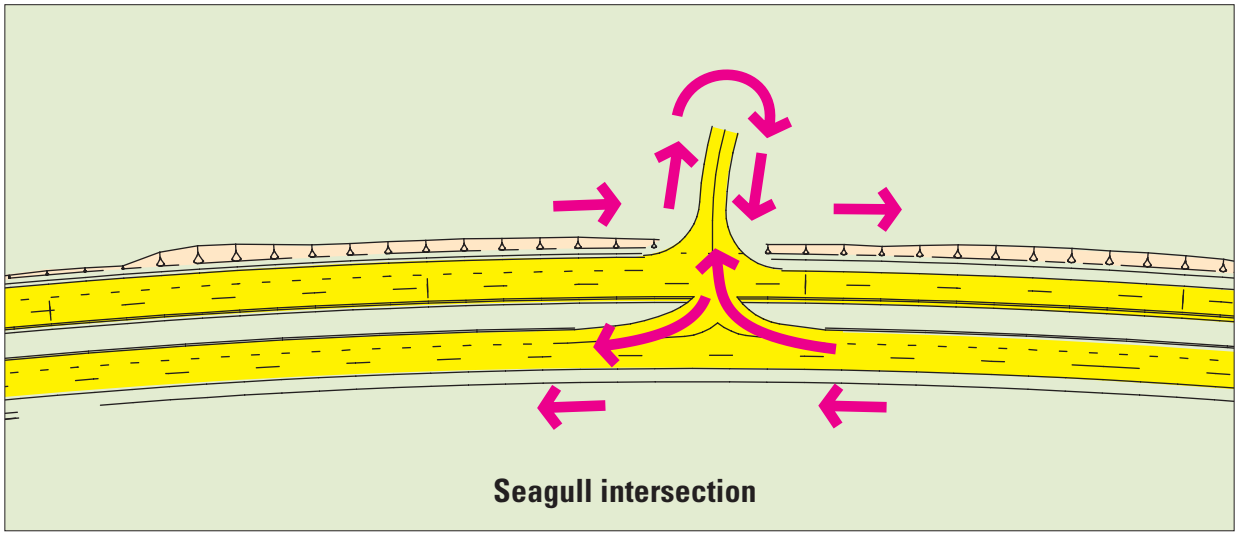
Additionally, a road reserve has been identified to enable future parallel service roads to be provided on either side or both sides of the carriageway under a Class M scenario (also illustrated in **Figure 6.4**).



Left-in, left-out T-intersection



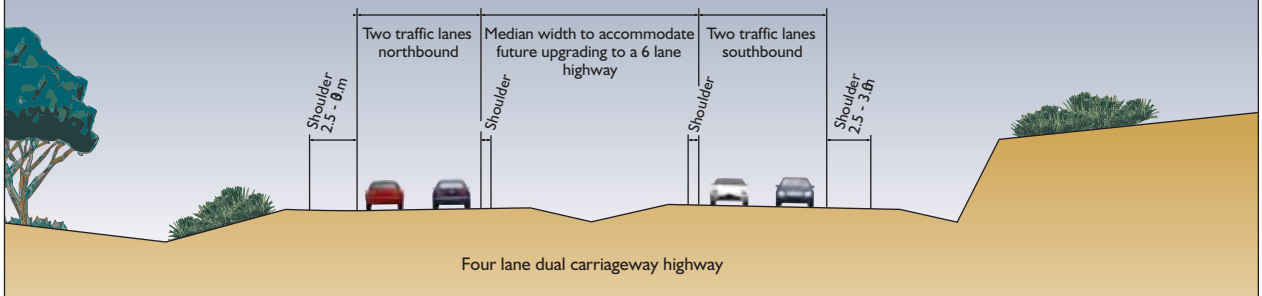
U-turn facility



Seagull intersection

FIGURE 6.3
TYPICAL INTERSECTIONS

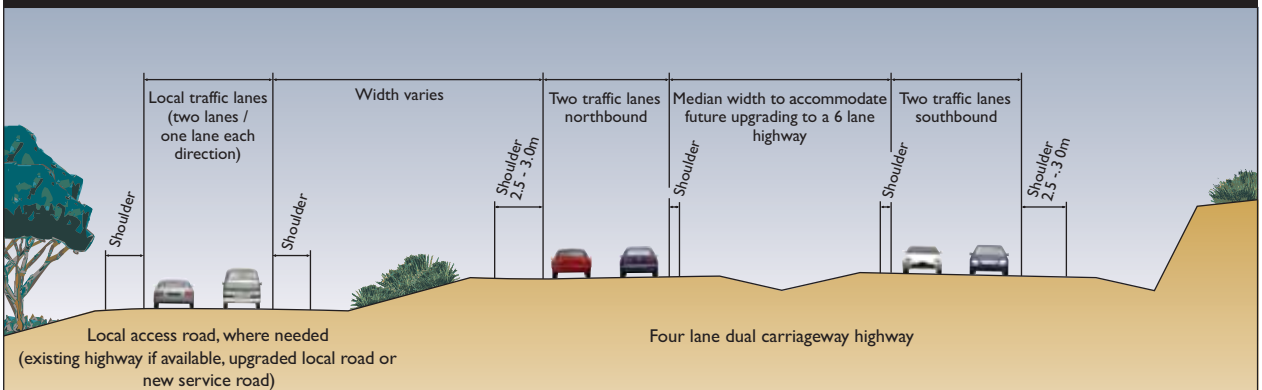
TYPICAL CROSS SECTION SHOWING AN UPGRADE, DUAL CARRIAGEWAY HIGHWAY



This cross section shows a typical arrangement of the Pacific Highway.
The final arrangement may vary as conditions change, for example, local topography.

A new carriageway is to be constructed along side the existing highway for much of this project. Which side of the existing highway the new carriageway will be built on may vary from location to location depending on environmental, engineering or other constraints.

TYPICAL CROSS SECTION SHOWING THE NEW MOTORWAY WITH A LOCAL ACCESS ROAD RUNNING PARALLEL



This cross section shows a typical arrangement of the Pacific Highway.
The final arrangement may vary as conditions change, for example, local topography.

A new carriageway is to be constructed along side the existing highway for much of this project. Which side of the existing highway the new carriageway will be built on may vary from location to location depending on environmental, engineering or other constraints.

6.4.2 Iluka Road to Mororo Road

At the southern end of the study area, the project will connect to the upgraded Pacific Highway being developed concurrently by the RTA for the Wells Crossing to Iluka Road project (see **Figure 6.2b**). This adjoining project includes a proposed grade-separated interchange (ie flyover) at Iluka Road, and associated north-facing on and off ramps enabling U-turns to be made in both directions. The proposed concept design will therefore connect to the interchange, with the existing highway becoming the southbound lanes, and two new northbound lanes being constructed on the western side. Just north of Banana Road the proposed carriageway switches sides to the eastern side with the existing road forming the northbound carriageway.

Banana Road and Mororo Road would each have left-in, left-out access onto the highway's northbound carriageway.

The terrain rises to a crest in the vicinity of Mororo Road, where the road would be built in a cutting, providing a potential source of fill material for other sections of the project.

6.4.3 Mororo Road to Jacky Bulbin Road

A U-turn bay is proposed approximately 1 km north of Mororo Road to permit northbound traffic to make a U-turn south.

At the curve north of Mororo Road, the new carriageway would switch sides, with the existing highway becoming the southbound carriageway, and two new lanes being constructed on the western side, and continuing for approximately 4 km. A 'Seagull' type T-intersection is proposed at Jacky Bulbin Road (see **Figure 6.2b**).

A U-turn bay is proposed south of Jacky Bulbin Road to enable southbound traffic to make a U-turn north and gain access to private properties on the western side of the highway.

Jacky Bulbin Road is located on the floodplain of Tabbimoble Creek, where existing highway levels are likely to require raising to achieve the desired flood immunity level. Some fill is therefore likely to be required.

6.4.4 Jacky Bulbin Road to Pine Road

Approximately 1 km north of Jacky Bulbin Road, the new lanes would again switch sides, with the existing highway becoming the northbound lanes and two new lanes being constructed on the eastern side (see **Figure 6.2b** and **c**). Pine Road, which provides access to Bundjalung National Park, would be limited to left-in, left-out turn movements only.

A U-turn bay is proposed to be located approximately 1.2 km south of Pine Road, to permit northbound traffic to gain access to private properties on the eastern side of the highway.

6.4.5 Pine Road to Serendipity Road (Devils Pulpit State Forest)

North of Pine Road the existing highway alignment is of a poor standard for approximately 3 km, with a series of bends combined with crests and dips. The proposed concept design therefore deviates near Pine Road, along a 3 km corridor to the east of the existing highway that has been acquired for the purpose. A new section of four-lane highway would be constructed along this corridor, reconnecting with the existing highway (being the northbound lanes) approximately 400 m south of Tabbimoble Floodway No. 3 (see **Figure 6.2c** and **d**).

The median between the two carriageways will increase substantially as the proposed southbound carriageway is on a Class M alignment and the northbound makes use of the existing carriageway where possible. Under a Class M arrangement, a new northbound carriageway could be constructed adjacent to the proposed southbound carriageway and the original highway would revert to a service road.

The reserved corridor ends at the southern end of the Tabbimoble Straight, and provides an opportunity to gain substantial quantities of fill material.

A U-turn bay is proposed to be located approximately 0.5 km south of Tabbimoble Floodway No. 3, to permit southbound traffic to gain access to private properties on the western side of the highway.

To the north of Tabbimoble Floodway No. 2, the new highway lanes switch again to the western side and the existing highway would become the southbound lanes. This configuration would continue for the length of the Tabbimoble Straight.

A 'Seagull' type T-intersection is proposed at Serendipity Road, which would be realigned so that it intersects with the highway approximately 150 m south of the existing intersection. The existing intersection is effectively a four-way junction, with Glencoe Road (a forest access road) making up the fourth arm of the intersection on the western side. Glencoe road would become left-in, left-out only.

Two major rest areas are proposed, one on each side of the carriageway, to serve both north- and southbound traffic. These rest areas would be designed to accommodate overnight parking for B-doubles as well as all other types of heavy and light vehicles. There would also be toilet facilities. For northbound traffic a major rest area is proposed approximately 2 km north of Pine Road, on the west side of the proposed highway deviation adjoining Devils Pulpit State Forest. For southbound traffic a major rest area is proposed approximately 1 km north of Mororo Road on the east side of the highway.

The location for the rest areas has been chosen to satisfy the RTA's rest area strategy, which suggests a maximum spacing of 50 km between major rest areas along the Pacific Highway. The proposed locations would also ensure that the rest areas are not in close proximity to any residences or other noise-sensitive land uses.

6.4.6 Serendipity Road to Cypress Road

The proposed carriageway continues on the western side with two new carriageways being required either side of Cypress Road in a cutting at the Cypress Road junction (see **Figure 6.2d**).

The proposed new construction would render a 1.7 km section of existing highway redundant, either side of Cypress Road. This section of road would be utilised as a local access road on the eastern side of the highway, servicing four private properties and the Tabbimoble Swamp Nature Reserve, but requiring only a single left-in, left-out access that would be located approximately 200 m north of Cypress Road.

Between Serendipity Road and Cypress Road, two U-turn bays are proposed. The first would be located approximately 1.5 km north of Serendipity Road, to enable northbound traffic to turn south and access properties on the east side of the highway. The second would be located approximately 1 km south of Cypress Road, and would permit southbound traffic to turn and head north, to access properties on the west side of the highway.

6.4.7 Cypress Road to Whites Road

Approaching New Italy, the proposed concept design again adopts the existing highway as the northbound carriageway (see **Figure 6.2d** and **e**). Adjacent to the Swan Bay New Italy Road intersection (which is situated on a crest with poor visibility to the south), the formation would be cut deeper, improving sight distances and gaining further fill materials.

Swan Bay New Italy Road will have a 'Seagull' type T-intersection, similar to the existing intersection, but with the inclusion of a median reserve and acceleration and deceleration lanes.

From New Italy to Whites Road the proposed concept design switches, with the existing highway becoming the southbound carriageway

The existing curve at Whites Road is sub-standard, requiring a larger radius to achieve an appropriate horizontal curvature. A new four-lane road would therefore be constructed on a new alignment approximately 100 m to the west of the existing, which would impact on private properties in this location (refer to **section 7.4** for an assessment of the potential impacts). However, the new curve would be built in cut and would therefore allow the topography to form a natural acoustic barrier.

The existing curve adjacent to Turners Road would become redundant, but would be retained for access to Redgates Road and Turners Road, with a single left-in, left-out entry point approximately 300 m north of Whites Road. Whites Road would become left-in, left-out only.

Between New Italy and Whites Road, the highway reaches its lowest point, with the existing road surface being at an elevation of less than 2 m AHD at the lowest point. Therefore, this length of road (approximately 1.25 km) would require considerable fill material to achieve the desired flood immunity on at least one carriageway.

6.4.8 Whites Road to The Gap Road

This section of the existing highway is also low-lying, and would require fill material to improve flood immunity. Between the Whites Road bend and Nortons Road, the existing highway would become the southbound lanes, with new construction on the western side to create the northbound lanes (see **Figure 6.2e**). Two U-turn bays are proposed north of the Whites Road bend, to enable safe turn movements from each of the north and southbound carriageways. Nortons Road would become left-in, left-out only.

The median has additional width on this section to enable the existing road to be converted to a service road and a new southbound carriageway to be constructed in the median under a future Class M arrangement.

Between Nortons Road and The Gap Road, the proposed concept design has a new northbound carriageway on the western side with the existing road forming the southbound carriageway.

6.4.9 The Gap Road to Tuckombil Canal

The existing curve adjacent to The Gap Road would need to have a reduced radius to minimise impact on the surrounding residential area to enable the dual carriageway to be constructed around the existing centre line (see **Figure 6.2e**). This would require some private property acquisition on the western side, affecting land that is currently accessed via Wondawie Way. Wondawie Way would retain a left-in, left-out access onto the highway.

The straight section of existing highway north of The Gap Road would incorporate the existing highway as the southbound lanes, and two new northbound lanes would be constructed on the western side, continuing to the project's termination near Trustums Hill on the southern side of the Tuckombil Canal.

Tuckombil Road would remain as a local access road, but the existing connection from Tuckombil Road onto the Pacific Highway adjacent to The Gap Road would be closed. Access from The Gap Road to the Pacific Highway would be via the northern end of Tuckombil Road, where the proposed concept design connects to the adjoining Woodburn to Ballina Pacific Highway upgrade project via a grade-separated (flyover) interchange south of Tuckombil Canal. This would provide a direct connection to Tuckombil Road.

The existing access from the highway into the northern end of Tuckombil Road would also be closed, with traffic diverted to the connection referred to above.

6.4.10 Rest areas

Major rest areas are proposed with appropriate facilities on both sides of the highway, as referred to in **section 6.4.5** above. They would provide adequate and safe overnight parking for heavy vehicles and other road users. For northbound traffic a major rest area is proposed approximately 2 km north of Pine Road, on the west side of the proposed highway deviation adjoining Devils Pulpit State Forest. For southbound traffic a major rest area is proposed approximately 1 km north of Mororo Road on the east side of the highway.

The proposed major rest areas would ensure that the concept design complies with the RTA's rest area strategy, which suggests a maximum spacing of 50 km between major rest areas. The existing parking facility at New Italy will remain, but will be reduced in size. The remainder of the existing lay-bys and stopping areas are located at sporadic intervals, and vary widely in size and in terms of the facilities offered. These existing stopping areas will not be accommodated within the proposed concept design.

6.4.11 Stopping bays

In addition to the emergency shoulders, the concept design includes emergency stopping bays at 5 km intervals throughout the scheme. For emergency purposes only, these stopping bays will provide safe emergency stopping off the shoulder, and an emergency telephone.

6.5 Class M design layout

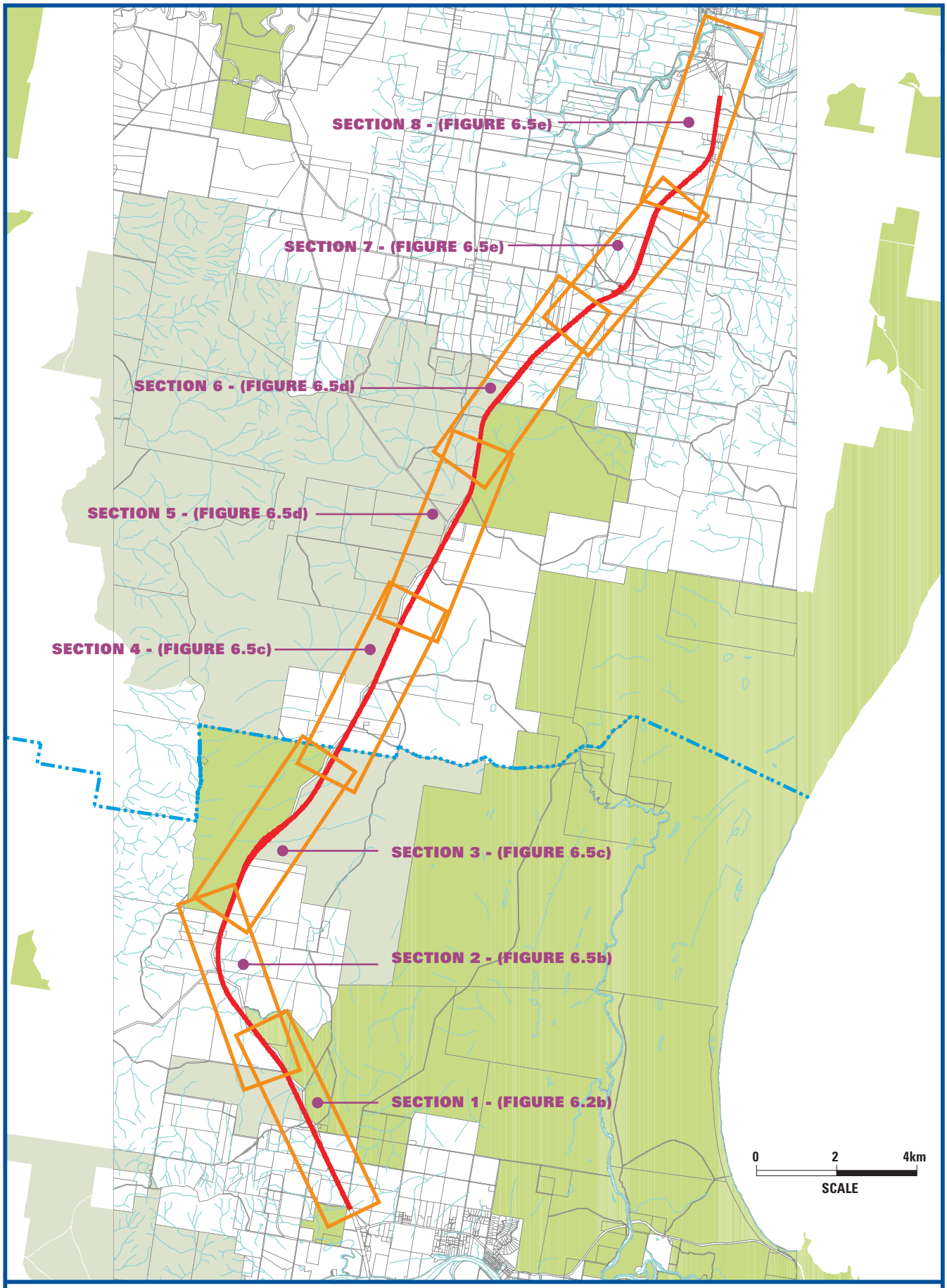
The RTA is planning for a possible future upgrade to a 'Class M' or motorway standard road, with two lanes in each direction, but with the capability of being upgraded to three lanes in each direction when warranted. A Class M road would have 110 km/h posted speed, controlled access, and grade-separated or flyover-type interchange access. Under a future Class M scheme, local traffic would be diverted to a parallel service road, having two lanes and with a posted speed limit of less than 100 km/h.

Class M refers to a motorway-standard road, where access is restricted to grade-separated (flyover-type) interchanges, and there is no direct access on or off the highway to local roads or private property.

The Class M scenario has not been subject to any detailed design beyond a conceptual, schematic layout as depicted in **Figures 6.5a** to **6.5e**. This schematic layout indicates the likely potential extent of land acquisition that would be required in order to implement the ultimate Class M scheme. This 'footprint' for the Class M layout has been adopted by the RTA however, in order to facilitate negotiations for land acquisition for the proposed Class A concept design. The intention behind this strategy is that, should the Class M strategy be implemented at some future time, no further land would be required in addition to that identified on the maps in **Figures 6.5a** to **6.5e**.

The Class M strategy includes a possible grade-separated interchange at New Italy, when warranted. An interchange at New Italy would further improve safety at this location, and would also continue to support and promote the cultural heritage values and economic viability of the New Italy Museum Complex. Grade separated interchanges are currently proposed at Iluka Road, and south of the Tuckombil Canal, as part of the adjoining Wells Crossing to Iluka Road and Woodburn to Ballina projects, respectively. A Class M scheme would therefore require construction of a 33 km parallel local service road to provide access to communities between these two interchange locations.

All of the U-turn facilities, left-in and left-out turn facilities, and T-intersections proposed under the Class A concept design would be removed under a Class M scheme.



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 6.5a
PROPOSED CLASS M
CONCEPT DESIGN SECTIONS MAP

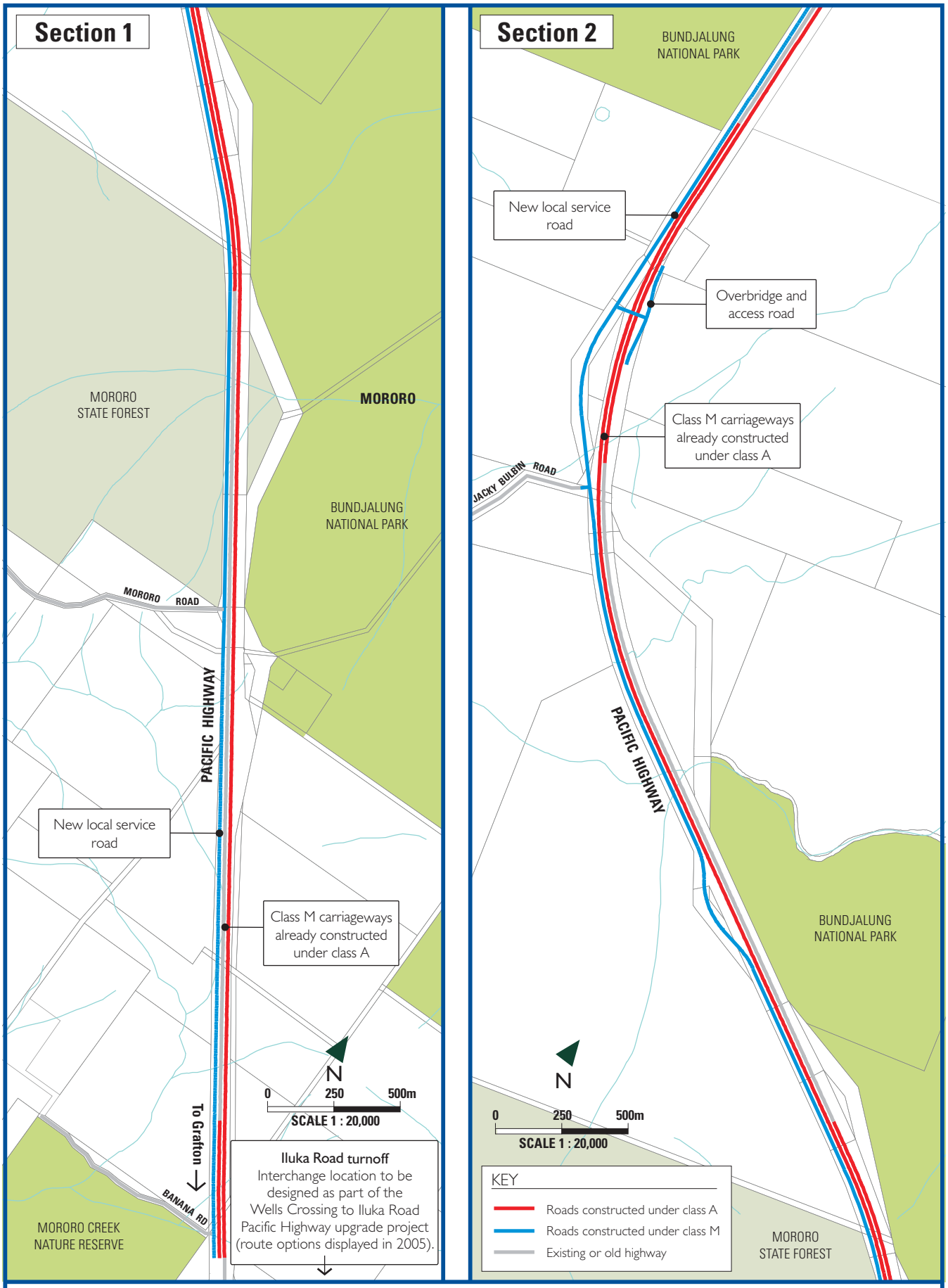
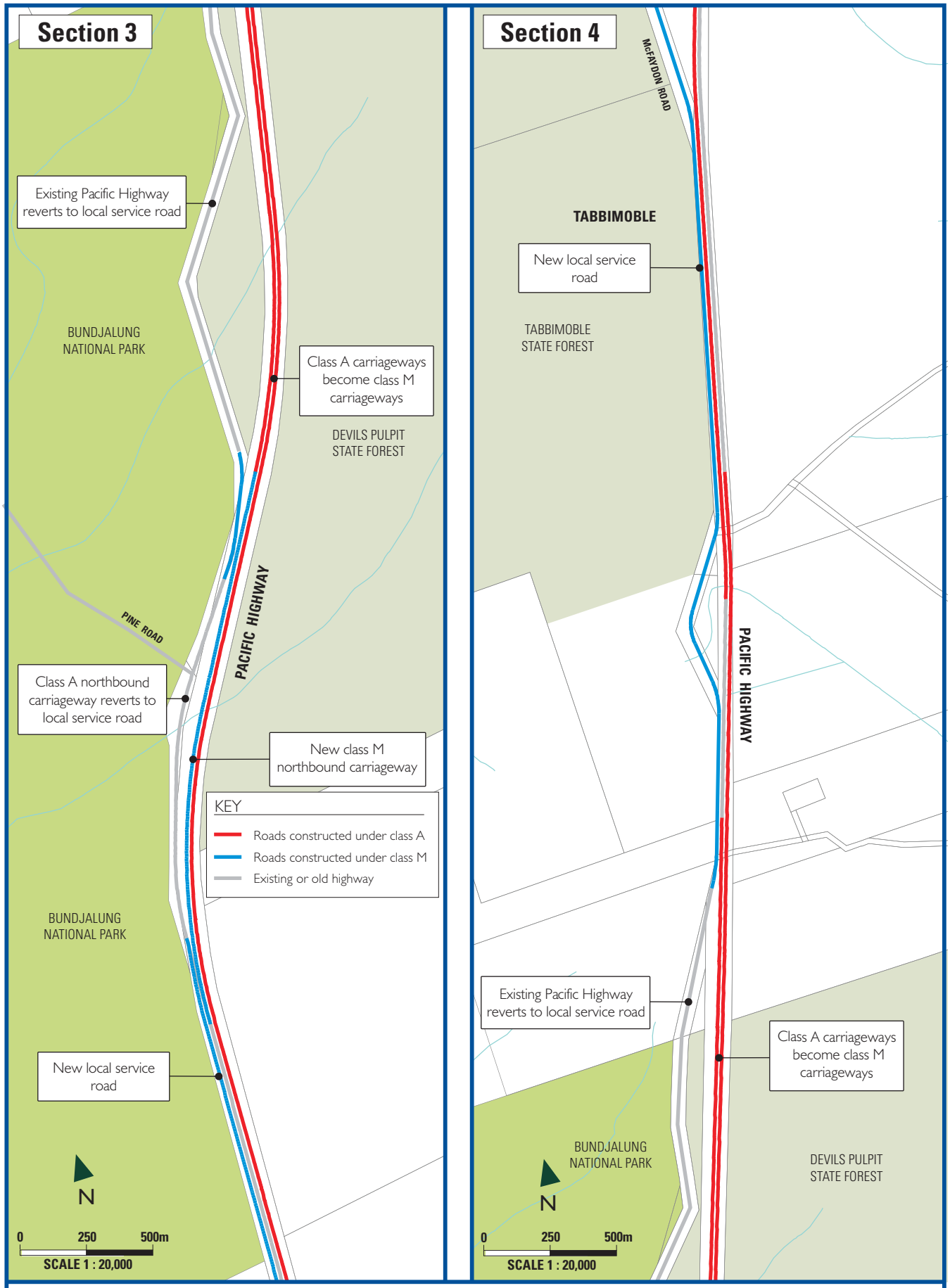
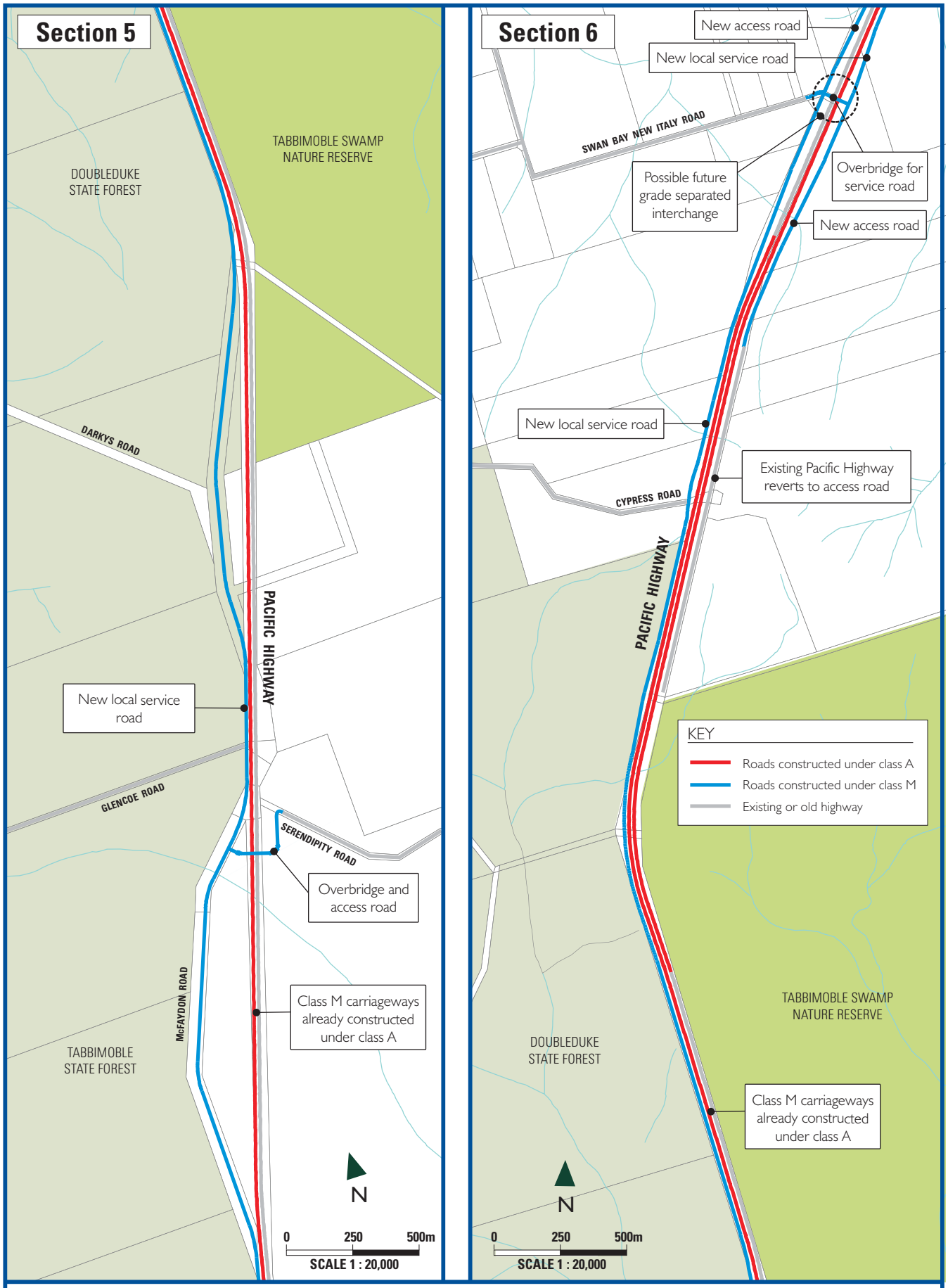


FIGURE 6.5b
PROPOSED CLASS M CONCEPT DESIGN



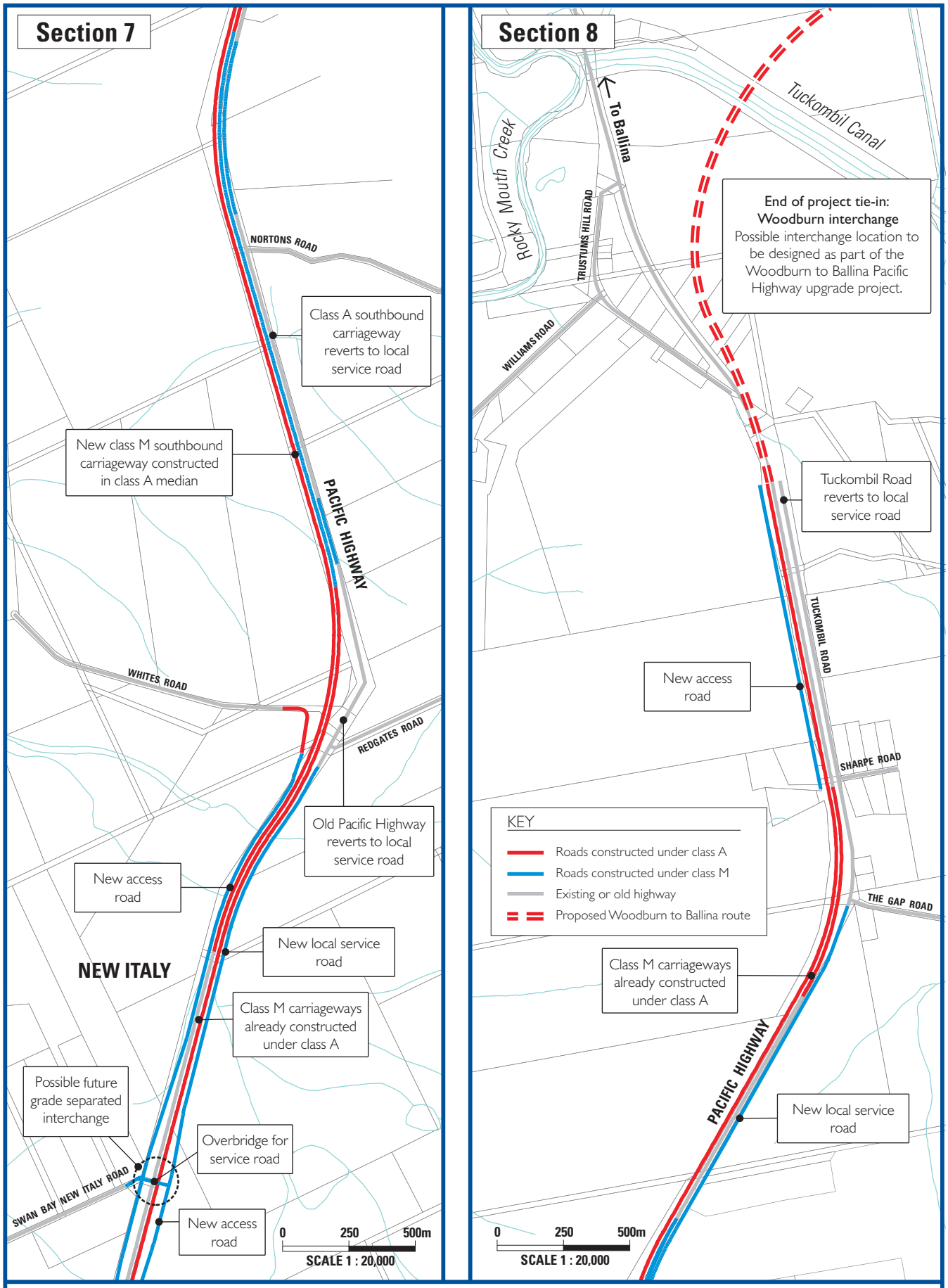
ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 6.5c
PROPOSED CLASS M CONCEPT DESIGN



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 6.5d
PROPOSED CLASS M CONCEPT DESIGN



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 6.5e
PROPOSED CLASS M CONCEPT DESIGN

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7. Evaluation of the concept design

The proposed concept design detailed in section 6.4, has been the subject of a preliminary evaluation against the PHUP and project objectives and assessment criteria as well as the issues and constraints identified in this report. The key issues and overall results of the evaluation are discussed below.

7.1 Key issues

The evaluation has revealed a number of key issues arising from the proposed route concept design. These issues, which are discussed in detail in the relevant sections below, are:

- Crash rate target;
- Fauna habitat fragmentation and loss of key habitat;
- Impacts on threatened flora species during construction;
- Flood immunity;
- Disturbance of high risk potential acid sulphate soil during construction;
- Impacts on the New Italy Museum Complex and its cultural heritage significance;
- Impacts on and acquisition of private property; and
- Lower economic performance in terms of relative costs and benefits.

These, and other issues, will be fully documented and comprehensively assessed during the EIA phase, based on the refined concept design for the route. During this phase appropriate mitigation measures and ameliorative strategies will be developed to minimise potential impacts.

7.2 Assessment criteria

Assessment criteria for the option development process have been developed for the project objectives detailed in **section 4.1.3**. The assessment criteria, listed in **Table 7.1**, have been used to assess the relative performance of the preferred option and to assist in justifying the selection of the proposed concept design.

7.2.1 Evaluation against the objectives and assessment criteria

The proposed concept design has been evaluated against the PHUP and Project objectives detailed in **Chapter 4**, using the assessment criteria detailed in **Table 7.1**. The objectives and assessment criteria were considered throughout the route development process in order to ensure that the proposed concept design satisfies the requirements of the overall Pacific Highway upgrade program, and the project-specific objectives developed in consultation with the local community and government agencies.

Table 7.1 Evaluation of the proposed concept design against the objectives and assessment criteria

PHUP objectives	**Assessment criteria – a*chieved in proposed concept design (Y/N)***	**Y/N**
Significantly reduce road crashes and serious injuries	**Improvement in road safety**	
	▪ Comply with design and engineering safety standards.	**Y**
	▪ Retain existing rest areas.	**N/A***
	▪ Optimise number of direct access points onto highway.	**Y**
	▪ Optimise number of at-grade intersections.	**Y**
	▪ Provide emergency stopping bays.	**Y**
	Design to bypass sections of road with poor existing horizontal alignment	
	▪ Replace existing sections of sub-standard highway with new road that meets current RTA design standards.	**Y**
	Design to make allowance for future upgrade to Class M	
	▪ Identify locations for potential future interchanges, service roads, etc.	**Y**

* *Existing rest areas will be replaced with new high-standard rest areas catering for all road users, with one rest area for each direction of travel*

Cont.

PHUP objectives	**Assessment criteria – a*chieved in proposed concept design (Y/N)***	**Y/N**
	Identify property acquisition requirements for Class M corridor, including service roads	
	▪ Total Class M corridor requirements identified.	**Y**
	Provision of rest areas and truck parking bays at intervals as required by RTA design guidelines	
	▪ Retain or relocate existing rest areas and truck parking bays – in accordance RTA design guidelines.	**Y**
Reduce travel times and delay	**Minimise length of upgraded highway and travel times**	
	▪ Minimise route option length.	**Y**
	▪ Minimise travel time.	**Y**
	▪ Minimise vehicle operating costs.	**Y**
	Improve the reliability of travel times on the highway	
	▪ Achieve appropriate Level of Service.	**Y**
	▪ Ensure capacity to accommodate seasonal traffic variations.	**Y**
	Ensure upgrade is flood-proof for the 1:100 year flood	
	▪ Design for 1:100 year flood (subject to hydrology and hydraulics report).	**Y**
	Minimise disruption to traffic during construction	
	▪ Optimise length of highway under construction at one time.	**Y**
	▪ Maximise off-line construction where possible within corridor.	**Y**
	▪ Minimise cross-over points for new second carriageway.	**Y**
	▪ Utilise available RTA-owned 'controlled access road' land adjacent Devils Pulpit State Forest.	**Y**
	▪ Design to current RTA design standards within available RTA corridor/land assets.	**Y**
	Deliver travel benefits as soon as possible	
	▪ Ability to stage project works.	**Y**
	Optimise highway alignment and geometry	
	▪ Enable trucks and B-doubles to travel safely at maximum legal speed limit.	**Y**
Develop route that involves the community and considers their interest	**Achieve community acceptance of the selected route**	
	▪ Maintain community support for preferred option.	**Y**
	▪ Minimise severance across highway corridor.	**Y**
	▪ Minimise impacts on areas of cultural or archaeological significance.	**Y**
	▪ Minimise impact to native flora and fauna.	**Y**
	▪ Minimise businesses affected by potential acquisition.	**Y**
	▪ Minimise length of highway in visually sensitive (or medium-high visual quality) areas.	**Y**
	▪ Minimise number of properties that will experience noise that could require mitigation.	**Y**
	Improve/maintain existing traffic and access	
	▪ Improve local traffic circulation, safety, separation from highway traffic.	**Y**
	▪ Improve vehicle, cyclist and pedestrian facilities.	**Y**
	▪ Maintain/improve availability of safe access across the highway corridor for all residents.	**Y**
	▪ Direct access points and intersections onto the highway will be formalised to Class A standard.	**Y**
	▪ Traffic surveys and forecasts for future performance at key intersections indicate that the performance of intersections would be good with the proposed upgrade.	**Y**

Cont.

PHUP objectives	**Assessment criteria – a*chieved in proposed concept design (Y/N)***	**Y/N**
	Minimise property impacts	
	▪ Retain private property access on and off the highway.	**Y**
	▪ Minimise property acquisition and displacement impacts.	**Y**
	▪ Minimise number of sensitive land uses that may be subject to construction dust and other air quality impacts.	**Y**
	▪ Minimise impacts of altered flood flows.	**Y**
A route that supports economic development	**Maintain access to and from the highway for businesses and producers**	
	▪ Minimise distance from local producers to nearest highway access or interchange.	**Y**
	▪ Optimise highway to meet RTA flood requirements.	**Y**
	▪ Maintain access to Bundjalung National Park.	**Y**
	Provide access to New Italy for north and south-bound traffic on highway	
	▪ Minimise direct property impacts.	**Y**
	▪ Retain Driver Reviver facility.	**Y**
	Minimise impacts on high quality agricultural land and existing agricultural enterprises and resources	
	▪ Minimise number of properties with greater than 10% of land acquired by the preferred option.	**Y**
	▪ Minimise number of agricultural enterprises that will experience reduction in primary production.	**Y**
	▪ Minimise length of route encroaching on State Forests.	**Y**
Manage the upgrading in accordance with ecologically sustainable development principles	**Conserve biological diversity and ecological integrity**	
	▪ Minimise impact on threatened species and habitats.	**Y**
	▪ Minimise impact on endangered ecological communities (EEC).	**Y**
	▪ Mitigate against risk identified for loss of, or disturbance to flora and fauna, including threatened species during construction and operation.	**Y**
	Eliminate the threat of serious or irreversible environmental damage	
	▪ Minimise the area of high and moderate conservation value land affected.	**Y**
	▪ Develop a comprehensive Environmental Management Plan (for the construction phase).	**Y**
	▪ Minimise use of energy and non-renewable resources.	**Y**
	▪ Maintain or improve water movement across the highway corridor.	**Y**
	▪ Minimise disturbance of potential acid sulphate soils.	**Y**
	▪ Minimise potential for elevated total suspended solids levels in watercourses from construction.	**Y**
	▪ Minimise the risk of water quality impacts in small creeks draining to sensitive SEPP 14 wetlands.	
	Eliminate encroachment or direct impact on National Parks and wildlife estate	**Y**
	▪ National Parks and wildlife estate lands preserved with no encroachment.	
	Improve air quality and reduce greenhouse emissions	
	▪ Minimise travel distance, travel time and delays.	**Y**
	▪ Ensure atmospheric carbon monoxide concentrations would be well below Department of Environment and Conservation criteria.	**Y**
Provide best value for money	**Design to make allowance for future upgrade to Class M**	
	▪ Locations identified for potential future interchanges, service roads.	**Y**
	▪ Total Class M corridor requirements identified.	**Y**
	Minimise impacts on existing utility infrastructure	
	▪ Minimise cost of public utility adjustments.	**Y**
	▪ Maximise use of existing road infrastructure.	**Y**

Cont.

PHUP objectives	**Assessment criteria – a*chieved in proposed concept design (Y/N)***	**Y/N**
	Maximise economic benefits to offset costs	
	▪ Minimise construction cost.	**Y**
	▪ Minimise operation cost.	**Y**
	▪ Deliver earlier economic benefits.	**Y**
	▪ Maximise benefit/cost ratio for the preferred option.	**Y**
	▪ Optimise benefit/cost ratio of construction staging options.	**Y**
	▪ Maximise compatibility of the preferred option with broader long term land use and development strategies.	**Y**

Source: Connell Wagner, 2006.

7.3 Evaluation against biophysical constraints

7.3.1 Topography geology and soils

Topography

There are no significant topographic issues in the development of the proposed concept design. The existing Pacific Highway traverses low hills, undulating rises, broad valleys and alluvial plains, none of which would be classified as 'steep'.

Geological, geotechnical and soils

Within the undulating rises and low hills, moderate cuts and fills would be required. This may have the advantage of producing more suitable construction materials and hence reduce the requirement for expensive imported materials.

Field mapping at the Cypress Road straight indicates that excavation into highly weathered bedrock would be required in cut areas. Excavation into the rock may be an issue and appropriate machinery/equipment would be required.

Whites Road realignment: Borehole investigation (BH2 and BH3) indicates that cut materials would comprise loose to medium sand underlain by very stiff to hard clay. Testing identified that potential acid sulphate soil is present in this area, therefore an Acid Sulphate Soils Management Plan is required for any excavation in this zone.

The main concerns across lowland areas will be deeper compressible alluvial soils associated with creek flood plains. Shallow water tables, low bearing capacity and potential acid sulphate soil sub-grades may present constructability issues. Shallow water tables may be encountered across the Tabbimoble floodways.

Structures

Piled foundations, bored or driven, are expected to be the most appropriate foundation type for structures on deep alluvial soils.

Piled foundations, bored or driven, or shallow pad footings are expected to be suitable foundation types on the higher ground and undulating lands.

Fill embankments

Fill batters where possible would need to be constructed from material excavated from cuttings in the higher sections along the route. Fill batters should be constructed no steeper than 1 vertical to 2 horizontal for stability purposes but where feasible should be flattened to 1 vertical to 3 horizontal for ease of maintenance. Batter slopes should be topsoiled and grassed to reduce the possibility of erosion.

Fill embankments across the Tabbimoble floodways and the Clarence River flood plain are not expected to create potential settlement problems, as most of the settlement is expected to occur within the construction period due to the drainage provided by the intermittent sand layers. The absence of such a drainage sand layer at the northern end (Richmond River flood plain, between Trustums Hill and Tuckombil canal) and the presence of soft clay at depth may create potential settlement problems. Detailed investigation in this area would be required to assess the amount of settlement.

Any soft ground should be over-excavated and replaced with suitable material. Alternately, geogrids/geotextiles may be required. If over-excavation of softer ground is not possible, a bridging layer (with or without geogrid/geotextile depending on conditions) should be provided over the softer ground.

In soft/poor sub-grade area, a minimum embankment height of 1.5 m to 2.0 m should be adopted to assist with providing a suitable bridging layer over the sub-grade. Over-excavation is not recommended in potential acid sulphate soil areas.

Cuttings

Many existing cuttings show signs of soil erosion and weak rock material. The steeper batter slopes show signs of instability. The erosion and instability is generally associated with residual soil to highly weathered rock materials exposed in cuttings, and variable weathering of the layers of material. As part of any upgrading works all batter slopes from ground surface should be reduced to 1 vertical : 2 horizontal. In addition, the batter slopes should be topsoiled and revegetated to minimise erosion. More detailed investigation and assessment of cuttings and batter slopes is required prior to adoption in the design.

Variable weathering and eroding of material can present excavation suitability problems as well as variable founding conditions for structures. The material is therefore expected to be suitable for reuse as general fill material with the possibility of selectively stockpiling some of the more competent rock, for reuse as select fill quality material.

Final design of cut batters will rely on future detailed geotechnical investigations, consideration of long term maintenance requirements (including a whole of life assessment) and an assessment of risks to both workers and motorists.

Slope stability

Fill embankments are expected to be constructed of silty clay with scattered gravels of siltstone and less weathered sandstone, which is typical of the material likely to be excavated from the cuttings. It is therefore recommended that for stability purposes, batters constructed of this material be no steeper than 1 vertical : 2 horizontal.

Sub-grade materials

Over-excavation of the sub-grade and replacement with suitable material or the use of geogrids/geotextiles may be required in some of the alluvial backswamp areas. If over-excavation of softer ground is not possible, a bridging layer (with or without geogrid/geotextile depending on conditions) should be provided over the softer ground. In soft or poor sub-grade areas, a minimum embankment height of 1.5 m to 2.0 m should be adopted to assist with providing a suitable bridging layer over the sub-grade.

Erosion hazard

The fine-grained soils covering approximately 90% of the study area are extremely susceptible to high sheet and gully erosion when cleared of vegetation. However, the even topography associated with the corridor means that water run-off will be more easily controlled, therefore limiting erosion. Adequate protection of both cut batters and fill embankments would be provided, using measures such as revegetation, provision of cut-off drains, and landscaping.

7.3.2 Hydrology and hydraulics

A detailed assessment of the proposed concept design in respect of hydrology and hydraulics cannot be provided until the current study has been completed. This is dependent upon completion of aerial laser scanning to enable completion of development of the hydraulic models. However, a primary purpose of the hydrology and hydraulics study is to assist in the highway design process through determination of likely flood levels and prediction of flood volumes. Predicting the likely flood levels and flow volumes is critical for setting pavement levels for flood immunity, sizing of structures (eg culverts, pipes etc.), determining the required volumes and suitability of fill material, and ensuring that earthworks do not create a potential flood hazard upstream or downstream of the highway.

Development of the proposed concept design to date has incorporated 'sensitivity analysis' in setting theoretical pavement levels and embankment heights at existing low points along the route, solely in order to assist in estimation of project costs arising from the importation of fill material. At two of the lowest points along the existing highway (Tabbimoble Floodways 2/3 and the floodway approximately 1 km north of New Italy), the proposed concept design has been costed (preliminary estimate) at the existing pavement level and 600 mm above the existing pavement low point. While this does not provide certainty in relation to flood levels, it has enabled some estimating of fill quantities and associated costs, and provides for comparative benchmarking against which future estimates can be tested.

7.3.3 Water quality

The results of the water quality sampling and testing described in **section 3.2.4** indicate that the most important risks associated with the subsequent route development and construction phases of the project include:

- The potential for disturbance of high risk acid sulphate soil in the vicinity of SW14 during the construction phase;
- The potential for disturbance of low risk acid sulphate soil in the proposed construction corridor adjacent to creek SW12, with the potential for resulting acidic impacts to the creek;
- The potential for elevated TSS levels caused by the off-site loss of suspended solids from construction activities to watercourses throughout the study area; and
- The risk of water quality impacts to small creeks draining to sensitive SEPP 14 wetlands (principally SW3-4 and SW6-9).

It is anticipated that monitoring during the Environmental Assessment phase of the project will be undertaken at all of the monitoring locations not sampled during the initial baseline investigation, to provide baseline water quality data on these sites. Ideally this monitoring should be undertaken during or immediately after a prolonged period of rain to ensure that sufficient water is available from which to obtain representative samples.

7.3.4 Ecology: threatened flora

The results of the ecology study showed that clearing of native vegetation (a 'Threatening Process' under the TSC Act) would be minimised under the project as proposed. In following the existing highway footprint as closely as possible, the proposed concept design will support a strategy of minimised native vegetation clearing, and protection of EECs. However, the proposal would still be likely to have a significant impact on threatened species.

The likely overall effect of the proposed concept design on threatened flora species, either recorded in the study area or considered likely to occur (by virtue of the existence of suitable habitat), is summarised in the following paragraphs.

Melaleuca irbyana (Small-leaved Paperbark)

A population of Melaleuca irbyana is already known to exist in the study area. It is considered that the proposed upgrade may result in the loss of a number of Melaleuca irbyana individuals. This has the potential to constitute a significant impact on the species in terms of its total distribution and population size. This potential impact would need to be fully assessed at the EIA stage including the possibility of providing appropriate control measures to minimise the impact to this population.

Lindsaea incisa (a Fern)

A population of Lindsaea incisa is already known to exist in the study area. It is considered that a loss of, or disturbance to, Lindsaea incisa plants in Mororo State Forest has the potential to have a significant impact on the species in terms of its distribution and population size. This potential impact would need to be fully assessed at the EIA stage including the possibility of providing appropriate control measures to minimise the impact to this population.

Cyperus aquatilis (a Sedge)

The population of Cyperus aquatilis in the study area appears to be part of a larger population extending north east into Tabbimoble Swamp Nature Reserve and Bundjalung National Park. It is considered that loss of, or disturbance to, Cyperus aquatilis plants in the study area has the potential to have a significant impact on the species in terms of its distribution and population size. This potential impact would need to be fully assessed at the EIA stage including the possibility of providing appropriate control measures to minimise the impact to this population.

Oberonia titania (an Orchid)

The single plant recorded at Nortons Road would not represent a viable population, however other plants may occur in the locality. It is considered that the loss of this specimen may have a significant impact on the species in terms of its distribution and population size. This potential impact would need to be fully assessed at the EIA stage including the possibility of providing appropriate control measures to minimise the impact to this population.

Prostanthera palustris (Swamp Mint Bush)

Although the stronghold of Prostanthera palustris is in Bundjalung National Park east of the study area, the loss of the population near Tabbimoble may have a significant impact on the species in terms of its total distribution and population size. This potential impact would need to be fully assessed at the EIA stage including the possibility of providing appropriate control measures to minimise the impact to this population.

Species likely to occur but not recorded

A detailed assessment has not been made of the likely impact of the proposed concept design on the additional 18 threatened flora species identified as likely to occur in the study area, but which were not recorded.

Established populations of particular species, if occurring within the area likely to be affected by road construction would be subject to detailed assessment during the EIA phase of the project.

Other identified species

The other threatened flora species identified during the field surveys are located outside the area that would be affected by the proposed upgrade.

7.3.5 Ecology - threatened fauna

Fragmentation of habitats

The results of the fauna study showed that diminished habitat continuity has the potential to disrupt movement and decrease the total amount of habitat available. A roadway can also have a similar effect by disrupting a wildlife linkage between two separate areas of bushland located in a cleared landscape.

Although the existing highway already bisects the habitats in the study area, the proposed concept design has the potential to further fragment areas of native vegetation.

Loss of tree hollow resource

Hollow bearing trees are a critical habitat feature for a number of threatened species, providing breeding and/or sheltering habitat. Hollow bearing trees are more common in older stands, gullies, vegetation that has not been logged and on flat terrain. Habitats with high productivity have also been noted to support a higher number of hollow bearing trees.

Loss of foraging resources

A number of threatened fauna species require winter flowering to supply food year-round, or to coincide with migratory movements. As such, the presence or absence of winter flowering species is considered a limiting factor for a number of threatened fauna.

Potential impacts on fauna

The results of the fauna study shown that the main potential ecological impacts associated with the proposed Pacific Highway upgrade include:

- Direct mortality of, or injury to, fauna during vegetation clearing;
- Loss of, or disturbance to, essential fauna habitat features, such as tree hollows, roost sites within culverts and under bridges, foraging habitat (particularly winter-flowering eucalypts);
- Increase in the barrier effect posed by the existing highway, as a barrier to movement and genetic dispersal and exchange;
- Increased fragmentation, removal, modification and isolation of habitats; and
- Subdivision and isolation of populations.

The likely specific impacts on individual species of fauna cannot be determined until a detailed impact assessment is undertaken. These assessments will be undertaken during the environmental impact assessment phase of the project.

However, based on the work completed to date, there are a number of fauna species considered likely to be at risk from the project including, but not limited to:

- Hollow-dependent fauna such as the Squirrel Glider, Brush-tailed Phascogale, Yellow-bellied Glider, Masked Owl, Powerful Owl, Brown Treecreeper and Glossy Black-cockatoo.
- Grey-crowned Babbler.
- North Coast Bioregion Emu population.
- Microchiropteran bats, including tree-roosting and cave-roosting species (the latter are likely to be roosting in drainage structures along the highway).
- Frogs, including Green Thighed Frog and barred frogs.

Fauna underpasses may be an option to mitigate against some of the impacts on terrestrial fauna. However, consideration also needs to be given to mitigating the impacts on arboreal fauna, particularly gliders. Squirrel Gliders have been recorded gliding up to 50 m, while Yellow-bellied Gliders are known to glide as much as 100 m.

Substantial clearing of land is likely to be required along the majority of the length of the road corridor. Some of the corridor is already cleared to a width that would be adequate to accommodate the proposed upgrade. However, the overall effect would be to create a road corridor that would be, on average, approximately 50 m wider than the existing road corridor, for the full length of the study area.

The presence of the existing Pacific Highway means that many if not all of the above impacts are likely to be already occurring. Widening the highway corridor is likely to increase the cumulative impact by removing an extensive area of habitat, and by increasing the barrier effect posed by the highway.

7.3.6 Ecology - mitigation and amelioration measures

Mitigation and amelioration measures may include, but not necessarily be limited to:

- The minimisation of vegetation clearance and disturbance, as far as practicable;
- Narrowing the road footprint (wherever possible, and subject to geotechnical and design constraints) to avoid significant habitat areas, such as concentrations of hollow-bearing trees and locations of threatened plant species;
- Incorporating fauna underpasses into the road design, and including dual purpose drainage structures that can act as 'default' fauna underpasses;
- Minimising construction phase disturbance of bat roost sites, such as culverts and bridges;
- Installation of directional/exclusion fauna fencing in appropriate locations;
- Landscaping and revegetation;
- Site rehabilitation;
- Traffic control and driver education (measures to reduce risk of road kill).

Specific details of the mitigation measures to be applied are not known at this stage but will be developed during the EIA stage of the project. Most of the measures listed above are typically employed in highway planning to reduce ecological impact.

Field surveys undertaken for the preliminary assessment were conducted during autumn and winter (March-July 2005). Further targeted summer surveys have recently been carried out (February – March 2006) to assess the occurrence of species for which the surveys undertaken to date were seasonally inappropriate. The summer surveys have targeted spring-summer flowering plant species that are undetectable outside their flowering period, as well as frogs and reptiles that are generally inactive during the cooler months. The findings from these surveys, which are yet to be documented, will enable the distribution and population of threatened flora species to be refined.

7.3.7 Climate and air quality

As discussed in **section 3.2.6**, air quality monitoring is not routinely carried out in sparsely populated rural areas and no specific air quality assessment has been carried out during the concept design development phase of the project. However, the results of studies carried out for the Woodburn to Ballina section of the Pacific Highway indicate that atmospheric carbon monoxide concentrations would be well below DEC criteria.

It can be assumed that total emissions from vehicles would increase as the volume of highway traffic increases. An assessment of the likely impacts of the predicted increase in traffic volumes on air quality will be made during the environmental assessment phase of the project.

7.4 Property and land use effects

7.4.1 Property effects

The potential impacts to private property have been assessed for this report based on a conservative estimate of the likely extent of the upgraded road reserve. At the time of preparing this report, the proposed concept design has been developed to a preliminary level, and will be subject to refinement. Therefore, the potential extent of property impact indicated in **Figures 7.1a** to **c** should be viewed as indicative.

Many of the parcels of land identified in **Figures 7.1a** to **c** may not be directly affected by the proposed alignment but would be close to the edge of the proposed highway formation (whether that be the road edge, a cutting or an embankment). All potentially affected property owners will be contacted in writing by the RTA as part of the concept design display and the potential impacts discussed in more detail.

One of the design aims of this project is to minimise property impact, and therefore the proposed concept design does not deviate significantly from the existing highway alignment through the majority of the study area. Where private property is affected, the impact would be acquisition of narrow strips of land along the highway frontage. The proposed highway upgrade would not result in any severance or isolation of private property. Any acquisition of agricultural land is likely to be minor and would not have a significant impact on the viability of individual agricultural holdings.

The only proposed notable deviation from the existing highway alignment is within a 3 km corridor east of the existing highway adjacent to Devils Pulpit State Forest. The land is owned by the RTA, having been purchased for the specific purpose of diverting the Pacific Highway around a short section of the existing highway where the alignment is not suitable for upgrading to dual carriageway. The proposed deviation would not require any further private property acquisition.

A total of 35 properties are potentially impacted by the preferred highway route, comprising 31 privately owned properties and small sections of Devils Pulpit, Tabbimoble and Doubleduke State Forests.

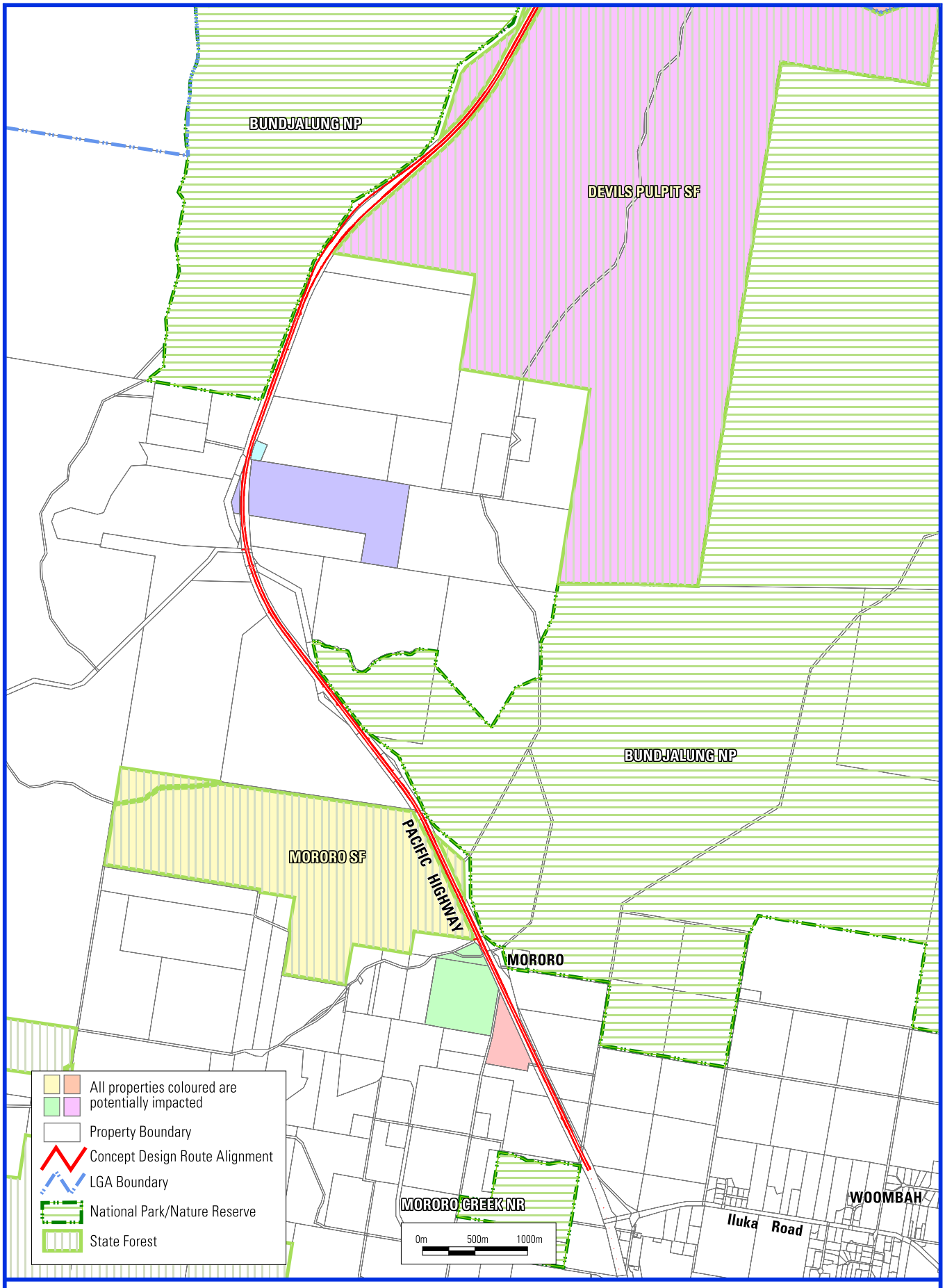
Property acquisition will not be finalised until the actual alignment and design for the proposed Pacific Highway upgrade are determined. Property acquisition for the project will then be negotiated between the RTA and affected private landowners, in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.

Property accesses will be maintained at all times during and after construction either directly to the new highway, via side roads or by a service road.

State Forests

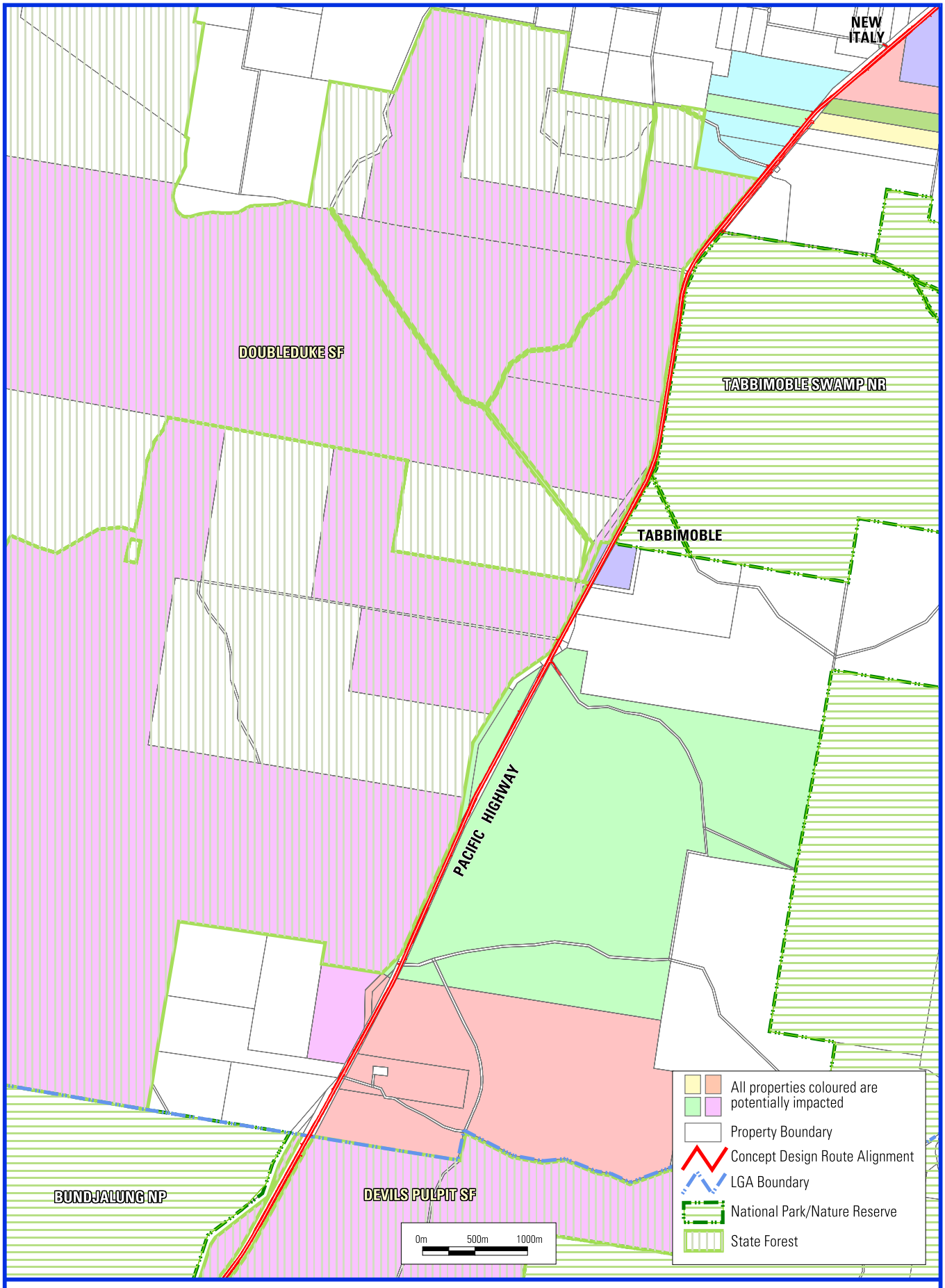
Where the proposed concept design requires the acquisition of land within State Forests, the acquisition process is partially governed by the Forest Management Zones (FMZ) applying to the affected parcel(s) of land. The DPI (NSW Forests) manages forests according to a zoning system which defines those areas to be used for log production, conservation, recreation, scenic protection and other categories as relevant. Land within FMZ 3(a) – Harvesting Exclusions is protected under the *Forestry Act 1916*, and a parcel of land within the 3(a) FMZ having an area greater than 20 hectares cannot be resumed without an Act of Parliament to amend the Forestry Act. Parcels having an area of less than 20 hectares may however be acquired through internal DPI administrative process, to revoke the State Forest dedication.

Some land within the 3(a) FMZ is likely to be affected by the proposed concept design. However, until detailed design progresses further to enable more accurate assessment of the area of affected land within each State Forest that is zoned 3(a), the procedure for acquisition of



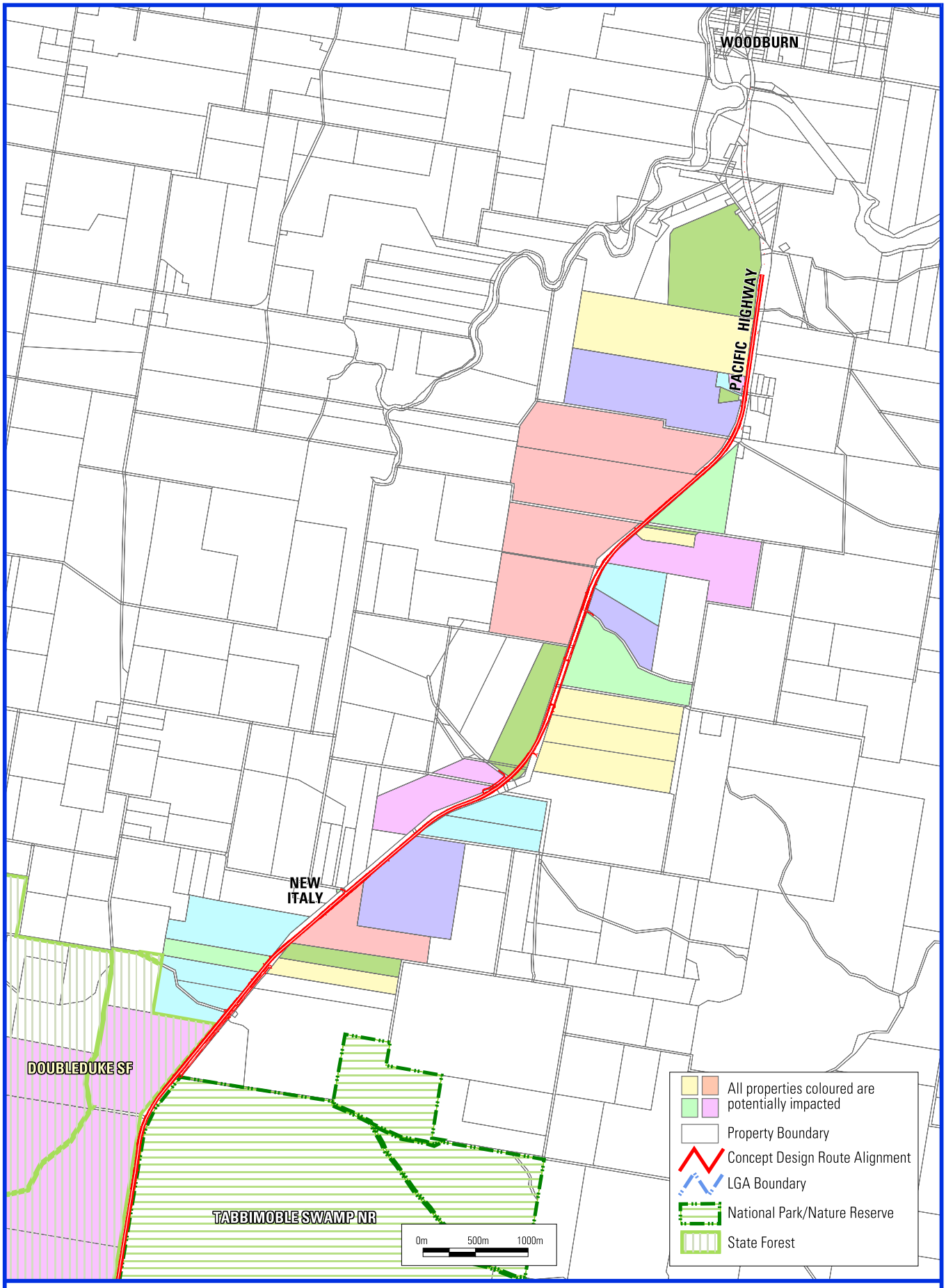
ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 7.1a
POTENTIALLY IMPACTED PROPERTIES



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 7.1b
POTENTIALLY IMPACTED PROPERTIES



ILUKA ROAD TO WOODBURN
CONCEPT DESIGN REPORT

FIGURE 7.1c
POTENTIALLY IMPACTED PROPERTIES

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these lands can not be finalised. Discussions with DPI (NSW Forests) have commenced in this regard and will continue as the concept design is developed further.

7.4.2 Land use

An assessment of the extent to which acquisition affects the management and operation of land has been undertaken as part of the Iluka Road to Woodburn project. The assessment also examined the potential effect of the proposal on current and future land use.

The assessment concluded that the greatest impacts on land use would potentially occur at three rural residential areas between New Italy and The Gap Road, where existing curves in the highway are to be eased so as to meet the RTA's minimum design standards. Acquisition of strips of land would be required at these locations from the frontages of some residential properties.

The likely 'worst case' scenario in terms of impact on residential properties would be at Whites Road, where the road corridor boundary would be realigned along the arc of the curve, up to 100 m west of the existing road boundary. There are two large rural residential properties situated on the north and south sides of Whites Road, adjacent to the highway in this location, each of which would be subject to some acquisition of land under the proposed concept design. The property on the northern side of Whites Road would potentially require acquisition of a wedge-shaped strip of land approximately 700 m long, and up to 100 m wide, tapering to a point approximately 700 m north of Whites Road. Most of this land is currently heavily wooded.

Other rural residential properties would be affected in a similar manner, although for most, the width of the 'strip' would be considerably less than 100 m. Under the proposed concept design in its current form, no residences would be demolished. Some residences would be closer to the road than they are at present, and any impacts resulting from the new road alignment, such as increased road noise or visual impacts, would be fully assessed and mitigated during the impact assessment and detailed design phases of the project.

All affected landowners would be fairly compensated under the law as discussed above in **section 7.4.1**.

The potential impacts on agricultural properties would be minor. Most acquisition would be in the form of strip acquisition along the frontage to the existing highway. This would not generally affect the management of the properties. However access arrangements would need to be considered for the construction stage.

7.4.3 Fencing and access

The RTA would replace fencing where existing fences are affected. It would also provide both temporary and permanent access where this is impacted in consultation with the affected landholders. For most properties, access to the highway is by way of internal access roads, private driveways or minor local roads. The proposed concept design allows for left-in, left-out access to all private properties and local roads, with T-intersections at those local roads carrying higher volumes of local traffic. Provision for truck and trailer access would be considered in the design of intersections to take account the requirements for rural properties.

Liaison with Forests NSW has commenced, with a view to determining access requirements and providing for State Forests in highway design. Logging operations are infrequent, and while the duration of each logging operation can be measured in months, Forests NSW has indicated that it anticipates no disruption to its operations as a consequence of the proposed highway upgrade.

The ongoing commercial activities at New Italy can be protected by providing planned safe access and suitable parking.

Property access will be maintained at all times during and after construction either directly to the new highway, via a side road or a service road.

7.5 Recreation and tourism

As discussed in **section 3.4** of this report, the immediate study area is not in itself a significant destination for recreation or tourism. The Pacific Highway through the study area does however provide access to Bundjalung National Park, two nature reserves, and the coastal town of Iluka. Iluka is a recreation and tourism destination, while Bundjalung National Park contains a number of camping areas under the control of the NPWS. To the north, the coastal town of Evans Head is accessed via Woodburn.

The proposed concept design is not considered likely to result in any significant impact on these or any other north coast recreation and tourism facilities, other than to better facilitate travel to and from holiday and recreational destinations. Potential impacts on the New Italy Museum Complex are discussed below in **section 7.8**.

7.6 Public utilities

A number of utilities would be affected by the route, including a number of electricity pylons, street lights and telecommunication infrastructure.

Most of the services feeding the communities along the route are overhead and can be relocated relatively easily and with little disruption to residents. However the main Sydney to Brisbane fibre optic cable, owned by Telstra, straddles the route and may need to be relocated in places. Prior to construction, sections of the cable may need to be diverted to enable works to proceed without risk to communications services. There are no substantial impediments to diversion of sections of cable, and it is considered that this can be successfully achieved with little or no disruption to telecommunications users. Should any temporary disconnection of services be required during construction, this would be managed during periods of lowest network traffic, such as early in the morning.

The impact on utilities and services owned by Clarence Valley and Richmond Valley Councils is considered minor and would not pose any significant disruption to service users.

7.7 Indigenous heritage

The results of the Indigenous heritage field survey discussed in **section 3.8** indicate that the study area contains a low density of archaeological sites, probably indicative of resource gathering activities, but also reflecting that the study area has suffered an overall high level of disturbance due to construction of the existing highway, agricultural activity and timber harvesting in the adjoining forests.

Co-ordinators of all Local Aboriginal Land Councils were contacted prior to carrying out Indigenous heritage field surveys, and a representative of each Council provided field survey assistance as required. In order to determine whether any unidentified sites/places of particular significance or concern would be threatened by the proposed highway upgrade, consultation was undertaken with all Aboriginal group representatives involved in the survey, as well as with local Elder and Native Title claimant Lawrence Wilson. Lawrence Wilson was acknowledged by all groups as the only person known to them with detailed traditional knowledge of the study locality.

The survey focused on reasonably intact well-drained land beyond the highway reserve boundaries, however, 78% of the study area's length was walked and a further 8% has been included in past study areas. It is concluded that the study area is unlikely to contain any significant undetected Aboriginal sites, and that undetected evidence will most likely be restricted to a low level background distribution of stone artefacts, few of which will be in a primary depositional context. Local Indigenous representatives involved in the field surveys have indicated their support for the study's conclusions, and raised no objections to the project proceeding, provided that the burial site near The Gap Road, and the scarred tree near New Italy, are protected.

The scarred tree identified in **section 3.8** is a sufficient distance from the existing highway to ensure that it would not be affected by any of the works required for the proposed Pacific Highway upgrade.

7.8 European heritage

The study area includes two items listed on the NSW State Heritage Register, the New Italy settlement and Vineyard Haven.

Chapter 8 of the 2002 New Italy Settlement Conservation Management Plan (CMP) provides conservation management recommendations for the New Italy Museum Complex, as part of the New Italy Settlement site. Of particular relevance to this project are the management measures relating to the use of the site, and especially the use of the site for a driver reviver location, which brings travellers to the museum complex. Recommendation 2 of section 8.4 of the 2002 CMP identifies the driver reviver facility as a valuable tool for the promotion of the site and promotes the continued use of the site for this purpose.

The proposed concept design would increase the footprint of the highway such that the formation would come closer to the eastern boundary of the museum complex portion of the New Italy settlement. It is likely that the proposed concept design would have an impact on access arrangements for patrons to the museum complex and would require relocation of the existing parking facilities. It should be noted that the existing parking facilities are located within the Pacific Highway road reserve and are not part of the New Italy complex as noted on the heritage register.

The proposal would not directly affect any aspect of Vineyard Haven, which is located approximately 1.5 km to the west of the existing Pacific Highway alignment.

7.9 Visual amenity

It is anticipated that the visual impact would be relatively minor, given the rural nature of the environment, the topography, and the nature of the upgrade. A full visual amenity and impact assessment will be undertaken as a component of the EIA and during the detailed design stage. Visual amenity would be in the form of planting and earth bundings (where appropriate) sensitive to the surrounding environment.

7.10 Acoustic environment

7.10.1 Road traffic noise assessment goals

The noise goals appropriate to the project are located in the DEC publication Environmental Criteria for Road Traffic Noise and the RTA's Environmental Noise Management Manual. The goals are described below.

'Baseline' goals

For arterial road/freeway upgrades and re-developments, 'baseline' noise assessment goals of 60dB(A) daytime and 55dB(A) night-time are recommended. The goals are applicable at a distance of 1m from the most exposed external residential building facade at the road opening and 10 years after opening.

'Allowance' goal

Where the existing traffic noise exceeds the 'baseline' goals, the 'allowance' goal requires the proposed road upgrades/re-developments be designed so as not to increase the 'future existing levels' by more than 2dB(A). The 'future existing levels' are the noise levels resulting from 10-year traffic growth on the existing roads if there were no upgrades/re-developments.

'Acute' noise exposure

Where feasible and reasonable, consideration should be given to reduce the external traffic noise levels where the predicted future noise levels (10 years after road opening) exceed the 'acute' noise exposure levels of 65dB(A) daytime and 60dB(A) night-time.

7.10.2 Noise prediction

The noise predictions for this assessment are preliminary and for the purpose of developing conceptual noise control options. The noise predictions take account of projected traffic growth and changes to the road alignment. It was assumed that traffic speeds would be 110 km/h.

Detailed noise predictions will be undertaken when details of the vertical and horizontal road alignments, cuttings, embankments, etc are finalised.

There are approximately 75 residential dwellings located within 260 m of the existing and proposed upgraded road alignments (**Figure 3.12a** and **b**).

For the purpose of this assessment, a desktop study based on the calculation of road traffic noise (CORTN) modelling procedures was undertaken and shows that existing road traffic noise levels would:

– increase by 1dB(A) at the road opening (2016) due to traffic growth;
– increase by 2dB(A) 10 years after road opening, due to traffic growth;
– decrease by 1–4dB(A) at about 17 dwellings in 2016, due to the proposed road upgrade being further from the existing residents;
– increase by 1–3dB(A) at about 16 dwellings in 2016, due to the road being closer to existing residents.

7.10.3 Noise assessment

The predictions show that, for the majority of dwellings along the study route, the increase in future road traffic noise levels (ten years after opening) would be within 2dB(A) and satisfy the 'allowance' goals as outlined in **section 7.10.1**.

For a small number of dwellings along the study route, future road traffic noise (ten years after opening) could increase by up to 5dB(A) and noise mitigation would need to be considered in order to satisfy the 'allowance' assessment goal.

Where feasible and reasonable, consideration should be given to reducing the external traffic noise levels to the 'acute' noise exposure levels of 65dB(A) daytime and 60dB(A) night time (10 years after road opening). Results of the noise measurements and preliminary calculations have shown that approximately 50 properties are likely to experience higher than the acute noise levels.

7.10.4 Conceptual noise control options

Noise mitigation options that could be considered for the proposal include quieter road surfaces, acoustic barriers/mounds and treatment to individual dwellings. Final noise mitigation measures would be developed during the preparation of the environmental assessment, in consultation with landowners.

For the purpose of minimising truck pass-by noise levels, it is proposed that road design factors such as curvature and gradient (which contribute to the need for application of engine compression brakes, acceleration and deceleration), and pavement surface type, be taken into consideration at the road design stage.

Road construction works could cause localised noise and vibration impacts at exposed dwellings. These impacts would be minimised with the implementation of a Construction Noise and Vibration Management Plan.

7.11 Traffic

7.11.1 Traffic forecasts

An analysis of the future highway traffic volumes and associated future traffic and transport conditions has been undertaken for the following scenarios:

– Base case (do minimum) -
This scenario represents the existing highway and, in addition, includes all recent and proposed wire rope installations along the median of the highway from Ch75.4 km to Ch91.4 km (south of Tuckombil Canal).

– Proposal – Class A upgrade
This upgrade proposal represents the scenario with the highest volume of traffic that could potentially use the upgraded Pacific Highway. If the highway is upgraded at some time in the future to Class M or Motorway standard (with grade-separated intersections and a local service road), local traffic would be diverted to the parallel local service road, thereby reducing the overall highway traffic volume.

Forecasting method

Future traffic volumes were predicted based on historic traffic volumes and the annual growth in traffic between 1991 and 2001, using the linear growth method. It is assumed that this annual increase represents the underlying rate of traffic growth that occurred in the study area prior to the opening of the Pacific Highway upgrade between Yelgun and Chinderah.

It is also assumed that this historical rate of traffic growth will continue to occur in the future. Therefore, the historical growth rate has been applied to the 2005 AADT figures from Table 2.1, to predict traffic volumes in the future years of 2016 (theoretical opening year for the proposed upgrade) and 2036 (20 years after opening).

The higher rate of growth in the intervening period between 2001and 2005 represents the impact of the Yelgun to Chinderah upgrade on the volumes of traffic (and in particular heavy vehicles) using the Pacific Highway.

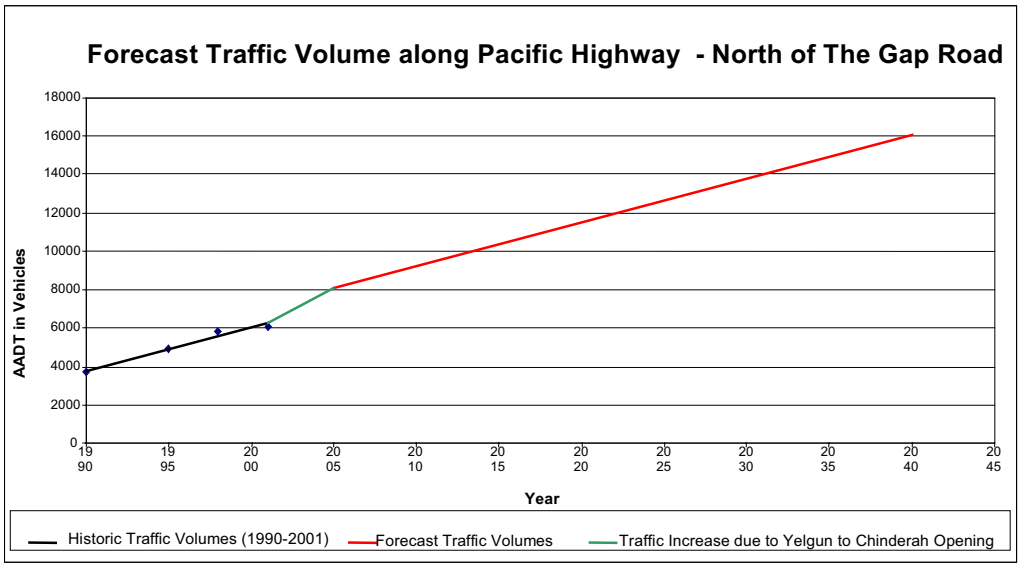
Lastly, it is assumed that no major land use developments are proposed within the study area during the analysis period. Therefore, no increase in local traffic is expected to occur.

Figure 7.2 illustrates the forecast traffic volumes as per the above method and assumptions. The forecasts are based on the AADT as calculated for the traffic counts taken north of The Gap Road, which represents the highest volumes.

As illustrated in **Figure 7.2**, the AADT volume along the highway is predicted to be 10,600 vehicle movements in 2016 during the opening year of the proposed duplication and associated improvements, and 15,190 vehicle movements in 2036 (20 years after opening). Of these total volumes, heavy vehicle movements make up approximately 2,060 per day in 2016 and 2,960 in 2036. Both the total and heavy vehicle traffic movements are therefore predicted to increase by approximately 88% in 2036 compared to existing traffic levels.

Based on the historical growth rates and the linear forecasts, these results indicate that, even for the increased traffic volume, the highway is likely to operate at an excellent LOS (LOS A) for the proposed Class A highway upgrade up to 2036.

Figure 7.2 Forecast traffic volumes along the Pacific Highway



Source: Connell Wagner, 2005.

7.11.2 Future performance at intersections

The proposed Class A upgrade would include at-grade 'Seagull' type T-intersections at a number of locations including two of the three existing intersections where traffic surveys were carried out (see **section 2.2**). An analysis of the future performance of the key intersections for the design hour (100th highest hour) has been undertaken for the base case (ie the 'do minimum' option as described in **section 4.1.2**). The analysis of future performance of the intersections at Jacky Bulbin Road and Swan Bay New Italy Road under a 'do minimum' scenario revealed the following results:

– In 2016, the performance of these key intersections under the base case is acceptable (LOS C or better); and
– In 2036, the performance remains acceptable (LOS C) for all intersections.

It is evident from the above that the performance of the existing intersections in the base case would deteriorate over time to a level at which sufficient gaps would potentially not be available for traffic to enter safely into the main traffic stream along the highway. This would occur in particular during the holiday periods (on which the analysis is based), but could also occur during the peak hour periods on a normal (average) day by 2036.

The provision of 'Seagull' intersections at Jacky Bulbin Road, Serendipity Road and Swan Bay New Italy Road for the proposed concept design would increase the intersection capacity and safety at these locations relative to the base case. Since the performance of the highway would be good (LOS A at 2036 for the concept design as discussed in **section 2.2.3**), sufficient breaks would be available for traffic to enter into the traffic stream travelling along the highway. Therefore, the future performance of these intersections is expected to be good with the proposed upgrade.

7.12 Socio-economic assessment

7.12.1 Road user benefits

Road user benefits for a road transport project are typically measured in terms of the reduction in road user costs that arise from building an option compared to the base case scenario of doing nothing (or doing only minimum improvements in the case of this project, in order to allow for necessary safety improvement works which are already programmed and which will occur whether or not any of the upgrade options proceed).

Travel cost parameters

Table 7.2 shows the travel cost parameters that have been used in the economic analysis to estimate vehicle operating, travel time and accident costs. Rural cost parameters have been used to estimate the travel costs for vehicles travelling along the highway, based on the economic parameters for 2003 within the Economic Analysis Manual (RTA).

Table 7.2 Travel cost parameters

Item	Cost
Vehicle Operating Costs per vehicle km • Base case (2 lane highway) • Proposal (dual carriageway)	 $0.38 $0.33
Value of time per hour	$27.59
Accident cost per crash	$139,000

Source: Connell Wagner, 2005.

Construction costs

The estimated cost of construction for the proposed concept design is $236 million.

Maintenance costs

An allowance for future routine and periodic maintenance has been made in the analysis based on a typical maintenance schedule and associated unit costs for a concrete pavement surface specified in the *Economic Analysis Manual* (RTA). The maintenance schedule and unit costs used are summarised in **Table 7.3**.

Table 7.3 Maintenance schedule and unit costs

Treatment	*Year*	*Cost per m^2 of pavement*
Routine Maintenance	1-30 inclusive	$0.15
Cross stitching 20m cracks	2, 6, 12, 20	$0.06
0.5% slab replacement	2, 5, 10, 15, 20, 25, 28, 30	$1.03
Cross stitching 40m cracks	28	$0.12
Remove and Replace Sealant	10, 20, 30	$2.19
30% retexture	20	$0.84

Source: Connell Wagner, 2005.

The salvage value of the pavement beyond the 30 year period from opening is assumed to be zero.

7.12.2 Business impacts

The New Italy Museum Complex is the only site on the Pacific Highway between Iluka Road and Woodburn relying solely on the highway for its income. The facility relies on attracting passing motorists, and potential changes to its accessibility to or from the highway may influence the decisions of motorists as to whether they choose to stop at New Italy.

The physical impacts of the proposed concept design on New Italy will be better defined at detailed concept engineering design stage, after a preferred route has been decided. As a general statement, the ongoing viability of the New Italy Museum Complex is considered an important objective for this project, given the local historical and cultural significance of the centre. The ongoing design of the project will take these considerations into account.

7.13 Summary and conclusions

The proposed concept design has been subjected to a preliminary evaluation in respect of all of the issues so far identified as being relevant to the project. There are eight issues which could be described as key items in terms of potential negative or harmful impacts, or where the proposed concept design does not achieve the stated objectives. These are:

- Crash rate objective as outlined by the RTA;
- Fauna habitat fragmentation and loss of key habitat;
- Impacts on threatened flora species;
- Flooding;
- Disturbance of high risk potential acid sulphate soil during construction;
- Impacts on the New Italy Museum Complex and its cultural heritage significance;
- Impacts on and acquisition of private property; and

In summary, the overall performance of the proposed concept design can be assessed as follows:

7.13.1 Biophysical issues

– While soils and geotechnical conditions are not ideal for major highway construction, based on the studies undertaken to date the existing ground conditions do not pose any major constraints to the development of the proposed concept design. Potential acid sulphate soils would have to be managed in accordance with an approved Acid Sulphate Soil Management Plan.
– Hydrological and hydraulic modelling are not yet complete. However, there are recognised flood-prone locations that require bridging to meet the RTA's prescribed design standards.
– Sourcing of imported fill materials may be an issue for embankment construction, given that there is likely to be a material deficit, and there are a number of Pacific Highway projects in development concurrently, many of which will also be in deficit.
– Further information about local flooding behaviour will greatly assist in progressing the design of a preferred option.
– Existing water quality in the creeks and rivers is fair to poor. The proposed highway upgrade could affect water quality, particularly during construction.
– The proposal has the potential for impacts on threatened flora and fauna, as the study area displays high species diversity and a number of threatened plant and animal species. The main potential ecological impacts include habitat fragmentation, increased barrier effects through corridor widening, subdivision and isolation of populations.
– Results of air quality studies carried out for other Pacific Highway upgrade projects indicate that atmospheric carbon monoxide concentrations would be well below DEC criteria. Further assessment will be undertaken during the environmental assessment phase of the project but are expected to be within allowable limits

7.13.2 Land use and property effects

– The proposed concept design is considered to have a minor potential impact on land use except for three rural residential areas between New Italy and The Gap Road, where strip acquisition would bring the road corridor edge closer to some houses. The potential impacts on agricultural properties are minimal. Forests NSW has indicated that there would not be any likely disruption to its operations as a consequence of the proposed highway upgrade.
– The proposed route does not deviate significantly from the existing highway alignment and therefore the potential property impacts are minimal. There are 35 parcels of private property where narrow strips of land along the highway frontage would potentially be affected. The proposed highway would not result in any severance or isolation of private property.

7.13.3 Recreation and tourism

– There is likely to be minimal negative impact on recreation and tourism as a result of the proposal as there are few facilities along this section of the highway.

7.13.4 Public utilities

– Public utilities along the route would be relocated relatively easy and with little disruption to residents.

7.13.5 Indigenous heritage

– The study area contains a low density of archaeological sites and it is most likely that any undetected evidence will be a low-level background distribution of stone artefacts. A scarred tree identified near New Italy would not be affected by the proposed highway upgrade.

7.13.6 European heritage

– The proposed highway upgrade would come closer to the New Italy Museum Complex, and the existing car parking facilities would require relocation. The Museum Complex and surrounding area is covered by the 2002 New Italy Settlement CMP. Recommendations have been provided by the CMP for the highway upgrade project and cover car parking, signage, the Driver Reviver and a thorough assessment of the potential heritage impacts on the Museum Complex.

7.13.7 Visual amenity

– Opportunities have been identified for enhancement of the visual amenity of the study area. Enhancements include those to the natural environment through revegetation and landscaping, improvements to facilities and incorporating visual treatments into the design of the highway.

7.13.8 Acoustic environment

– A preliminary noise assessment has been undertaken as part of the project planning. Following highway construction, 16 dwellings would be 5 – 42m closer to the highway alignment. With the combined effects of traffic growth and reduced distance separation, the predicted road traffic noise levels at these 16 dwellings would increase by up to 4dB(A) in 2016 and 5dB(A) in 2026 and may require noise mitigation.
– Noise mitigation options would be developed in consultation with landowners and could include quieter road surfaces, acoustic barriers/mounds and treatment to individual dwellings.

7.13.9 Traffic

– The analysis of future highway traffic volumes and associated future traffic and transport conditions predicts the AADT volume along the highway to be 10,600 vehicle movements in 2016, and 15,190 vehicle movements in 2036 (20 years after opening). Of these total volumes, heavy vehicle movements make up approximately 2,060 (19.4%) per day in 2016 and 2,960 (19.5%) in 2036.
– 'Seagull' type T-intersections are proposed for the proposed Class A upgrade at a number of locations including the key intersections of Jacky Bulbin Road and Swan Bay New Italy Road. Traffic surveys and forecasts for future performance at these intersections indicates that the performance of the intersections would be good with the proposed upgrade.

7.13.10 Socio-economic assessment

The New Italy Museum Complex relies solely on passing motorists along the highway for its income and access to the Museum Complex would need to be maintained for survival of this business. A full assessment of the potential impacts on this business will be undertaken when the preferred route has been decided and during the Environmental Assessment phase of the project. The ongoing viability of the Museum Complex is an important objective of this project.

8. Project Cost

8.1 Scope of works

The cost estimates of the works are based on costings for each of the major work elements associated with the project, including:

- Project development;
- Investigation and design;
- Property acquisitions;
- Public utilities adjustments;
- Construction; and
- Handover.

8.2 Strategic cost estimate

The strategic cost estimates have been compiled in accordance with the RTA's Project Estimating Manual, Edition 1, Revision 0 (December 2001) and the RTA's Iluka Road to Woodburn Scope of Works and Technical Criteria – Appendix 6 - Estimating, Scope and Cost Control for Development Projects.

The strategic cost estimates are summarised in **Table 8.1** An E50 estimate is the cost estimate for which there is a 50% probability of being achieved, while the E90 estimate has a 90% probability of being achieved.

Table 8.1 Summary of cost estimates

Route Stage	Length	E50 Estimate	E90 Estimate
Strategic estimate dated March 2006	32.72 km	$221M	$236M

Source: Connell Wagner, 2006.

8.2.1 Explanation

Contingency factors are applied to the E90 strategic cost estimates to allow for certain unforeseen circumstances. In accordance with the RTA's Estimating Manual, these contingencies generally range between 25% and 50% and can be reduced as the design progresses and uncertainty decreases.

Similarly, with the E50 estimate all cost items are based on a contingency factor of 31%, although the pavement contingency is 25%.

9. Proposed concept design and next steps

9.1 Proposed concept design

The route development process for upgrading the Pacific Highway between Iluka Road and Woodburn involved a range of technical investigations and concept design development as well as close consultation with the affected local communities and key stakeholders. Upgrading to dual carriageway standard generally along the existing highway alignment was the only feasible option to emerge from this process. This route is to be taken to concept design display, to receive public comment. It was identified at an early stage that there would be a limit to the route options available for this section of the Pacific Highway. The Iluka Road to Woodburn upgrade is unusual in that it does not pass through any residential or commercial centres. Furthermore, deviation from the existing highway corridor would yield little or no functional or transportation benefits, but would have severe environmental impacts on the surrounding area.

The study has therefore concluded that the most suitable option is to upgrade the existing Pacific Highway to dual carriageway (Class A) standard for the entire length of the subject section, and to reduce direct cross carriageway access to three intersections with the remaining access points serviced by left-in left-out turn facilities and strategically located U-turn bays.

The proposed concept design would generally comprise widening adjacent to the existing carriageway and within the existing road reserve, but with some short sections of realignment in order to achieve the required road design standards.

9.2 Next steps

The recommendation of this study is that the proposed concept design outlined above be adopted as the preferred route and be made available for public review and feedback.

At completion of the concept design display, a report will be prepared summarising the issues raised in submissions from the community and stakeholders, for consideration by the RTA. The submissions report will assist in developing assessment criteria with which to carry out a detailed evaluation of the proposed concept design through the value engineering process.

Following completion of the value engineering process and detailed evaluation and refinement, it is anticipated that the RTA will then be in a position to decide, subject to a satisfactory consultation, to recommend to the Minister that the proposed concept design be announced as the Preferred Route.

Following adoption of the proposed concept design as the RTA's preferred route for the Pacific Highway between Iluka Road and Woodburn, the RTA proposes to submit the Iluka Road and Woodburn project to the Department of Planning (DoP) for approval under Part 3A of the EP&A Act.

Further survey, geotechnical, ecological and other investigations would also be undertaken to provide input into the refinement of the design and environmental assessment.

The level of environmental assessment (EA) required for the proposal under Part 3A would be determined by the Director-General of Planning, who issues EA requirements after consultation with the relevant public authorities and local councils. The EA may include a statement of commitments in respect of environmental management and mitigation measures proposed to be undertaken if the project is approved.

When completed, the EA would be publicly exhibited and submissions would be sought. The RTA may be asked to prepare a report on the submissions and revise its statement of commitments. It would also consider modifications to the project to minimise environmental impacts. The DoP may request the RTA to display, for public information, a Preferred Project Report identifying the proposed modifications.

The DoP would consider the EA, the public submissions and any report requested from the RTA in recommending to the Minister for Planning whether the project should be approved.

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