3 Route options development and assessment

3.1 Key characteristics of the study area

3.1.1 General

A summary of the key characteristics of the study area and the major constraints to highway planning and development is presented below. The study area identified for the project extends from the northern end of the existing Allgomera deviation south of Warrell Creek to the existing Waterfall Way interchange at Raleigh.

Key engineering, planning and environmental considerations and constraints to highway planning and development included:

- The need to provide a connection to the existing highway at each end of the Proposal and service existing population centres.
- The need to provide opportunities to stage construction of the proposed Upgrade.
- The Nambucca and Kalang Rivers and associated flooding and drainage issues.
- The towns of Macksville, Nambucca Heads and Urunga.
- Urban land use development.
- Rural land use.
- Local council road strategies.
- Geological conditions.
- Topography and earthworks.
- Visual impacts.
- Flora and fauna.
- Heritage.
- Connections to surrounding areas, including coastal towns.
- The North Coast Railway.

The key planning and ecological constraints influencing the development of the project are illustrated in **Figure 3-1** and **Figure 3-2**, respectively.

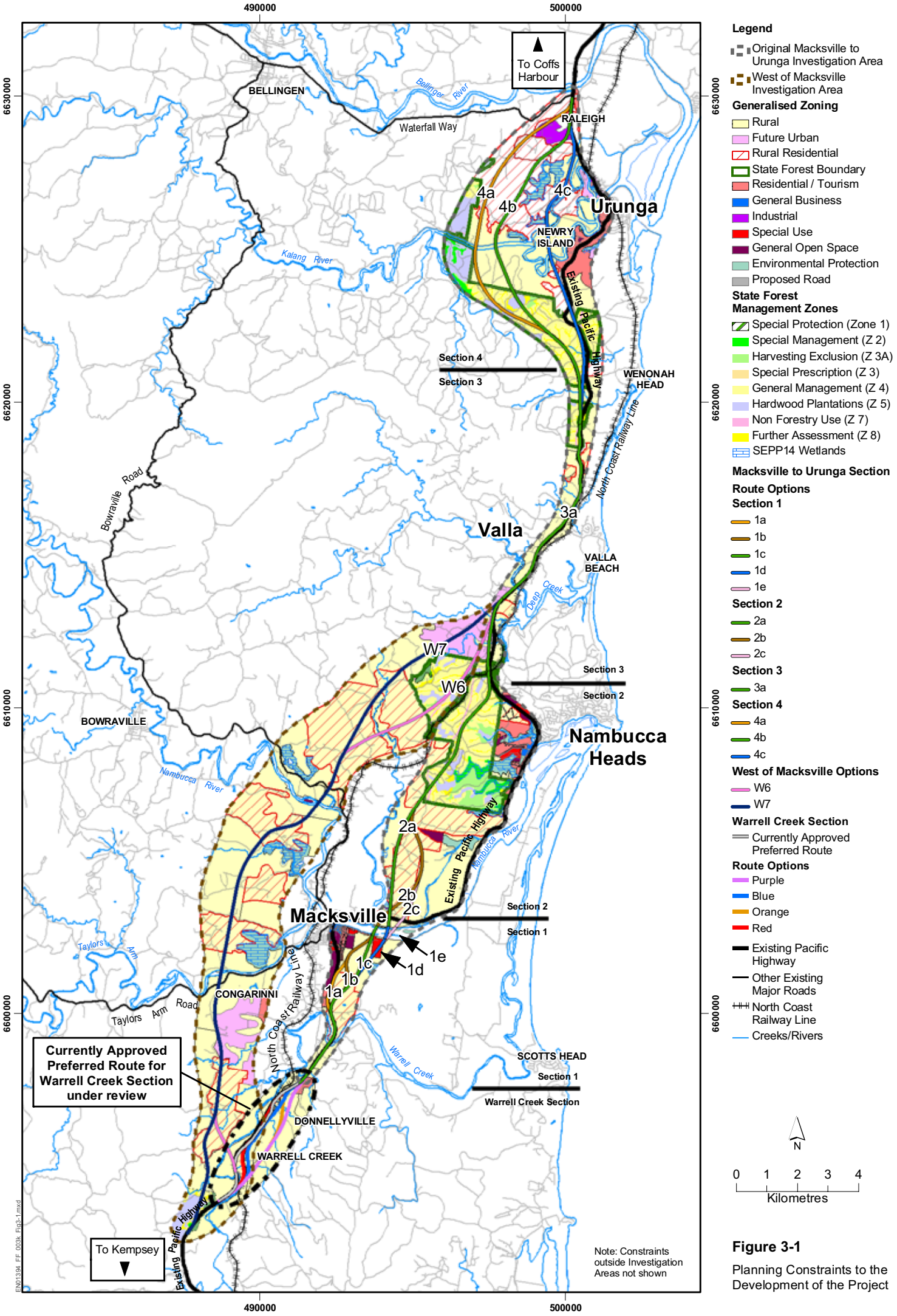


Figure 3-1

Planning Constraints to the Development of the Project

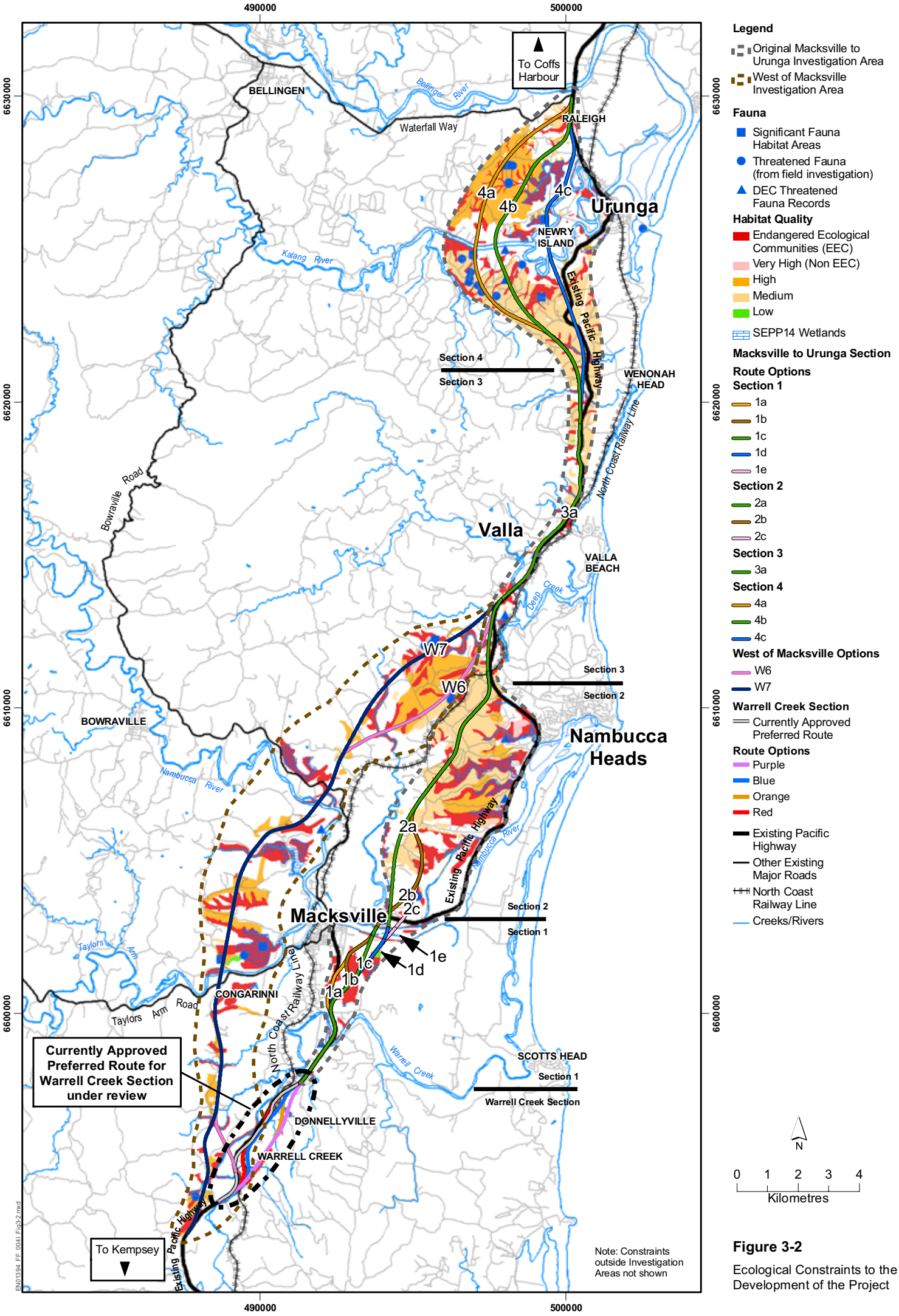


Figure 3-2

Ecological Constraints to the Development of the Project

3.1.2 Traffic and transportation

Traffic issues associated with the development of the project included:

- Provision of an acceptable roadway capacity for through and local traffic volumes at least 30 years after opening.
- Travel time savings.
- Reduction of vehicle accident rates by providing a higher standard roadway and a more direct route.
- Provision of appropriate local access through interchanges and local access roads.
- Provision of rest areas and "Driver Reviver" rest areas.
- Provision of truck stopping bays to suit B-Doubles located approximately every 5 kilometres.

3.1.3 Land use constraints and issues

Assessment of current land use and potential future changes within the investigation area identified a number of land use constraints to the development and assessment of route options for further investigation. A hierarchy of land use constraints was identified and provided an input into the development and assessment of feasible route options.

3.1.4 Economic considerations

The upgrade of the Pacific Highway between Warrell Creek and Urunga could have a direct negative impact on businesses that are significantly dependent on highway through traffic, e.g. accommodation services, motor vehicle services, cafes and restaurants and specialised food retailers. However, the overall economic impact of the highway upgrade on businesses is likely to be small as through traffic dependent business does not represent a major component of the economic base of the area.

A survey undertaken in 2003 of businesses in the Macksville to Urunga section found that the number of persons directly dependent on highway through traffic for employment represents only about 3 per cent of persons employed in the study area. Details of the survey can be found in the *Business Impact Survey Report* (SKM, February 2004).

Possible indirect economic impacts of the highway upgrade include:

- Impacts on local businesses providing inputs to businesses that are significantly dependent on highway through traffic.
- Reduction in consumption expenditure by local residents as a result of loss of employment in through traffic dependent businesses.

As through-traffic-dependent business does not represent a major component of the economic base of the area, the indirect economic impacts of the highway upgrade are also likely to be small. Consequently, any losses of turnover and employment in through traffic-related businesses are unlikely to have a significant cumulative effect on the economic viability of the study area.

Studies undertaken elsewhere on the Pacific Highway and on the Hume Highway indicate that the impact of bypass roads on local businesses is short term and that economic growth recovered in the towns surveyed in the medium to long term. Useful references are:

- Bureau of Transport and Communication Economics, *The Effect on Small Towns of Being Bypassed by a Highway: A Case Study of Berrima and Mittagong*, Working Paper 11, 1994.
- School of Geography, University of New South Wales, *Evaluation of the Economic Impacts of Bypass Roads on Country Towns*, Final Project Report, prepared for NSW RTA, 1996.
- Urban and Regional Planning Program, University of Sydney, *The Karuah Highway Bypass – Economic and Social Impacts, the 1- year report*, prepared for NSW RTA, November 2005.

3.1.5 Environmental issues

Biodiversity

Terrestrial ecology

The ecological issues that were considered important to the development of the project included:

- Minimising the clearing of areas of high-quality native vegetation.
- Minimising the direct impact to areas identified as comprising endangered ecological communities.
- Minimising direct impact to threatened species habitat.
- Maintenance of fauna movement corridors.

Aquatic ecology

The aquatic ecological issues that were of particular importance to the development of the project included:

- The location and design of watercourse crossings to meet NSW Fisheries Guidelines.
- Minimising the extent of loss of riparian vegetation.
- Minimising disturbance to surrounding fish habitat and areas of oyster leases.
- Minimising the extent of local flooding and drainage changes that could impact on floodplain habitat and ecological processes.
- Minimising disturbance to potential acid sulphate soils during construction which, if not properly managed, could have an adverse impact on water quality and hence on aquatic ecology.
- Minimising impact to threatened species such as black cod (*Epinephelus daemelii*) and green sawfish (*Pristis zijsron*) which may occur in, or encroach on, the investigation area.

Heritage

Aboriginal heritage

The investigation area lies within the Unkya, Bowraville, Nambucca Heads and Coffs Harbour Local Aboriginal Land Council areas. Other relevant groups include the Gumbular Juliri and Gumbangerii Elders groups. A number of sites and areas of significance or sensitivity for Aboriginal cultural heritage occur in the investigation area. The majority of these sites are located to the west of Macksville. An objective in the development of route options within the study area was to avoid and/or minimise direct impact on significant Aboriginal sites and areas.

Non-Aboriginal heritage

A number of non-Aboriginal heritage sites occur in the study area. Two items at Macksville are listed on the Nambucca local environmental plan Schedules. There are no heritage items listed on the local environmental plan Schedules of Bellingen Shire Council, although a number of items have been identified by the council as Conservation Areas and nine of these are located within the investigation area. Congarinni Village, to the west of Macksville was identified as potentially significant with three sites (two of local and one of potential State significance) identified in this area. These sites were considered as constraints in the development and assessment of route options for the project.

Water quality

The investigation area is characterised by two major water courses, the Nambucca and the Kalang Rivers and their associated tributaries. The majority of the waterways are estuarine, dominated by saline conditions. Water quality investigations indicated that waterways in the study area have water quality characteristics consistent with predominantly rural catchments. The investigations did not identify any parameters that would particularly influence route selection.

Flooding and drainage

The Nambucca and Kalang Rivers and Warrell Creek are broad systems with extensive floodplains. Deep Creek is also an important waterway, although with a significantly smaller catchment area.

Nambucca River

The Nambucca River and floodplain has experienced significant flooding with 20 flood events recorded in the past 100 years. Investigations into the assessment of route options concluded that the maximum increase in 1 in 100 year ARI flood levels due to any of the route options to the east of Macksville would be less than 50millimetres in the Nambucca River downstream of Macksville and less than 30millimetres in Gumma swamp. These increases occur immediately upstream of the route options and would not affect flood flows or flood levels in Macksville.

Warrell Creek

Warrell Creek is a major tributary of the Nambucca River. The two watercourses meet immediately upstream of the Nambucca River entrance near the town of Nambucca Heads. During concept design any proposed crossings of the Warrell Creek floodplain would be designed with the objective of achieving a maximum increase in flood levels upstream of the Proposal of less than 50millimetres.

Kalang River

The Kalang River is the major tributary of the Bellinger River and the two rivers meet near the town of Urunga. Investigations found that any of the proposed crossings of the Kalang River floodplain could be designed to achieve maximum increases in flood levels upstream of the route options of approximately 50millimetres.

Air quality

While residents adjacent to the Proposal would potentially experience a decrease in air quality, residences adjacent to bypassed sections of the existing highway would potentially experience an improvement in air quality.

In late 2005 and early 2006, the RTA undertook air quality monitoring adjacent to the highway at Korora, north of Coffs Harbour. This was the first air quality monitoring conducted for the Pacific Highway Upgrade program and is understood to be the first air quality monitoring conducted on the NSW North Coast. The monitoring conformed to Australian Standards.

As outlined in the Department of Environment and Climate Change's (DECC) (previously Department of Environment and Conservation) *Action for Air: 2006 Update*, NSW has adopted the national standards and goals in the National Environment Protection Measure for Ambient Air Quality (Air NEPM) which was issued in 1998.

For the key parameters measured at the Korora monitoring site (carbon monoxide (CO), nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$)), the recorded air quality was better than the NSW goals for ambient air quality.

The air quality monitoring station was located approx 20metres from the edge of the existing 4-lane dual-carriageway highway. The signposted speed limit on this section of the highway is 100 km/h. This section of the highway is on a gradient of 5.2 per cent. While 2006 Annual Average Daily Traffic of this section of the highway is approximately 20,500 vehicles per day, the air quality monitoring at Korora included the 2005/06 Christmas/New Year holiday period when traffic volumes were significantly higher than annual average traffic volumes.

In terms of traffic volumes, signposted speed limit and gradient, the highway opposite the Korora monitoring site represents a "worst-case" scenario for the proposed upgrade of the highway. Consequently, air quality at the Korora monitoring site represents the expected "worst-case" scenario for air quality along the proposed highway corridor.

The results of the air quality monitoring at the Korora monitoring site indicate that ambient air quality along the Proposal would meet or exceed the NSW goals for ambient air quality.

Noise

The acoustic amenity of the investigation area is influenced by the Pacific Highway where existing traffic noise levels at the closest residential receivers are predicted to already exceed DECC base criteria for "new" or "redeveloped roads". Noise levels away from the existing highway and within towns and villages would generally be low, particularly at night.

The investigation area has a large number of residential buildings, some of which are clustered together in developments, while those in rural areas are generally more widely dispersed. Any option to upgrade the Pacific Highway within the investigation area would result in potential new or increased noise impacts to nearby residences and to other sensitive receptors such as schools, churches and hospitals. The development of the route options was undertaken with this in mind and aimed to avoid large areas of residential development as much as practicable.

Geology and soils

Two major geological terrain units occur in the investigation area and include significant areas of floodplains as well as hills.

Floodplains dominate the southern and northern parts of the investigation area. In this type of terrain the road would probably be carried on fill embankments. A key geotechnical issue for the proposed upgrade is the presence of low strength and highly compressible soils of alluvial and estuarine origin that underlie the relatively low-lying floodplains. The embankments will cause settlement of the compressible foundation soils during and following construction. These soils would impact on the design of the upgrade, the time that is needed to construct the road, the cost of its construction and the techniques required to manage the embankment fill materials during construction.

The construction of the pavement on the top of the embankment will not commence until there is a low risk of future settlement of the foundation soils causing damage to the pavement. This will require the selection of a suitable pavement type and may mean that additional time is needed after completion of construction of the embankment for additional foundation settlement to occur.

Deep compressible, alluvial and estuarine soils are expected at most of the river crossings. Bridges will most likely be supported on piles founded on rock. As fill embankments on the highly compressible soils on the floodplains will settle, bridge approach treatment will be needed to provide a smooth transition between the bridges and embankments on floodplains.

The soils underlying the floodplains are expected to be potential acid sulphate soils. Techniques are available to manage these soils during construction.

Roads in hilly terrain would require cuts through soil and rock. Most material excavated from cuttings is expected to be relatively low quality, but suitable for general embankment fill.

3.2 Route options development and assessment

This section of the Application summarises the development and assessment of route options for the project. Details of the process involved in the identification of the study area, selection of route options and the selection of the preferred route for the Macksville to Urunga section of the project are contained in *Macksville to Urunga, Upgrading the Pacific Highway – Preferred Route Report* published in November 2005. Details of the review of the preferred route for the Warrell Creek section of the project are contained in the *Draft Warrell Creek Review Report* published in July 2007. Both reports are available on the project website.

3.2.1 Macksville to Urunga section

The investigation area for the Macksville to Urunga section was notionally divided into four sections to allow more detailed assessment of constraints and identification of route options to be undertaken. Based on the initial constraints analysis, up to six possible route options were identified in each section. Feasible route options in each were short-listed for further investigation and displayed for community comment. The option of upgrading the existing highway through Macksville, Nambucca Heads and Urunga is not acceptable due to the impacts on these towns.

3.2.1.1 Description of route options

The short-listed options that were identified and evaluated as part of the project are shown on **Figure 3-3** and are briefly outlined below.

Section 1 – Albert Drive, Donnellyville to Nambucca River

Five options were developed in this section (1a, 1b, 1c, 1d and 1e). All were located to the east of Macksville's main commercial and residential areas and provide a new dual-carriageway bypass of Macksville.

Section 2 – Nambucca River to North Coast Railway Line west of Nambucca Heads

Three options were identified in this section (2a, 2b and 2c). These converge to a common alignment in the vicinity of Old Coast Road south of Nambucca State Forest. All options provide a new dual carriageway bypass of Nambucca Heads.

Section 3 – North Coast Railway Line west of Nambucca Heads to Mines Road, south of Urunga

As the area between Nambucca Heads and South Urunga is highly constrained by wetlands to the east and significant forested areas to the west, Section 3 of the investigation area is narrow and the only option in this section (Route 3a) involves upgrading the existing highway alignment.

Section 4 – Mines Road, south of Urunga to Raleigh deviation

Three options were developed in this section of the investigation area (4a, 4b and 4c). All would provide a new dual-carriageway bypass of Urunga.

Options to the west of Macksville

During the initial public information days, some sections of the community suggested that options to the west of Macksville should also be investigated due to concerns associated with potential flooding impacts in the areas to the east. The RTA decided to undertake a desk-top study of an option west of Macksville, as part of the overall project investigation.

The desk top study progressed to the development of two options to the west of Macksville (W6 and W7) to be considered as part of the route option assessment process. A number of preliminary environmental studies were also undertaken to assess the potential impacts of these options.

3.2.1.2 Evaluation of route options

Detailed analyses of engineering, environmental, social and economic considerations were undertaken to establish which route options best met the needs of road users and the community. Geotechnical investigations and field investigations for terrestrial ecology, aquatic ecology, Aboriginal and non-Aboriginal heritage, flooding and drainage studies were also carried out.

The information gathered enabled a comparison to be made between the corridors to the east and west of Macksville.

The route options are documented in a number of key reports. These include the *Draft Route Options Development Report* (RTA 2004) and *Draft West of Macksville Options* (RTA, 2004). Another document, *Route Options Submissions Report* (RTA 2005) outlines the main issues raised by the community as a result of the public display of the route options.

A value management workshop was held in April 2005 to consider the options. The workshop participants represented a broad range of community areas and organisations, Nambucca and Bellingen Shire Councils, government agencies and members of the project team. The workshop assessed the feasible options against the project objectives and agreed functional, social, economic and environmental criteria. The findings of the value management workshop were reported in Appendix A of the *Macksville to Urunga Preferred Route Report* (RTA, 2005).

The workshop process was highly structured in order to deliver the required outcomes within the time available. The focus for the first day of the workshop was to provide an understanding of the various viewpoints and opinions held by the workshop participants, develop a series of selection criteria for the evaluation of the options and to weight the criteria according to the agreed relative importance or priority of each criterion. A sensitivity analysis of some of the scores was undertaken to determine the impact of the relative weightings.

The second and third days were used for decision making. The second day focused on the available options for the southern part of the study area - Sections 1 and 2 of the original investigation area and the options to the west of Macksville. The third and final day of the workshop was dedicated to the analysis of the options in Section 4. Section 3 was not considered at the workshop as the only feasible option for that section is Option 3a which involves upgrading along the existing highway.

The key outcomes of the workshop were:

- Consensus that options located in the original study area to the east of Macksville were preferred over options to the west of Macksville.

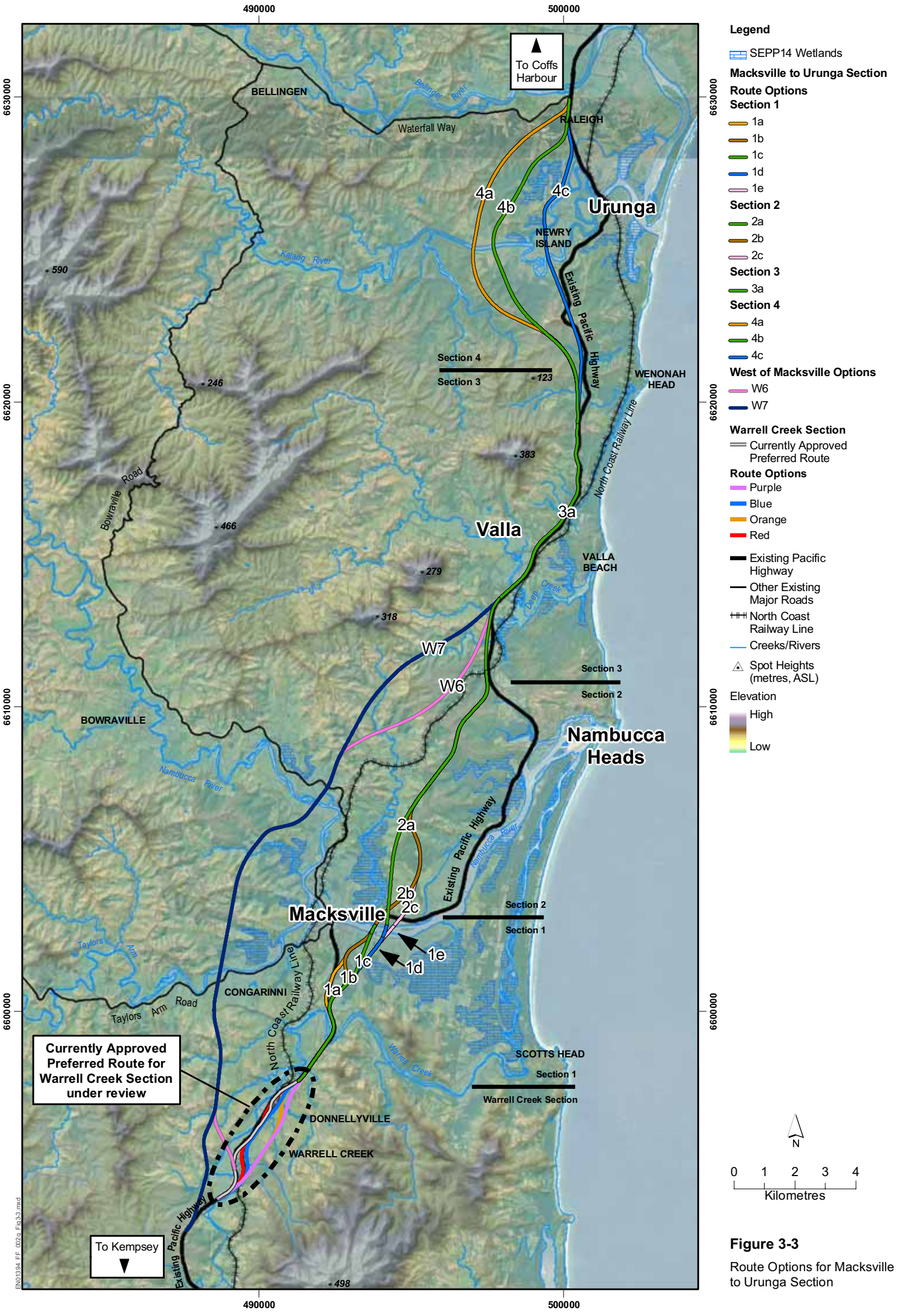


Figure 3-3

Route Options for Macksville to Urunga Section

- Recommendation of Option 1c, 2a, 3a and 4b as the preferred route for the project.

An important outcome of the value management workshop was the identification of a number of suggested refinements to the recommended route. These suggestions were considered as part of the refinements undertaken for the recommended route and are discussed in Section 4 of this Report.

3.2.1.3 Selection of the preferred route

After an extensive period of route planning and assessment the preferred route for the Macksville to Urunga section of the project was identified and publicly exhibited as a combination of Options 1c, 2a, 3a and 4b on the basis that it:

- Is the route recommended by the value management workshop and subsequent reviews.
- Best meets the objectives of both the Pacific Highway Upgrade Program and the Warrell Creek to Urunga project.
- Provides the best outcome in terms of road safety and transport efficiency.
- Provides for the ultimate grade separation of the Pacific Highway and local road intersections including consolidation of accesses by the use of local access roads.
- Provides efficient connections from the upgraded highway to the key centres of Macksville, Nambucca Heads and Urunga through the construction of interchanges.
- Provides the best overall balance across functional, ecological, social and economic considerations.
- Provides reasonable physical separation from existing and proposed residential areas so that, with sensitive urban design, acceptable visual and traffic noise outcomes could be achieved.
- Can be designed to minimise property impacts.
- Has minimal impact on existing flooding and drainage flows.
- Has relatively minor biodiversity impacts compared to other options considered – the impacts are expected to be at a level that can be effectively managed.
- Has minimal impacts on Aboriginal heritage sites/areas and non-Aboriginal heritage items.
- Enables construction staging opportunities to be realised.
- Is the lowest cost option and provides a benefit – cost ratio at or near the upper end of the range achievable from the route options available.

3.2.2 Warrell Creek section

3.2.2.1 Review of the Warrell Creek section

Following the announcement of the preferred route for the upgrade of the highway between Macksville and Urunga in November 2005, a review was carried out on the 5 kilometre section of highway between the southern end of the upgrade and the northern end of the Allgomera deviation (the 5 kilometre section is referred to in this report as the Warrell Creek section).

The preferred route for the Warrell Creek section was selected and designed in the late 1990s to a standard earlier than that proposed for current upgrades of the Pacific Highway. The route and design for the Warrell Creek section was reviewed to determine if it provides an appropriate connection between the existing Allgomera deviation and the Macksville to Urunga Upgrade, as well as meeting current design and environmental standards. The review found that the late 1990s route and design for the upgrade would need to be modified to meet current design standards for the

Pacific Highway. The review also found that the design would have significant noise impacts on the village of Warrell Creek and would need to be substantially modified to meet current noise guidelines.

In response to the outcomes of the review, a number of options for the Warrell Creek section were developed. The new route options were assessed against a range of functional, environmental, social, economic and cost considerations. Comments received from government agencies, Nambucca Shire Council and the community were considered during the identification of the options.

3.2.2.2 Review process

The review of the Warrell Creek section has involved the following steps:

- Review of currently approved design for the Warrell Creek section.
- Assessment of the adequacy of the currently approved design.
- Stakeholder consultation including a community information evening to identify community interests, issues and concerns and a planning focus meeting with government agencies and Nambucca Shire Council.
- Site visits and preliminary ecological, heritage, traffic, geotechnical and other investigations.
- Development of feasible route options.
- Shortlisting of route options.
- Assessment of shortlisted route options.

3.2.2.3 Development of route options

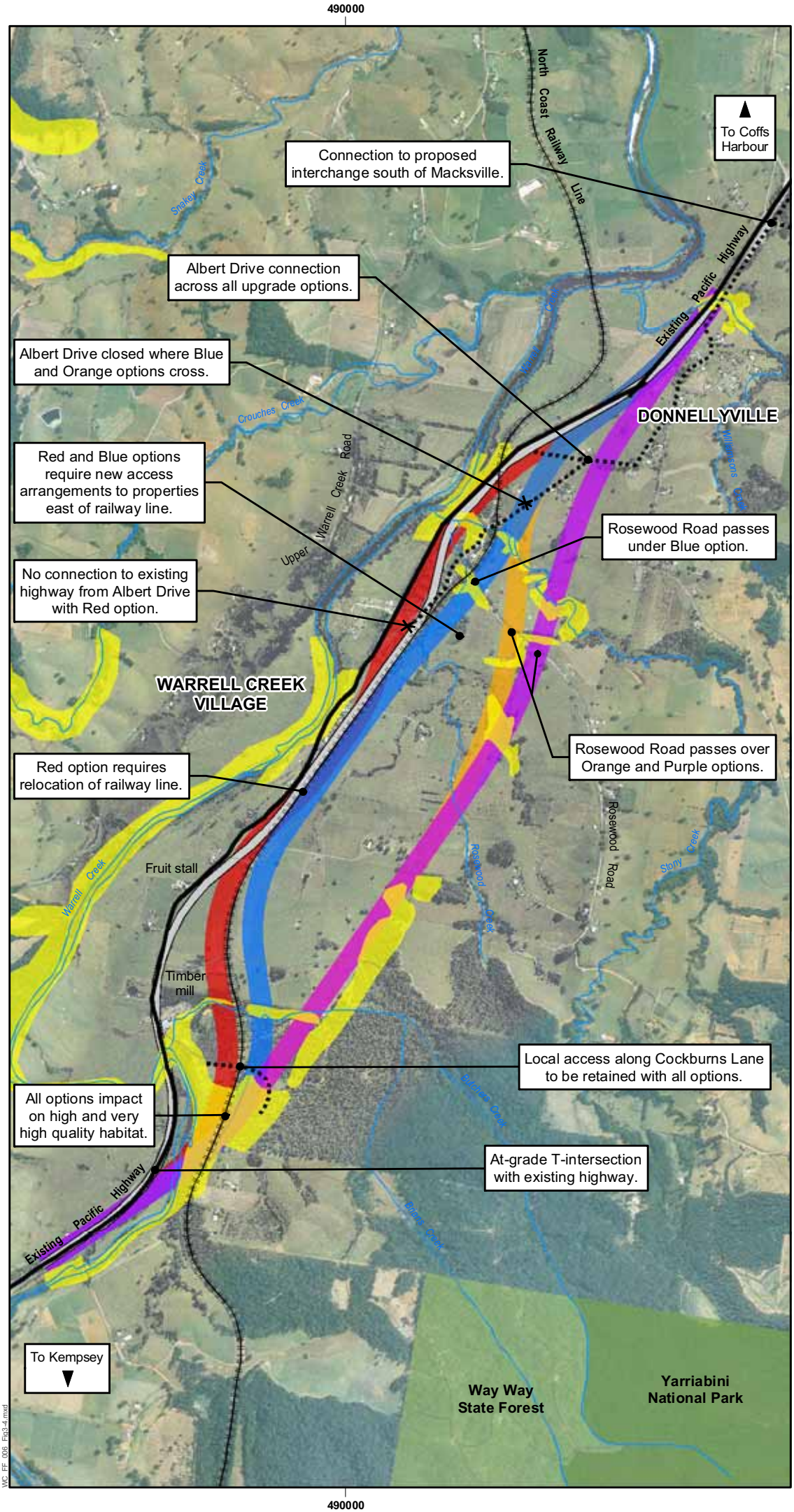
Desktop studies and field investigations were undertaken to identify possible constraints to building a highway through the study area. Comments received from government agencies, Nambucca Shire Council and the community were considered during the identification of route options.

A value management methodology was adopted to assess the route options against a range of functional, environmental, social, economic and cost considerations. The assessment identified a shortlist of the four most feasible routes. The options are summarised in **Appendix B** and shown in **Figure 3-4** below.

3.2.2.4 Assessment of short-listed options

A workshop was held to assess the merits of the four short-listed route options. The key conclusions of the assessment were:

- As the study area is primarily used for residential and farming purposes, the extent of very high and high quality habitat is limited. Most of the native flora and fauna located on the eastern side of Warrell Creek is in the south of the study area.
- Overall, the Red Option (a modification of the 1990s route) was the poorest performing option as it provides little change to existing noise levels at Warrell Creek village, requires the most acquisition of houses, would require new arrangements to provide access to properties east of the upgrade at Warrell Creek village and has the most construction difficulties. The Red Option is also the most expensive.



Legend

Warrell Creek Section

- Currently Approved Preferred Route

Route Options

- Blue Option
- Orange Option
- Red Option
- Purple Option
- High quality and very high quality habitat
- National Park
- State Forest
- Local Access Route
- Existing Pacific Highway
- Other Existing Major Roads
- North Coast Railway Line
- Creeks/Rivers

Aerial Photography:
Date Flown - 5th March 2006

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Figure 3-4

Short Listed Route Options from Review of the Warrell Creek Upgrade

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- While the western (Red and Blue) options would have less impact on farming properties than the eastern (Orange and Yellow) options, they would provide little change to existing noise levels at Warrell Creek village, would require new arrangements to provide access to properties east of the upgrade and have more construction difficulties than the eastern options.
- Of the two eastern options, the Purple Option was assessed as performing better than the Orange Option as Albert Drive would continue to connect Warrell Creek village and Donnellyville, it would have fewer construction difficulties and slightly lower noise impacts that the Orange Option. The Orange Option is also the more expensive than the Purple option.
- The Purple Option would have the least noise impacts of any of the options. It would result in the least change to access arrangements and would have the least construction difficulties. The Purple Option is also the least expensive.

The Purple Option was considered to be one of the best performing option overall and provided the best value for money. On balance, it was considered to have more merit than the other options.

3.2.2.5 Next steps

The proposed next steps for the Warrell Creek Upgrade are to:

- Seek and consider community comments on the route option considered to have the most merit.
- Determine and announce the outcomes of the review of the Warrell Creek section.
- Include the outcomes of the review in the environmental assessment of the upgrade of the highway between Warrell Creek and Urunga.