Warrell Creek to Urunga
Upgrading the Pacific Highway

ENVIRONMENTAL ASSESSMENT

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4. Alternatives considered and route development

This chapter describes the alternatives that were considered during the development of the Proposal and the selection of the preferred route.

Director-General's requirements	Where addressed in the EA	
Project Justification – describe the need for and objectives of the project; alternatives considered (including the assessment of the environmental costs and benefits of the project relative to alternatives), and provide justification for the preferred project (including interchange locations) taking into consideration the objects of the *Environmental Planning and Assessment Act 1979*.	Section 3.2	Need for the Project
	Section 3.3	The "do nothing" option
	Section 3.4	Proposal objectives
	Section 3.5	Statement of strategic need
	Section 4.1	Route planning and development process
	Section 4.3	Macksville to Urunga
	Section 4.4	Warrell Creek options
	Section 4.5	Interchanges
	Section 4.6	Alternatives considered
	Section 4.7	Conformation of the Proposal as the preferred option
	Section 20.1	Cumulative and synergistic impacts
	Section 20.3	Relationship between the proposed upgrade and the Objectives of the EP&A Act
	Section 20.4	Conclusion

4.1 Route planning and development process

Planning for the Proposal, as part of the Pacific Highway upgrade, began in June 2003.

Figure 4-1 and Figure 4-2 provide a chronology of the process used for route development for this Proposal. One of the key objectives of the Pacific Highway Upgrade Program is to ".... manage the Program in accordance with ecologically sustainable development principles." A robust route development process provides significant opportunity to address sustainability issues by avoiding significant impacts where practicable. Where it is not practicable to avoid these constraints, the route development process can enable minimisation of impacts through effective route refinement and selection.

An extensive process of constraints identification, route development, consultation and route refinement has been undertaken. The results of this are explained in more detail in the following sections.

The route development process evolved over time and in response to suggestions from the community. It initially started with the intent of developing and assessing route options between Macksville and Urunga. It then looked at community options to the east and west of Macksville that extended further south than the boundary of the initial study area. When the preferred route was identified for the Macksville to Urunga section, it necessitated a review of the Warrell Creek section and resulted in the subsequent inclusion of that section in the overall Proposal.

Public exhibition of the preferred route also generated suggested potential alternative routes from sections of the community. These were reviewed and assessed against the criteria used to identify the preferred route and resulted in the refinement of the preferred route option. Additionally, alternatives or options were developed for the location of interchanges to provide effective access to and from the Proposal.

These iterations of options identification and options assessment are described in the following sections. The resultant preferred Proposal is described in Chapter 6 – *Description of the proposal*.

The various route options which were considered during the development of the Proposal were reviewed and compared against specific measurable criteria to ensure equitable consideration of the functional requirements of the Proposal and the social, environmental and economic goals. These criteria were developed specifically for this Proposal and considered community values obtained through the various consultations with the community described in Chapter 5 – *Community consultation*.

The route development process for the Proposal has been described in the following publicly available documents:

- *Draft Route Options Development Report* (RTA 2004a) – Described the route selection process and feasible route options developed for the Macksville to Urunga section.
- *Draft Assessment of West of Macksville Route Options Report* (RTA 2004b) – Described route options developed in response to a request from sections of the community and the Macksville Chamber of Commerce.
- *Draft Route Options Submissions Report* (RTA 2005a) – Provided a response to written submissions received on the route options for the Macksville to Urunga section.
- *Preferred Route Report* (RTA 2005b) – Described the preferred route for the Macksville to Urunga section and the selection process which determined it.
- *Warrell Creek to Urunga Part 3A Project Application Report* (RTA 2007a) – Prepared for the Director-General of the Department of Planning to accompany the project application.
- *Macksville to Urunga Preferred Route Submissions Report* (RTA 2007b) - Provided a response to written submissions received on the route options for the Macksville to Urunga section, and also provided a detailed response to community suggested options in the Old Coast Road area.

- *Draft Warrell Creek Review Report* (RTA 2007c) - Described the route selection process and feasible route options developed for the Warrell Creek section of the Proposal.
- *Warrell Creek Review Report* (RTA June 2008a) - Described the preferred route for the Warrell Creek section and the selection process which determined it.

4.2 Identification of constraints

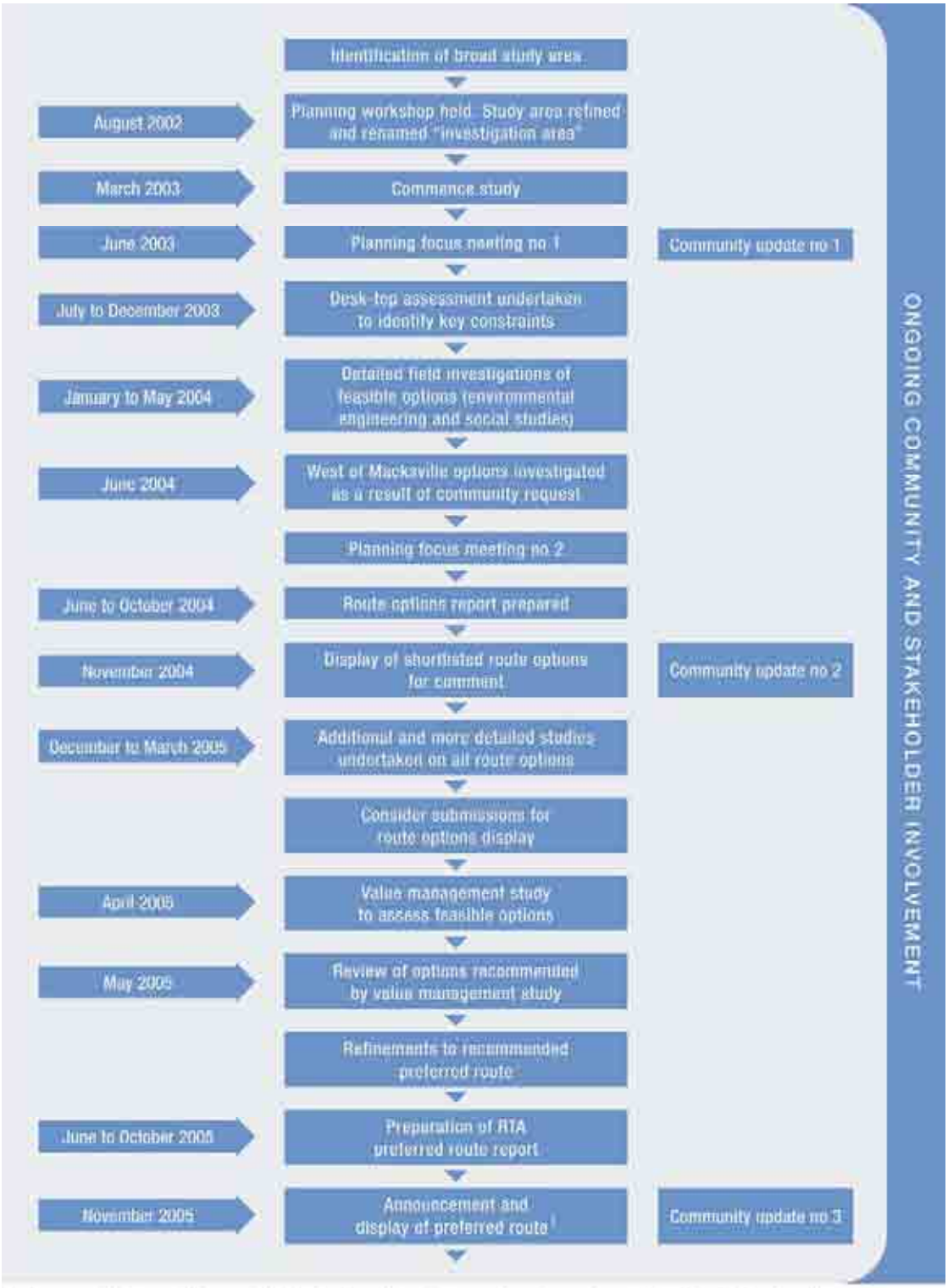
An initial investigations area for the Macksville to Urunga section was defined in June 2003 at a planning focus meeting that included representatives from local government and state government agencies. The shape of the investigation area was influenced by significant environmental, social and topographical constraints. This investigation area was presented to the community in June 2003 to provide community members with an opportunity to comment and identify additional key constraints within the study area. This information was combined with aerial photography and digital constraints mapping information from a range of data sources, including state government agencies and both Nambucca and Bellingen Shire Councils and was supplemented with field investigations throughout the investigation area, both as a verification mechanism and to enhance the desktop assessment. Identified constraints in the investigations area included:

- Existing and proposed urban and rural residential development and industrial and commercial lands.
- Location of watercourses and designated wetland areas.
- Areas of ecological sensitivity, for example endangered ecological communities.
- Items and sites of Aboriginal heritage significance (previously identified items and sites of Aboriginal heritage significance).
- Areas of potential archaeological sensitivity where further investigation is required. Areas of flood prone land.
- Topographical features and geotechnical conditions.
- Environmental protection zones associated with state forests.

Constraints mapping was developed to provide input to the ongoing engineering concept development of possible highway corridors and route options. The Macksville to Urunga study area was divided into four sections to allow for a more detailed assessment of constraints. These sections are further described in Section 4.3.1. The process for the identification of the preferred route for Macksville to Urunga can be seen in Figure 4-1.

The southern end of the Macksville to Urunga route options linked to the previously approved preferred route for the Warrell Creek upgrade. Approval for this section was granted in the 1990s to an earlier standard than that proposed for current upgrades of the Pacific Highway. A review of the route approved in the 1990s identified that the design would need to be modified to meet current design standards for the Pacific Highway and provide an appropriate connection between the existing Allgomera deviation and the Macksville to Urunga upgrade.

Figure 4-1 Identification of preferred route for Warrell to Urunga



1. As a result of one of the east of Macksville options being preferred, a review of the Warrell Creek section was required to ensure a consistent design standard to connect with the Allgomera deviation.

In addition to typical constraints for options development as noted above, further constraints specific to the Warrell Creek area include:

- Potential noise impacts as a result of more stringent criteria and assessment guidelines being adopted by government agencies.
- Impact on properties and severance of agricultural land.
- Presence of endangered ecological communities.
- The existing North Coast Railway line.
- Visual impacts from surrounding residences.

The Warrell Creek section forms part of the Proposal and is described in Section 4.4.1. The process for the identification of the preferred route for the Warrell Creek section can be seen in Figure 4-2.

4.3 Macksville to Urunga

4.3.1 Identification of route options

Initially, broad corridors were developed to avoid or minimise impacts on key constraints within the investigation area. Key constraints in terms of topography and ecology are shown in Figure 4-3 and Figure 4-4 respectively. Constraints information was verified through initial investigations in the field, which also resulted in the identification of additional constraints. These were used in the further development of options. Where practicable, further modifications were then made to minimise potential impacts on communities and sensitive environmental areas.

The investigation area included a large number of dwellings, some of which are clustered, while others are more widely dispersed. Any option to upgrade the Pacific Highway within the investigation area would result in potentially new or increased noise impacts to nearby dwellings and other sensitive receptors such as schools, churches and hospitals. The development of route options was undertaken with this in mind and aimed to avoid large areas of residential development as much as practical, while also achieving the objectives of the Proposal.

The option of upgrading the existing highway through the townships of Macksville, Bellwood, Nambucca Heads and Urunga was investigated. However, it was not considered acceptable due to the potential impacts on the large number of residential and commercial properties within these towns, particularly during construction.

4.3.2 East of Macksville options

Section 1

Section 1 of the investigation area extended from the northern end of the then proposed Warrell Creek realignment to the northern bank of the Nambucca River at Macksville. This was later extended to the northern end of the Allgomera deviation following the decision in November 2005 to review the previously approved preferred route for the adjacent Warrell Creek upgrade (see Section 4.4).

Figure 4-2 Route options development for Warrell Creek and the environmental assessment process

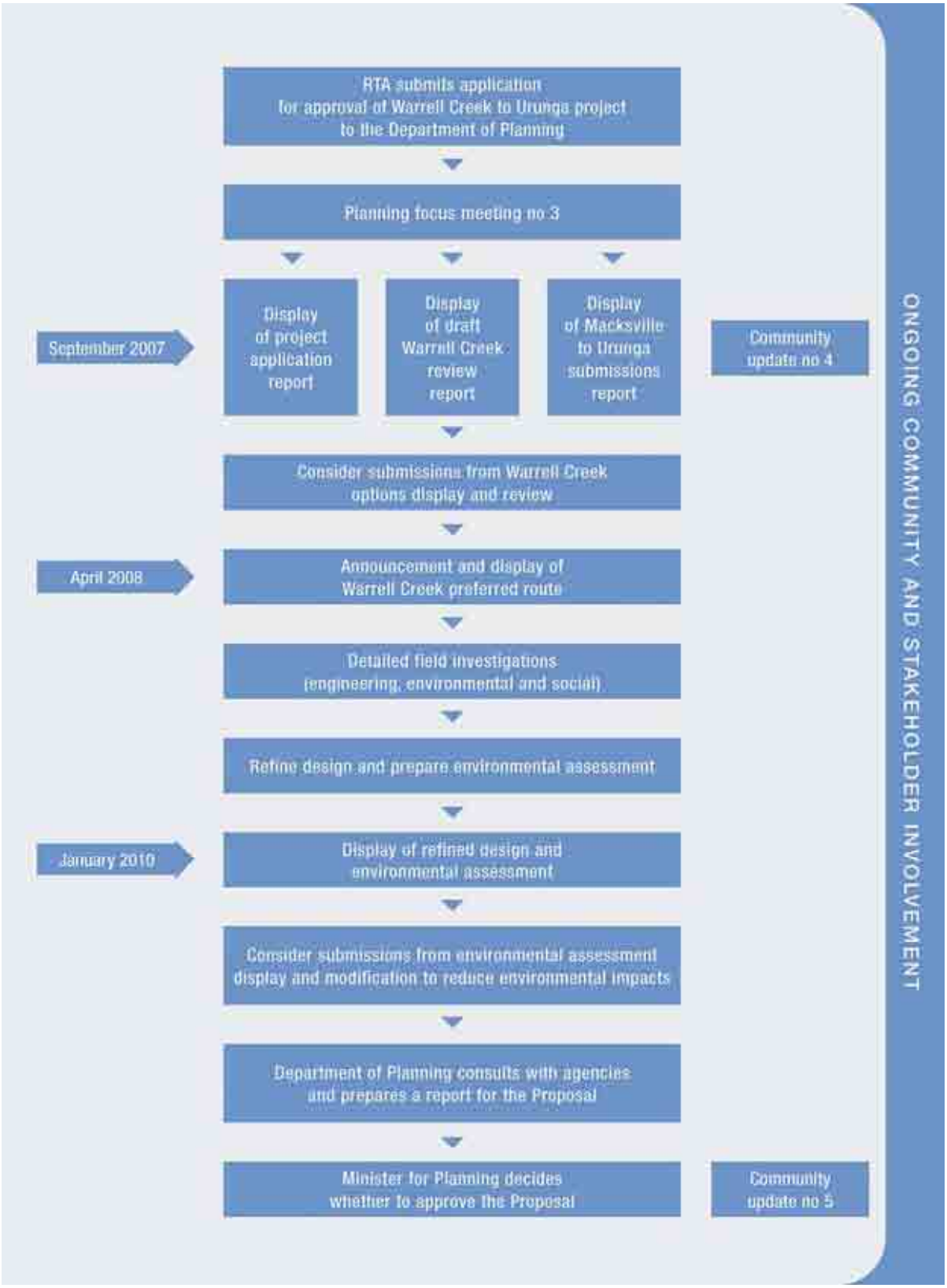


FIGURE 4-3 | TOPOGRAPHICAL CONSTRAINTS AND ROUTE OPTIONS

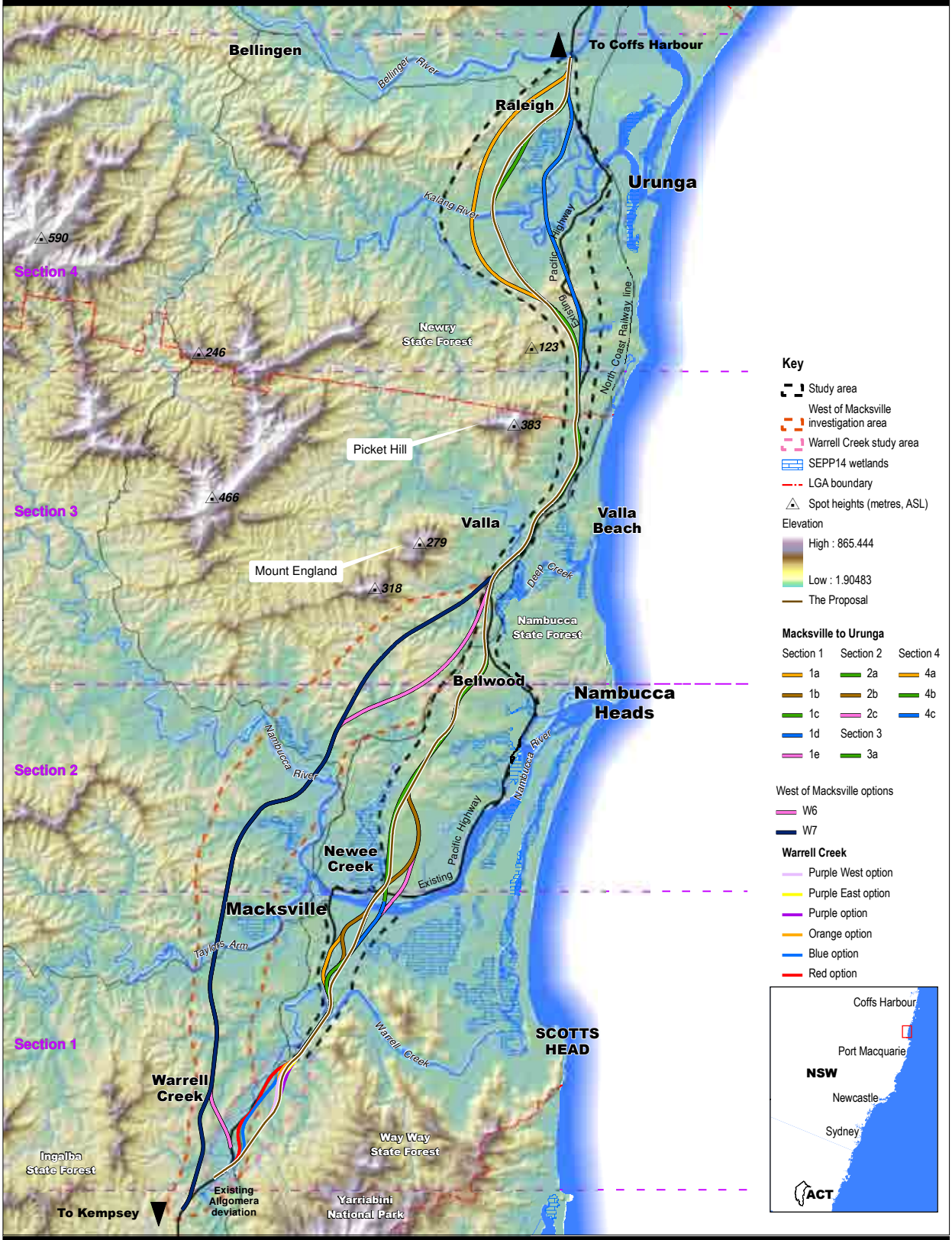
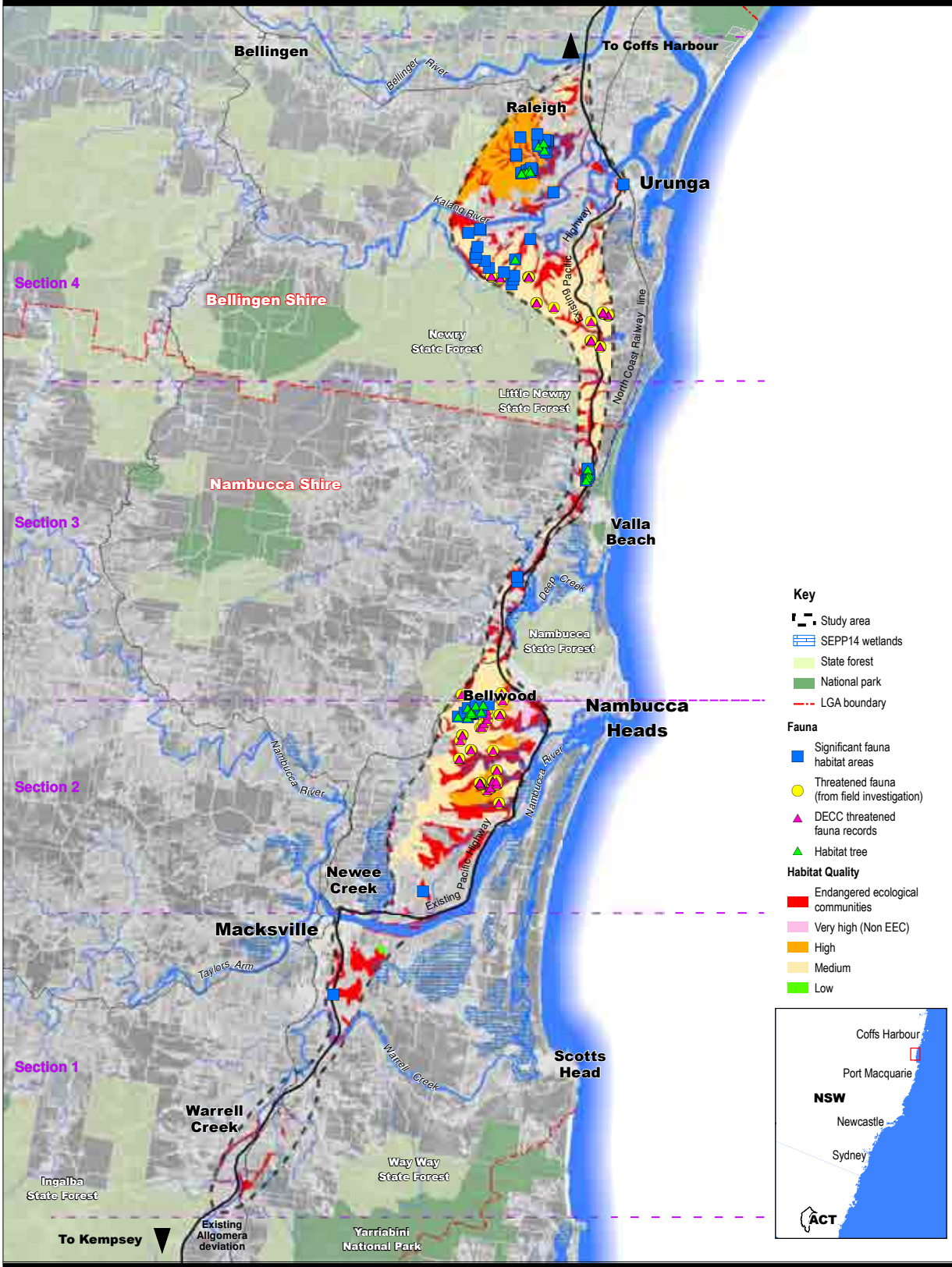


FIGURE 4-4 | ECOLOGICAL CONSTRAINTS



Five options were developed in Section 1 of the study area, all of which were east of Macksville's main commercial and residential areas. The options shared a common alignment at the southern end of the study area from Albert Drive, Donnellyville, to where Bald Hill Road joins the existing Pacific Highway. This common alignment extended for a distance of approximately 2.5 kilometres. All options provided a new dual carriageway bypass of Macksville. The options are described in Error! Not a valid bookmark self-reference. and depicted in Figure 4-3.

Table 4-1 Description of options in Section 1

Option	Brief description
1a	Option 1a maximised the use of the existing Pacific Highway alignment. It was located as close as feasible to the existing highway up to Macksville and avoided impacts on residences along Bald Hill Road and Wedgewood Drive. Option 1a involved the duplication of approximately 4 km of the existing Pacific Highway from Albert Drive, Donnellyville, to just south of Macksville. It then traversed the Nambucca River floodplain to the east of Macksville in a north-easterly direction for approximately 2.4 km, prior to crossing the Nambucca River.
1b	This option commenced at Albert Drive, Donnellyville, and then veered from the existing highway approximately 400 metres south of its intersection with Bald Hill Road. It travelled north-east for a distance of about 1 km, veering north for a length of 1.2 km to avoid wetlands and areas of high habitat quality, and then followed a similar alignment to Option 1a, prior to crossing the Nambucca River.
1c	Option 1c commenced at Albert Drive, Donnellyville, sharing a similar alignment to Option 1b for approximately 3.5 km and then traversed in a north-easterly direction, passing close to SEPP 14 Wetland No. 388 and mostly avoiding the adjacent vegetation. Option 1c passed close to the western side of Macksville sewage treatment plant site. Options 1c, 1b and 1a all crossed the Nambucca River at the same location immediately downstream of the confluence with Newee Creek.
1d	Option 1d commenced at Albert Drive, Donnellyville, and followed the alignment of Option 1c prior to traversing in a north-easterly direction, passing close to SEPP 14 Wetland No. 388 and bisecting the southern portion of the Macksville sewage treatment plant site. The alignment allowed for a crossing of the Nambucca River just to the east of the sewage treatment plant and Option 1a, 1b and 1c.
1e	Option 1e followed the same alignment as Option 1d for most of its length. At its northern end, approximately 100 metres south of the river, it veered further to the east than Option 1d. The alignment would require a skewed bridge crossing of the Nambucca River. This bridge arrangement provided for an option in Section 2 (Option 2c) that was to the east of rural residential development north of the Nambucca River.

Section 2

Section 2 of the investigation area extended from the northern bank of the Nambucca River to where the existing Pacific Highway crosses the main North Coast Railway Line, west of Nambucca Heads. This section of the study area is characterised by scattered rural residential development along the Old Coast Road and rural residential estates (such as Kingsworth Estate located to the north of Watt Creek). The existing highway is located along the southern and eastern boundary of the investigation area in this section and follows the Nambucca River from Macksville to Nambucca Heads. It is primarily single carriageway with limited overtaking opportunities.

Section 2 included the town of Bellwood, which is located on the urban fringe of Nambucca Heads. Bellwood is generally located west of the existing Pacific Highway and incorporates an Aboriginal reserve, shopping centre and low density residential development. There are also commercial and tourist developments along the highway, including motels, service stations and takeaway food premises.

A large portion of Section 2 comprised the Nambucca State Forest. Six gazetted SEPP 14 coastal wetlands exist within or in close proximity to this section of the investigation area, the majority of which are located within the north-eastern portion of the section. All options provided a new dual carriageway bypass of Nambucca Heads. The options developed for Section 2 are described in Table 4-2.

Table 4-2 Description of options in Section 2

Option	Brief description
2a	Option 2a would involve the construction of 9.3 km of new dual carriageway from north of the Nambucca River east of Macksville to where the highway crossed the North Coast Railway Line west of Nambucca Heads. It generally followed a ridgeline in the vicinity of Old Coast Road. Option 2a traversed north from the Nambucca River closely following Old Coast Road in an approximate north-south direction. Option 2a avoided impact on the Newee Creek wetland (SEPP 14 Wetland No 383).
2b	Option 2b would involve the construction of 9.7 km of new dual carriageway from north of the Nambucca River east of Macksville, to where the existing highway crossed the North Coast Railway Line west of Nambucca Heads. Option 2b avoided impact to the Newee Creek wetland (SEPP 14 Wetland No 383). This option crossed Old Coast Road near the existing Pacific Highway then traversed low lying land at the fringe of the floodplain, west of Watts Creek, in a new dual carriageway formation on fill. It joined Option 2a approximately 3.5 km north of the existing Pacific Highway.
2c	The southern portion of Option 2c was further east than Option 2b. While Option 2c avoided impacts on rural residential development in the southern section of the Old Coast Road area north of the river, it increased the impacts on the caravan park on the southern side of the existing highway. Option 2c was located in its southern section to follow property boundaries as much as possible. It joined Option 2b approximately 1.7 km north of the existing Pacific Highway, sharing its finish point with Options 2a and 2b. This option would involve the construction of 9.3 km of new dual carriageway.

Section 3

This section of the investigation area is relatively narrow (less than one kilometre wide) and extended from the existing highway crossing of the North Coast Railway Line, west of Nambucca Heads, to Little Newry State Forest in the vicinity of Mines Road, south of Urunga. This section passes through a series of gently undulating coastal hill slopes separated by a series of creek lines associated with Cedar, Boggy, Cow, Deep and Oyster creeks.

Existing rural residential development occurs on either side of the existing highway and was specifically zoned as such between the existing highway and the North Coast Railway Line, in the vicinity of Cow Creek and around East West Road. Nambucca Shire Council identified future urban land in the vicinity of the Boggy Creek/Cow Creek area.

Option 3a was considered the only feasible route option for this section of the investigation area due to topographical constraints. This option involved the construction of a new dual carriageway highway to the west of the existing highway. The existing highway would be utilised as a local service road, with some realignment and modifications required.

Section 4

Section 4 of the investigation area extended from Mines Road, south of Urunga, to the southern end of the existing dual carriageway at Waterfall Way, Raleigh (Raleigh deviation), a distance of 11 kilometre. The Urunga urban area

is located south of the Kalang River on the eastern side of this section of the investigation area. It comprises low density residential development, with some commercial and industrial uses along the existing highway alignment. Residential development also occurs at the northern end of Newry Island and rural residential development is centred along South Arm Road and Short Cut Road.

The Raleigh industrial area is the only industrial land within this section of the study area. Substantial further development of this area is constrained by the typically moderately steep topography, which falls to low-lying flood prone land. All options provide a new dual carriageway bypass of Urunga. Options within Section 4 are described in Table 4-3.

Table 4-3 Description of options in Section 4

Option	Brief description
4a	Option 4a would involve the construction of 13.5 km of new dual carriageway from Mines Road, south of Urunga, to the southern end of the existing dual carriageway at Raleigh. This route option would involve construction of a new bridge of approximately 170 metres in length over the Kalang River, approximately three km west of Urunga. Option 4a was the most western of options in Section 4, and was furthest from the town of Urunga. It passed through considerable areas of state forest and existing vegetation.
4b	Option 4b would involve the construction of approximately 11.4 km of new dual carriageway from Mines Road, south of Urunga, to the existing Pacific Highway north of Urunga and a one km duplication of the existing highway, before joining the southern end of the existing dual carriageways at Raleigh. Option 4b would involve construction of a new bridge of approximately 155 metres in length over the Kalang River, approximately 2.5 km west of Urunga. Option 4b passed through a section of Newry State Forest and was located in close proximity (within 200 metres) of the existing Raleigh industrial area.
4c	This route option was closest of all options to the town of Urunga. It would involve the construction of approximately 9.3 km of new dual carriageway. It crossed the Kalang River and Newry Island approximately one km west of Urunga. This option would involve new bridges of approximately 160 metres and 195 metres length over southern and northern arms respectively of the Kalang River on either side of Newry Island.

4.3.2.1 West of Macksville options

During the initial public information days in 2003, some sections of the community, including the Macksville Chamber of Commerce, suggested that options outside the identified investigation area, to the west of Macksville, should be investigated. In response to these requests from the community, the RTA undertook a study of the western options.

Three alternative options and two sub-options that provided the required design speed for the Proposal were subsequently developed.

The options commenced south of Warrell Creek - further south than the study area for the Proposal. The west of Macksville options potentially bypassed approximately 2 kilometre of existing dual carriageway that had previously been constructed to the south of the town of Warrell Creek.

Following review of the road safety, transport efficiency and cost implications and potential environmental impacts of the initial options and sub-options, two refined options (option W6 and option W7) were developed for further consideration. These options can be seen in Figure 4-3.

Option W7 was the longer of the options, at 25 kilometre, as it had the most southerly starting point of the two options, starting approximately three kilometres south of Warrell Creek, and potentially bypassed approximately two kilometres of existing dual carriageway. Option W6 was 22.6 kilometres long and had its southern starting point approximately one kilometre south of the Warrell Creek township, at the northern end of the existing dual carriageways. With the exception of the different points of connection to the existing highway, the two options shared a common alignment for most of their length, to approximately Irvines Road at Newee Creek. From that location, Option W7 traversed a more western route and Option W6 a more eastern route, before rejoining the existing highway south of Deep Creek.

Option W6 would require a crossing of Taylors Arm and the Nambucca River and would involve three major bridges. Option W7 would have five major bridges, crossing Warrell Creek (twice), Taylors Arm, Blackbutt Creek and the Nambucca River. Both options would also include bridges and/or culverts across the Nambucca River floodplain where required.

Option W6 and W7 would be required to be constructed as one single project, as there were no available intermediate connections to the existing Pacific Highway. Both options would bypass Warrell Creek village, Macksville and Nambucca Heads.

4.3.3 Options evaluation

Draft selection criteria were developed to assist in the evaluation of options. The selection criteria and the levels of importance attributed to each criterion were reported in the Preferred Route Report (RTA 2005a) and the Warrell Creek Review Report (RTA 2008a). Information was collected against each of the criteria to enable a comparison of options. A value management process was used to provide a structured approach to options assessment and to facilitate greater objectivity in the assessment process.

Detailed analyses of engineering, environmental, social and economic considerations were undertaken for each option. Geotechnical investigations and field investigations for terrestrial ecology, aquatic ecology, Aboriginal and non-Aboriginal heritage, flooding and drainage studies were also carried out.

Information identified through supplementary investigations, as well as data gathered from previous field surveys of the investigation area, enabled a comparison of the western and eastern corridors to be made. The key areas for comparison centred on key design, social, environmental and economic issues.

4.3.3.1 Value management process

A comparative evaluation of the Macksville to Urunga route options was undertaken through a value management study. This included a value management workshop held over three days in April 2005. A total of 43 stakeholders participated in the workshop, including community members, business community representatives, members of the

local Aboriginal community, representatives of state government agencies, and representatives of the NRMA and project team members.

Following the comparative assessment of the options, the workshop participants agreed on the following outcomes from the value management process based on specific functional, environmental, social and economic criteria identified at the outset.

- Options 1a, 1c and 1d initially ranked fairly equally with no option emerging as the best performer overall in Section 1. On the basis of further assessment for Section 1 in light of the preferred option chosen for Section 2, it was unanimously agreed that Option1c/2a was the preferred alignment in the southern part of the investigation area.
- Option 2a was readily adopted as the preferred option in Section 2 as it was considered to be the superior option particularly with regard to "safety and transport efficiency", "impact on threatened species and sensitive environmental areas", "flooding impacts", "impact on rural activities", and "impact on urban businesses".
- When compared against the options for the southern section of the investigation area it was unanimously agreed that the western options should not be considered further due to their low relative performance against the selection criteria, and particularly in terms of 'safety and transport efficiency', the most crucial criteria according to the assigned weightings.
- Section 3 was not considered in the workshop as the only feasible option in this section was an upgrade of the existing highway, Option 3a.
- In Section 4, Option 4b was unanimously endorsed as the preferred option as it had the shortest floodplain crossing, lowest overall grades and least environmental impact.

4.3.4 Selection of the preferred route for the Macksville to Urunga section

Following the value management workshop, the suggestions for improvement were investigated and refinements were made to the recommended preferred route. This included refinement of the alignment where it crossed the Nambucca River, to provide effective connection between the northern end of Option 1c and the southern end of Option 2a. The centreline of the refined alignment was located to provide a minimum 100 metre offset between the alignment and the edge of SEPP 14 wetland No. 383 adjacent to Newee Creek.

Following consideration of project technical investigations, community consultation and the outcomes of the value management workshop, the refined alignment for the Macksville to Urunga sections comprising Options 1c, 2a, 3a and 4b was announced as the preferred route in November 2005. Further refinements to reduce environmental and community impacts have since been made to the alignment based on subsequent detailed survey, community consultation and environmental assessment undertaken during preparation of the concept design. The final alignment (the Proposal) is described further in Chapter 6 – *Description of the Proposal*.

4.3.4.1 Other community options

The project team investigated a number of refinements to the preferred route suggested by members of the community. These included refinements in the vicinity of Bald Hill Road and alternative routes north of the Nambucca River in the vicinity of Old Coast Road.

The investigations into the alternative route options suggested by the community were reported in the Macksville to Urunga - Preferred Route Submissions Report (RTA 2007b). The investigations concluded that although the alternative route options had lower property and residential (including noise) impacts than the preferred route, they also:

- Provided poorer road safety and transport efficiency.
- Had greater impacts on rural activities and flora and fauna.
- Had greater constructability issues and potential flooding impacts due to the longer crossings of the Nambucca River floodplain downstream of Macksville.
- Were more costly and provided less value for money.

The route options, including the community suggested alternative route options, have been assessed at various stages during development of the Proposal. The process for evaluation of the options developed is outlined in the Project Application Report (RTA 2007a). Following detailed assessment and comparison of options it was concluded that the preferred route announced in November 2005 provided the best overall balance between functional, economic, ecological and social considerations.

4.4 Warrell Creek options

4.4.1 Identification of route options

As discussed in Section 4.3.1.2, the west of Macksville options bypassed the village of Warrell Creek, including the previously approved route for the upgrade of the Pacific Highway at Warrell Creek. The preferred route for the Macksville to Urunga section announced in November 2005, did not comprise one of the options to the west of Macksville. Consequently there was a need to review whether the previously approved preferred route at Warrell Creek could provide an appropriate connection between the existing Allgomera deviation and the Macksville to Urunga upgrade, as well as meeting current design and environmental standards. The RTA announced it would review the preferred route for the Warrell Creek section as part of the announcement about the preferred route for the Macksville to Urunga section in November 2005.

The investigations leading to the selection of a preferred route for the Warrell Creek section was approved in the 1990s to an earlier standard than that proposed for current upgrades of the Pacific Highway. The review undertaken in 2005 found that the route approved in the late 1990s and the design for the upgrade would need to be modified. Modifications to the design would be required to meet current design standards for the Pacific Highway and to provide an appropriate connection between the existing Allgomera deviation and the Macksville to Urunga upgrade.

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

As a result of this review, a number of feasible route options for the Warrell Creek section were developed. Comments received from government agencies, Nambucca Shire Council and the community were considered during the identification of route options.

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

- Review of previously approved preferred route for the Warrell Creek section.
- Assessment of the adequacy of the previously approved design.
- Stakeholder consultation, including landowner meetings, community information evenings and public meetings to identify community interests, issues and concerns. This included 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 and assessment of route options.
- Preparation and exhibition of the Draft Warrell Creek Review Report (RTA 2007c).
- Review of community input/submissions on the Draft Warrell Creek Review Report (RTA 2007c).
- Review of data used in the assessment of route options along with incorporation of new and more detailed data.
- Refinement and assessment of route options to address community issues.
- Preparation and exhibition of the Warrell Creek Review Report (RTA 2008a) which identified the preferred route for the Warrell Creek section for incorporation into the Warrell Creek to Urunga proposal.

Desktop studies and field investigations were undertaken to identify environmental, social and functional constraints to building a highway through the Warrell Creek study area. Comments received from government agencies, Nambucca Shire Council and the community were considered during the identification of route options. Of the eight route options developed, a shortlist of four of the most feasible was taken forward for community comment (see Figure 4-3).

Red option

The red option was developed by amending the previously approved preferred route to comply with current road design standards. It largely followed the route of the existing highway and the North Coast Railway Line. This option would require relocating 700 metres of the railway 100 metres to the east of its current location.

The red option commenced 500 metres south of the Upper Warrell Creek bridge at the northern end of the Allgomera deviation. It would require the construction of a bridge 400 metres upstream of the existing bridge across

Upper Warrell Creek. The Red option would then run along the western edge of Way Way State Forest before veering north-west to continue adjacent to the North Coast Railway Line on its western side, towards the village of Warrell Creek.

The route would pass 200 metres to the east of Cockburn's Sawmill and would require the relocation of the rail line as it continued north along the eastern edge of Warrell Creek village. This section of the road would require acquisition of seven residential properties. North of the village, the route followed the existing highway, crossing Stony Creek 50 metres upstream of the existing Stony Creek Bridge. The route then headed north-east to connect to the preferred route for the Macksville to Urunga upgrade.

Blue option

The blue option was designed to create a transport corridor in the Warrell Creek area and was primarily located to the east of the North Coast Railway Line. The route would enable the existing highway to be used as a local access road.

The blue option commenced 500 metres south of the Upper Warrell Creek bridge and ran north-east, crossing Warrell Creek 450 metres upstream of the existing bridge. It then crossed the North Coast Railway Line 450 metres southeast of Upper Warrell Creek Bridge before it veered north-west towards the village of Warrell Creek. The route passed 350 metres to the east of Cockburn's Sawmill and followed the North Coast Railway Line along its eastern boundary, bypassing the Warrell Creek village before it headed north across Rosewood Road and Stony Creek. North of Stony Creek, the route veered north-east to connect to the preferred route for the Macksville to Urunga upgrade.

A local road connection along the eastern side of the highway upgrade was proposed from Donnellyville to the proposed interchange south of Macksville. Access across the highway upgrade was proposed via a western extension of Albert Drive, north of the railway line. New arrangements would be required to provide access to properties east of the route at Warrell Creek village.

Orange option

The orange option started 500 metres south of the existing Upper Warrell Creek Bridge at the northern end of the Allgomera deviation. It headed north-east to cross Warrell Creek 450 metres upstream of the existing bridge. After crossing the North Coast Railway Line the route continued northward along the edge of the Way Way State Forest and passed 450 metres east of Cockburn's Sawmill. North of the mill, the orange option followed the boundaries of the large rural properties located east of the existing highway and west of Rosewood, crossing Rosewood Road 450 metres to the east of the village and connected to the preferred route for the Macksville to Urunga upgrade.

A local road connection along the eastern side of the highway upgrade was proposed from Donnellyville to the proposed interchange south of Macksville. Access across the highway upgrade was proposed via a western extension of Albert Drive, north of the railway line to enable the existing highway to be used as a local access road.

Purple option

The purple option was the most eastern option, traversing agricultural grazing land for the majority of its length and reconnecting with the existing Pacific Highway at Donnellyville. This followed the same alignment as the orange option up to Rosewood Road where the Orange option diverts to the west to connect with the existing Pacific Highway just south of Donnellyville.

4.4.2 Selection of the preferred route for the Warrell Creek section

Comments received from government agencies, Nambucca Shire Council and the community were considered during the identification of route options. Following the development of potential route options, further investigations were undertaken to identify feasible route options. Selection criteria were developed to assess the route options against a range of functional, environmental, social and economic considerations to determine a preferred route for the Warrell Creek section.

The assessment identified a shortlist of the four most feasible routes including the Red, Blue, Orange and Purple options. The four options were placed on public exhibition between 4 September and 30 November 2007. Following the exhibition, the study team obtained more refined data including updated property information, high resolution aerial photography and aerial laser scanning of the study area which allowed further investigation to be undertaken on the route options. Important information was provided by the community on each of the options. In response to concerns raised by residents on the eastern side of the study area regarding the potential indirect impacts (predominantly noise and visual impacts) of the Purple option, the project team investigated a number of options to achieve a greater separation of the route from residences, while still maintaining an improvement in amenity for residents to the west of the railway.

Initially, two refinements, the Purple East and Purple West option were developed and these two options plus the previous four shortlisted options (Red, Blue, Orange and Purple) were re-assessed using the updated and more detailed data. This confirmed the findings that the eastern options out-performed the western options. Of the eastern options investigated, the Purple West option provided the greatest opportunity to increase the separation from residences on the eastern side of the study area, while not adversely affecting people in the Warrell Creek village. In terms of amenity It should be noted that, while on balance the Purple West option performed better than other options, it did result in the acquisition of four more residences than the Purple option. As a result, further design work was carried out to optimise the Purple West route and a modified Purple West was developed which reduced the number of residences to be acquired. This was then assessed against the other six options which resulted in the selection of the modified Purple West as the preferred route. The Warrell Creek Review Report (RTA 2008) was prepared and the preferred route for the Warrell Creek section was announced in June 2008.

4.5 Interchanges

4.5.1 Interchange options

Following identification of the Macksville to Urunga preferred route, preliminary interchange options were developed for south of Macksville, at Nambucca Heads and north of Urunga. The key considerations were to maintain access and connectivity through the study area and to complement major existing and planned urban development and employment land uses.

A workshop was held on 27 February 2006 to obtain input from Nambucca and Bellingen Shire Councils into the most appropriate interchange locations and configurations. This workshop allowed the relative merits, and advantages and disadvantages of each of the proposed locations to be addressed and the options compared. Input received during this workshop was used to further develop the interchange options. During the workshop, various sub-options were considered for the interchanges, generally relating to local roads and connectivity. Further detail on the land use considerations for interchange locations is provided in Chapter 11 – *Land use and property*. As part of the workshop recommendations, specific sub-options were identified as the starting point for concept design development.

In response to concerns from Bellingen Shire Council, the Urunga Chamber of Commerce and the Valla Beach community regarding access to Urunga from the south and Valla Beach from the north, an additional interchange was included in the concept design in 2008 at Ballards Road, just to the south of Urunga.

Following inclusion of the Warrell Creek section a further interchange was proposed south of Warrell Creek to allow access onto the highway from the south.

4.5.1.1 Warrell Creek interchange

The proposed Warrell Creek interchange would be located at the southern end of the upgrade where the proposed alignment leaves the existing highway. It would provide access to the Warrell Creek village from the south. Initial options considered for this location included a grade separated interchange and an at-grade intersection.

Provision for an at-grade T-intersection to connect the Warrell Creek section with the Allgomera deviation was included at the southernmost end of the Proposal in September 2007 as part of the route options display for the Warrell Creek route options. Whilst the inclusion of the intersection matched with the provisions for local road connections south of the project, it did not match with the criteria adopted for this upgrade or with the future planning requirements for full motorway conditions.

The Warrell Creek interchange does not include a northbound on-ramp due to the proximity of the interchange with the bridge over Upper Warrell Creek and the railway line. Consideration was given to inclusion of the ramp on the bridge at Cockburns Lane. However, the expected traffic usage on this ramp did not justify the cost of the option. In reviewing the omission of this ramp in the context of the project as a whole, vehicles travelling north from Warrell Creek village would be able to use the existing highway to the next interchange at Bald Hill Road approximately 5 kilometre to the north.

4.5.1.2 Macksville interchange

Two options were considered for an interchange south of Macksville at:

- Bald Hill Road.
- Scotts Head Road.

Option 1 – Bald Hill Road

This interchange option was located north of Warrell Creek using the proposed Bald Hill Road overbridge as part of the interchange. The key features of this interchange include:

- Located approximately 2.8 kilometre south of Macksville.
- Access to Macksville via Bald Hill Road and the existing Pacific Highway.
- Access to Warrell Creek and Scotts Head via the existing highway and local road network.
- Makes use of proposed Bald Hill Road overbridge as part of interchange.
- Interchange ramps clear of Warrell Creek bridges.

Option 2 – Scotts Head Road

This option was located south of Warrell Creek, at the Scotts Head Road turnoff. Key features included:

- Located approximately 4.1 kilometre south of Macksville.
- Access to Macksville would be via the existing highway and bridge over Warrell Creek.
- Access to Warrell Creek would be via the existing highway.
- Access to Scotts Head would be via the existing Scotts Head Road.
- Interchange ramps would extend onto the proposed Warrell Creek Bridges, requiring wider crossings.

4.5.1.3 Nambucca interchange

Two options were considered for an interchange at Nambucca:

- Old Coast Road.
- Boggy Creek.

Option 1 – Old Coast Road

This interchange option was developed using the proposed Old Coast Road overbridge as part of the interchange. The key features of this interchange included:

- Located approximately 2.5 kilometres west of Nambucca Heads.
- Access to Nambucca Heads via Old Coast Road and Mann Street.

- Access to communities north of Nambucca Heads would be via Old Coast Road, Pioneer Street and the existing Pacific Highway.
- Makes use of proposed Old Coast Road overbridge as part of interchange, with only the need for the inclusion of ramps.
- Interchange is located within the Newry State Forest Area and would require additional acquisition of state forest.

Option 2 – Boggy Creek

This option was located near Boggy Creek, north of the crossing of the main North Coast Railway Line. The key features of this interchange included:

- Located approximately 3.5 kilometres north-west of Nambucca Heads.
- Access to Nambucca Heads via existing Pacific Highway, Pioneer Street and Mann Street.
- Access to communities north of Nambucca Heads would be via the existing Pacific Highway.
- The interchange does not make use of existing infrastructure as part of the connecting roads and would require a new bridge, ramps and a local road connection to the existing Pacific Highway.
- The interchange would provide improved access to Nambucca Shire Council's proposed future urban area.

4.5.1.4 Ballards Road interchange

The need for an access to Urunga from the south to and Valla Beach from the north was identified during consultation with local residents, Bellingen Shire Council, the Urunga Chamber of Commerce, bus companies and local businesses. In response to these concerns an additional interchange was included in the concept design in 2008 at Ballards Road, just to the south of Urunga. This interchange allows better access to and from Urunga, provides access to emergency services and would also service the growing community of Valla Beach. The interchange at Ballards Road would be a conventional diamond interchange and provides access to Urunga from the south and the Valla area from the north. This location was selected as it is approximately where the Proposal leaves the existing highway alignment. The available space and the requirement for the upgrade to pass below Ballards Road meant that this arrangement was the only option considered.

4.5.1.5 Raleigh interchange

Access north of the upgrade is provided by the existing Raleigh interchange, also known as the Waterfall Way interchange at Raleigh. The development of the design required consideration of the local access between Waterfall Way, Raleigh and Urunga as well as review of the existing ramps to ensure compatibility with a design speed of 110km/h.

Two options were considered for providing local access:

- The first option utilised the existing road network through Raleigh to provide access to Urunga. Other than some minor works (signage, linemarking, etc) and decommissioning of a section of the existing highway, little would be required for this option. The option directed all the local traffic back through Raleigh, south of Waterfall Way, and would result in additional traffic through this section of the town. Access to Urunga via this option was slightly longer and less direct than the second option.
- The second option provided a new service road on the eastern side of the upgrade from the Waterfall Way interchange to the existing Pacific Highway. Some modification of the ramps on the eastern side of the highway would be required to facilitate this option. This option was adopted for the concept design.

4.5.2 Selection of preferred interchange options

The selection process led to the development of three new grade separated interchanges at Bald Hill Road south of Macksville, at Boggy Creek north of Nambucca Heads and Ballards Road, south of Urunga and modifications to the existing Waterfall Way interchange to a 110km/hr design standard. Following inclusion of the Warrell Creek section a further interchange was proposed south of Warrell Creek to allow access onto the highway from the south. The location of the five key interchanges is shown in Figure 1-1. Further details of the design concepts for the interchanges are provided in Chapter 6 – *Description of the Proposal*.

The preferred locations for the Macksville, Nambucca and Waterfall Way interchanges include the following:

- The Bald Hill Road interchange north of Warrell Creek (Option 1), as it:
  - Is closer to Macksville than other alternatives considered.
  - Provides improved access to Scotts Head, Warrell Creek and Donnellyville from both the highway and Macksville.
  - Has less impact on adjacent properties.
- Boggy Creek (Option 2), as it
  - Provides improved access to Nambucca Heads, Valla/Valla Beach and adjacent areas and South Urunga.
  - Provides access into the Boggy Creek future urban area north-west of Nambucca Heads.
- New service road at the Waterfall Way interchange (Option 2), as it:
  - Provides more direct access into Urunga and does not divert additional local traffic through Raleigh.

Further design refinement in the southernmost end of the Proposal to connect the Warrell Creek section with the Allgomera deviation was undertaken following the announcement of the Warrell Creek route options. A grade separated interchange was announced concurrently with the preferred route for the Warrell Creek section in June 2008 as it:

- Provides for northbound traffic to leave the Proposal and for southbound traffic to access and leave the Proposal
- Is significantly safer than the T-Intersection originally proposed.

4.6 Alternatives considered

4.6.1 Modal alternatives

Consultation with the Australian Rail Track Corporation (ARTC) confirmed that there was no significant short term investment planned for the upgrade of the North Coast Railway Line. This line is shared by passenger and freight trains and has a number of sections of track that limit its current competitiveness against road freight.

Early feasibility planning has commenced on an inland rail line between Melbourne and Brisbane. However, this is likely to represent a long-term proposal to achieve a greater modal split for rail freight. Therefore, with the expected population increases in the Pacific Highway corridor, there is a need for investment in enhancements to both rail and road transport infrastructure to meet the short term and long term transport tasks.

4.6.2 Route alternatives

The preferred route (the Proposal) is a combination of options comprising purple 1c, 2a, 3a and 4b options. The preferred route was determined following consideration of the options summarised in Table 4-4. The structured sustainability assessment approach and the details of the various options considered are explained in more detail in the following reports, which are available at www.pacifichighwayupgrade.com.au/macksville/:

- Route Options Development Report (RTA 2004a).
- Preferred Route Report (RTA 2005b).
- Draft Warrell Creek Review Report (RTA 2007c).
- Warrell Creek Review Report (RTA 2008a).

The preferred route provided the best overall balance between functional, ecological, social and economic considerations. A comparison of these considerations is provided in Table 4-5 to Table 4-8, which summarises the assessment within the reports listed above.

Table 4-4 Consideration of alternatives for the preferred route

Section of the Proposal	Route option
Warrell Creek and west of Macksville	Purple, green, yellow, red, W6 and W7.
Bald Hill Road to Nambucca River	1a, 1b, 1c, 1d, 1e, W6 and W7.
Nambucca River to Nambucca Heads	2a, 2b, 2c, W6, W7 and community suggested options.
Nambucca Heads to Ballards Road	3a (this was the only feasible option).
Ballards Road to Waterfall Way interchange	4a, 4b, 4c.

Table 4-5 Comparison of Warrell Creek, including west of Macksville route options

Attribute	Route option					
	purple	green	yellow	red	W6	W7
Functional data						
Overall length (km)	5.2	5.2	5.4	5.4	25.7	25
Length of option on lower terrace of floodplain (m)	930	740	475	350	-	-
Length across floodplain (m)	-	-	-	-	5,100	4,500
Length of option adjacent to existing highway	2,250	1,100	1,100	350	-	-
Engineering risk (risk rating out of 10)[1]	2	4	7	8	-	-
Social data						
Number of houses to be acquired	7	2	1	1	16	16
Noise – number of houses between 50 and 60 dB(A) at night (without mitigation)	48	61	26	23	75	73
Noise – number of houses above 60 dB(A) at night (without mitigation)	11	3	0	2	0	0
Noise – number of houses > 5 dB(A) increase	1	5	2	2	-	-
Noise – number of houses > 5 dB(A) decrease	21	30	50	53	-	-
Visual impact (score out of 40)[2]	15	19.5	23	23	-	-
Number of houses severed from largest portion of property	2	0	2	1	-	-
Economic data						
Length through cleared farmland (m)	1,640	3,550	3,350	3,200	-	-
Length through plantation timber (m)	480	200	130	250	-	-
Property severances (ha severed)	9	12	30	39	-	-
Environmental data						
Area of endangered ecological community, high and very high quality habitat impacted (ha)	8.8	10.3	16.1	16.5	84.6	102.1
Number of Aboriginal heritage sites potentially affected	2	2	5	4	5	8
Number of non-Aboriginal sites potentially affected	2	0	0	0	3	4
Cost estimates						
Cost estimate [3]	122	102	91	88	286	296

1 - scale of engineering risk is 1 to 10, where 10 is high.

2 - scale of visual impact is 1 to 40, where 40 represents the highest impact.

3 - preliminary cost estimates for purple, green, yellow, and red options $million 2006 and W6 and W7 options $million 2003.

Table 4-6 Comparison of Bald Hill Road to Nambucca River route options

Attribute	Route option				
	1a	1b	1c	1d	1e
Functional data					
Overall length (km)	6.1	6.1	6.0	6.1	6.3
Length across floodplain (m)	2,400	2,800	2,800	3,000	3,000
Social data					
Number of houses to be acquired	9	6	7	10	9
Noise – number of houses between 50 and 60 dB(A) at night (without mitigation)	238	252	96	79	75
Noise – number of houses above 60 dB(A) at night (without mitigation)	20	19	19	16	19
Environmental data					
Area of endangered ecological community, high and very high quality habitat impacted (ha)	12.3	13.9	14.7	19.6	19.5
Number of Aboriginal heritage sites potentially affected	0	0	0	0	0
Number of non-Aboriginal sites potentially affected	2	2	2	0	0
Cost estimates					
Cost estimate ($million 2003)	124	116	114	117	124

Table 4-7 Comparison of Nambucca River to Nambucca Heads route options

Attribute	Route option			
	2a	2b	2c	Crossing of North Coast Railway to Cow Creek
Functional data				
Overall length (km)	9.3	9.7	9.3	2.4
Length across floodplain (m)	700	2,900	2,800	-
Social data				
Number of houses to be acquired	18	7	14	5
Noise – number of houses between 50 and 60 dB(A) at night (without mitigation)	116	90	75	21
Noise – number of houses above 60 dB(A) at night (without mitigation)	0	7	35	2
Environmental data				
Area of endangered ecological community, high and very high quality habitat impacted (ha)	3.3	10.6	13.4	9.4
Number of Aboriginal heritage sites potentially affected	0	0	0	1

Attribute	Route option			
	2a	2b	2c	Crossing of North Coast Railway to Cow Creek
Number of non-Aboriginal sites potentially affected	0	0	0	0
Cost estimates				
Cost estimate ($million 2003)	87	88	83	-

Table 4-8 Comparison of Ballards Road to Waterfall Way interchange route options

Attribute	Route option		
	4a	4b	4c
Functional data			
Overall length (km)	13.5	12.4	11.3
Length across floodplain (m)	1,300	2,000	3,500
Social data			
Number of houses to be acquired	8	6	5
Noise – number of houses between 50 and 60 dB(A) at night (without mitigation)	77	73	267
Noise – number of houses above 60 dB(A) at night (without mitigation)	1	6	12
Environmental data			
Area of endangered ecological community, high and very high quality habitat impacted (ha)	44.2	36.8	8.7
Number of Aboriginal heritage sites potentially affected	1	1	2
Number of non-Aboriginal sites potentially affected	1	2	2
Cost estimates			
Cost estimate ($million 2003)	166	156	180

4.6.3 Interchange alternatives

Throughout the development of the Proposal, a number of alternatives were considered in respect of interchanges, as discussed in Section 4.5.1.

As part of the concept design process, the interchanges were subject to design development. This design development considered functional requirements of the highway (e.g. inclusion of rest areas), design standards and constructability. Refinements were made to all the interchanges to improve these aspects of the design without significant change to environmental and social impacts.

4.7 Confirmation of the Proposal as the preferred option

The Proposal is consistent with relevant State Government plans, strategies and polices and with the strategic outcomes of the Pacific Highway Upgrade Program. The Proposal addresses safety, traffic and transport issues. It meets requirements for the projected growth in traffic and transport on the highway by providing for a dual carriageway that meets appropriate RTA design standards. When compared to other options and assessed against the Proposal objectives, the Proposal is preferred in relation to social, environmental, design and economic considerations.

The Proposal is the result of extensive analysis of potential options within the study area. This led to the RTA decision on the preferred route. There was extensive community consultation throughout that process and agency, community and stakeholder representatives participated in a number of meetings and workshops that contributed to the decision process.

The Proposal described in detail in Chapter 6 – *Description of the Proposal* performs best in relation to social, environmental and design factors. A justification of the Proposal in consideration of the objects of the *Environmental Planning and Assessment Act* 1979 is provided in Chapter 20 – *Justification and conclusions*.