

3 Strategic alternatives and design options

This chapter describes the various alternatives that were considered as part of the project development process and explains how and why the project was selected as the preferred option. Design options for particular elements of the project are also covered. It also addresses the Director-General's requirements (DGRs) for the project justification as shown below.

Director-General's requirements	Where addressed
<i>Project justification:</i>	
<i>Assess the alternatives considered (including an assessment of the environmental costs and benefits of the project relative to alternatives).</i>	Chapter 3 Chapter 11 (Justification and Conclusion).

3.1 Options development process

This section presents a summary of the process undertaken to develop, assess and select options for various components of the project including the route, access options and interchanges at Berry, the local road modifications and pedestrian access. Information is also provided on when input on the options was sought from community, stakeholder groups and government agencies. As well as input from these external sources, an integrated design approach was taken for the development of the project, involving engineers, urban designers and bridge architects working collaboratively with environmental and heritage specialists to develop and compare the options against the project objectives including:

- Improve road safety.
- Improve efficiency of the Princes Highway between Toolijooa Road and Schofields Lane.
- Support regional and local economic development.
- Provide value for money.
- Provide significant beneficial environmental effects for the Berry town centre and manage potential adverse environmental impacts elsewhere.
- Optimise the benefits and minimise adverse impacts on the local social environment.

The environmental sensitivities and constraints of Foxground, Berry and its surrounding areas have been taken into account in the design development process, with adverse impacts avoided or minimised in design to the greatest extent practicable.

3.1.1 Development and assessment of strategic alternatives

Strategic alternatives to the project were assessed as part of this environmental assessment. Alternatives included the upgrade of other transport corridors, including road and rail within the project area and a base case 'do nothing' option which were assessed against the project objectives.

3.1.2 Development and assessment of route options

Figure 3-1 shows the route options development process that was undertaken for the project.

Route options for the project were developed as part of the broader Princes Highway upgrade program. This program included all three highway upgrade projects between Gerringong and Bomaderry. The Foxground and Berry bypass project forms part of the overall upgrade shown in **Figure 3-2**.

Route options development process

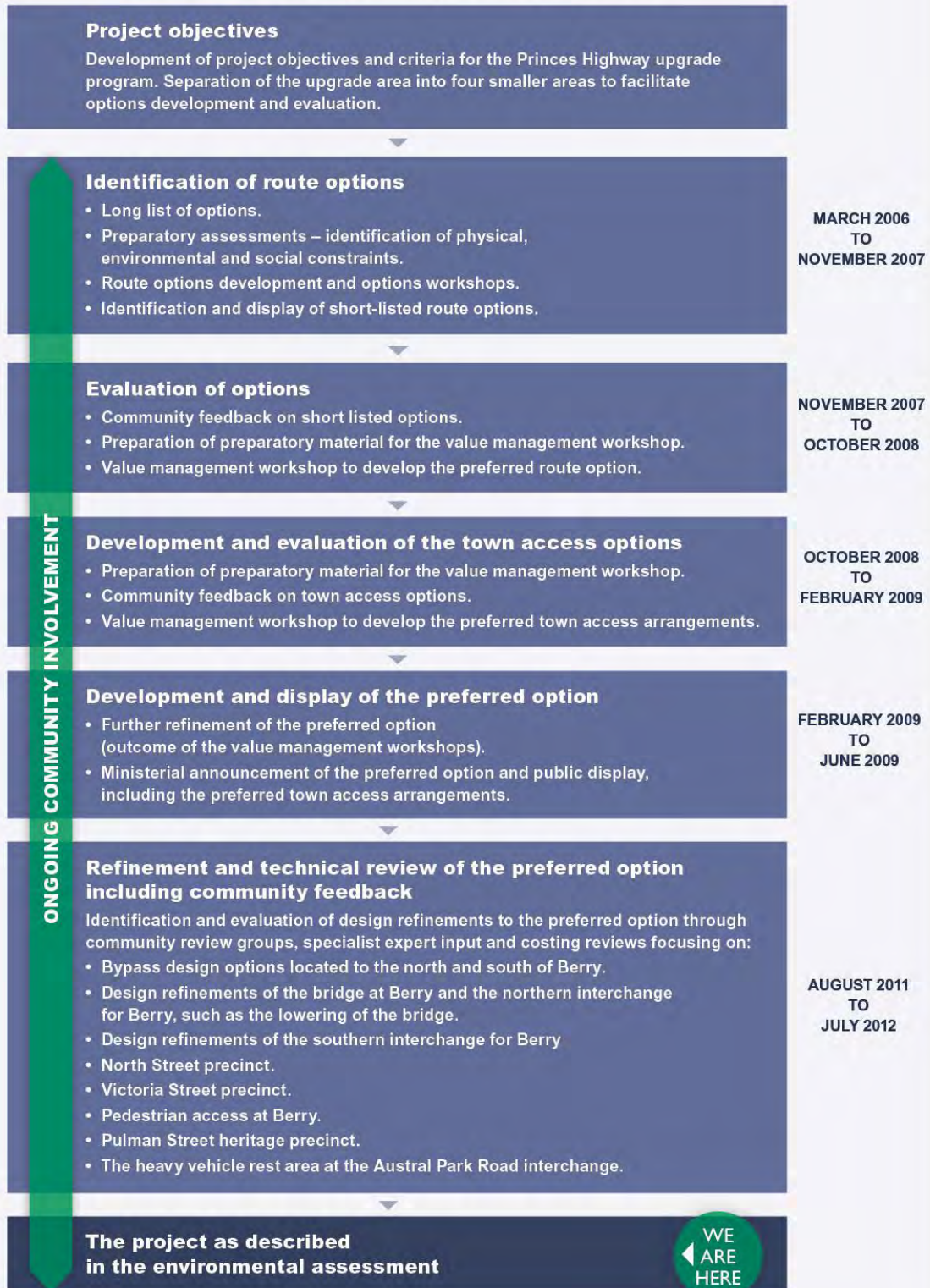


Figure 3-1 Route options development process

The Foxground and Berry bypass project area was selected as it encompasses both the bypass of the Foxground bends and the bypass of Berry in one project. On completion of either bypass, traffic studies show that most through traffic (about 85 per cent) would be travelling on the upgraded highway. If only one of the bypasses were constructed, safety and efficiency issues on the remaining unimproved section of the highway would be exacerbated. The project area extends from Toolijooa Road to Schofield's Lane as the Toolijooa Road endpoint is the start of the section with the worst remaining crash statistics and the Schofield's Lane end point is the earliest tie in point after addressing the efficiency concerns in Berry.



Figure 3-2 Preferred project route within the context of the Princes Highway between Gerringong and Bomaderry

To assist in the development of options, the broader study area including Gerringong, Berry and Bomaderry was divided into four geographical areas referred to as 'sections' (sections A, B, C and D). Section B and section C represent the project area (refer to **Table 3-1** and **Figure 3-3**).

Table 3-1 Description of sections within the context of the three upgrade projects

Section	Description	Relevant project/proposal
Section A	Commences at Mount Pleasant and extends to Belinda Street, Gerringong.	The Gerringong upgrade.
Section B	Commences at Belinda Street, Gerringong and extends just north of Berry.	The Gerringong upgrade and the project.
Section C	Commences just north of Berry and extends to Croziers Road, south of Berry.	The project and the Berry to Bomaderry upgrade proposal.
Section D	Commences at Croziers Road, south of Berry and extends to Cambewarra Road, Bomaderry.	The Berry to Bomaderry upgrade proposal.



Figure 3-3 Geographical sections within the context of the three upgrade projects between Gerringong and Bomaderry

RMS considered and evaluated the route options for all three highway upgrade projects at the same time across the broader study area. However, the following sections of this chapter focus on how the options relevant to this project (sections B and C) were assessed and the outcomes that determined the preferred route option for the project.

A discussion on the methodology followed to assess and evaluate the route options is provided in detail in the following reports:

- *Gerringong to Bomaderry Princes Highway Upgrade, Route Options Development Report* (RTA, November 2007).
- *Gerringong to Bomaderry Princes Highway Upgrade, Preferred Option Report* (RTA, October 2008).
- *Gerringong to Bomaderry Princes Highway Upgrade, Gerringong and Berry Preferred Access Arrangements Report* (RTA, June 2009b).
- *Gerringong to Bomaderry Princes Highway Upgrade, Toolijooa Ridge Preferred Option Report* (RTA, June 2009c).

The reports are available on the project website www.rms.nsw.gov.au/fbb.

Long list of options

Feasible route options were identified by RMS and the project team and a long list of route options was developed. These were based on the output of a computer software package called Quantm, desktop studies and the application of route selection principles that include consideration of engineering and functionality constraints, avoidance of known environmental and social constraints and minimisation of environmental and social impacts.

Preparatory assessments were undertaken by the project team and technical specialists to assess the physical, environmental and social constraints associated with the long list options. These assessments fed into the route options development workshop attended by the project team and technical specialists and undertaken to short list potential options for further assessment (refer to **Chapter 6** for further details).

The assessment of the long list options considered the project objectives and specialist investigations and compared each route option against a base case scenario to determine short-listed route options. Specialist investigations considered the biophysical environment, social and cultural environment, land use and property, landscape and potential amenity impacts. Engineering functionality and economic factors were also considered.

Short-listed route options

RMS held a route options value management workshop to develop key assessment criteria and evaluate the potential options. The workshop attendants included the project team, technical specialists and members of the community from across the study area and considered specialist assessment of each option and community and stakeholder feedback. The options were assessed and weighted against the project objectives (**Section 2.3**) and the following key assessment criteria:

- *Functional* – focused on the design objectives and included constructability, maintenance, safety and efficiency considerations.
- *Socio-economic* – included business and agricultural impacts, property severance, connectivity, road traveller experience, views and impacts on community facilities/amenity.
- *Environmental (natural and cultural)* – included ecological, Aboriginal heritage, flooding, noise, groundwater and climate change impacts.

The value management workshop process and the key findings are documented in *Gerringong to Bomaderry Princes Highway Upgrade, Value Management Workshop Report (RTA, May 2008a)*.

The urban design principles and objectives (**Section 4.3.2**) are embedded in the assessment criteria and as such each option has been evaluated against them.

Following the value management workshop, a preferred option was announced by the then Minister for Roads in 2009.

3.1.3 Development and assessment of the design refinements

Ongoing community and stakeholder consultation has been undertaken throughout the planning and design stages of the project and the outcomes of this consultation have been considered during the refinement of the preferred option.

A number of options were developed and assessed against the project objectives for different sections of the project including:

- Access options for Berry.
- Bypass design options for Berry.
- Design for the bridge at Berry.
- Alignment options and design around the North Street precinct.
- Arrangement of the southern interchange for Berry.
- Options for the intersection of the Princes Highway and Victoria Street in Berry.
- A southern bypass of Berry.
- Pedestrian access in Berry.
- Rest areas.
- Pulman Street heritage precinct.

The evaluation of these design refinement options is discussed in detail in **Section 3.6**.

Access options for Berry

The access options value management workshop assessed a combination of southbound and northbound options against the following assessment criteria established by the workshop group. The workshop process is discussed in detail in *Gerringong to Bomaderry Princes Highway Upgrade, Access Value Management Workshop Report (RTA, February 2009a)*. The construction cost estimates for each combination were also assessed together with the following objectives:

- Provide safer use for all users of the network.
- Minimise environmental impacts including, but not limited to, noise, flora, fauna, and dust.
- Minimise impact on heritage elements.
- Facilitate business and employment opportunities.
- Minimise visual intrusion to and from the town.
- Provide easily legible access and intuitive access for all users.
- Provide access amenity to at least current or a better level of service.
- Complement existing and future local traffic movement patterns and the social network.
- Improve access during flooding.
- Provide appropriate emergency services access.

Other stakeholder and community lead access design refinements have also been considered. These have been assessed separate to the value management workshop process and include:

- Shoalhaven City Council requested that RMS consider providing a second northbound off-ramp for Berry. This ramp would cater for future traffic growth on the highway and within Berry.
- A community submission sought consideration of splitting the southern interchange for Berry into two smaller interchanges, with the south-facing on and off-ramps relocated further south, close to Schofields Lane.

Berry bypass design options

RMS undertook a review into the preferred route north of Berry in consultation with the community. This followed a request by the Member for Kiama to consider the community's concerns relating to the potential noise and visual amenity impacts of the preferred option.

The study area considered in this review is represented as the purple zone in **Figure 3-4** and includes the northern interchange, the bridge at Berry and the North Street corridor.

A community review group (CRG) was established to examine improvements to the preferred route where it passes close to Berry.

Seven community review group meetings were held to examine the design and consider how to improve it. The process included inputs from technical studies, independent experts and community submissions. Updates documenting the meeting proceedings were published to inform the wider community. The review process also included two separate one-day workshops to carry out a detailed review of the bridge at Berry and northern interchange alignment and design.

The revised preferred option was continually developed through the CRG meetings and workshops. It did not involve a direct comparison between design refinements. Instead, options were discounted and new alternatives developed in consultation with CRG members that would best meet the project objectives and the objectives of the review.

Meetings were held with the registered CRG participants and independent experts with experience in urban design, civil engineering, noise management and construction of major road and transport projects as discussed in detail in **Chapter 6**.

Several amendments were made to the concept design for the Berry bypass through this process including:

- Shifting the Berry bypass and Berry bridge further north.
- Realigning the Huntingdale Park off-ramp to avoid Huntingdale Park Road.
- Lowering the bridge at Berry by up to 6.4 metres.

Following the CRG meetings a series of open public workshops were undertaken to further refine design issues which had arisen and to allow for increased public input to the design refinement process. The workshops were organised into design components to address urban design and community use of various areas of the project, including the:

- Austral Park Road area.
- Bridge at Berry and northern Berry interchange.
- North Street precinct.
- Southern interchange at Berry and Victoria Street arrangement.

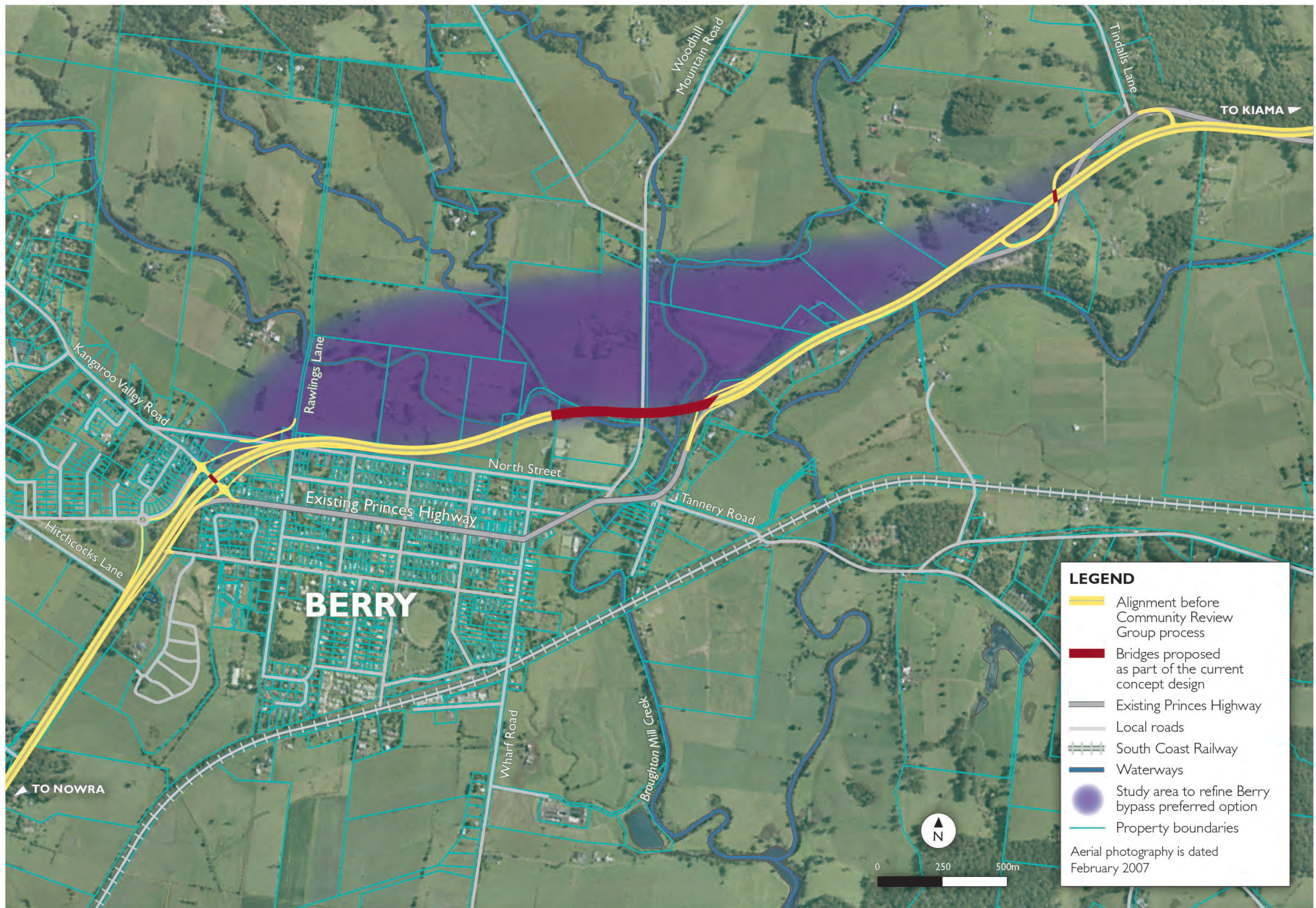


Figure 3-4 Bridge at Berry and North Street study area

Bridge at Berry and northern interchange for Berry

The CRG for the bridge at Berry and northern interchange identified 12 considerations for the review that generally related to the design and aesthetics of the bridge structure. These considerations are discussed in the *Bridge design workshops process report* (RMS, 2011). The CRG agreed that further reviews of the design take into account these considerations. However, optimising the revised preferred alignment was the primary focus of the CRG workshop.

Several design refinements were discussed in the CRG process one-day workshops. These focused on different combinations of ramp configurations, embankments, cuttings and retaining walls at the northern interchange that would optimise the cut/fill ratio and maximise the lowering of the bridge. These had varying degrees of impact on neighbouring properties (due to embankments and retaining walls), the cut/fill ratios and on road safety.

The workshop process for the bridge at Berry and northern interchange investigated urban design, landscaping and related issues for the bridge and northern interchange. This included considerations such as bridge form and colour, abutment and pier design and noise mitigation issues.

North Street precinct

The CRG for the North Street precinct assessed various options to lower the alignment and move it north, away from North Street. Through this process the need to divert Town Creek in order to facilitate the lowered alignment was identified and developed and potential urban design treatments and preferred solutions were also considered.

The workshop process following the CRG investigated urban design treatments, noise amelioration issues and potential designs for the public open space areas in the precinct. Urban design treatments considered included:

- Design concepts and approaches for the main alignment as visible to drivers and residents north of the alignment.
- Design concepts for the area facing North Street.
- Potential use of the public open space area along North Street.

Arrangement of the southern interchange for Berry

RMS undertook a review of the arrangement of the southern interchange for Berry with a particular focus on the northbound off-ramp. This process was undertaken in response to community concerns regarding the safety and amenity of the southern interchange for residents in Huntingdale Park Road. To address these concerns five community workshops were held to develop and assess different options for the location of the northbound off-ramp to address these concerns.

Victoria Street

During the workshops that were undertaken for the southern interchange for Berry, discussions were held with regards to the options to either maintain existing or modified access at Victoria Street or to close it at its western end. RMS sought advice from Shoalhaven City Council and the local community in order to provide a direction for the concept design. Community opinion on the options was split and no agreed direction was achieved. As a result RMS undertook a qualitative assessment of the options in order to progress the concept design.

Southern bypass of Berry

RMS received a submission from a community member with a suggested design for a bypass to the south of Berry between Tindalls Lane and Croziers Road. A technical investigation group (TIG) was established to develop and evaluate this option. The group comprised technical experts from a range of disciplines including road design, cost estimating, flooding and drainage, geotechnical and constructability. The TIG examined technical criteria and construction methodologies in order to develop an optimised design and cost estimate for a bypass to the south. A panel of independent reviewers was also established to verify the work undertaken by the TIG to ensure that due process was followed and the investigation was rigorous, transparent and appropriate.

Pedestrian access in Berry

Feedback from the community about the preferred option expressed concern by some about the potential loss of pedestrian and cyclist connectivity as a result of the severance of North Street. RMS responded to these concerns by assessing the feasibility of including a pedestrian overbridge to connect the two ends of North Street and investigating design options at the Kangaroo Valley Road interchange.

Rest areas

Due to community concerns regarding the location of a proposed heavy vehicle rest area near Austral Park Road, RMS established a community working group to review the social, environmental and design issues associated with the rest area. This group, together with RMS, assessed the issues against the project objectives and determined whether or not the rest area should be included as part of the project or alternatives developed and the rest area removed from the project. Light vehicle rest areas were deliberately not proposed so as to be able to direct vehicles to local towns, to assist with meeting project objective of supporting regional and local economic development.

Pulman Street heritage precinct

The community suggested moving the roundabout that was proposed at the junction of Tannery Road and the existing Princes Highway, to the junction of Woodhill Mountain Road and the existing Princes Highway in order to reduce potential impact on the curtilage of the Pulman Street heritage precinct.

3.2 Ecologically sustainable development in project development

The *Sustainability Factors, Climate Change and Economic Appraisal* (Maunsell, 2009) report prepared as part of the project development assessed the impacts of climate change, greenhouse gas (GHG) emissions, Peak Oil theory and greenfield land (not previously developed land) consumption associated with the short-listed options. This report was then included in the route options development process to assist in the selection of the preferred option.

Opportunities to reduce the environmental impact during construction and operation of the preferred option were also identified by researching contemporary best practices in sustainable transport infrastructure, including onsite reuse of materials, incorporation of renewable energy technology in the road, energy efficiency measures and infrastructure sustainability tools. Refer to **Section 8.4** for further details.

3.3 Strategic alternatives

3.3.1 Description of the alternatives

The following alternatives were addressed:

Princes Highway upgrade - Foxground and Berry bypass
Roads and Maritime Services
Environmental assessment

- Base case ('do nothing').
- Upgrade of the Princes Highway.
- Upgrade of the 'Sandtrack'.
- Upgrade of the South Coast Railway.

These alternatives are described below.

The base case or 'do-nothing' option

RMS considered a theoretical base case or 'do nothing' alternative. It was defined as the least possible upgrade to the existing alignment with only minor improvements and ongoing maintenance. These minor improvements might include widening of road shoulders, some work on unsafe bends or installing wire rope in medians to separate northbound and southbound traffic.

This alternative did not meet the project objectives as it did not satisfy the fundamental project requirements, including the provision of a safe and efficient highway alignment. The 'do nothing' alternative would not provide a satisfactory solution from a strategic, regional, local planning or transport context.

The section of the Princes Highway between Toolijooa Road and Schofields Lane has an unacceptable crash record and limited overtaking opportunities. Crash analysis shows that the existing fatality rate in the project area, as defined in **Section 3.2.1**, is about 0.8 fatalities per 100 million vehicle kilometres travelled (MVKT), which is almost 50 per cent more than the projected NSW average fatality rate of 0.6 fatalities per 100 MVKT. This highlights the poor safety record of the highway in this area, and the need for this project.

Under the 'do nothing' alternative, highway traffic would continue to travel through the centre of Berry, impacting the amenity of the area and the main street. The efficiency and safety of the overall highway system would also be compromised in this area as travel demand increases over the next 20 years. Flow on effects to the local and regional economy would result from reduced travel efficiencies, particularly for the freight and tourism industries. This could hinder the realisation of regional and local planning objectives.

Princes Highway upgrade

The Princes Highway between Gerringong and Bomaderry is one of the remaining sections of the highway between Waterfall and the Jervis Bay Road junction, Falls Creek that has not been upgraded to four lanes.

An upgrade of the Princes Highway would consist of the upgrade of existing sections of the highway and/or the construction of new sections of highway between Mount Pleasant, north of Gerringong, and Cambewarra Road in Bomaderry (refer to **Figure 3-1**). The construction of new sections of the highway would be required where the existing corridor could not be upgraded to meet current design requirements (such as the Foxground bends) or where beneficial environmental, safety and efficiency outcomes can be achieved (such as bypassing environmentally sensitive areas or communities).

Environmental and socio-economic impacts, such as impacts on Toolijooa Ridge and Broughton Creek, or impacts on agricultural properties and the Berry township, may occur depending on what options are available within the corridor.

An upgrade to the Princes Highway would meet the project objectives as:

- It would improve the road safety and efficiency of the Princes Highway between Toolijooa Road and Schofields Lane.

- It could provide the opportunity to upgrade the existing alignment. An upgrade to the existing alignment would maximise the use of an existing asset, reducing construction and operational costs. It would also minimise the amount of land that would need to be acquired.
- It would provide an opportunity to remove traffic from Berry, while remaining close enough to the town to minimise the economic impacts on local businesses from the loss of highway generated trade.

The 'Sandtrack'

As described in **Chapter 2**, the 'Sandtrack' provides an alternative route for regional traffic travelling between Gerringong and Bomaderry. An upgrade of this route would be an alternative option to an upgrade of the Princes Highway between Gerringong and Bomaderry/Nowra. This option would require the widening and upgrade of the local roads that make up the 'Sandtrack'.

The upgrade of the 'Sandtrack' would be constrained by the Seven Mile Beach National Park, and the close proximity of Coomonderry Swamp (a wetland protected by *State Environmental Planning Policy No.14 (Coastal Wetlands)*). Other constraints include the topography closer to Gerringong and Gerroa, the floodplain areas close to the Shoalhaven River, existing industrial areas at Bomaderry and the need to cross an existing freight rail line. These constraints would mean that an upgrade of the 'Sandtrack' would need to be constructed on line, limiting staging opportunities during construction.

An upgrade to the 'Sandtrack' would achieve the project objective of delivering environmental and social benefits to Berry due to the removal of through traffic not wanting to stop in Berry. It would also improve the road safety of the 'Sandtrack'. It would not however satisfy the remainder of the project objectives as:

- It may have negative economic impacts for businesses in Berry that rely on highway generated trade, given the considerable distance separating the 'Sandtrack' and Berry and the loss of visual connectivity between the town and the highway.
- It would result in adverse amenity impacts to the communities located along the 'Sandtrack' that are currently not impacted by highway traffic and heavy vehicles, such as Gerringong and Gerroa. The 'Sandtrack' is accessed via Fern Street which runs through the centre of Gerringong and unless a bypass is provided for Gerringong, an upgrade to Fern Street would have significant severance impacts on the town resulting in adverse socio-economic impacts.
- It would provide limited improvement of the safety of the overall road network. The full length of the highway between Toolijooa Road and Schofields Lane would continue to have road safety issues albeit with lower traffic volumes.
- Greater land acquisition would be required than for upgrading the Princes Highway. Strip acquisition along the entire length of the route, including along the edge of the Seven Mile Beach National Park and through the industrial and commercial area of Bomaderry, would be required to cater for the full four lane design and interchanges.

South Coast rail upgrade

The South Coast railway extends from Waterfall in southern Sydney to Bomaderry. From Kiama, the line is non-electrified and consists of a single line. There are no direct services from Berry to Sydney, with passengers required to change trains at Wollongong, Dapto or Kiama. Rail passengers currently represent around one per cent of average weekday travel mode share in the region.

An upgrade to the South Coast railway line south of Kiama would involve the duplication of the railway to Bomaderry. Removal of level crossings and other improvements may be necessary to accommodate the widened corridor and the increase in train movements.

In the absence of an upgrade to the highway, a significant shift from road to rail would be required to improve the efficiency of the highway and to deliver significant environmental benefits to Berry. An upgrade to the rail network in the region is not likely to achieve this shift as:

- The railway line currently terminates at Bomaderry. Any freight or passengers travelling further south would be required to change transport modes at Bomaderry. The railway line would need to be extended further south for it to provide any comparable alternative service to the highway for the region.
- The low volume of freight movements along the South Coast would not make rail financially competitive compared with road transport.
- There are current and future competing needs of passenger and freight movements on the railway network between Sydney and Wollongong. This would have implications on the number of additional services that the South Coast railway line could accommodate in the absence of other rail network upgrades.

Road safety issues would also remain in the absence of any significant improvement to the highway, particularly for local rural communities that would still rely on the highway as the main transport corridor. Regional and local economic development would also suffer, as the road safety and efficiency challenges of the highway would remain.

The project would not limit the potential for the upgrade of the South Coast railway in the future.

3.3.2 Evaluation of the alternatives

A 'do nothing' alternative would not satisfy any of the project objectives. The highway would continue to have safety, efficiency and capacity problems. This would have flow on effects to the regional and local economy, as well as to the communities located along the corridor. Highway traffic would also continue to travel through Berry with continued adverse road safety impact to the community and local businesses. For these reasons, the 'do nothing' alternative was not considered further.

An upgrade to the 'Sandtrack' would not provide any distinct benefits to the environment, the economy or communities in the region when compared to an upgrade of the Princes Highway. It would generate adverse impacts on a number of communities located along the 'Sandtrack' that are not currently exposed to highway traffic. The Princes Highway would continue to have road safety issues for traffic travelling to local destinations between Gerringong and Bomaderry, and regional destinations west of Berry that cannot be accessed via the 'Sandtrack'.

An upgrade to the South Coast railway would be unlikely to deliver a significant shift from road to rail to resolve the safety and efficiency problems of the Princes Highway. As it would be unlikely to replace the Princes Highway as the main transport corridor, the predicted increase in traffic would further decrease the safety, efficiency and capacity of this regional route. Impacts on the local and regional economy, and local communities, would result. For these reasons, an upgrade to the railway is not considered a viable alternative to an upgrade to the Princes Highway or the 'Sandtrack'.

3.3.3 Preferred alternative

An upgrade to the Princes Highway best meets the project objectives. The Princes Highway is the preferred alternative as:

- It would improve the road safety and efficiency of the Princes Highway, particularly near Foxground bends and Berry.
- It would support regional and local economic development.
- It could provide the opportunity to upgrade the existing alignment which would minimise impacts on the environment, communities and the local economy.
- It would result in the least change to community connectivity.
- It would provide beneficial effects for Berry by bypassing the town and removing highway traffic, while remaining close enough to the town to minimise the loss of highway generated trade.

3.4 Long list of options

3.4.1 Description of the options

Figure 3-5 presents the long list of options which were assessed as part of the route options development process. These options consisted of a number of nodes which were joined to form the individual routes. Within sections B and C, over 30 options were assessed.

Long list options considered in section B were generally located between the South Coast Railway and the existing Princes Highway. There were two main options that followed the South Coast Railway, an option to the north of the existing highway and a number of options with varying alignments in the vicinity of Toolijooa Ridge and the bypass of the Foxground bends.

Long list options considered in section C largely focussed on the bypass of Berry. A number of options and variances between nodes were assessed that passed both to the north and the south of Berry at varying distances from town, including a continuation from Section B of an alignment following the South Coast Railway line on the southern side of town.

3.4.2 Evaluation of the options

The most feasible route options in sections A and D were both determined to be upgrades of the existing highway. These sections are outside of the focus of this project, but the need to tie in to these options was also considered during the assessment of the long list options.

In section B, options that followed the railway line generally performed well against the project objective of improving road safety, improving efficiency and managing potential adverse environmental impacts. These options generally performed poorly against the project objectives of providing value for money, supporting economic development and minimising social impacts. The best performing options in section B generally followed the alignment of the existing highway before bypassing the Foxground bends and rejoining the existing highway alignment north of Austral Park Road.

In section C, options that bypassed Berry to the north, including options following the North Street corridor, generally performed well against the project objective of improving road safety and efficiency and had varied performances against the remaining project objectives. Options that bypassed Berry to the south, including options along the railway line, generally performed well against the project objectives of improving road safety and efficiency but performed poorly against the remaining objectives, particularly providing value for money and supporting economic development.

The best performing options in sections B and C in the assessment were carried forward as short listed route options and further consideration through the value management workshop process. A description and evaluation of the shortlisted options is presented in **Section 3.5**.

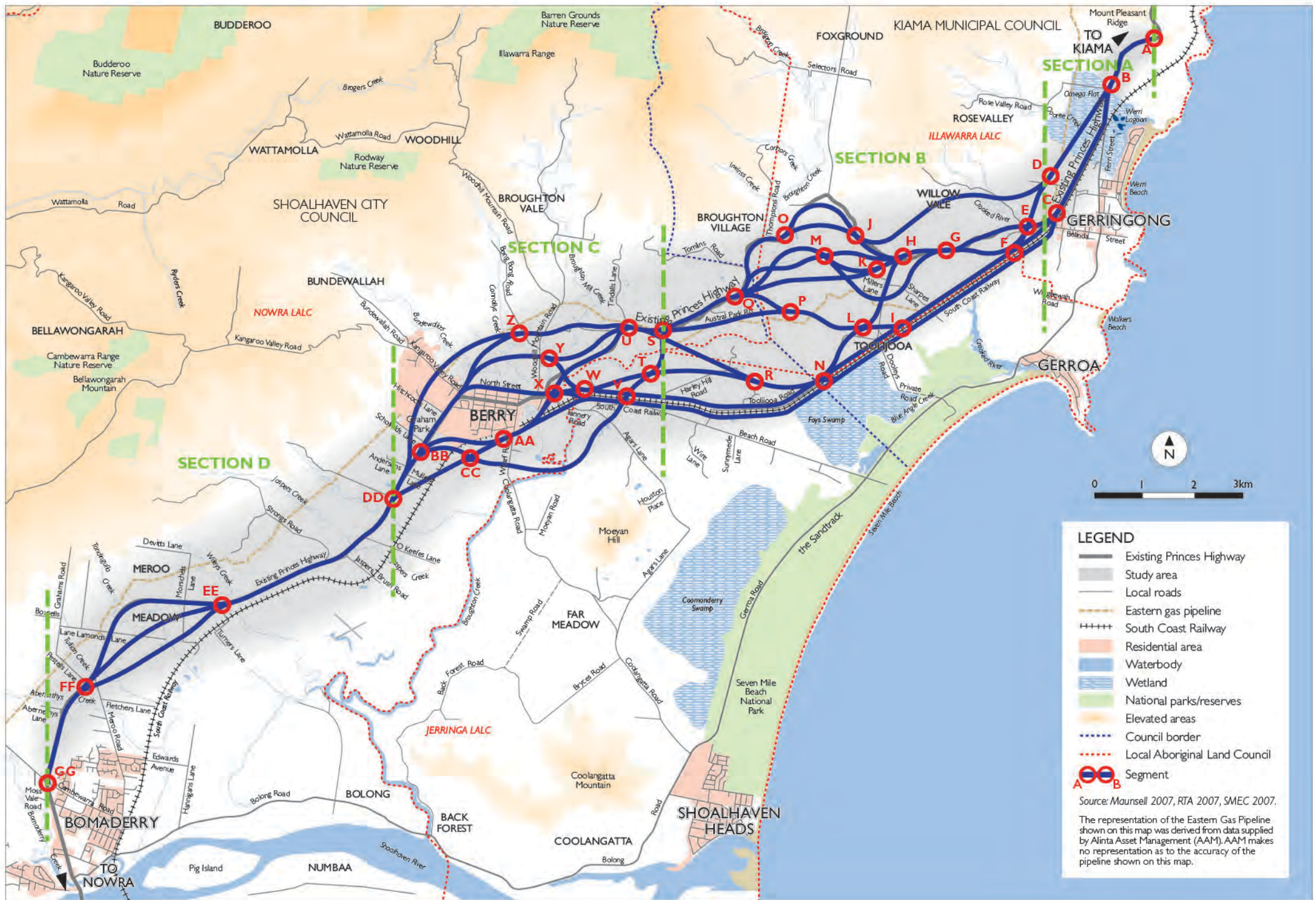


Figure 3-5 Long list of options

3.5 Short-listed route options

3.5.1 Description of route options

Options for sections B and C are described in **Table 3-2** and illustrated in **Figure 3-6**. Three options were proposed in section B, the pink, green and yellow options. The blue and orange options were proposed in section C and a third option, the modified orange option was developed through the value management process in response to community feedback (refer to **Chapter 6**). The modified orange option and the orange option are shown in **Figure 3-7**. The brown option was the only option to cover sections B and C.

As described in **Section 3.1.3**, an option for a bypass to the south of Berry was also assessed.

Table 3-2 Description of route options for sections B and C

Section	Route option	Description
B	Pink option	The pink option followed the existing highway from Gerringong to around Toolijooa Road north of Berry where the existing alignment became significantly sub-standard. At this point, around one kilometre southeast of Foxground Road, the pink option cut through the peak of Toolijooa Ridge. The option included a cutting around 900 metres in length, descending to Broughton Creek in a long sweeping curve. This curve crossed Broughton Creek three times before ascending a ridge to rejoin the existing highway at Austral Park Road. From this point, the pink option was common with the green option and generally followed the existing highway to around 500 metres east of Tindalls Lane.
	Green option	The green option diverged to the southwest from the existing highway at Toolijooa Road in a new corridor. The corridor passed under the north saddle of the Toolijooa Ridge in a 350 metre long twin tunnel. The option emerged in the Broughton Creek floodplain and curved south before crossing Broughton Creek three times. The green option then ascended a ridge to meet the existing highway at Austral Park Road and was common with the pink option and generally followed the existing highway to around 500 metres east of Tindalls Lane.
	Yellow option	The yellow option formed a new road corridor along the western edge of the railway line south of Gerringong for around 4.5 kilometres. This option then went west around the south eastern spur of the Toolijooa Ridge, passing under the south saddle in a 350 metre long twin tunnel. From the western side of the ridge, the route travelled in a relatively straight alignment before it rejoined the existing highway at Austral Park Road and followed an alignment common to the pink and green options and generally followed the existing highway to around 500 metres east of Tindalls Lane.
C	Blue option	The blue option began at around 500 metres east of Tindalls Lane and travelled west, across Woodhill Mountain Road and Bundewallah Creek in a circular arc to bypass Berry. It swept to the south under Kangaroo Valley Road and across North Street where it joined the existing highway in a cutting. The option continued to follow the existing highway to Croziers Road.

Section	Route option	Description
	Orange option and modified orange option (Figure 3-7)	The orange option generally followed the existing highway from around 500 metres east of Tindalls Lane until the northern entrance to Berry. The route then curved right onto and along the North Street corridor to bypass Berry. The option ran parallel to North Street within an existing road reserve to the north of North Street and enabled North Street to remain operational as a service road. The orange option rejoined the existing highway as it passed under Kangaroo Valley Road in a cutting and continued to follow the existing highway to Croziers Road. The modified orange option was developed as an outcome of the value management workshop in consultation with the community. The option departed from the existing Princes Highway alignment from around 500 metres east of Tindalls Lane with the aim of avoiding the sportsground, Camp Quality Memorial Park and the heritage precinct at Pulman Street. The option crossed Bundewallah Creek to the north of the sportsground and joined the North Street corridor near Albany Street.
B and C	Brown option	The brown option was about 16 kilometres in length and was the only short listed option that passed through sections B and C. This option ran along the western side of the railway line in a new 10 kilometre corridor from south of Gerringong to the north of Berry. Travelling west from the David Berry Hospital this route crossed the existing highway, Broughton Mill Creek and Woodhill Mountain Road and continued west along the North Street corridor along a common alignment to the orange option to bypass Berry. It turned south as it passed under Kangaroo Valley Road in a cutting, continuing along the existing highway to Croziers Road.



Figure 3-6 Short listed route options

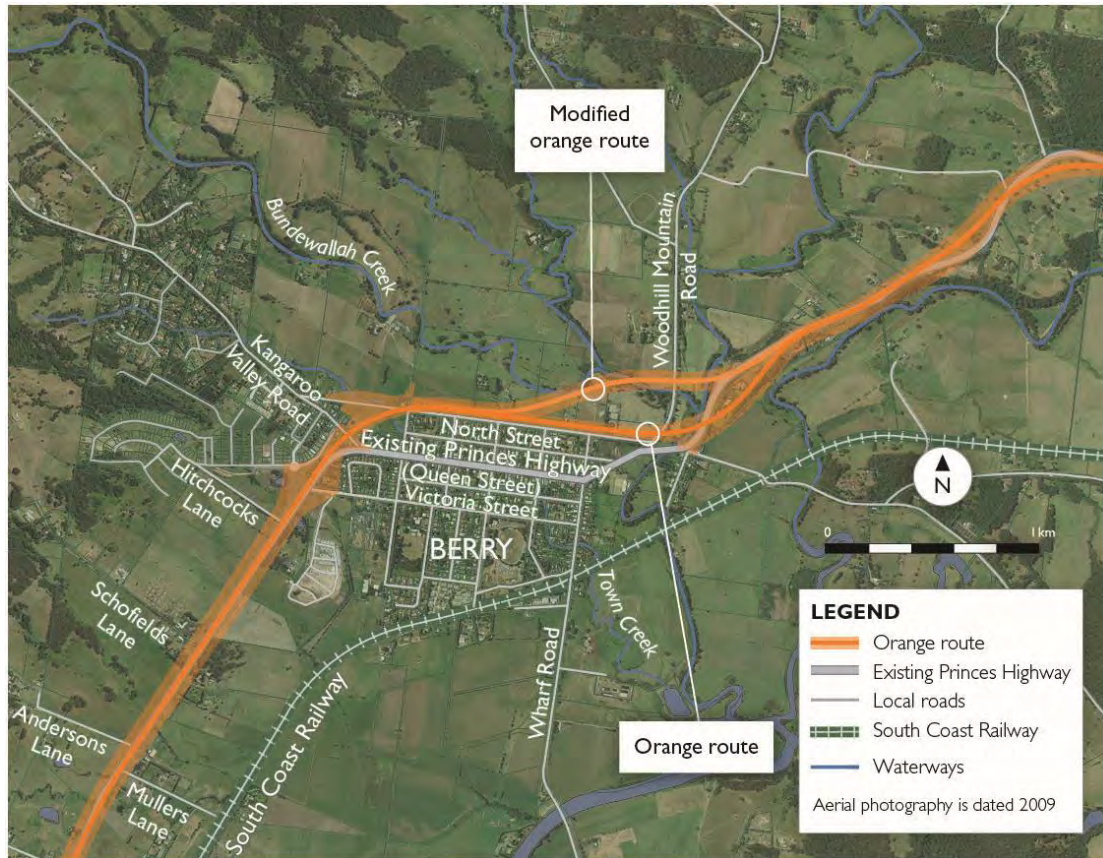


Figure 3-7 Modified orange option and the orange option

Southern bypass of Berry

An option to bypass Berry to the south was investigated and is shown in **Figure 3-8**. The southern option commenced around the same location that the blue and orange options started. This option followed the existing highway before running directly south, on the eastern side of Berry. It crossed Tannery Road (east of Pulman Street) and the South Coast Railway before sweeping west with a large curve and crossing Broughton Mill Creek. The option crossed Wharf Road and required a second crossing of the South Coast Railway before rejoining the existing Highway near Mullers Lane.

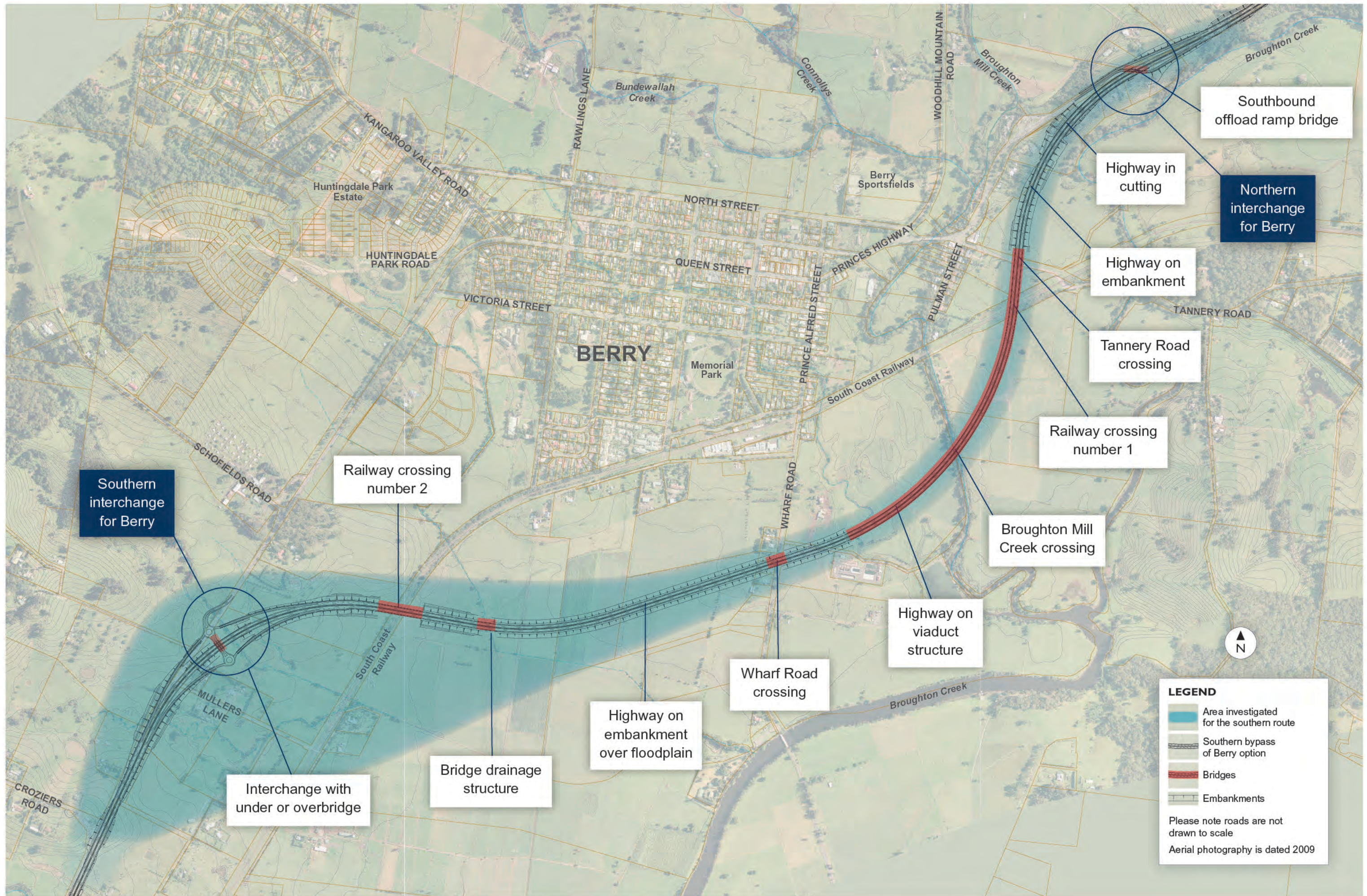


Figure 3-8 Southern bypass of Berry

3.5.2 Evaluation of route options

Evaluation of route options for section B

Yellow option

The yellow option performed marginally better against the environmental criteria when compared to the pink and green options. The option had the least impact on threatened species, habitats and biodiversity corridors. It also had the least impact on Aboriginal and non-Aboriginal heritage.

However, the value management workshop concluded that the yellow option should not be pursued as it performed poorly against the functional and socio-economic criteria. The option created a new highway alignment remote to the existing alignment, crossed high value agricultural land and required a greater level of land acquisition. As such, when compared to the pink and green options, it was determined that the yellow option would:

- For functionality, perform the worst in terms of constructability due to the presence of acid sulfate soils and soft soils, and due to the need to import fill for the construction of embankments. It would also leave a significant length of residual highway with a lower frequency but higher severity of accidents.
- For communities, have a direct impact on the viability of local communities and a significant change to the landscape due to impact on relatively undisturbed rural land and communities.
- For agricultural and non-agricultural businesses, perform the worst due to the impact on higher quality agricultural land, including the severance and acquisition of agricultural land.

For these reasons the yellow option would not meet the project objectives of supporting regional and local economic development and minimising adverse impacts on the local social environment.

Pink and green options

The pink and green options performed well against the value management assessment criteria and project objectives. In particular, both performed well against the project objectives of improving road safety and efficiency. The pink option included a deep cutting through Toolijooa Ridge and the green option included a tunnel through the ridgeline. To different degrees, the options also satisfied the project objectives of minimising adverse environmental and local social impacts.

To determine a preferred option for section B, additional investigations were undertaken as an outcome of the value management workshop. These investigations concluded that the green option generally performed better than the pink option against the socio-economic and environmental selection criteria as:

- For the socio-economic environment, the tunnel minimised the intrusion into the landscape and required a smaller project footprint. This also minimised the severance and acquisition of properties, and the associated impacts on agricultural businesses.
- For the natural and cultural environment, the tunnel largely avoided direct impacts on the cultural and ecological values of Toolijooa Ridge including impacts on an endangered ecological community and a potential wildlife corridor along the ridgeline.

However, through the gathering of detailed geotechnical information and design development of the tunnel as part of these investigations, it was found that the construction of the portal at the northern end of the tunnel would require some removal of the vegetation that it was intending to avoid. This therefore lessened the potential benefits that the tunnel was believed to provide.

Further, the traffic efficiencies associated with the gentler grades and shorter length of the tunnel were not deemed sufficient to out-weigh the additional capital and operation and maintenance expenditures of about \$91 million (in present value terms calculated in 2009) required for the tunnel compared to the cutting. Therefore, based on the project objective of providing value for money, the pink option was carried forward as part of the preferred option for the project.

Further discussion of the evaluation of the pink and green options is provided in *Gerringong to Bomaderry Princes Highway Upgrade, Toolijooa Ridge Preferred Option Report (RTA, June 2009c)*.

Evaluation of route options for section C

Blue option

There was little difference between the blue, orange and the modified orange options when assessed against the functionality criteria. However, the blue option was considered to provide the best alignment and had the least constructability issues.

Due to the distance from Berry, the blue option was considered to have a lower noise and visual impact on the Berry community. It was also considered to have the least impact on Aboriginal and non-Aboriginal heritage, including the heritage precinct at Pulman Street. However, the blue option overall performed the worst against the environmental and the socio-economic criteria as:

- The option was largely greenfield and impacted on high value agricultural land. This would result in a greater impact on agricultural productivity and viability of the directly impacted properties, the severance of land, and the viability and connectivity of the rural community.
- The option would result in a greater impact on businesses within Berry, due to the potential losses in highway generated trade associated with a loss of visual connectivity with the town with a bypass diverge point and interchange located about three kilometres from town at Tindalls Lane.
- The option performed the worst in terms of the impacts on the natural and cultural environment. In particular, it had the greatest impact on endangered ecological communities (EECs), threatened species and wildlife corridors, compared to the orange and modified orange options.

As such, the blue option would not satisfy the project objectives of supporting regional and local economic development, and minimising adverse environmental and local social impacts. For these reasons the blue option was not pursued further.

Orange option

Due to the proximity to Berry, both the orange and modified orange options had the greatest visual and noise impacts on the town. However, both options performed consistently better than the blue option against the environmental, and the socio-economic criteria as they would:

- Maintain the visual connection between the highway and Berry.
- Minimise the potential losses in highway generated trade, while enhancing the amenity of Queen Street through the removal of highway traffic.
- Minimise land take, vegetation clearance and impacts on agricultural land by utilising an existing road corridor for much of its length.

As such, the orange and modified orange options would satisfy the project objectives of supporting regional and local economic development and maximising the benefits to the local social environment.

The value management workshop recommended that the modified orange option be pursued further, subject to proving its feasibility, as it performed better than the orange option against the socio-economic, natural and cultural value management assessment criteria. This specifically related to the impacts of the orange option on the Berry sportsground, the Camp Quality Memorial Park, and on the heritage precinct at Pulman Street. For these reasons, the modified orange option would be better placed to meet the project objectives of minimising adverse environmental and local social impacts, and supporting regional and local economic development.

Evaluation of route options across both sections B and C

Because the brown option extended across both Section B and Section C, it was evaluated against the combined options of the pink/modified orange and green/modified orange options. The value management workshop recommended that the brown option should not be pursued further as it was considered deficient on constructability, environmental, functionality and socio-economic grounds. Specifically, the key limitation of the brown option was that it had the greatest impact on:

- The natural environment, including impacts on EECs, wetlands, wildlife corridors and water quality.
- The cultural environment, specifically impacts on the David Berry Hospital, Broughton Mill and the heritage precinct at Pulman Street.
- The socio-economic environment, with significant impacts on agricultural properties and the associated flow on effects on productivity and viability resulting from land take and the exacerbation of property severance.
- Communities, with the route having a greater level of severance and property acquisition, impacting on community connectivity, accessibility and amenity (such as at Toolijooa Ridge and Harley Hill).
- Landscape, with poor integration with the natural landform and the introduction of new visual impacts.

As such the brown option did not satisfy the project objectives of supporting regional and local economic development, minimising adverse local social and environmental impacts.

The brown option also performed inconsistently against the functional criteria. While it provided the greatest saving in travel times and minimised the number of direct or controlled accesses, it performed poorly against elements of the functional criteria, as:

- The option had greater constructability challenges due to soft soils, flooding risks and the need to import significant volumes of fill. This would not meet the project objective of providing value for money.
- It ranked the lowest in overall network safety due to the considerable length of residual highway that would remain with continued safety issues. As such, the brown option would not meet the project objective of improving road safety.

Evaluation of the southern bypass of Berry

The southern bypass of Berry option differed from the other options assessed. Its location to the south of the Berry township presented environmental, social and functional constraints and benefits that were not associated with the northern options. Specific limitations included impacts on:

- The cultural environment, specifically impacts on the David Berry Hospital, the heritage precinct at Pulman Street and an Aboriginal heritage encampment located at the confluence of Broughton Mill Creek and Broughton Creek.
- Constructability, there would be a high probability of encountering soft soils and acid sulfate soils through this area.
- Surface water and flooding, with the alignment being located across a floodplain.
- The socio-economic environment, with the severance of a number of large agricultural properties as opposed to the northern options that utilise the existing road corridor.
- Landscape character, with the introduction of new visual impacts due to the dominant structures required through this area.

As such the southern bypass of Berry did not satisfy the project objectives of supporting regional and local economic development, and minimising adverse local social and environmental impacts.

The option would also require the construction of nine viaduct or bridge structures in order to cross the floodplain and the South Coast railway. As a result the southern bypass of Berry would not meet the project objective of providing value for money. Further discussion of the evaluation of the southern Berry bypass option is provided in **Section 3.6.7**.

3.5.3 Preferred option

The options evaluation process and the additional investigations clearly identified and documented the route and access options to be carried forward as the preferred option. The preferred option was a combination of the pink and modified orange route options.

The preferred option was considered to provide the best outcome for the local environment and community. It performed the best against the project objectives of providing value for money, supporting regional and local economic development, traffic efficiency and maximising the benefits to the local social environment and road safety.

3.6 Design refinement options

3.6.1 Access options for Berry

A number of access options for Berry were assessed as part of the value management workshops. As well as this, additional options were also assessed, which included the provision of flood free access to Berry, the inclusion of a second northbound off-ramp and the splitting of the southern interchange to provide ramps in two separate locations.

Description of access options

Workshop options

Nine separate access options were shortlisted for Berry (B1-B9), as shown in **Figure 3-9** and **Figure 3-10**. These were a combination of on and off-ramps at both ends of the town and at a central location.

The distinguishing features of the access options into Berry were:

- Option B1 provided a northbound off-ramp that connected to an existing roundabout in Huntingdale Park Estate.
- Option B2 provided a northbound off-ramp that travelled under the proposed Kangaroo Valley Road overbridge, rounding in a loop to the left to join with Kangaroo Valley Road opposite Huntingdale Park Estate.
- Option B3 provided a northbound off-ramp that travelled under the proposed Kangaroo Valley Road overbridge, then curved to the left onto North Street to join Kangaroo Valley Road.
- Option B4 provided a southbound off-ramp that connected directly to Alexandra Street.
- Option B5 provided a southbound off-ramp that connected to the existing highway around 400 metres north of Tannery Road.

The distinguishing features of the highway access options from Berry were:

- Option B6 provided a northbound on-ramp at Woodhill Mountain Road.
- Option B7 provided a northbound on-ramp that connected to the existing highway around 500 metres north of the property 'Mananga' and required a bridge over the proposed alignment.
- Option B8 provided a southbound on-ramp at the western end of Queen Street.
- Option B9 provided a southbound on-ramp at Alexandra Street.

Flood free access options

Several options were identified to provide flood immune access to Berry. These options were the upgrade of a residual section of the existing highway in the vicinity of the existing Broughton Mill Creek bridge to provide flood immune access for Berry, a flood free u-turn facility at Schofields Lane, a gated access at Alexandra Street for use during flood times and additional ramps that would connect to Kangaroo Valley Road.

Additional northbound off-ramp

An option was considered to provide a second northbound off-ramp to provide access to Berry. The off-ramp would likely be located at the western end of the bridge at Berry and tie into Woodhill Mountain Road.

Split southern interchange

An option was considered that split the southern interchange for Berry into two smaller interchanges, with the north-facing on and off-ramps remaining at Kangaroo Valley Road and the south-facing on and off-ramps relocated further south, close to Schofields Lane. This option was assessed against the provision of a full interchange at Kangaroo Valley Road.



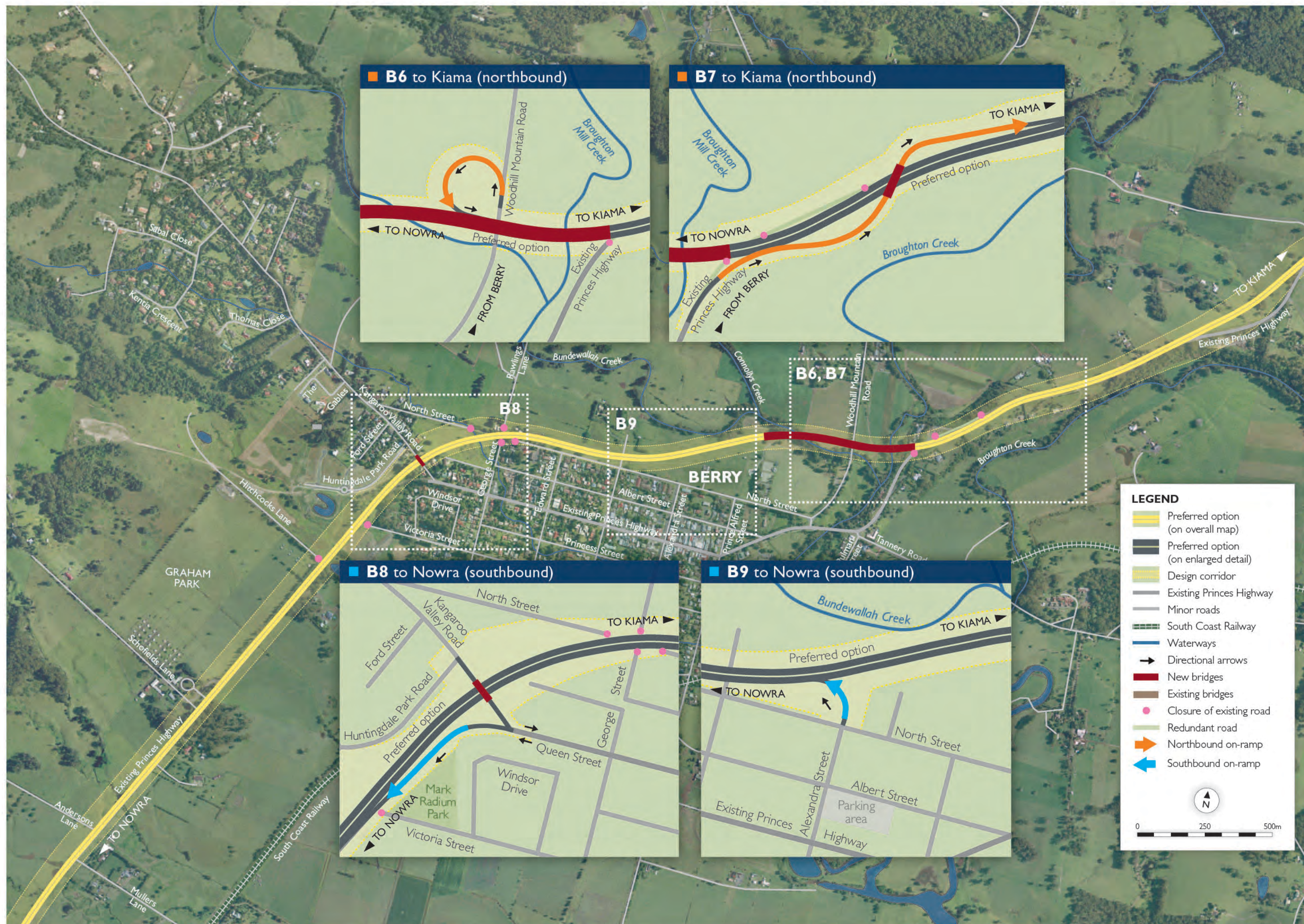


Figure 3-10 North and southbound on-ramp options B6 to B9

Evaluation of access options

Workshop options

The outcomes of the access options workshop were as follows:

- Options B9 and B4 (which provides access to/from Berry via Alexandra Street) were not favoured due to the potential impacts on the local residential amenity, socio-economic environment (given the retail core of Berry focuses on Queen Street) and the alterations to the local road network. As such, these options would not satisfy the project objectives of minimising adverse impacts on the local social environment, supporting the regional and local economic environment.
- Option B3 was removed from the assessment as it was considered to be an indirect route, was overly intrusive, and impacted on a greater number of residences. This option failed to meet the project objective of minimising adverse impacts on the local social environment. Option B2 provided the same function but with a lesser potential social and visual impact.
- Option B1 was not favoured given the potential amenity impacts on the Huntingdale Park estate (particularly noise and visual impacts associated with the increased traffic). This would be inconsistent with the project objective of minimising adverse impacts on the local social environment.
- A combination of remaining access options (B2, B5, B6, B7 and B8) at both the northern and southern ends of Berry were favoured and recommended to be carried forward for further consideration as these options maintained the existing gateway into Berry from the north and the east-west traffic movements through town. These options would support the project objectives of minimising adverse impacts on the local social environment, and supporting the regional and local economic environment.
- The access options at the northern end of Berry (B5, B6 and B7) rely on the existing flood prone highway alignment and would remain flood prone at and above the 1 in 5 year flood event. As a result, further investigations were recommended to assess ways to provide flood immune access to and from Berry.

Further evaluation and investigation of the workshopped options led to:

- A reduction in the footprint and bulk of the access options at the northern end of Berry (Option B5 and B7) by consolidating the ramps and passing the northbound ramp exiting Berry under the highway.
- The southbound on-ramp exiting Berry (Option B8) being shifted to the south of Victoria Street to minimise the direct impact on Mark Radium Park and to maintain access to the park from Queen Street.
- The reintroduction of the northbound off-ramp providing access into Berry that connects to Huntingdale Park Road (Option B1) in favour of Option B2. The long term safety concerns with the 180 degree turn associated with the Option B2 ramp were considered to outweigh the potential amenity impacts associated with Option B1.

Flood free access options

The assessment of the flood immune access options concluded that:

- The upgrade of the existing highway between Broughton Mill Creek bridge and the retail precinct of Berry represented poor value for money (with an estimated cost of \$3 million). The extent of works would have adverse impacts on surrounding land use, business viability and amenity. As such, this option failed to meet the project objectives of providing value for money, and minimising adverse impacts on the local social environment.
- A flood free u-turn facility at Schofields Lane would not provide a safe or efficient solution during adverse weather when compared to a dedicated access. Therefore, this option did not satisfy the project objective of improving road safety.
- A gated access at Alexandra Street (Option B4), which would be used in times of flood only, would not be carried forward, as it would alter the existing local road network and traffic movements in town. This would result in amenity impacts on surrounding residential areas and would create conflicts between motorists and pedestrians. In addition gated accesses have proven difficult to manage, resulting in uncontrolled use. Therefore this option did not satisfy the project objectives of minimising adverse impacts on the local social environment, improving road safety, and supporting regional and local economic development.
- Providing a northbound on-ramp from Berry and a southbound off-ramp into Berry at the southern interchange for Berry was the preferred option. This would provide flood immune access as well as direct access to the highway for existing residents to the north west of Berry along Kangaroo Valley Road and beyond. It would also service the Huntingdale Park Estate, which is the major growth area of Berry. This option supports the project objective of improving road safety and negates the need to travel through Berry to access the highway when heading north.

Second northbound off-ramp for Berry

Traffic modelling undertaken for the southern interchange for Berry indicated that the proposed northbound off-ramp would experience minimal delays during the holiday peak period. As such, including a second northbound off-ramp is not considered to provide value for money as modelling indicates that the southern interchange for Berry would continue to operate at an acceptable level of service until around 2070.

Providing a second northbound off-ramp for Berry would also not meet the project objectives of managing adverse environmental and social impacts. The off-ramp would likely be located at the western end of the bridge at Berry and tie into Woodhill Mountain Road, which would result in additional environmental impacts during construction and operation due to the proximity of Bundewallah Creek and associated geological conditions.

The second northbound off-ramp for Berry has not been included as part of the project. However, the concept design does not preclude the addition of this ramp should it become warranted in the future. Further details are provided in **Section 7.1.3** and **Appendix D**. The ramp would be subject to a separate environmental assessment in the future should it be needed.

Split southern interchange

The option to split the southern interchange for Berry was assessed against the construction of a full interchange at Kangaroo Valley Road.

It was proposed that the split southern interchange option would reduce the operational noise and visual impacts associated with a full interchange at Kangaroo Valley Road. It would also slightly reduce the size and cost of excavation required for the construction of this interchange at Kangaroo Valley Road.

Overall however, the split southern interchange option would increase the cost of construction of the southern interchange for Berry as it would require the construction of an additional bridge close to Schofields Lane and a two-way service road (approximately 1 kilometre long) between the interchange and Berry. As a result this option would not meet the project objective of providing value for money.

The split southern interchange option would also not meet the project objectives of minimising adverse environmental and social impacts. The option would require a larger footprint and would increase impacts on adjacent properties.

The split southern interchange has not been included in the project and as such further consideration of this option is not included in this environmental assessment.

Preferred option

The preferred access options for Berry are:

- A half interchange comprising a combination of access options B5 and B7 to form the northern access interchange, providing an exit from Berry for traffic travelling to the north and access into Berry for traffic travelling from the north.
- An all-movements interchange at Kangaroo Valley Road, allowing access into and out of Berry from the north and south.

3.6.2 Berry bypass design options

The objectives of the Berry bypass review were to identify possible refinements that could:

- Improve the aesthetics and form of the bridge at Berry.
- Lower the height of the bridge at Berry as much as practicable, to minimise environmental and community impacts.
- Relocate the alignment near North Street further north and to identify urban design solutions for the area between the Berry bypass and North Street.

Description of options

Three options were presented to and developed by the CRG which placed the alignment to the north of Bundewallah Creek. These initial options are shown in **Figure 3-11** and are described in **Table 3-3**.

Table 3-3 Initial design refinement options

Option	Description
Bypass option 1	This option moved the alignment further north near Tindalls Lane. It crossed Woodhill Mountain Road north of the existing preferred option, which required Woodhill Mountain Road to bridge over the highway. The option crossed Connelly's Creek, Bundewallah Creek and the associated floodplain before rejoining the existing preferred option near Kangaroo Valley Road.
Bypass option 2	This option deviated from the existing preferred option near Tannery Road. It swept steeply to the north adjacent to Connelly's Creek. It then crossed Bundewallah Creek and associated floodplain before rejoining the existing preferred option near Kangaroo Valley Road.
Bypass option 3	This option deviated from the existing highway slightly north east of the existing preferred option. It crossed Woodhill Mountain Road and traversed the North Street corridor north of the existing preferred option. It then rejoined the existing preferred option near Rawlings Lane.

Evaluation of options

Preliminary design investigations for option one and option two determined that the construction of extensive structures, such as bridges and/or viaducts would be required to cross Bundewallah Creek and the associated floodplain on the northern side of the creek. These options would not be consistent with the project objective of providing value for money, as they could potentially cost double that of the existing preferred option to construct.

The social and environmental impacts were also considered when analysing these options against the remaining project objectives. Bypass option one in particular would sever a number of agricultural properties that would not be largely impacted by the existing preferred option. Both option one and option two would cross the Bundewallah Creek floodplain and would have surface water and flooding impacts. As a result, option one and option two would not be consistent with the project objectives of minimising social and environmental impacts.

In comparison to option one and option two, the location of bypass option three closer to the existing preferred option, minimised the property severance impacts and reduced the requirement for large structures to be built. As a result, bypass option three was able to satisfy the objectives of the CRG process by moving the alignment further north away from Berry whilst still meeting the project objective of providing value for money.

Preferred option

The CRG concluded that bypass option one and option two did not represent value for money. As a result bypass option three was accepted as the preferred option. Further refinements of the preferred option were undertaken and split the alignment into two sections for development by separate community working groups, the bridge at Berry and the northern interchange as one section considered by one group, and the North Street corridor as the other section developed by another group (refer to **Section 3.6.3** and **Section 3.6.4** for further details). Bypass option three was used as the benchmark for these design refinements.

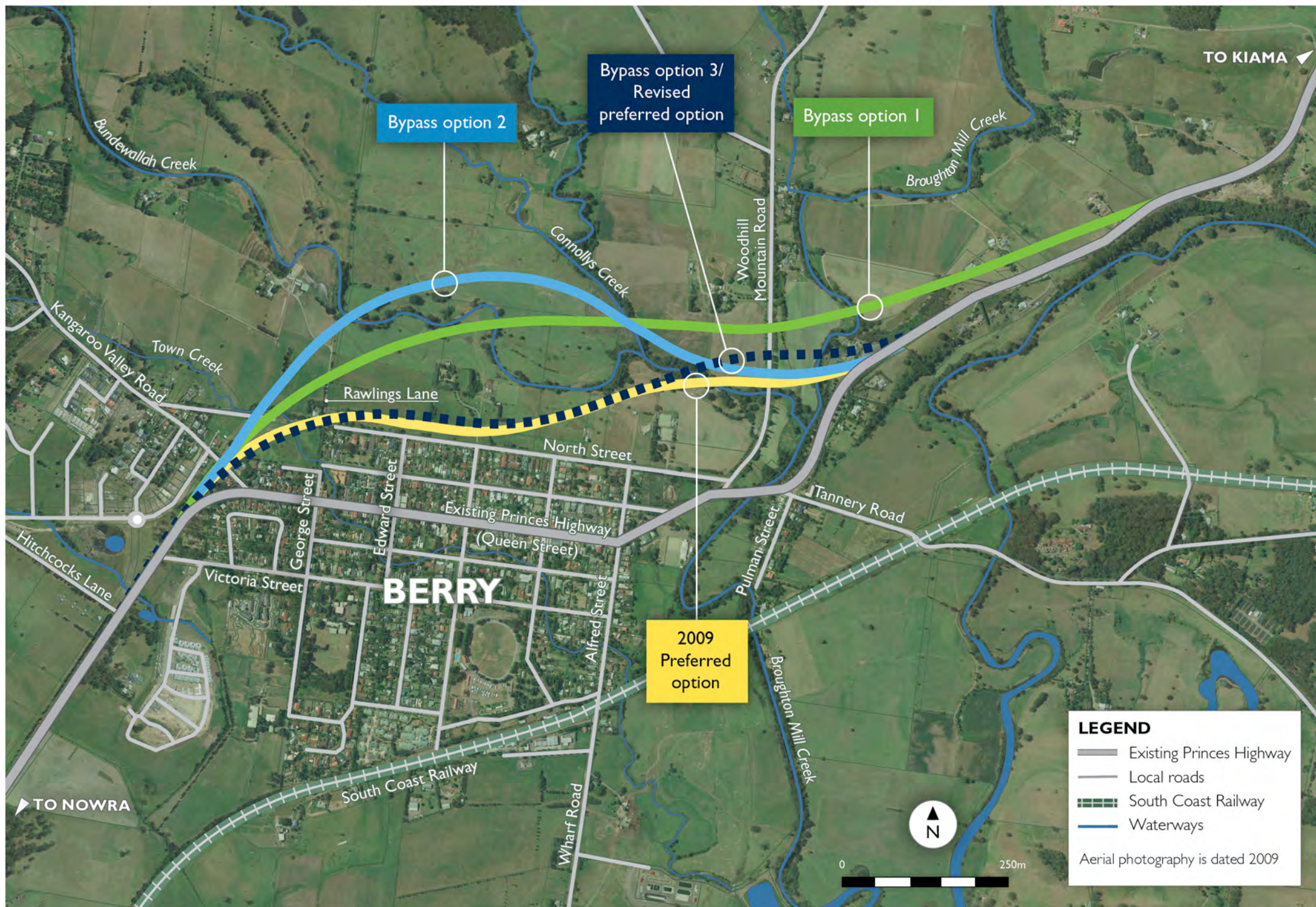


Figure 3-11 Bypass options north of Berry and the preferred option

3.6.3 Bridge at Berry and northern interchange for Berry

The aims of refining the preferred option through north of Berry included:

- The relocation of the bridge further north away from Berry.
- The redesign of the northern interchange to accommodate the change in bridge location, and to lower the bridge as much as possible.

The key constraints to the alignment within the preferred corridor included:

- The additional volumes of excess fill that would be generated at the northern interchange at Berry to accommodate a lower bridge, and the associated costs.
- The vertical grade of the bridge. This was set at a three per cent vertical grade to avoid noise impacts from heavy vehicles accelerating or slowing down at this location.
- The minimum height clearance for vehicles on Woodhill Mountain Road.

Evaluation of options

There were no specific options assessed, however a number of different combinations of ramp and bridge configurations were developed through the community review workshop process. These included assessing different embankments, cuttings and retaining walls at the northern interchange that would optimise the cut/fill ratio and the lowering of the bridge. These had varying impacts on neighbouring properties (due to embankments and retaining walls), the cut/fill ratios and on road safety.

Preferred option

The revised preferred option is shown in **Figure 3-12**. The key differences between the previous preferred option and the revised preferred option were that:

- The bridge has been moved around 95 metres to the north where it crosses Woodhill Mountain Road.
- The bridge has been lowered by around 6.4 metres where it crosses Woodhill Mountain Road.
- The highway at the northern interchange would depart further north along the existing highway alignment, requiring the use of more extensive cut and fill embankments (or retaining walls) on the south side of the project.

The revised preferred option was considered to best meet the project objectives as:

- The reduction in bridge height has been maximised within the identified constraints. This would minimise the visual and noise impact of the project and as such would best meet the project objectives of minimising the social and environmental impacts.
- An optimised cut/fill balance has been achieved to accommodate the north Berry review objectives. Reducing the size of the cutting and increasing the size of the embankments on the north side of the project at the northern interchange to lower the bridge (when compared to the other design refinements considered) would balance the earthworks with the larger cutting on the south side of the project and reduce the costs involved with removing excess spoil from the site. The preferred option was considered to best meet the project objective of providing value for money as it minimises the costs associated with managing excess spoil while still lowering the bridge.

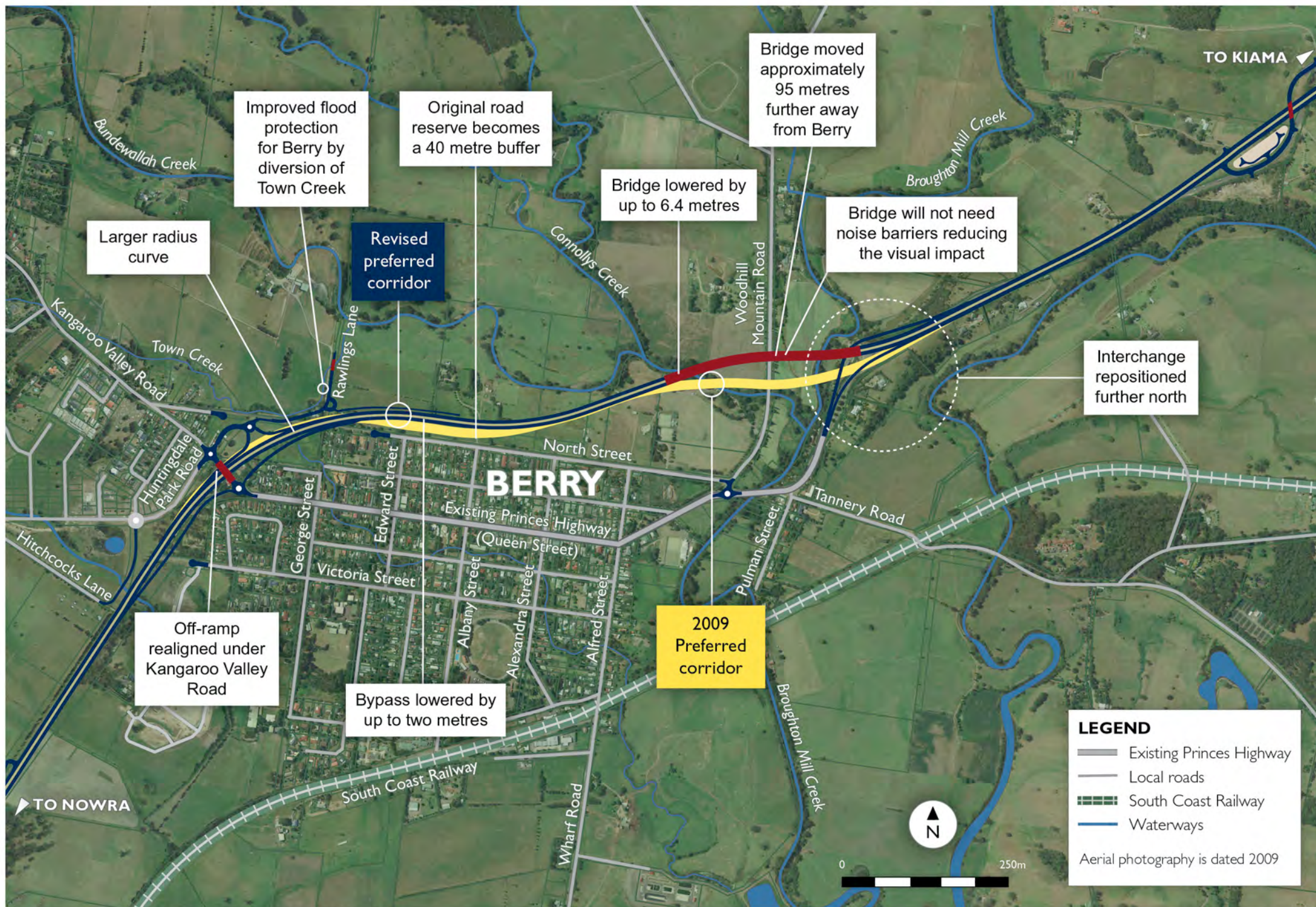


Figure 3-12 The revised preferred option north of Berry

3.6.4 North Street corridor

Options for location of the alignment

Description of options

The preferred corridor through this section moved the alignment further north, away from North Street. Design options were assessed to find the optimal location of the project between North Street and the rural agricultural residence at Lot 31 DP 818336 (property 46 on **Figure 7-38** in **Section 7.9**). The first option was the mid-point between the rural residence building line and a typical building line on North Street. Other options looked at locating the alignment at varying distances between the residence and North Street.

Evaluation of options

Consultation with the owner of the agricultural property determined that locating the alignment at the mid-point between the rural residence building line and a typical building line on North Street would compromise the viability of agricultural activities due to severance and the quality and flood prone nature of remaining land. The best option was considered to be locating the alignment about 40 metres from North Street. This option provided a 40 metre buffer between the North Street residents and the alignment and also reduced the impact on the productive agricultural land of the rural property.

Options for lowering of the alignment

Description of options

Lowering the alignment would minimise the visual and amenity impacts along North Street. However, the ability to lower the alignment was significantly constrained by flooding, the limitations of appropriate pavement drainage and the need to maintain partial flows in Town Creek. As such, the following options were considered in order to facilitate a lowered alignment:

- Lower the alignment as much as possible to the point that permanent pumps would be required to drain the road pavement and flood waters.
- Lower the alignment to the maximum depth to allow the pavement to drain naturally without introducing pumps and include a full diversion of Town Creek to Bundewallah Creek.

Evaluation of options

The use of permanent pumps to drain road pavement and flood waters was not considered viable given the cost of the options, the volumes of water required to be pumped and the risk for road closures. The design of the full diversion of Town Creek considered measures to minimise the impacts on Town Creek, Bundewallah Creek and riparian vegetation. This is discussed in **Section 7.2**, **Section 7.4** and **Section 7.4**. The full diversion of Town Creek would best meet the project objectives of improving road safety and minimising environmental impacts whilst providing a lowered alignment and improved visual amenity for North Street residents.

Preferred option

The revised preferred option is shown in **Figure 3-12**. The key differences between the previous preferred option and the revised preferred option are:

- The alignment has been moved further north and would provide a buffer of around 40 metres between the majority of North Street residents and the bypass.
- The alignment along North Street has been lowered by up to two metres. While the height of the noise wall relative to the highway pavement would remain the same, the height of the noise wall as viewed from North Street would be lowered. This would help to reduce the visual impact of the project.

The preferred option in this section is considered to best meet the project objectives of providing beneficial environmental effects for Berry town centre and minimising the impacts on the local social environment.

Urban design, with the objective to minimise the visual impact of the project was a key consideration during the design refinement process outlined above. A series of urban design workshops were held with a focus to optimise the preferred option in consultation with the community and minimise the visual impact of the project in this area. The outcomes of these workshops and the ongoing consideration of urban design and visual amenity have been included in the concept design and are documented in detail in **Section 7.6** and **Appendix I**.

3.6.5 Arrangement of the southern interchange for Berry

As discussed in **Section 3.6.1**, the southern interchange for Berry would be a full interchange comprising both northbound and southbound on and off-ramps. Further to this, options were assessed to change the arrangement of the interchange, primarily focussed on the alignment of the northbound off-ramp to reduce the potential amenity impacts on Huntingdale Park Road.

Description of options

RMS investigated three alternative options for the southern interchange:

- Option one involved the consolidation of the two proposed roundabouts on Kangaroo Valley Road to a single roundabout centred over the highway. All on and off-ramps would directly connect to this roundabout.
- Option two maintained Kangaroo Valley Road as a single span bridge over the highway but included a new northbound off-ramp that would directly connect to Kangaroo Valley Road at a roundabout. This option would require the realignment of Huntingdale Park Road further west along Kangaroo Valley Road in order to accommodate this ramp.
- Option three resembled the initial option B2 which had previously been assessed at the route options phase. As with option B2, it provided a northbound off-ramp under the Kangaroo Valley Road overbridge. It differed from option B2 by providing a roundabout that would connect to the northbound off-ramp, the northbound on-ramp, Kangaroo Valley Road and the eastern end of North Street. It would also provide for access to the two agricultural properties on Rawlings Lane.

Evaluation of options

The benefits of option one were the streamlined design and the separation of the northbound off-ramp from Huntingdale Park Road. However, this option was considered overly large in terms of bulk and scale, presented constructability difficulties and would be significantly more expensive to construct. As such this option was not considered to support the project objective of providing value for money. The scale and engineered features of the option were also not considered to fit within the landscape character of Berry's rural setting.

Option two would reduce noise impacts due to the separation of highway and local traffic volumes and would reduce changes to the character of Huntingdale Park Road. However, it would also require the additional acquisition of two properties for the realignment of Huntingdale Park Road.

Option B2 was initially rejected due to safety concerns arising from the 180 degree turn required to connect with Kangaroo Valley Road. Option three has alleviated this concern by including a roundabout to slow and control traffic. Option three would further minimise the amenity impact along Huntingdale Park Road and would minimise property acquisition as the land required for the off-ramp and roundabout have already been acquired by RMS.

Preferred option

Option three was chosen as the preferred option as it would best meet the project objectives of providing value for money and minimising environmental and social impacts.

3.6.6 Victoria Street

Description of options

Three options were considered for the western end of Victoria Street. These options are displayed in **Figure 3-13** to **Figure 3-15** and included:

- Option 1** Full closure of Victoria Street (created by a cul-de-sac) with a southbound on-ramp from Queen Street. providing access to the new bypass.
- Option 2** Victoria Street remains open, providing one-way travel between Queen and Victoria streets, with a southbound on-ramp south of Victoria Street.
- Option 3** Victoria Street remains open, maintaining two-way travel adjacent to the highway between Queen and Victoria streets, with a southbound on-ramp south of Victoria Street.

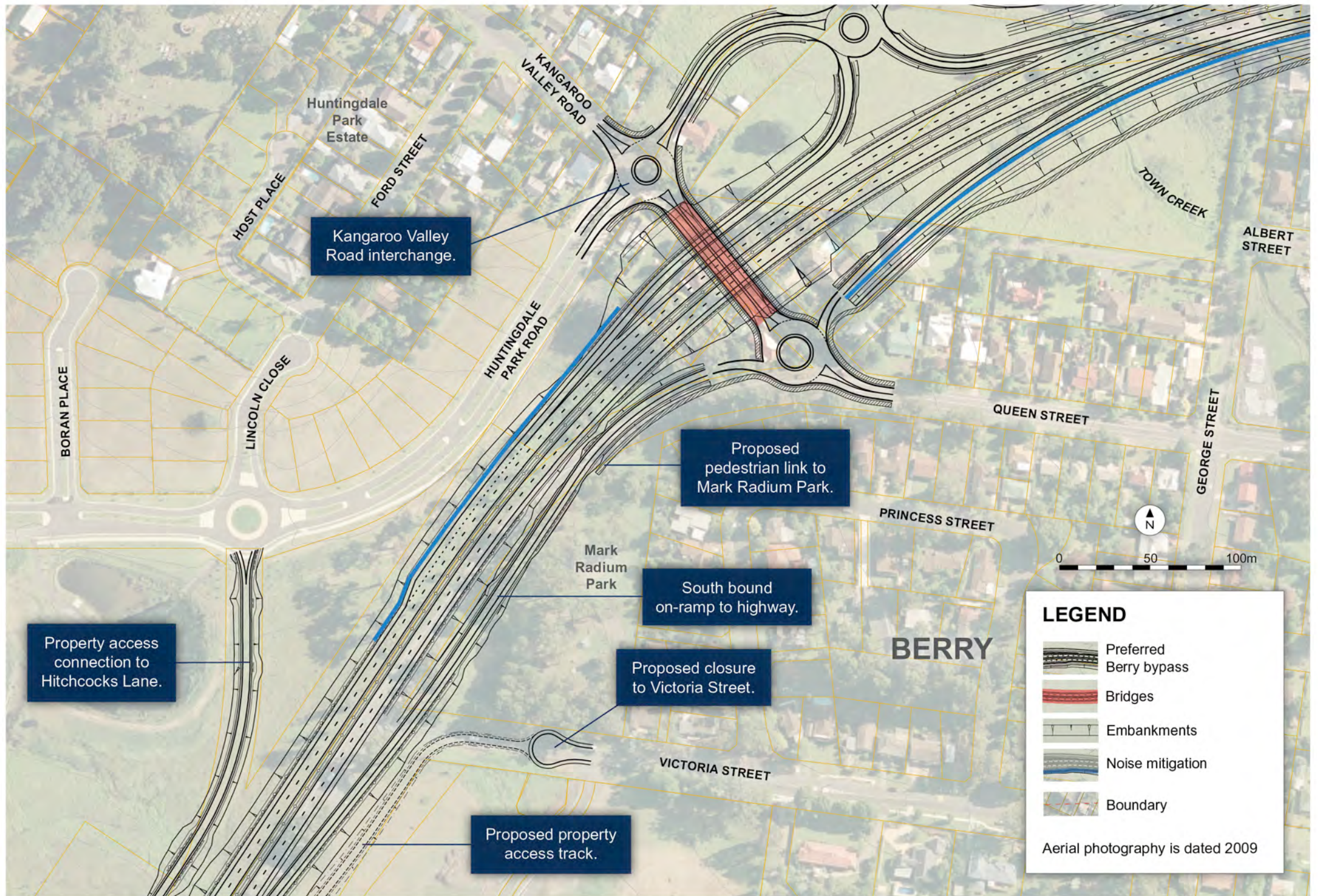


Figure 3-13 Victoria Street Option 1

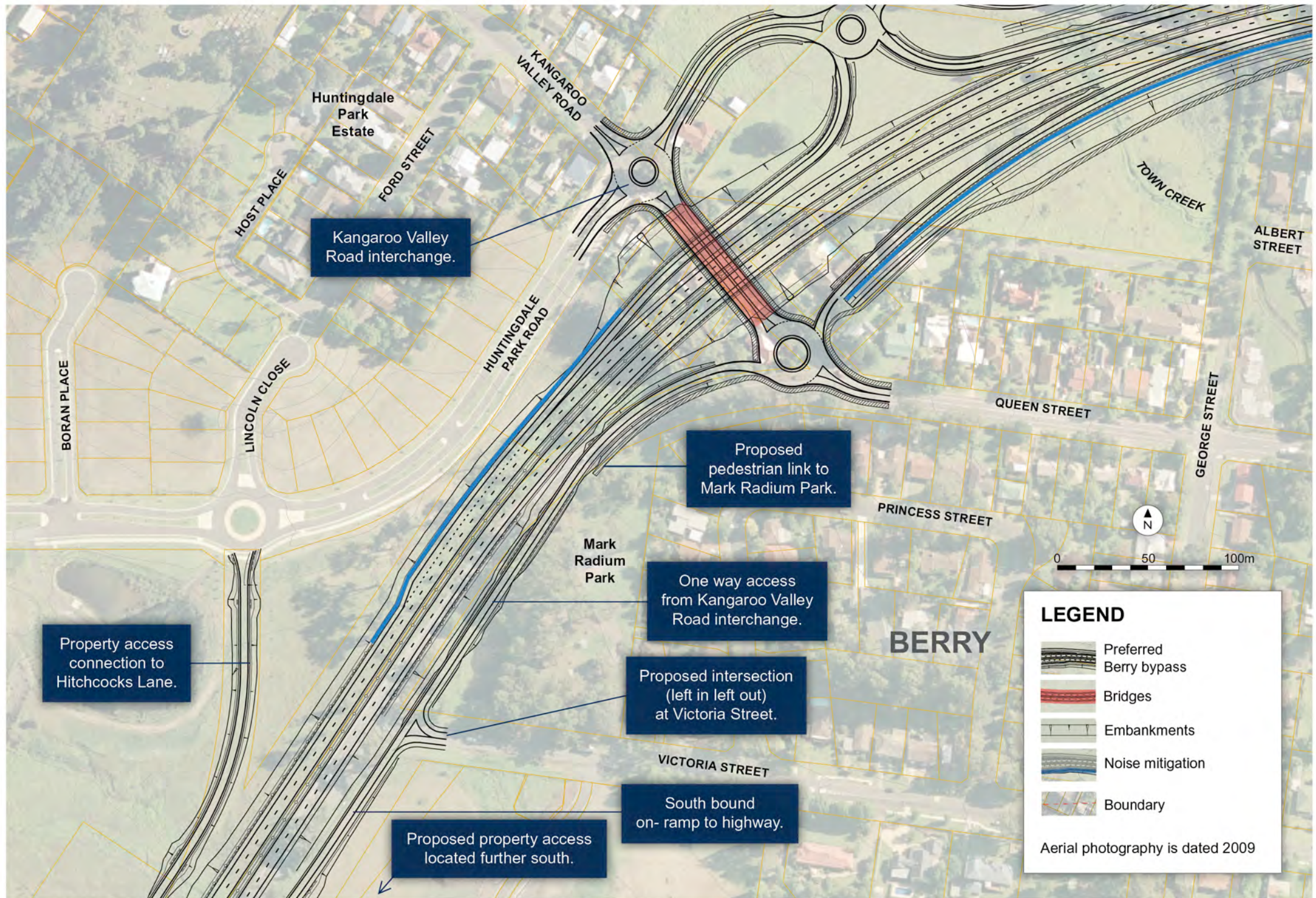


Figure 3-14 Victoria Street Option 2

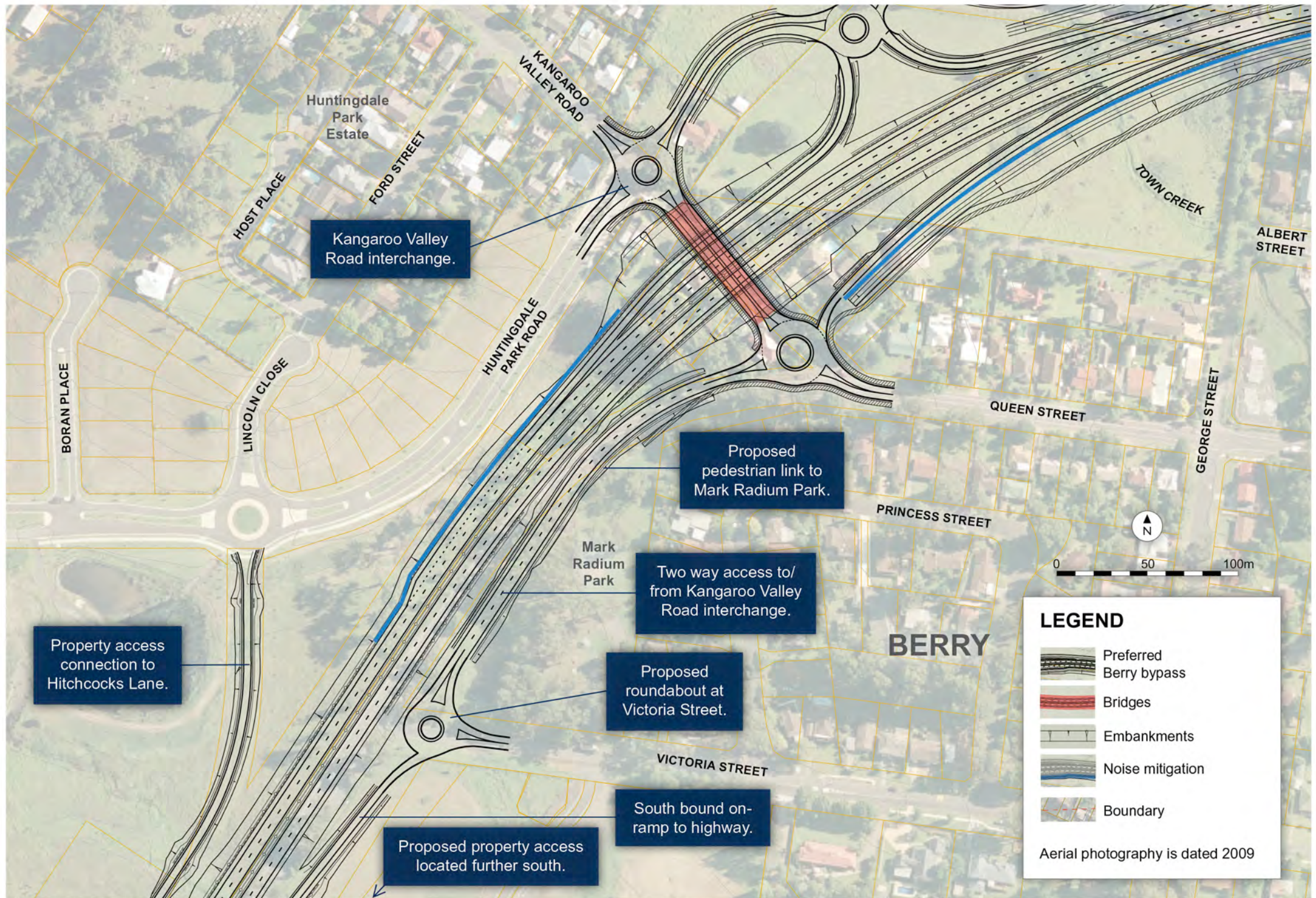


Figure 3-15 Victoria Street Option 3

Evaluation of options

Community feedback to close Victoria Street at its western end or to keep it open with a connection to the highway suggested that there was generally a split with some preferring to keep it open and others preferring the closure. This feedback is discussed in more detail in **Chapter 6**.

With no clear agreed direction forthcoming from the consultation undertaken, a qualitative assessment of the three options was undertaken by RMS against the project objectives. The aim of this assessment was to develop a clear preferred option to take forward, with the understanding that the concept design would not preclude any of the options being developed in the future.

The full closure of Victoria Street would have the greatest impact on local traffic movements within Berry by redirecting the traffic currently utilising Victoria Street to access the highway, to the southern interchange via Queen Street. **Section 7.1.3** discusses the existing traffic patterns within Berry and the impacts of the closure of Victoria Street at the western end in detail. The result of this would be an increase in traffic volumes on the north-south local roads between Victoria Street and Queen Street. These roads include George Street, Edward Street, Albany Street, Alexandra Street and Prince Alfred Street.

However, the full closure of Victoria Street would also best meet the project objective of improving road safety by reducing the potential traffic conflicts associated with traffic accessing the southbound on-ramp in one or both directions and potential conflicts associated with the school and retirement villages at the western end of Victoria Street.

All three options would have some impact on Mark Radium Park. Option 1 would impact about 25 per cent of Mark Radium Park. Option 2 would impact around 24 per cent of Mark Radium Park and Option 3 would impact about 29 per cent. Therefore, given that the full closure of Victoria Street would reduce the overall footprint of the southern interchange for Berry and would have a relatively small impact on Mark Radium Park, it would satisfy the project objective of reducing environmental and social impacts.

Preferred option

The assessment found that the closure of Victoria Street at the western end with a cul-de-sac and a one-way southbound on-ramp from Queen Street narrowly outperformed the other options when assessed against the project objectives and should be taken forward as the preferred option on that basis with the understanding that the concept design would not preclude any of the options being developed in the future.

3.6.7 Southern bypass of Berry

A description of the southern bypass of Berry has been provided in **Section 3.5.1**. Evaluation of this option against the project objectives has also been provided in **Section 3.4** and **Section 3.5**. A number of options to the south of Berry were assessed as part of the route options development process. These options were considered in the long list of options and the physical, environmental and social constraints of these options were assessed. Options south of Berry did not perform as well against the project objectives as the short-listed options to the north of Berry.

Further to this, a cost estimate was prepared to assess the value of this option against the northern bypass of Berry. The cost estimate of the southern bypass of Berry was greater than the cost estimate for the northern bypass by around \$150 million. The main factors contributing to this difference were the cost of the structures and earthworks required. As a result, the southern bypass of Berry did not meet the project objective of providing value for money and was not carried forward as part of the project. This review process is documented in *'Foxground and Berry bypass Princes Highway upgrade, Report on route feasibility comparative cost estimates'* (RMS, June 2012).

Further consideration of this option is not included in this environmental assessment.

3.6.8 Pedestrian access to Berry

The feasibility of including a pedestrian overbridge to connect the two ends of North Street was assessed. **Section 7.1** provides an assessment of the number of pedestrians currently utilising North Street and the likely impact of the severance of North Street on these pedestrians. It concluded that the small number of pedestrians currently using the corridor would not justify the large cost of the bridge and as such the option would not meet the project objective of providing value for money.

The provision of shared path connections on both sides of the Kangaroo Valley Road overbridge linking the proposed pedestrian and cyclist link along the northern side of North Street to the sports ground is considered to be appropriate to cater for the number of pedestrians currently using this link and expected future growth.

The provision of additional pedestrian connectivity along North Street via a pedestrian overbridge that is separate and in close proximity to the Kangaroo Valley Road overbridge would be unlikely to provide value for money and has not been taken forward for further consideration.

3.6.9 Rest areas

Description of options

Two rest area options were proposed and considered:

- No rest area as part of the project, with consideration for an alternative location outside of the scope of this project.
- Inclusion of a heavy vehicle rest area near the Austral Park Road interchange to service southbound heavy vehicles only and not light vehicles.

Evaluation of options

Issues associated with the inclusion of the heavy vehicle rest area at Austral Park Road generally related to amenity impacts including noise, air quality and light spill. These impacts meant that the heavy vehicle rest area did not meet the project objective of minimising impacts to the local social environment.

Other issues associated with the rest area would not meet the project objectives of minimising environmental impacts, supporting the local economy and providing value for money. These issues included proposed property accesses, property acquisition, potential flooding and potential biodiversity issues associated with the impact of additional infrastructure on local fauna movement corridors and landscaping. These issues are discussed in **Chapter 6**.

Preferred option

An alternative location for the southbound heavy vehicle rest area outside of the scope of this project was considered to best meet the project objectives. Consequently the rest area at Austral Park Road was not proposed as part of the preferred option.

3.6.10 Pulman Street heritage precinct

The existing preferred option included a roundabout at the junction of Tannery Road and the existing Princes Highway. The purpose of this roundabout is to provide a u-turn facility for property owners just north of Tannery Road who would access the highway via a left-in left-out movement.

The location of this roundabout at Tannery Road would impact on the heritage curtilage of Pulman Street and the original junction arrangement that formed part of the original Berry. As a result, the roundabout was moved to the junction of Woodhill Mountain Road and the existing Princes Highway. This change would not affect the u-turn functionality of the roundabout but it would better preserve the historic heritage of original Berry. As such it performed better against the project objectives of minimising adverse social and environmental impacts and is included as part of the project.

3.7 The project

The project incorporates the preferred option announced in 2009 and the design refinements developed through ongoing community engagement since. The project is shown in **Figure 1-1** and is described in detail in **Chapter 4**.

The project is considered to best meet the project objectives as well as the functional, socio-economic and environmental criteria established through the value management workshop process (See **Section 3.2.2**).

Specifically, the project would best meet the project objectives as follows:

- Improving road safety:
 - The alignment would satisfy road safety criteria.
 - Interchanges that deliver flood immune access to Berry would be provided.
 - The safety of pedestrians crossing Queen Street in Berry would be improved.
- Improving road efficiency
 - Traffic would be able to maintain a 100 kilometres per hour travel speed.
 - Parking manoeuvres in Queen St Berry would no longer block the passage of through traffic.
- Providing value for money:
 - The design solution at Toolijooa Ridge achieves the project objectives but at a lower overall cost.
 - The realignment of the project north of Berry would reduce the amenity impacts experienced within Berry, while optimising the cut/fill balance to provide the best value solution.
- Supporting regional and local economic development:
 - The impacts on high quality agricultural land would be minimised.
 - The existing internal road network in Berry would remain unaltered as a result of the access arrangements and the east-west movements through Berry would be maintained, except at Victoria Street.
 - There would be a visual connection between the highway and Berry, minimising potential losses in highway generated trade, while enhancing the amenity of Queen Street through the removal of highway traffic.

- Providing significant beneficial environmental effects for the Berry town centre and managing potential adverse environmental impacts elsewhere:
 - There would be a lower impact on ecology as the extent of disturbance to threatened species, EECs, wetlands and the associated drainage catchments was minimised through the options assessment.
 - The diversion of Town Creek would reduce flooding impacts experienced within Berry.
 - The project generally responds to the natural landscape by following the existing contours and utilising the existing highway alignment where possible. It maintains a visual connection to the ocean, Berry, rural land and forested escarpment, and maximises the broader regional views.
- Optimising the benefits and minimising adverse impacts on the local social environment.
 - The heritage precinct at Pulman Street, Berry would be preserved and impacts on the David Berry Hospital would be avoided.
 - Direct impacts on the Berry sportsground and Camp Quality memorial park would be avoided and the connectivity of these community spaces with the main township of Berry would be maintained.
 - The extent of property severance would be minimised, as would the potential impacts on community connectivity by following the existing highway alignment where possible and the North Street corridor.
 - The heritage and cultural values of the area would be protected by limiting the extent of the project footprint, by upgrading sections of the existing highway.
 - The location of the project within the North Street corridor balances the social (visual and noise) impacts to North Street residents with the economic impacts of maintaining viable agricultural land north of the bypass of Berry, by providing a 40 metre buffer between north street and the project.