2 Need and options considered

2.1 Strategic need for the proposal

The Princes Highway is the main north-south corridor between Sydney, the Illawarra, the south coast of NSW and through to north-eastern Victoria. It is an important link as it provides the following:

- A commuter route between Sydney, Wollongong and Nowra.
- A local route for residents of surrounding smaller towns and rural residences.
- A major tourist route for key destinations including Berry, Nowra and the south coast with peak traffic on weekends and holiday periods.
- An important freight and bus route, particularly for the south coast and far south coast as the existing rail services currently terminates at Bomaderry.

Traffic growth of the magnitude forecast over the next 20 years would place substantial operational demands on the existing highway between Mount Pleasant and Toolijoona Road operating at an unacceptable level of service (LoS) F.

Level of service is a qualitative measure describing operational conditions within a traffic stream. The desirable maximum capacity of each road section is determined from AUSTROAD’s “Guide to Traffic Engineering Practice: Part 2 – Roadway Capacity”. It is generally described in terms of such service measures as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and road safety. There are six levels of service, designated LoS A (best – free flow) to LoS F (worst – break-down in flow).

Travel times on the Princes Highway along the proposed upgrade would increase as the level of congestion increases. Delays would be caused by local traffic conflicting with major through traffic movements at the main Belinda Street and Fern Street intersections. Long delays would also result in economic impacts, especially to freight and tourist traffic travelling either to local areas or long distance destinations.

Crash analysis shows the existing highway has a fatality rate of 2.6 per 100 MVKM, almost four times the NSW average, highlighting the poor safety record of the highway in this area. If the highway is not upgraded, the potential for crashes is likely to increase with increased traffic volumes especially at major intersections along the route, such as Fern Street and Belinda Street in Gerringong.

Existing access points to Gerringong are less than desirable, with the northern access point over the South Coast Railway Line identified as number 20 in the NSW Government’s top 300 priority list for safety treatment of level crossings.

The upgrade of the Princes Highway forms part of the RTA’s broader strategy of providing four lanes between Sydney and Jervis Bay Road, which includes the North Kiama Bypass; Oak Flats to Dunmore; South Nowra and the future bypass of Albion Park Rail. With the recent opening of the Oak Flats to Dunmore upgrade, the section of highway from south of Mount Pleasant to Nowra will remain the only two lane section of the Princes Highway between Sydney and Nowra. Figure 2.1 shows the proposal in the regional context.
Figure 2.1: Regional context
The NSW Government is committed to the investigation and assessment of this section of the Princes Highway. This commitment was recently demonstrated by the NSW Treasurer in the 2008/09 budget, when he announced a further budget allocation of $4m towards planning of the Princes Highway upgrade and the announcement by the RTA of a final preferred option for the proposal in June 2009.

2.1.1 Supporting NSW Government plans and strategies

**NSW State Plan**

The NSW State Plan: ‘Investing in a Better Future’ was released in March 2010. The Plan provides goals and targets focussing on areas such as strengthening regional economies, environmental protection, employment and improving the efficiency and safety of the road network. Development of safer and more efficient transport infrastructure such as the proposal, would contribute to achieving many of these goals.

**NSW State Infrastructure Strategy**

The State Infrastructure Strategy – ‘New South Wales 2008-09 to 2017-18’ identifies infrastructure projects in the short-to-medium term that, among other things, support population growth and demographic change on the south coast. The strategy was first published in 2006 and is updated every two years.

The proposal is one of the projects identified as necessary to support population growth and demographic change on the south coast. This demonstrates its regional importance and that it is a high priority for the State Government to implement.

**Shoalhaven – An Enterprising Alternative (An Economic Development Strategy) 2005**

A report entitled ‘Shoalhaven – An Enterprising Alternative, an Economic Development Strategy’ (2005) was developed by Shoalhaven City Council, NSW Department of State and Regional Development, the Commonwealth Department of Transport and Regional Services and the Shoalhaven Area Consultative Committee.

A key transport focus area identified in the Strategy is to “significantly improve access between Shoalhaven, Sydney, Canberra and Wollongong with respect to movement of goods and people” (Shoalhaven Economic Development Strategy, 2005). The proposal would improve access on the Princes Highway for people travelling between Sydney and the Shoalhaven, and Wollongong and the Shoalhaven.

A key tourism focus area identified in the Strategy is to “foster higher levels of visitation and increased visitor yield” (Shoalhaven Economic Development Strategy, 2005). The proposal would improve access and reduce travel times which would have the effect of increasing visitation to the region. The proposal is generally consistent with the Shoalhaven Economic Development Strategy.

2.1.2 Regional strategy

The Illawarra Regional Strategy was released in January 2007. It outlines the region’s objectives for the next 25 years. It is relevant for an understanding of the future plans for the region.
**Illawarra Regional Strategy**

The Illawarra Regional Strategy (Department of Planning, 2007) applies to the local government areas (LGAs) of Kiama, Shellharbour and Wollongong, and recognises the importance of the region’s transport networks in supporting economic growth and maximising the efficiency of freight transport.

The primary purpose of the strategy is to ensure that land is appropriately utilised to accommodate projected housing and employment needs. The strategy represents an agreed NSW Government position on the future of the Illawarra region on areas including housing, water, energy and the natural environment.

The strategy includes regional transport objectives, highlighting the importance of the Princes Highway as the major north-south corridor linking the Illawarra region to Sydney and the south coast, and citing the upgrade of this highway as an important transport infrastructure project in the region.

2.1.3 Road user benefits

A quantitative analysis of the proposal was used to determine the benefit cost ratio (BCR). A BCR compares the costs (all cash flows over a 30 year period at a seven percent discount rate) and the benefits (e.g., travel time savings) of a proposal to assess if there are net benefits to society.

The outcome of the BCR indicated the proposal is economically viable providing a net benefit to society through travel time savings from faster trips, vehicle operating cost savings and reduction in crashes.

2.2 Proposal objectives

The proposal objectives are to:

- Improve road safety.
- Improve efficiency of the Princes Highway between Mount Pleasant and Toolijooa Road.
- Support regional and local economic development.
- Provide value for money.
- Enhance potential beneficial environmental effects and manage potential adverse environmental impacts.
- Optimise the benefits and minimise adverse impacts on local social environment.

2.3 Alternatives and options considered

2.3.1 Methodology for selection of preferred option

Duplicating the Princes Highway to a four lane divided carriageway between Mount Pleasant and Toolijooa Road, including two climbing lanes and two grade-separated interchanges has been selected as the preferred option for the proposal. The preferred route best meets the route selection study objectives.
The proposed route of the Gerringong upgrade was developed during the broader route options selection study for the Princes Highway between Gerringong and Bomaderry. The general methodology for the route selection study was as follows:

- Project familiarisation, including review of previous studies.
- Preliminary investigations and preparatory assessments to determine potentially feasible routes.
- Facilitate route options development workshop conducting a qualitative assessment of potentially feasible routes.
- Preparation of route option development report outlining the process undertaken to identify a short list of options.
- Display of shortlisted route options.
- Community feedback following route options display.
- Facilitate a three day value management workshop between 14 and 16 May 2008 to analyse the performance of each route option against selection criteria (refer Section 2.3.3).
- Facilitate a two day access value management workshop on 18 and 19 November 2008 (refer Section 2.3.4).
- Preparation of two value management workshop reports, including multi-criteria analysis.
- Identification and display of preferred route.

A set of critical selection criteria were applied in line with the proposal objectives to consider feasible routes and facilitate the process of selecting a preferred option for further development. A summary of these selection criteria is provided in Table 2.1.
### Table 2.1: Critical selection criteria at route options selection

<table>
<thead>
<tr>
<th>Project objectives</th>
<th>Critical criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve road safety</td>
<td>• Reduce pedestrian / vehicle conflict.</td>
</tr>
<tr>
<td></td>
<td>• Improve road alignment.</td>
</tr>
<tr>
<td></td>
<td>• Improve roadside environment safety.</td>
</tr>
<tr>
<td></td>
<td>• Reduce vehicle conflicts.</td>
</tr>
<tr>
<td></td>
<td>• Provide for heavy vehicles.</td>
</tr>
<tr>
<td></td>
<td>• Provide for the separation of opposing traffic.</td>
</tr>
<tr>
<td>Improve efficiency of the Princes Highway between Mount Pleasant and Toolijooa Road</td>
<td>• Reduce traffic congestion in Gerringong.</td>
</tr>
<tr>
<td></td>
<td>• Improve road alignment.</td>
</tr>
<tr>
<td></td>
<td>• Reduce travel time.</td>
</tr>
<tr>
<td></td>
<td>• Increase highway capacity.</td>
</tr>
<tr>
<td>Support regional and local economic development</td>
<td>• Be consistent with current and planned land use.</td>
</tr>
<tr>
<td></td>
<td>• Minimise the adverse impact on land acquisition.</td>
</tr>
<tr>
<td></td>
<td>• Be consistent with local and state planning policies.</td>
</tr>
<tr>
<td></td>
<td>• Provide flood immunity.</td>
</tr>
<tr>
<td>Provide value for money</td>
<td>• Minimise the risks of construction and related proposal risks.</td>
</tr>
<tr>
<td></td>
<td>• Optimise financial return.</td>
</tr>
<tr>
<td>Enhance potential beneficial environmental effects and manage potential adverse</td>
<td>• Support the principles of ESD.</td>
</tr>
<tr>
<td>environmental impacts</td>
<td>• Minimise adverse impacts on biological diversity and ecological integrity.</td>
</tr>
<tr>
<td></td>
<td>• Minimise adverse impacts on threatened species.</td>
</tr>
<tr>
<td></td>
<td>• Minimise the risk of serious environmental damage.</td>
</tr>
<tr>
<td></td>
<td>• Minimise adverse air quality impacts and greenhouse gas emissions.</td>
</tr>
<tr>
<td></td>
<td>• Minimise use of energy and non-renewable resources.</td>
</tr>
<tr>
<td></td>
<td>• Minimise adverse impacts on cultural heritage values.</td>
</tr>
<tr>
<td>Optimise the benefits and minimise adverse impacts on local social environment</td>
<td>• Maintain or improve the overall amenity of the community.</td>
</tr>
<tr>
<td></td>
<td>• Minimise adverse impacts on places of community value and rural areas.</td>
</tr>
<tr>
<td></td>
<td>• Minimise / mitigate adverse social impacts of property acquisition.</td>
</tr>
<tr>
<td></td>
<td>• Optimise the alignment / formation of the road in respect to land form and</td>
</tr>
<tr>
<td></td>
<td>settlements.</td>
</tr>
</tbody>
</table>
2.3.2 Identified options

Route options

Route options development for the Princes Highway upgrade program commenced in March 2006. The Princes Highway upgrade program consists of three sections, Mount Pleasant to Toolijooa Road, Foxground Berry bypass, and Berry to Bomaderry. The preferred route for the proposal (Mount Pleasant to Toolijooa Road) was announced in June 2009.

Due to the number and complexity of the long list of route options identified and to facilitate the assessment of the options, four geographical areas (section A, B, C and D) were used to identify shortlisted options. Section A and section B relate to the study area. Section A extends from Mount Pleasant to Belinda Street and section B extends from Belinda Street to beyond the study area, to the north of Berry.

One option, the ‘red route’ was the only shortlisted option identified in section A (Figure 2.2), which follows the existing highway alignment subject to relatively minor adjustments to meet the required design and safety parameters.

A total of four shortlisted options were considered in section B, each of which formed part of a longer option continuing beyond the study area towards Berry.

The ‘pink route’ and ‘green route’ follow the existing highway from the start of section B and continue on this alignment until they diverge away from the highway in the vicinity of Toolijooa Road, outside of the study area. Defining features of the ‘pink route’ and ‘green route’ include:

- Alignment generally following the existing highway corridor with a reduced property acquisition and severance of class 2 and class 3 agricultural land.
- Minimised retention of poorly aligned existing highway corridor.
- Avoidance of areas of habitat significance.

The ‘yellow route’ and ‘brown route’ diverge from the existing highway at the start of section B and follow an alignment parallel to the South Coast Railway Line until just passed dwellings at Toolijooa. Defining features of the ‘yellow route’ and ‘brown route’ include:

- Provision of a long flat alignment adjacent to the railway line.
- Embankment 4.5 km long and generally two to three metres high adjacent to the railway line required to achieve flood immunity.
- Up to 500,000 cubic metres volume of imported fill required for the construction of the embankment along the railway line.
- Interaction with potential acid sulfate soils adjacent to the railway line and risk of downstream environmental impact during construction.
- Direct impact on an operating effluent re-use scheme.

A theoretical ‘do nothing’ option was also considered as a base case, which was defined as the least possible upgrade of the existing road to two lanes in each direction with conforming geometry ie to desirable minimum horizontal and vertical alignment.
Figure 2.2: Options considered during the route selection process

Note: shading around the options denotes the extent of the option design corridor
**Access options for Gerringong**

Several options for the provision of access to Gerringong were developed. Three options G1, G2 and G3 were shortlisted and displayed to the community for feedback and further assessment.

G1 provided a single access point accommodating all turning movements between Gerringong and the highway via a new interchange in the vicinity of Sims Road and an overpass to Gerringong above the railway and highway. Existing access to and from Gerringong via Fern Street and Belinda Street would be closed. G1 is shown in Figure 2.3.

G2 provided two half interchanges, one at Fern Street and one at Belinda Street. The grade-separated half interchange at Fern Street would provide southbound access to Gerringong via Fern Street using an overpass of the railway and northbound access to the highway via Fern Street and an overpass of both the railway and the highway. The existing left-out of Fern Street to head south on the highway would be closed.

The half interchange at Belinda Street would provide southbound access to Gerringong via the existing railway underpass and Belinda Street and a new highway underpass would provide northbound access to town. A southbound on ramp would provide southbound access to the highway via Belinda Street. The existing left-in to town and right-out of town would be removed. G2 is shown in Figure 2.4.

G3 provided a half interchange at Sims Road for northbound traffic to enter Gerringong and leave Gerringong travelling north on the highway. Southbound traffic would enter Gerringong via Fern Street using an overpass of the railway and traffic leaving Gerringong to travel south on the highway would be directed via Belinda Street and a southbound on ramp. Existing left and right turns from Fern Street and existing left-in, right-in and right-out turns at Belinda Street would be removed. G3 is shown in Figure 2.5.
Figure 2.3: Gerringong access option GI
Figure 2.4: Gerringong access option G2
Figure 2.5: Gerringong access option G3
In response to substantial community feedback during the consultation period, three additional access options were developed for further consideration:

- G2/6 provided a full interchange at Belinda Street catering for all four movements at Fern Street with southbound access to Gerringong and northbound exit from Gerringong via Fern Street.
- G2/8 provided a full interchange catering for all movements at Rose Valley Road with connection to Fern Street via two-way service road and a full interchange providing all movements at Belinda Street.
- G3/5 provided a half interchange at Sims Road for northbound traffic, similar to ‘G3’, a southbound access to Gerringong at Fern Street and southbound access to and from town at Belinda Street.

The additional options are shown in Figure 2.6, Figure 2.7 and Figure 2.8.
Figure 2.6: Additional Gerringong access option G2/6
Figure 2.7: Additional Gerringong access option G2/8
Figure 2.8: Additional Gerringong access option G3/5
2.3.3 Analysis of options

Discussion of the analysis carried out for all options considered during the route selection process for the broader Princes Highway upgrade program between Gerringong and Bomaderry and the reasons why they were not carried forward is included in detail in the following reports:

- Gerringong to Bomaderry Princes Highway Upgrade, Route Options Development Report, RTA November 2007. This report documents the process undertaken to refine the long list of route options into a short list of options to be carried forward for further consideration. The report presents the shortlisted options.
- Gerringong to Bomaderry Princes Highway Upgrade, Preferred Option Report, RTA October 2008. This report presents the option that emerged from the refinement of the shortlisted options as the preferred option and documents the process and consideration undertaken to arrive at that option.

These reports are available on the project website www.princeshighwayupgrade.com.au.

The route options were assessed to determine how they met the objectives listed in Section 2.2. Each route was considered against the other routes and against the ‘do nothing’ option.

A number of specialist studies were also undertaken to inform the route options selection process and the reports outlined above and assist in choosing, evaluating, comparing and selecting the preferred option. These included:

- Geotechnical.
- Topography, geology and soils.
- Urban design, landscape and visual amenity.
- Traffic, transport and road safety.
- Public utilities and services.
- Social-economic.
- Flora and fauna (terrestrial and aquatic).
- Water quality.
- Cultural heritage (Aboriginal and non-Aboriginal).
- Flooding and drainage.
- Land use and planning.
- Noise and vibration.
- Climate and air quality.

Value management workshops

Two value management workshops have been undertaken during the assessment of route options. The first, a three day route options value management workshop was held on 14, 15, and 16 May 2008. The purpose of this workshop was to bring together a wide range of stakeholder interests and expertise to review the outcomes of the investigations undertaken to date and, on the balance of issues and consideration of the options against agreed assessment criteria, to recommend a direction for further investigation to progress the route options development.

The workshop group reached a consensus on which routes (and therefore options) should progress and what conditions, if any, should apply to their assessments. They also recommended a clear direction and way forward for the development of a preferred route.
During the route options display and selection process, community feedback highlighted the importance of the access arrangements for Gerringong to the community. An option assessment workshop using a similar value management approach as that used to assess the route options was undertaken to consider the various Gerringong access options.

A two day access value management workshop was held in Nowra on 18 and 19 November 2008.

The findings of both value management workshops are documented in detail in the following reports:


These reports are available on the project website www.princeshighwayupgrade.com.au.

**The ‘do nothing’ option**

The ‘do nothing’ option does not meet the proposal objectives because it could not satisfy the fundamental requirements of this proposal including the provision of a safe and efficient highway alignment.

The section of the Princes Highway between Mount Pleasant and Toolijooa Road has a poor accident record and limited safe overtaking opportunities. Crash analysis shows the existing highway has a fatality rate of 2.6 per 100 MVKM, almost four times the NSW average, highlighting the poor safety record of the highway in this area and the need for the upgrade.

Scenarios involving a ‘do nothing’ option requiring only minor improvements would not meet the proposal objectives and safety requirement. Implementation of minor improvements would also not provide a satisfactory solution from a strategic, regional, local planning or transport context.

**‘Yellow route’ and ‘brown route’**

The ‘yellow route’ and ‘brown route’ performed well against the road safety and efficiency objectives as they provide a long length of flat alignment. However, they were not carried forward because they did not perform well against other proposal objectives, including cost for a number of reasons. The negative features associated with the ‘yellow route’ and ‘brown route’ outweighed the potential benefits and are the same for both routes as they share a common alignment within the study area:

- Property acquisition and severance of class 2 and class 3 agricultural land ie mainly used for dairy production and organic farming.
- Retention of a long length of poorly aligned existing highway corridor.
- Potential interference with acid sulfate soils adjacent to the railway line and risk of downstream environmental impact during construction.
- Substantial embankment adjacent to the railway line to achieve flood immunity.
- Import of up to 500,000 cubic metres of fill material required to build the embankment along the railway line, which has an increased level of risk, cost and difficulty associated with constructing on potentially soft soils adjacent to the railway line.
• Direct impact on an operating effluent re-use scheme requiring acquisition of suitable additional land to relocate irrigation plant.

2.3.4 Access options

Option G1 performed well in consideration of cost and constructability, but resulted in major social impacts including changed traffic patterns potentially affecting business viability in Gerringong and noise, visual amenity and safety impacts associated with introducing potentially high volumes of traffic into an existing residential and low traffic volume area.

Option G2 and G2/6 were not carried forward based on the relative performance of G2/8, which provides additional traffic movements and better meets the needs of the community and maintained the benefits of G2 and G2/6.

Options G3 and G3/5 resulted in similar impacts to G1 as they included the same central element at Sims Road and the inherent social implications associated with changed traffic patterns.

2.4 Preferred option

2.4.1 Preferred route

Duplicating the Princes Highway to a four lane divided carriageway between Mount Pleasant and Toolijooa Road, including two climbing lanes and two grade-separated interchanges has been selected as the preferred option for the proposal. The preferred route best meets the route selection study objectives.

The preferred option is one which performs well across a combination of the technical input gathered through investigations undertaken to date (including a review of studies from previous investigations into the upgrade), community feedback and the findings of the two value management processes undertaken as part of the route selection study.

The preferred option is a combination of the following shortlisted routes:

• ‘Red route’ from section A.
• Combined ‘pink route’ and ‘green route’ from section B.

The route selection process found that the benefits of the preferred option differentiate it from the other options considered and the proposal generally performs the best in relation to the proposal objectives. Table 2.2 shows how the preferred option meets the proposal objectives and Table 2.3 shows how the urban design principles and objectives are addressed in the proposal design.

The preferred access arrangement for Gerringong is a modification of the G2/8 option that was developed following substantial community feedback during the display of options and assessed through a value management process. It includes a southern interchange at Belinda Street linked to Willowvale Road and Baileys Road by a two-way service road and a northern interchange at Rose Valley Road linked to Fern Street by a two-way service road.
The preferred option best addresses the access requirements of the town and performs well with regard to its relative strategic cost estimates compared to the other options. The preferred option:

- Best meets the safety objectives considered for town access.
- The number of access movements for entering and exiting Gerringong would be increased from seven to eight.
- Best meets the balance of social, economic, environmental and functional considerations.
- Provides the best value for money.
- Best meets the needs of the community retaining the existing two access points and maintaining existing traffic patterns.
- Provides for 1 in 100 flood immune access to and from town via Belinda Street.
- Maintains the business viability of the town.
- Addresses access to Sims Road, Willowvale Road and Rose Valley Road.

Table 2.2: How the preferred option meets the proposal objectives

<table>
<thead>
<tr>
<th>Project objective</th>
<th>How the preferred option meets the objective</th>
</tr>
</thead>
</table>
| Improve road safety                                    | • Meets all the required design and safety standards.  
• Controlled access and grade-separated interchange provisions would improve safety at town access points, local roads and property access. |
| Improve efficiency of the Princes Highway between Mount Pleasant and Toolijooa Road | • Provides two lanes in each direction.  
• Includes two climbing lanes, one northbound at Mount Pleasant and southbound south of Gerringong. |
| Support regional and local economic development        | • Minimises property acquisition and severance of class 2 and class 3 agricultural land.  
• Consistent with State and regional strategies. |
| Provide value for money                                 | • Minimises the retention of poorly aligned existing highway corridor.  
• Minimises property acquisition and severance of class 2 and class 3 agricultural land. |
| Enhance potential beneficial environmental effects and manage potential adverse environmental impacts | • Avoids areas of habitat significance.  
• Generally follows the existing highway corridor with a reduced greenfield footprint compared to the other options. |
| Optimise the benefits and minimise adverse impacts on local social environment | • Minimises property acquisition and severance of class 2 and class 3 agricultural land.  
• Optimises town access points and maintains the long-term traffic patterns in Gerringong. |

The urban design objectives and principles were established and used to develop and assess the concept design in line with the RTA’s overall strategy for urban design of the Princes Highway and at a more detailed local level for the proposal.
The six objectives and design principles that make up the urban and regional design framework for the proposal are:

1. Provide a flowing highway alignment that is responsive and integrated with the natural landscape.
2. Protect the natural systems and ecology of the corridor.
3. Protect and enhance the heritage and cultural values of the corridor.
4. Respect the communities and towns along the highway.
5. Provide an enjoyable, interesting highway with strong visual connections to the Pacific Ocean, immediate hinterland, and mountains to the west.
6. Develop a simple and unified palette of elements and details that are easily maintained.

The unifying philosophy behind these various objectives is the goal to develop an upgraded highway that not only meets functional and engineering criteria, but one that respects the environment in which it is situated. A number of design principles are associated with each of the objectives. These are addressed in Table 2.3 in relation to the design response for the proposal.

Table 2.3: How the urban design principles and objectives are addressed in the proposal design

<table>
<thead>
<tr>
<th>Objective #1</th>
<th>Design principles</th>
<th>Design responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a flowing highway alignment that is responsive and integrated with the landscape</td>
<td>1. Respond to the grain of the landscape in route selection, including following the edge of valleys and hills, and avoiding disruption of stands of vegetation including both natural vegetation and cultural plantings.</td>
<td>The proposal comprises an upgrade, including widening, of the existing highway alignment. The surrounding landscape has developed around the existing road for the past 80+ years. The proposal would therefore have impact on any adjacent stands of cultural vegetation that have evolved over time. At the Rose Valley Road interchange, the alignment has been designed to preserve the most established Moreton Bay Fig tree which has cultural significance for both Aboriginal and non-Aboriginal heritage. The vertical alignment has been designed to improve grades and improve road safety. Nevertheless, the road generally responds to the natural grain of the landscape by following the existing contours through the landscape and utilising the existing road alignment.</td>
</tr>
<tr>
<td></td>
<td>2. Integrate cut and fill embankments with surrounding terrain by grading out and varying slopes.</td>
<td>Cut and fill embankments would integrate with the adjacent landscape and be assessed at a detail level in each case based on geotechnical options, slope, aspect and existing adjacent landscape character.</td>
</tr>
<tr>
<td></td>
<td>3. Consider independently grading carriageways.</td>
<td>Generally, the nature of the landform surrounding the proposal does not require the consideration of independently graded carriageways.</td>
</tr>
<tr>
<td>Objective #1</td>
<td>Provide a flowing highway alignment that is responsive and integrated with the landscape</td>
<td></td>
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<tr>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Design principles</strong></td>
<td><strong>Design responses</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Preservation of cultural patterns in the landscape.</td>
<td>The proposal would include small integrated interventions to cut and fills slopes and revegetation to essentially preserve the cultural patterns. This would be achieved by reinforcing the patterns of the broader landscape context.</td>
</tr>
<tr>
<td>5</td>
<td>The alignment should avoid as much as possible significant features of the areas through which it passes.</td>
<td>The impact of significant features would be minimised as far as practicable without compromising road safety. The interchange at Rose Valley Road has been designed to minimise the impact on a culturally sensitive area comprising mature Moreton Bay Fig trees and Renfrew Park Estate. The healthiest of the three Moreton Bay Figs would be preserved and become part of the landscaping ‘gateway’ introducing motorists to Gerringong.</td>
</tr>
</tbody>
</table>
| 6 | Vary the gradient of the earthworks to provide visual interest and reflect the characteristics of the surrounding landform and landscape | Earthworks would be integrated by understanding the opportunities and constraints identified by the geotechnical investigations. A number of embankment strategies have been developed to:  
  - Increase the usability of pasture land adjacent to the road and integrate the highway with the surrounding landscape.  
  - Reduce the visual impact of cuttings and embankments by introducing plantings to the base and top of new batter where practicable. |
| 7 | Cuttings and embankments should be graded out, wherever practicable, to best fit the characteristics of the local landform, returning the land to either its former use or replacing vegetation lost to the highway upgrade. | Cuttings and embankments would be graded out to be integrated with the local landform, land coverage and land use. Areas of vegetation lost would be reinstated. |
### Objective #2
**Protect the natural systems and ecology of the corridor**

<table>
<thead>
<tr>
<th>Design principles</th>
<th>Design responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Avoid areas of natural vegetation, particularly those containing threatened species and communities.</td>
<td>Since much of the landscape has been cleared for agricultural purposes, some of the remaining vegetation is within the current road reserve and would be impacted during construction. Impact to threatened species and communities would be minimised and any natural vegetation removed would be replaced and rehabilitated.</td>
</tr>
<tr>
<td>2 Minimise disruption to natural drainage patterns both through route selection and road design.</td>
<td>Existing drainage systems would be retained and improved where appropriate. Undersized existing drainage structures would be upgraded to meet capacities required to minimise disturbance and reduce flooding during peak rain events particularly to the Omega Flat area. New bridges would traverse the Crooked River.</td>
</tr>
<tr>
<td>3 Minimise the number of creek crossings in the study area.</td>
<td>Creek crossings would be kept to a minimum.</td>
</tr>
<tr>
<td>4 Use medians and road verges to maximise habitat value and maintain pollination paths and wildlife movement patterns where feasible.</td>
<td>The areas for planting included the embankments associated with new interchanges at Rose Valley Road, Belinda Street and Willowvale Road, new embankments along Omega Flat and ribbon plantings along property boundaries and waterways. Plantings would also be made at the base of new cuttings where possible. Median widths are not sufficient to support plantings. Generally the median would consist of pastoral grass reestablishment which reinforces the landscape context.</td>
</tr>
<tr>
<td>5 The landscape qualities and characteristics of the highway corridor landscape should respond to and be integrated with the areas through which it passes.</td>
<td>The proposal passes through four landscape unit types. These differ in vegetation type, land use and landform. The highway corridor would reflect the differences in these landscape units and their associated patterns.</td>
</tr>
<tr>
<td>6 Water quality basins should be integrated with the landscape form and character.</td>
<td>Water quality basins would be integrated into the landscape to best represent how water bodies appear in the natural landscape. This could be done by creating organic shapes, a low profile form by reducing steep batters, placing naturalistic objects in and around the basins and planting throughout the basin with native grass and ephemeral plant species.</td>
</tr>
<tr>
<td>Objective #3</td>
<td></td>
</tr>
<tr>
<td>Protect and enhance the heritage and cultural values of the corridor</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design principles</th>
<th>Design responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Avoid items of identified Aboriginal and non-Aboriginal heritage and cultural value.</td>
</tr>
<tr>
<td>2</td>
<td>Acknowledge and respond to the heritage and cultural values of the rural landscape.</td>
</tr>
<tr>
<td>3</td>
<td>Acknowledge and respond to Aboriginal value placed on the broader landscape.</td>
</tr>
<tr>
<td>4</td>
<td>Reduce the visual and noise impact of the highway through the design of the proposal.</td>
</tr>
<tr>
<td>5</td>
<td>Consider the important value of the productive landscape within the landscape.</td>
</tr>
</tbody>
</table>
### Objective #4
**Protect and enhance the heritage and cultural values of the corridor**

<table>
<thead>
<tr>
<th>Design principles</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Minimise the impact of the highway upgrade on the amenity of residents of Gerringong.</td>
<td>The visual impact of the proposal itself on Gerringong would be minimised by providing suitable cultural and indigenous planting, providing a refined, simple bridge connection to Fern Street over the railway line and considering noise attenuation as appropriate.</td>
</tr>
<tr>
<td>2. Provide effective and efficient access to Gerringong.</td>
<td>The number of access movements for entering and exiting Gerringong would be increased from seven to eight. The upgraded interchanges would include landscaping and plantings to provide a legible gateway at the Rose Valley Road interchange and at the Belinda Street interchange to include wayfinding and visual connectivity.</td>
</tr>
<tr>
<td>3. New town access points to be designed as an important and integral part of the town, ensuring a clear and consistent way showing.</td>
<td>The new town access points comprise the largest new footprint associated with the proposal. This space would be part of a combined strategy for providing connection to the towns and would include the use of cultural plantings and locally derived materials (stone and gravels). In the case of Gerringong the strong historical plantings of Norfolk Island Pines are a distinctive identifying feature and would be reiterated at the interchanges and access points.</td>
</tr>
<tr>
<td>4. Minimise the disruption and loss of amenity to rural communities in the study area.</td>
<td>There would be a small loss of amenity to rural communities with the increased footprint of the proposal. Access points are provided at Rose Valley Road and Willowvale Road. The revegetation strategy would provide a balance of visual screening and reinforcement of the existing landscape character to minimise the loss of amenity to rural communities.</td>
</tr>
</tbody>
</table>
### Objective #5
**Provide a safe, enjoyable and interesting highway with strong visual connections to the Pacific Ocean, immediate hinterland and mountains to the west**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Acknowledge the role of this section of Princes Highway as an important part of a longer scenic drive along the NSW South Coast.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Maximise opportunities for high quality and varied views of the coast, the rural landscape and adjacent mountain ranges.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Provide visual connections and easy, well marked access to the towns along the route.</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Use landscape treatments to soften the appearance of the road for the road user without compromising opportunities for key views.</td>
</tr>
</tbody>
</table>
### Objective #5
**Provide a safe, enjoyable and interesting highway with strong visual connections to the Pacific Ocean, immediate hinterland and mountains to the west**

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<tr>
<td>5</td>
<td>Consider the heritage of the highway in the upgrade so that where practicable road users may experience it.</td>
</tr>
</tbody>
</table>

### Objective #6
**Develop a simple and unified palette of elements and details that are easily maintained**

<table>
<thead>
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</table>
| 1                  | Develop a consistent approach to the development of bridges along the highway upgrade. Urban design principles to be consistent with those outlined in the RTA’s ‘Bridge Aesthetics-Design guidelines to improve the appearance of bridges in NSW’ (RTA 2003). | There would be four important bridges associated with the proposal:  
- The bridge over the highway at Rose Valley Road.  
- The bridge over the existing railway line that joins to Fern Street.  
- The bridge over Belinda Street at the interchange.  
- The bridge over the Crooked River.  
All of these bridges are designed as simple, elegant forms sympathetic to the surrounding landscape rather than as gateway elements. |
| 2                  | Develop a consistent approach to the design of noise walls along the highway upgrade. Urban design principles to be consistent with those outlined in the RTA’s ‘Noise Wall Design Guidelines- Guidelines to improve the appearance of noise walls in NSW’ (RTA 2007). | Noise attenuation would be considered along the interface with Gerringong during detailed design and plantings would be considered to screen possible elements as appropriate. |
| 3                  | Develop an integrated strategy for the avoidance, minimisation and improved appearance of shotcrete as outlined in the RTA’s ‘Shotcrete Design Guidelines- Design guidelines to avoid minimise and improve the appearance of shotcrete’ (RTA 2005). | A detailed geotechnical investigation would be undertaken during detail design to investigate actual need for shotcrete and minimise use where possible. |
### Objective #6
Develop a simple and unified palette of elements and details that are easily maintained

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<tr>
<td>4 Develop a consistent approach to the design of soft landscape along the highway upgrade.</td>
<td>The proposal includes soft landscaping at the new interchanges, along embankments and at property boundaries and creek crossings, as well as along the upgrade route as appropriate. The proposal does not pass through large stands of existing vegetation but mostly pasture lands with isolated clumps of either remnant or mostly historic cultural plantings.</td>
</tr>
</tbody>
</table>

#### 2.4.2 Integrating the principles of ecologically sustainable development

The principles of ecologically sustainable development (ESD) as defined in the EP&A Act and the Environmental Planning and Assessment Regulation 2000 and the EPBC Act have been considered during all aspects of the development of the preferred option.

The principles of ESD defined in the legislation require:

- Decision-making processes to effectively integrate both long-term and short-term environmental, economic, social and equitable considerations.
- Consideration of the precautionary principle.
- Consideration of inter-generational equity.
- Conservation of biological diversity and ecological integrity.
- Improved valuation, pricing and incentive mechanisms to be considered.

The principles of ESD have been considered at all stages during the development of the preferred option to achieve the optimum engineering design outcome whilst providing for the minimisation and management of environmental, social and economic issues. The consideration of the different facets of ESD is discussed in more detail in Section 6.13.