3.0 Landscape constraints analysis

3.1 General
Landscape constraint analysis has been carried out to assist in the route options development process. The visual constraint analysis evaluates three main factors influencing the likely landscape and visual impact of the road. These factors are:

a) Land cover;
b) Slope; and
c) Visibility

By combining these three factors in a geographical information system, a broad picture can be gained of the likely visual impact of the road at any point in the study area. This analysis can be viewed on its own, but is also designed to be incorporated into the overall constraint analysis and route options development process. The components of the visual constraint analysis are described below.

3.2 Land cover
Land cover refers to both human land uses and the vegetation cover that occurs across the study area. A new or upgraded highway will result in different levels of change to the landscape depending on the nature of the land cover in a given area.

Generally, a highway passing through vegetated areas will result in a greater change to the landscape than one passing through unvegetated areas because of the clearing required and possible corridor effect that would be created. Similarly, areas with concentrations of residents represent a land cover type that is less compatible with highway development than those that are sparsely settled. For the purposes of this analysis, the following constraint values were applied to the various land cover types shown in Figure 3.1.

a) Urban areas high constraint
b) Vegetation high constraint
c) Rural residential medium constraint
d) Rural low constraint
e) Railway low constraint
f) Roads (other than existing Princes Highway) low constraint
g) Existing Princes Highway no constraint
Figure 3.1 Land cover
3.3 Slope

Slope is important in identifying levels of visual constraint largely because of the correlation between slope and the volume of earthworks required. Generally the steeper the terrain, the greater the level of cut and fill that is required and therefore the greater the amount of change to the landscape. Slope is shown in Figure 3.2.

Localised factors, particularly the horizontal angle of the road in relation to that of the slope, will influence the actual magnitude of landscape change. When assessing levels of visual constraint at a broad level with no predetermined road alignment, it is reasonable to assume that the steeper the slope, the greater the constraint.

Constraint categories for slope were assigned as follows:

a) 20%+ high constraint  
b) 10-20% medium constraint  
c) 5-10% low constraint  
d) 0-5% no constraint

The divisions between the categories are based on an intuitive evaluation of the likely impact that a road of the type in question would have when aligned perpendicular to the aspect of the slope. The “no constraint” level is where little or no cut or fill would be required, while the highest constraint level represents a level of cut or fill that under any circumstances would be regarded as resulting in a high level of visual impact.
Figure 3.2  Slope analysis
3.4 Visibility

It can be reasonably assumed that the more a highway can be seen, the greater the level of potential visual impact. Areas of higher visibility within the study area have therefore been assigned higher levels of landscape constraint.

The visibility analysis was undertaken using a GIS based viewshed analysis. Forty three viewpoints were selected that represented the range of views to the study area. These included points both within and outside of the study area, and were selected on the basis of being vantage points and/or where there are concentrations of people. There are therefore larger numbers of points located around towns such as Berry.

A viewshed analysis was carried out for each viewpoint that identified the area that could be potentially seen from the point based on terrain only. Potential obstruction from buildings and vegetation was not taken into account. Each of the forty three separate viewshed analyses were then combined to produce a composite analysis that gives an overall estimate of relative visibility across the study area. Areas that could be viewed from the largest number of viewpoints were deemed to be areas of highest constraint from a visibility point of view. The visibility analysis is shown in Figure 3.3.

The constraint values applied to the visibility analysis are as follows:

a) Visible from more than 15 viewpoints high constraint
b) Visible from between 9 and 14 viewpoints medium constraint
c) Visible from between 4 and 8 viewpoints low constraint
d) Visible from between 0 and 3 viewpoints no constraint
3.5 Overall constraints

Numerical values assigned to the each of the component constraint levels discussed above were combined to produce an overall value when the three components are overlain. This results in an overall visual constraint level, which is shown in Figure 3.4.

This map indicates the highest level of constraint associated with the steeper forested parts of the study area, particularly north of Berry. This is because they have high levels of constraint for all three inputs into the overall analysis.

The urban areas of Berry and the edges of Gerringong and Bomaderry that occur within the study area are also of high constraint due largely to the sensitivity of the land use in these locations.

The lowest levels of landscape constraint occur where there are relatively flat rural areas, particularly where surrounding terrain lowers the potential visibility of these areas.
Figure 3.4 Landscape constraints

Gerringong to Bomaderry
PRINCES HIGHWAY UPGRADE

Legend
- Study Area
- Princes Hwy
- Higher Constraint
- Lower Constraint

Map showing landscape constraints for the Gerringong to Bomaderry Princes Highway Upgrade.
4.0 Urban and regional design framework

The RTA’s overall philosophy and approach to the urban and regional design of its roads is expressed in the *Beyond the Pavement* series of publications. A specific framework based on the principles of *Beyond the Pavement* has been established for the upgrade. This framework comprises a series of objectives and principles that reflect the particular requirements of this project. The objectives that make up the urban and regional design framework for the upgrade are as follows:

- a) Provide a flowing highway alignment that is responsive and integrated with the natural landscape;
- b) Protect the natural systems and ecology of the corridor;
- c) Protect and enhance the heritage and cultural values of the corridor;
- d) Respect the communities and towns along the highway; and
- e) Provide an enjoyable, interesting highway with strong visual connections to the Pacific Ocean, immediate hinterland, and mountains to the west.

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. The urban and regional design framework is intended to be a fundamental component of all stages of road planning and design.

Principles that apply to each objective are described below.

**Provide a flowing highway alignment that is responsive and integrated with the natural landscape**

- 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.
- Integrate cut and fill embankments with surrounding terrain by grading out and varying slopes.
- Consider independently grading carriageways.

![Preservation of and response to the natural landform](image)

**Preservation of cultural patterns in the landscape**

**Protect the natural systems and ecology of the corridor**

- Avoid areas of natural vegetation, particularly those containing threatened species and communities.
- Minimise disruption to natural drainage patterns both through route selection and road design.
- Minimise the number of crossings of Broughton Creek and other creeks in the study area.
- Use medians and road verges to maximise habitat value and maintain pollination paths and wildlife movement patterns where feasible.
Avoidance of wetlands, unique habitats and remnant plant communities

Respect of rivers, streams and natural drainage ways

**Protect and enhance the heritage and cultural values of the corridor**

- Avoid items of identified European and indigenous heritage and cultural value.
- Acknowledge and respond to the heritage and cultural values of the rural landscape.
- Acknowledge and respond to indigenous value placed on the broader landscape.

**Preservation of historical archaeological sites**

**Preservation of historical cultural landscapes**

**Respect the communities and towns along the highway**

- Minimise the impact of the highway upgrade on the amenity of residents of Gerringong.
- Provide effective and efficient access to Gerringong.
- Deviate the highway around the town of Berry, minimising the visibility of the highway from the fringes of the town.
- Provide effective access from the highway to Berry, maintaining visual connections that encourage road users to visit Berry without the highway being obtrusive in views from the town.
- Minimise the impact on residents and businesses on the northern side of Bomaderry.
- Minimise disruption and loss of amenity to rural communities in the study area.

**Preservation of context of communities**

**Consideration of adjacent land uses and access to and from highway**
Provide a safe, enjoyable and interesting highway with strong visual connections to the Pacific Ocean, immediate hinterland, and mountains to the west

- Acknowledge the role of this section of Princes Highway as an important part of a longer scenic drive along the New South Wales South Coast.
- Maximise opportunities for high quality and varied views of the coast, the rural landscape and adjacent mountain ranges.
- Provide visual connections and easy, well marked access to the towns along the route.
- Use landscape treatments to soften the appearance of the road for the road user without compromising opportunities for key views.
5.0 Implications for route options development

The landscape setting and the visual constraints are intended to be viewed in parallel to provide urban and regional design input into the development of route options. The visual constraint analysis is focused on identifying the potential visual impact of the upgraded highway. The visual impact also needs to be considered in the context of the overall road user experience, with both of these factors contributing to the identification of route options and ultimately, a preferred route.

Urban and regional design issues that are relevant to the development of route options for the upgrade are discussed below according to the objectives of the urban and regional design framework described in Section 4.

The existing Princes Highway alignment provides a useful reference point or control against which route options can be evaluated. Highway alignment issues are therefore discussed below with reference to the existing alignment.

5.1 Objective 1

Provide a flowing highway alignment that is responsive and integrated with the landscape

The existing highway alignment because, in part, it reflects outdated engineering standards, responds quite closely to the topography of the area. The highway traverses the higher elevations between Gerringong and Berry with a winding alignment and minimal cut and fill. It also tends to closely follow the more moderate undulations of the underlying topography between Berry and Bomaderry. Although it is responsive to the topography, the existing alignment is not completely flowing, with a number of areas with relatively tight bends that require speed reduction, primarily when it traverses the ridges north of Berry (Toolijooa ridge). Because the highway has been in place for a long period of time, the landscape has to some extent developed around the highway itself, particularly in relation to tree plantings on the boundary between the highway and adjacent properties, and the urban development patterns of Gerringong and Bomaderry.

The topography of the study area north of Berry presents significant challenges to identifying route options that respond to the landscape. The slope analysis (Figure 3.2) shows that there are opportunities to negotiate the steeper elevations and slopes with the impact of earthworks on the landscape being relatively contained. In avoiding steeper areas however, there is the potential for the alignment to be pushed towards lower lying areas to the south-east which may require additional earthworks to raise the carriageways above the design flood level. Creating a flowing alignment in options located on the eastern side of the study area north of Berry is potentially difficult because of the limited space between the higher elevations and the eastern edge of the study area.

South of Berry, the topography presents fewer challenges and it is unlikely that any route options in this area would require major earthworks.

Avoidance of significant stands of vegetation is achievable for the most part, with the larger areas of vegetation tending to occur on the higher elevations which are unsuitable for highway construction. Of significance are the isolated stands of cultural plantings and remnant native trees which have localised landscape significance and may in certain cases have heritage significance. Whilst this may be more applicable to later stages of the project (selection and design of the preferred route) there are opportunities for the alignment of route options to be altered to take these stands of trees into account. The same principal applies to built items of landscape and heritage.
5.2 **Objective 2**

**Protect the natural systems and ecology of the corridor**

The issues discussed above regarding the ability for route options to avoid large areas of native vegetation also apply to the objective of avoiding impacts on natural systems and ecology. Also important in relation to this objective is the minimisation of interference to the water cycle. At the route option identification stage this applies to route options traversing floodplain areas.

5.3 **Objective 3**

**Protect and enhance the heritage and cultural values of the corridor**

The heritage and cultural values within the study area are varied and considerable. The existing highway has developed over time without overtly addressing these issues, and at the same time having limited impact because of its relatively small scale.

The upgraded highway has the potential to have a higher impact on cultural and heritage values. Acknowledgement of the cultural and heritage significance of the broader landscape is of particular importance in the initial route planning stages, with consideration being given to how much route options would alter landscape patterns that represent historical land uses.

5.4 **Objective 4**

**Respect the communities and towns along the road**

The existing highway runs through the main street of Berry, the disadvantages of which have been a catalyst for this highway upgrade. Whilst bringing highway users directly into the town, the presence of high volumes of traffic that include many larger trucks has a generally deleterious effect on its overall amenity. Elsewhere in the study area the existing highway provides an important local road connecting the various communities and rural residents. Because of its two lane, single carriageway configuration it has few access restrictions.

It is a fundamental objective of the project that the new highway alignment bypasses Berry. The challenge in the identification of route options relates to how to avoid direct impacts on the fringes of the town, while providing easy access into Berry for users of the upgraded highway. The rail line to the south and eastern side of town already provides a significant physical barrier; any bypass should not further isolate areas of the town.

The ability for residents throughout the study area, particularly those in rural areas, to access the upgraded highway is important. Some routes may potentially require the construction of service roads if the upgraded highway would otherwise cause unacceptable isolation to some residents.

5.5 **Objective 5**

**Provide an enjoyable, interesting highway with strong visual connections to the Pacific Ocean, immediate hinterland, and mountains to the west.**

The existing highway within the study area and the Princes Highway as a whole is an outstanding scenic drive which contributes to the attraction of the entire area. Important issues are the potential for views to be gained from higher points of both the immediate landscape, the ocean and the mountain backdrop, the variation in landscape that would be traversed and any required earthworks that may restrict views and reduce the quality of highway user experience. There are opportunities for adjustments to be made to the alignment of options to potentially optimise the outcome in this regard.