Option 15 – Alternate community option

Option 15 would be around 1.8 kilometres long including work required to tie into the existing alignment and would be located to the eastern side of the existing Princes Highway. Option 15 could achieve a 100 kilometres per hour design standard for horizontal and vertical curves (with the exception of the curve on the southern tie in, which would not be necessary and could be realigned to tie in more appropriately with the existing Princes Highway). Due to the horizontal curve and the orientation of the creek where the crossing is proposed, a bridge of about 220 metres in length and up to 14 metres high would be required. Additionally, at the northern end of the alignment a very large retaining wall of around 300 metres long and between 12 and 21 metres high would be required due to the very steep terrain in this location. Option 15 includes small sections of cut (25,000 cubic metres) and substantial quantities of fill (about 430,000 cubic metres). Tie in to the RMS proposed stage 2 alignment would be possible, but would require a series of vertical curves which is not desirable. As a result of the long bridge, large retaining wall structure, and large earthworks quantities, option 15 has a strategic cost estimate of about $75 million.

2.4.3 Analysis of options

A summary of how each option performs against the proposal objectives as identified in Section 2.3 is outlined in this section and summarised in Table 2-1 for options 1 – 15.

Do nothing option

Performance against proposal objectives:

When considering the do nothing option against the proposal objectives, it was found that this option:

- Does not improve road safety as no changes would be made to the existing alignment.
- Does not provide a continuous 100 kilometres/hour travel speed environment as the existing road design speeds of 50 and 80 kilometres/hour would be retained.
- Does not improve economic efficiency including freight transport as no changes would be made to the existing alignment.
- Would minimise impact on the environment as no disturbance to the environment would occur.
- Would provide a value for money solution as only maintenance costs would be required to allow the road to continue operating in its existing condition.
- Does not provide a safe road transport facility that adheres to existing NSW road design requirements.

This option would not meet the proposal objectives (refer to Section 2.3), nor does it satisfy the RMS commitment to road safety, as such the do nothing option was rejected.

Analysis of full length options

Option 1

Performance against proposal objectives:

When considering option 1 against the proposal objectives, it was found that this option would:
• Improve road safety by realigning the entire length of the study area.
• Provide a continuous 100 kilometres/hour travel speed environment.
• Provide reasonable improvements in economic efficiency and transportation of freight along the Princes Highway by shortening the existing alignment by around 323 metres and through the increase in the road design speed.
• Provide a well engineered road with large improvements in road design.
• Entail major impacts on the environment, including:
  − Clearance of up to 2.1 kilometres of remnant vegetation.
  − Direct impacts to Kooraban National Park, including a 615 metre section through the most eastern section of the park.
  − Direct impacts to Gulaga National Park, including a 550 metre section through the most western section of the park.
  − Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  − Direct impacts to around 1.42 kilometres of koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  − Moderate impacts (85 metre linear section) to the TEC recognised as River-flat eucalypt forest on coastal floodplains located along Dignams Creek.
  − Impacts to around 10 hollow bearing trees and minor impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  − High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
  − High impact to the floodplain landform with large cut and fill required.
  − Production of about 59,000m³ of spoil with the need to identify a suitable location for the stockpiling of this material.
• Provide a high cost option with a strategic estimate of around $85 million that is considered a low value for money option. Further investigations into this option as a result of asset management and geotechnical concerns resulted in this cost escalating substantially above the estimated $85 million. These concerns are related to large fill batters on slopes and resulted in the need to lengthen the bridge. This would be a factor for any option east of the existing Princes Highway.

Whilst option 1 meets the proposal objectives, this option is considered to be a substantial project in terms of size, cost and work required. This option performed best of all full length options from an environmental perspective however the relative high cost of this option combined with low traffic volumes along this section of the Princes Highway has resulted in a very poor economic performance for option 1. Consequently this option was rejected.

**Option 2**

*Performance against proposal objectives:*

When considering option 2 against the proposal objectives, it was found that this option would:

• Improve road safety by realigning the entire length of the study area.
• Provide a continuous 100 kilometres/hour travel speed environment.
• Provide reasonable improvements in economic efficiency and transportation of freight along the Princes Highway by shortening the existing alignment by around 323 metres and through the increase in the road design speed.
• Provide a well engineered road with large improvements in road design.
• Entail major impacts on the environment, including:
  − Clearance of up to 2.1 kilometres of remnant vegetation.
  − Direct impacts to Kooraban National Park, including a 615 metre section through the most eastern section of the park.
  − Direct impacts to Gulaga National Park, including a 550 metre section through the most western section of the park.
  − Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  − Direct impacts to around 1.42 kilometres of koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  − Moderate impacts (85 metre linear section) to the TEC recognised as River-flat eucalypt forest on coastal floodplains located along Dignams Creek.
  − Impacts to around 10 hollow bearing trees and minor impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  − High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
  − High impact to the floodplain landform with large cut and fill required.
  − Production of about 59,000m³ of spoil with the need to identify a suitable location for the stockpiling of this material.
• Provide a high cost option with a strategic estimate of around $85 million that is considered a low value for money option. Further investigations into this option as a result of asset management and geotechnical concerns resulted in this cost escalating substantially above the estimated $85 million. These concerns are related to large fill batters on slopes and resulted in the need to lengthen the bridge. This would be a factor for any option east of the existing Princes Highway.
freight along the Princes Highway by shortening the existing alignment by around 180 metres and through the increase in the road design speed.

- Provide a well engineered road with moderate improvements in road design.
- Entail major impacts on the environment, including:
  - Clearance of up to 2.2 kilometres of remnant vegetation.
  - Direct impacts to Kooraban National Park, including a 615 metre section through the most eastern section of the park.
  - Direct impacts to Gulaga National Park, including a 550 metre section through the most western section of the park.
  - Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  - Direct impacts to around 1.62 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  - Minor impacts to the TEC recognised as River-flat eucalypt forest on coastal floodplains located along Dignams Creek (about a 50 metre linear section).
  - Impacts to up to eight hollow bearing trees and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  - High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
  - Moderate impact to the floodplain landform with moderate cut and fill required.
  - Production of about 129,000 m³ of spoil, with the need to identify a suitable location to stockpile this material.

- Provide a high cost option with a strategic estimate of around $90M that is considered a low value for money option.

Option 2 adequately meets the proposal objectives, however like all full length options it is considered to be a substantial project in terms of size, cost and work required. Option 2 has a higher environmental impact than options 1 and 10 but lower than 3. This option has the highest cost of all the options considered. The high cost of this option combined with low traffic volumes along this section of the Princes Highway has resulted in very low economic performance for option 2. Consequently this option was rejected.

**Option 3**

*Performance against proposal objectives:*

When considering option 3 against the proposal objectives, it was found that this option would:

- Improve road safety by realigning the entire length of the study area.
- Provide a continuous 100 kilometres/hour travel speed environment.
- Provide reasonable improvements in economic efficiency and transportation of freight along the Princes Highway by shortening the existing alignment by around 164 metres and through the increase in the road design speed.
- Provide a well engineered road with large improvements in road design.
- Entail major impacts on the environment, including:
  - Clearance of up to 2.5 kilometres of remnant vegetation.
− Direct and impacts to Kooraban National Park, including a 615 metre section through the most eastern section of the park.
− Direct impacts to Gulaga National Park, including a 550 metre section through the most western section of the park.
− Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
− Direct impacts to around 2.92 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
− A moderate to low potential impact to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (around 50 linear metre section).
− Impacts to around ten hollow bearing trees and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
− High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
− Moderate impact to the floodplain landform with moderate cut and fill required.

• Provide a high cost option with a strategic cost of around $75M that is considered a low value for money option.

Option 3 adequately meets the proposal objectives, however like all full length options it is considered to be a substantial project in terms of size, cost and work required. The relatively high cost of this option compared to the options, combined with low traffic volumes along this section of the Princes Highway has resulted in very low economic performance for option 3. This option also has the highest environmental impact of all full length options. Consequently this option was rejected.

**Option 10**

**Performance against proposal objectives:**

When considering option 10 against the proposal objectives, it was found that this option would:

• Improve road safety by realigning the entire length of the study area.
• Provide a continuous 100 kilometres/hour travel speed environment.
• Provide reasonable improvements in economic efficiency and transportation of freight along the Princes Highway by shortening the existing alignment by around 300 metres and through the increase in the road design speed.
• Provide a well engineered road with large improvements in road design.
• Entail major impacts to the environment, including:
  − Clearance of up to 2.1 kilometres of remnant vegetation.
  − Direct impacts to Kooraban National Park, including a 1.6 kilometre section through the most eastern section of the park.
  − Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  − Direct impacts to around 1.96 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
Moderate impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of around 80 linear metres).

- Impacts to 19 hollow bearing trees and minor impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
- High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
- High impact to the floodplain landform with large fill required.
- Earthworks are substantially reduced compared to options 1-3.

- Provide a high cost option with an estimated cost of around $80M that is considered a low value for money option.

Option 10 was found to satisfactorily meet all of the proposal objectives, and reduce the costs associated with the full length options by substantially reducing earthworks volumes. However, this option is considered to be a substantial project in terms of size, cost and work required. The relative high cost of this option combined with low traffic volumes along this section of the Princes Highway has resulted in very low economic performance for option 10. Consequently this option was rejected.

Analysis of shorter options

Option 4

Performance against proposal objectives:

When considering option 4 against the proposal objectives, it was found that this option would:

- Potentially improve road safety by realigning the northern section of the study area. However, the tie-in to a substandard alignment in the south could transfer crashes.
- Provide a continuous 100 kilometres/hour travel speed environment.
- Provide reasonable improvements in economic efficiency and transportation of freight along the Princes Highway by shortening the existing alignment by around 356 metres and through the increase in the road design speed.
- Provide a well engineered road with moderate improvements in road design.
- Entail minor impacts on the environment, as this alignment is only 1.7 kilometres long and avoids Kooraban National Park. However, this option has the potential to impact on Gulaga National Park in the southern section of the alignment. Impacts on the environment would include:
  - Clearance of up to 0.5 kilometres of remnant vegetation.
  - Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata* subsp. *exaltata*).
  - Direct impacts to around 0.2 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  - Moderate impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 75 linear metres).
  - Minor impacts to hollow bearing trees and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.

High impact to the floodplain landform with large cut and fill required.

Production of about 80,000m³ of spoil, with the need to identify a suitable location to stockpile this material.

- Provide a moderate cost option with a strategic cost estimate around $50M.
- Integrate with a potential future upgrade to the south.

Like all shorter options, option 4 reduces impacts to the environment, but does not fully address the road safety issues identified within this portion of the Princes Highway due to its shorter alignment. Whilst this option is considered to be a moderate cost option, future costs may be required given that the option only covers 1.7 kilometres of the section of highway identified in the preliminary corridor study for upgrade. Option 4 was rejected as it did not meet all the project objectives.

**Option 5**

**Performance against proposal objectives:**

When considering option 5 against the proposal objectives, it was found that this option would:

- Potentially improve road safety by realigning the northern section of the study area. However, the tie-in to a substandard alignment in the south could potentially transfer crashes.
- Provide a continuous 100 kilometres/hour travel speed environment.
- Provide minor improvements to economic efficiency including improved freight transport as the alignment would be shortened by around 135 metres and there would be an increase in road design speed.
- Provide a well engineered road with moderate improvements in road design.
- Entail moderate impacts on the environment as this alignment is only 1.7 kilometres long and avoids the two national parks in the southern section of the alignment. Impacts on the environment would include:
  - Clearance of up to 0.7 kilometres of remnant vegetation.
  - Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  - Direct impacts to around 0.46 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  - Minor impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 50 linear metres).
  - Minor impacts to one hollow bearing tree and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  - High noise and visual amenity impacts to one sensitive noise receiver and moderate impacts to all other adjacent sensitive receivers.
  - Partial acquisition of an additional private property.
  - High impact to the floodplain landform.
  - Production of about 200,000m³ of spoil, with the need to identify a suitable location to stockpile this material.
- Provide a moderate cost option with a strategic cost estimate around $60M.
- Fail to integrate with a potential future upgrade to the south.
Like all shorter options, option 5 reduces impacts to the environment, but does not fully address the road safety issues identified within this portion of the Princes Highway due to its shorter alignment. This option is also considered to be a relatively high cost option, given that the option only covers 1.7 kilometres of the section of highway identified in the preliminary corridor study for upgrade. Furthermore, when compared to the low traffic volumes along this section of the Princes Highway, this option has a low economic performance and does not tie into a future stage 2 alignment, consequently this option was rejected.

**Option 6**

*Performance against proposal objectives:*

When considering option 6 against the proposal objectives, it was found that this option would:

- Potentially improve road safety by realigning the northern section of the study area. However, the tie-in to a substandard alignment in the south could potentially transfer crashes.
- Provide a continuous 100 kilometres/hour travel speed environment.
- Provide reasonable improvements in economic efficiency and transportation of freight along the Princes Highway by shortening the existing alignment by around 250 metres and through the increase in the road design speed.
- Provide a well engineered road with moderate to high improvements in road design.
- Entail minor environment impacts as this alignment is only 1.2 kilometres long and avoids the two national parks in the southern section of the alignment.

Impacts on the environment would include:

- Clearance of up to 0.4 kilometres of remnant vegetation.
- Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
- Direct impacts to around 0.22 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
- Moderate impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 90 linear metres).
- Minor impacts to hollow bearing trees and minor impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
- High noise and visual amenity impacts to one sensitive noise receiver and moderate impacts to all other adjacent sensitive receivers.
- High impact to the floodplain landform with substantial cut and fill required.
- Earthworks quantities were not calculated however fill would need to be imported.
- Provide the highest cost option of all shorter options due to the requirement for a long bridge and substantial earthworks. The option is considered to be a low value for money option.
- Integrate with a future upgrade to the south.

Like all shorter options, option 6 reduces impacts to the environment, but does not fully address the road safety issues identified within this portion of the Princes Highway due to its shorter alignment. This option is also considered to be a high cost option, given that the option only covers 1.2 kilometres of the section of highway identified in the preliminary corridor study for upgrade. Furthermore, within the
context of the low traffic volumes along this section of the Princes Highway, this option has a very low economic performance and consequently was rejected.

Option 7

Performance against proposal objectives:
When considering option 7 against the proposal objectives, it was found that this option would:

- Potentially improve road safety by realigning the northern section of the study area. However, the tie-in to a substandard alignment in the south could potentially transfer crashes.
- Fail to provide a continuous 100 kilometres/hour travel speed environment.
- Provide limited improvements in economic efficiency including improved freight transport as although the alignment would be shortened by around 240 metres, there would not be an increase in the posted speed limit.
- Would provide an adequately engineered road with limited improvements in road design.
- Entail minor impacts to the environment as this alignment is only 0.8 kilometres long and avoids the two national parks in the southern section of the alignment. Impacts on the environment would include:
  - Clearance of up to 0.4 kilometres of remnant vegetation.
  - Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  - Minor direct impacts to around 0.27 kilometres of potential koala habitat and minor indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  - No impact to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek as this option uses the existing Dignams Creek Bridge.
  - Minor impact to one hollow bearing tree and minor impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  - High noise and visual amenity impacts to one sensitive noise receiver and moderate impacts to all other adjacent sensitive receivers.
  - High impact to the floodplain landform, additionally substantial cut required which is much greater than the fill requirements. Excess spoil would need to be transported off site.
  - Earthworks quantities were not calculated however a suitable location to stockpile spoil material would need to be identified.
- Provide a low cost option as the existing bridge would be used and widened. As such option 7 is considered a moderate value for money option.
- Integrate with a future upgrade to the south.

Although this option would cost the least to construct, and reduces impacts to the environment compared to the other options, option 7 was rejected as it does not meet the proposal objective to provide a continuous 100 kilometres/hour travel speed environment and does not adequately address the road safety issues.

Option 8

Performance against proposal objectives:
When considering option 8 against the proposal objectives, it was found that this options would:
• Potentially improve road safety by realigning the northern section of the study area. However, the tie-in to a substandard alignment in the south could potentially transfer crashes.
• Provide a continuous 100 kilometres/hour travel speed environment.
• Provide some improvements in economic efficiency and transportation of freight along the Princes Highway by shortening the existing alignment by around 36 metres and through the increase in the road design speed.
• Provide a well engineered road with moderate improvements in road design. However there would be constructability issues associated with the eastern private property access, which would require substantial earthworks.
• Entail minor impacts to the environment as this alignment is only 1.7 kilometres long and avoids the two national parks in the southern section of the alignment. Impacts on the environment would include:
  - Clearance of up to 0.7 kilometres of remnant vegetation.
  - Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata* subsp. *exaltata*).
  - Potential direct impacts to around 0.55 kilometres of potential koala habitat and minor indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  - Moderate to low impact to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 55 linear metres).
  - Impact to two hollow bearing trees and high impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  - High noise and visual amenity impacts to one sensitive noise receiver and moderate impacts to all other adjacent sensitive receivers.
  - Partial acquisition of an additional private property.
  - Good integration with the existing landform in the floodplain, although substantial cut would be required elsewhere, and excess spoil would need to be transported off site.
• Provide a high cost option due to the substantial earthworks and relocation of excess spoil. As such option 8 is considered a low value for money option.
• Integrate with a future upgrade to the south.

Like all shorter options, option 8 reduces impacts to the environment, but does not fully address the road safety issues identified within this portion of the Princes Highway due to its shorter alignment. This option is also considered to be a high cost option, given that the option only covers 1.7 kilometres of the section of highway identified in the preliminary corridor study for upgrade. Furthermore, within the context of the low traffic volumes along this section of the Princes Highway this option has a very low economic performance and consequently was rejected.

Option 9

**Performance against proposal objectives:**

When considering option 9 against the proposal objectives, it was found that this option would:

• Potentially improve road safety by realigning the northern section of the study area. However, the tie-in to a substandard alignment in the south could potentially transfer crashes.
• Provide a continuous 100 kilometres/hour travel speed environment.
• Provide limited improvements in economic efficiency and transportation of
freight along the Princes Highway by increasing the road design speed however the alignment would actually increase by around 64 metres.

- Provide a well engineered road with moderate improvements in road design.
- Entail minor impacts to the environment as this alignment is only 1.3 kilometres long and avoids the two national parks in the southern section of the alignment. Impacts on the environment include:
  - Clearance of up to 0.7 kilometres of remnant vegetation.
  - Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata* subsp. *exaltata*).
  - Potential direct impacts to around 0.31 kilometres of potential koala habitat and minor indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  - Highest impact of all options on the TEC recognised as River-flat eucalypt forest on coastal floodplains as this option crosses both Dignams Creek and Blind Creek where this vegetation community is located (up to 110 linear metres of clearing).
  - Low impact to hollow bearing trees but high impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  - High noise and moderate visual amenity impacts on two sensitive receivers and moderate impacts to other sensitive receivers located adjacent to the proposal.
  - Partial acquisition of an additional private property.
  - Good integration with the existing landform in the floodplain, and cut would be smaller than that required for options 4 to 8. The extent of fill would however be greater than cut and would require a large amount of borrowed fill to be transported to site.

- Provide a high cost option due to the requirement for a 180 metre long bridge or two smaller bridges. Additionally costs would be associated with transporting borrowed fill to site. Overall this option is considered a low value for money option.
- Integrate with a future upgrade to the south.

Like all shorter options, option 9 reduces impacts to the environment, but does not fully address the road safety issues identified within this portion of the Princes Highway due to its shorter alignment. This option is also considered to be a high cost option, given that the option only covers 1.3 kilometres of the section of highway identified in the preliminary corridor study for upgrade. Furthermore, within the context of the low traffic volumes along this section of the Princes Highway this option has a very low economic performance and consequently was rejected.

**Analysis of intermediate length options with staging**

**Option 11**

*Performance against proposal objectives:*

When considering option 11 against the proposal objectives, it was found that this option would:

- Improve road safety by realigning the northern section of the study area where the existing alignment is most deficient and crashes are more concentrated and severe. This option does not however address the entire study area achieved by the full length options, but addresses more than shorter options. The curvilinear alignment tying into the existing highway in the south during stage 1 is considered less likely to transfer crashes.
• Provide a continuous 100 kilometres/hour travel speed environment.
• Provide large increases in economic efficiency including improved freight transport as the alignment would be shortened by around 331 metres and there would be an increase in road design speed.
• Provide a well engineered road with moderate to large improvements in road design.
• Entail moderate impact on the environment as this alignment is only 2.5 kilometres long and avoids some of the national park in the southern section of the alignment. Impacts on the environment would include:
  – Clearance of up to 1.5 kilometres of remnant vegetation.
  – Direct impacts to Kooraban National Park, including a 530 metre section through the most eastern section of the park.
  – Potential minor impacts to the threatened flora species Square Raspwort (*Haloragis exaltata* subsp. *exaltata*).
  – Direct impacts to around 0.90 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  – Moderate to large impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 90 linear metres).
  – Impacts to one hollow bearing tree and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  – High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
  – High impact to the floodplain landform with large fill required.
• Provide a moderate cost option with an estimated cost of around $60M including

This option was further assessed in a value management workshop undertaken by RMS in March 2012 (RMS 2012). The workshop considered options 11, 12 and 13 and undertook a weighted analysis assessment of the three options using the six evaluation criteria summarised in Section 2.4.1. The workshop found that while all options performed similarly, option 11 was the best performing option according to the six weighted criteria. When evaluated against the estimated capital cost, this option was ranked as the second best performing option. This option was subsequently rejected in preference for option 13. Stage 2 impacts and costs were not calculated at the time of evaluation of these options.

Option 12

*Performance against proposal objectives:*

When considering option 12 against the proposal objectives, it was found that this option would:

• Improve road safety by realigning the northern section of the study area where the existing alignment is most deficient and crashes are more concentrated and severe. This option does not however address the entire study area achieved by the full length options, but addresses more than shorter options. The straight alignment tying into the existing highway in the south during stage 1 has the potential to transfer crashes.
• Provide a continuous 100 kilometres/hour travel speed environment.
• Improve economic efficiency and transportation of freight through the reduction
in the length of the existing alignment by around 361 metres and the increase in road design speed.

- Provide a well engineered road with moderate to large improvements in road design.
- Entail major impacts to the environment, including:
  - Clearance of up to 1.5 kilometres of remnant vegetation.
  - Direct impacts to Koorabann National Park, including a 530 metre section through the most eastern section of the park.
  - Potential minor impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  - Limited direct impacts to around 0.95 kilometres of potential koala habitat and minor indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  - Minor impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 50 linear metres).
  - Impacts to one hollow bearing tree and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  - High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
  - High impact to the floodplain landform with large fill required.
- Provide a moderate cost option with an estimated cost of around $65 million. Option 12 is considered to be a moderate value for money option.

This option was further assessed in the March 2012 value management workshop and compared against options 11, 12 and 13. The workshop undertook a weighted analysis assessment of the three options using the six evaluation criteria summarised in Section 2.4.1. The workshop found that while all options performed similarly, option 12 performed the worst. Option 12 remained as the lowest performing option following the evaluation of the estimated capital cost to determine the options value for money rating. Based on this outcome, this option was rejected. Stage 2 impacts and costs were not calculated at the time of evaluation of these options.

**Option 13**

**Performance against proposal objectives:**

When considering option 13 against the proposal objectives, it was found that this option would:

- Improve road safety by realigning the northern section of the study area where the existing alignment is most deficient and crashes are more concentrated and severe. This option does not however address the entire study area achieved by the full length options, but addresses more than shorter options. The curvilinear alignment tying into the existing highway in the south during stage 1 is considered less likely to transfer crashes.
- Provide a continuous 100 kilometres/hour travel speed environment.
- Provide large increases in economic efficiency including improved freight transport as the alignment would be shortened by around 279 metres and there would be an increase in road design speed.
- Provide a well engineered road with moderate to large improvements in road design.
• Entail moderate impacts to the environment (including stage 2), including:
  − Clearance of up to 1.1 kilometres of remnant vegetation in stage 1 and an additional 1.3 kilometres in stage 2 works.
  − Direct impacts to Kooraban National Park, including a 1,530 metre section through the most eastern section of the park.
  − Potential minor impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
  − Direct impacts to around 1.07 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
  − Limited impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 40 linear metres).
  − Impacts to around 17 hollow bearing trees (majority in stage 2) and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
  − High noise and visual amenity impacts on one sensitive receiver and moderate impacts to other sensitive receivers located adjacent to the proposal.
  − Partial acquisition of an additional private property.
  − High impact to the floodplain landform.

• Would provide a low cost option (for Stage 1 works) with a strategic estimate of $45 million. Option 13 is considered to be a high value for money option and is the best performing of all the options considered.

This option was further assessed in the March 2012 value management workshop and compared against options 11 and 12. The workshop undertook a weighted analysis assessment of the three options using the six evaluation criteria summarised in Section 2.4.1. The workshop found that while all options performed similarly, option 13 was the second best performing option after option 11. However when option 13 was evaluated against the estimated capital cost to determine the options value for money rating, it was found that option 13 was the best performing option. Stage 2 impacts and costs were not calculated at the time of evaluation of these options however these costs have now been undertaken as part of this REF.

The value management workshop concluded that option 13 should proceed for further development. Recommendations for road safety improvements at the southern end of option 13 aimed at addressing the typical crash types in this area, strategies to improve constructability and the requirement for further investigations of tying option 13 into a stage 2 alignment.

Further development of option 13 resulted in the alignment of the preferred option tying into the existing Princes Highway about 500 metres north of the option assessed during the value management workshop, while increasing the length of the road safety treatment on the existing alignment. This reduced the strategic cost estimate of the preferred option to $40 million for stage 1 which would further assist in obtaining funding for construction. Stage 2 has a strategic cost estimate of $20 million (2013 dollars); however it is a long term plan.
Analysis of community options

Option 14 – DCCG option

**Performance against proposal objectives:**

When considering option 14 against the proposal objectives, it was found that this option would:

- Potentially improve road safety by realigning the northern section of the study area. However the straight alignment tying into a substandard alignment has a greater potential for transferring crashes, despite the additional road safety treatment.
- Provide a continuous 100 kilometres/hour travel speed environment.
- Provide large improvements in economic efficiency and transportation of freight along the Princes Highway as the alignment would be shortened by 324 metres and increasing the road design speed.
- Provide a well engineered road with moderate improvements in road design.
- Entail minor impacts to the environment, until a Stage 2 alignment was constructed, as this alignment is only 1.7 kilometres long, avoids Kooraban National Park and only impacts on about 15 metres of Gulaga National Park.

Impacts on the environment include:

- Clearance of up to 0.65 kilometres of remnant vegetation.
- Potential impacts to the threatened flora species Square Raspwort (*Haloragis exaltata subsp. exaltata*).
- Direct impacts to around 0.15 kilometres of potential koala habitat and indirect impacts to the Koala (*Phascolarctos cinereus*) currently listed as vulnerable under both the TSC Act and the EPBC Act.
- Moderate impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 85 linear metres).
- Minor impacts to hollow bearing trees and moderate impacts to areas identified in the preliminary study by NGH Environmental (2010) as potential long-nosed Potoroo habitat.
- High impact to the floodplain landform with large cut and fill required.
- Importation of 165,000m³ of fill, with the need to identify a suitable source location.

- Provide a high cost option due to the requirement for a 200 metre long bridge and the importation of fill. Option 14 has a strategic cost estimate of $65 million. Overall this option is considered a low value for money option.
- Integrate with a future upgrade to the south.

This option reduces impacts to remnant vegetation, but is a high cost option for a short realignment. The high bridge is considered to have larger visual and noise impacts on the valley than the preferred option. Furthermore, within the context of the low traffic volumes along this section of the Princes Highway this option has a very low economic performance and consequently the RMS preferred option has been retained.

Option 15 – Alternate community option

**Performance against proposal objectives:**

When considering option 15 against the proposal objectives, it was found that this option would:

- Potentially improve road safety by realigning the northern section of the study area. However ties into a substandard alignment in the south could potentially
transfer crashes. This could be addressed by a road safety treatment as proposed for the RMS preferred option.

- Provide a continuous 100 kilometres/hour travel speed environment.
- Provide moderate improvements in economic efficiency and transportation of freight along the Princes Highway by increasing the road design speed and shortening the alignment by around 200 metres.
- Provide a well engineered road with moderate improvements in road design.
- Entail minor impacts to the environment, until a Stage 2 alignment was constructed, as this alignment is only 1.8 kilometres long, avoids Kooraban National Park but impacts on about 130 metres of Gulaga National Park.

Impacts on the environment include:
- Clearance of up to 1.1 kilometres of remnant vegetation, which may potentially include potential koala habitat however this area was not surveyed as part of the flora and fauna assessment.
- Moderate impacts to the River-flat eucalypt forest on coastal floodplains TEC located along Dignams Creek (clearance of up to 95 linear metres).
- Low impact to hollow bearing trees however the northern tie in point of this alignment adjacent to Dignams Creek has not been surveyed.
- High noise and visual amenity impacts on one sensitive receiver and low impacts to other sensitive receivers located adjacent to the proposal.
- High impact to the landform with large fill, bridge and retaining wall required.

- Provide a high cost option due to the requirement for a 200 metre long bridge, a 300 metre long retaining wall and the importation of fill. The strategic cost estimate for this alignment is $75 million.
- Integrate with a future upgrade to the south, although the tie in would require a series of vertical curves which is not desirable from a road design perspective.

This option would reduce noise and visual impacts for most residents in the valley as it sits lower and is between 150 and 500 metres further east than the existing alignment. The proposed alignment in the north would present substantial engineering difficulties with the need to construct a large retaining wall in steep terrain adjacent to Dignams Creek. This option is a shorter option with costs similar to full length options and within the context of the low traffic volumes along this section of the Princes Highway this option has a very low economic performance. Consequently the RMS preferred option has been retained.
## Design characteristics

<table>
<thead>
<tr>
<th>Option</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10 Avoid Gulaga NP</th>
<th>11</th>
<th>12</th>
<th>13 = preferred with stage 2 included</th>
<th>14 DCCG option</th>
<th>15 Alternate community option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (kilometres)</td>
<td>3.12</td>
<td>3.26</td>
<td>3.28</td>
<td>1.72</td>
<td>1.68</td>
<td>1.17</td>
<td>0.78</td>
<td>1.71</td>
<td>1.29</td>
<td>3.4</td>
<td>2.46</td>
<td>2.42</td>
<td>2.51</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Maximum Grade</td>
<td>8 %</td>
<td>8 %</td>
<td>8 %</td>
<td>9 %</td>
<td>7 %</td>
<td>5 %</td>
<td>7 %</td>
<td>7 %</td>
<td>9 %</td>
<td>9 %</td>
<td>9 %</td>
<td>8 % (with the exception of the tie in to the existing alignment</td>
<td>8 %</td>
<td>6.5 %</td>
<td>8 %</td>
</tr>
<tr>
<td>Design speed</td>
<td>110 km/hr</td>
<td>100 km/hr</td>
<td>100 km/hr</td>
<td>100 km/hr</td>
<td>100 km/hr</td>
<td>80 km/hr</td>
<td>100 km/hr</td>
<td>100 km/hr</td>
<td>110 km/hr</td>
<td>100 km/hr</td>
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<tr>
<td>Bridge structure</td>
<td>110 metres long 29 metres high</td>
<td>Further investigations resulted in a 274 metre long bridge in order to reduce the need for large fill batters</td>
<td>80 metres long 15 metres high</td>
<td>80 metres long 10 metres high</td>
<td>110 metres long and would include large 2:1 fill batters</td>
<td>80 metres long 110 metres long</td>
<td>Not required using the existing bridge</td>
<td>80 metres long 180 metres long</td>
<td>274 metres</td>
<td>274 metres</td>
<td>290 metres</td>
<td>91 metres 12 metres high</td>
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<tr>
<td>Cut volume (cubic metres)</td>
<td>727,000 includes stage 2 quantities</td>
<td>803,000 includes stage 2 quantities</td>
<td>642,000 includes stage 2 quantities</td>
<td>200,000 does not include stage 2 quantities which are estimated to be 213,000</td>
<td>340,000 does not include stage 2 quantities which are estimated to be 211,000</td>
<td>Substantial cut required but not calculated</td>
<td>Substantial cut required but not calculated</td>
<td>Cut would be smaller than cut required for Options 4 - 8</td>
<td>490,000 includes stage 2 quantities</td>
<td>340,000 does not include stage 2 quantities which were not calculated.</td>
<td>350,000 does not include stage 2 quantities which were not calculated.</td>
<td>446,000 includes stage 2 quantities</td>
<td>190,000 does not include stage 2 quantities which are estimated to be 213,000</td>
<td>25,000 does not include stage 2 quantities which are estimated to be 230,000</td>
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<tr>
<td>Fill volume (cubic metres)</td>
<td>658,000 includes stage 2 quantities</td>
<td>674,000 includes stage 2 quantities</td>
<td>643,000 includes stage 2 quantities</td>
<td>260,000 does not include stage 2 quantities which are estimated to be 230,000</td>
<td>120,000 does not include stage 2 quantities which are estimated to be 230,000</td>
<td>Substantial fill required greater than fill as such a large amount of excess fill needs to be transported off site anticipated</td>
<td>Not calculated but considered to be small</td>
<td>Substantial fill required greater than fill as such a large amount of excess fill needs to be transported off site anticipated</td>
<td>490,000 includes stage 2 quantities</td>
<td>340,000 does not include stage 2 quantities which were not calculated.</td>
<td>350,000 does not include stage 2 quantities which were not calculated.</td>
<td>452,000 includes stage 2 quantities</td>
<td>350,000 does not include stage 2 quantities which are estimated to be 230,000</td>
<td>430,000 does not include stage 2 quantities which are estimated to be 230,000</td>
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</tr>
<tr>
<td>Spoil produced (cubic metres)</td>
<td>59,000</td>
<td>129,000</td>
<td>Balanced</td>
<td>No spoil but an additional 80,000 cubic metres of fill would be required to be imported to the site</td>
<td>220,000</td>
<td>Not calculated</td>
<td>Substantial spoil anticipated requiring removal from site</td>
<td>Not calculated</td>
<td>Not Calculated</td>
<td>Balanced</td>
<td>Balanced</td>
<td>Balanced</td>
<td>6,000</td>
<td>No excess spoil but 165,000 cubic metres of fill required to be imported to the site</td>
<td>No excess spoil but 405,000 cubic metres of fill required to be imported to the site</td>
</tr>
</tbody>
</table>

**Proposal objectives**

- **To improve road safety.**
  - Large improvements
  - Large improvements
  - Large improvements
  - Moderate improvements
  - Moderate improvements
  - Minimal improvements
  - Moderate improvements
  - Moderate improvements
  - Large improvements
  - Moderate improvements
  - Large improvements
  - Moderate improvements
  - Moderate improvements

- **Continuous 100 kmph speed**
  - Yes
  - Yes
  - Yes
  - No
  - Yes
  - Yes
  - Yes
  - Yes
  - Yes
  - Yes
  - Yes
  - Yes
  - Yes

- **Improved travel time and alignment**
  - Large improvement 323 metres shorter w 110km/hr
  - Moderate improvement 180 metres shorter w
  - Moderate improvement 186 metres shorter w
  - Large improvement 356 metres shorter w 110km/hr
  - Moderate improvement 129 metres shorter w
  - Moderate improvement 139 metres shorter w
  - Limited improvement 240 metres shorter w 80
  - Moderate improvement 36 metres shorter w
  - Moderate improvement 64 metres shorter w
  - Large improvement 280 metres shorter w 100 km/hr
  - Moderate to high improvement 331 metres
  - Moderate to high improvement 361 metres
  - Large improvement 324 metres shorter w 100
  - Moderate improvement 200 metres shorter w 100

---

Upgrade of the Princes Highway, Dignams Creek
Review of Environmental Factors

44
### Environmental impacts

#### Impacts to threatened species

<table>
<thead>
<tr>
<th>Option</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Low cost</th>
<th>High cost</th>
<th>High cost</th>
<th>Moderate cost</th>
<th>Low cost</th>
<th>High cost</th>
<th>Moderate cost</th>
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#### Section of the alignment impacting on remnant vegetation, habitat trees and the Threatened Ecological Community (TEC) recognised as River flat Eucalypt Forest on Coastal Floodplains located along Dignams Creek (only the length of the impact is shown)

<table>
<thead>
<tr>
<th>Option</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Low cost</th>
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<th>High cost</th>
<th>Moderate cost</th>
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</tbody>
</table>

### Environmental impacts

**Well engineered, safe and environmentally acceptable road transport facility.**

- Yes
- Yes
- Yes
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- No, utilises existing narrow bridge and issues with tying in to poor alignment in the south potentially transferring crashes.
- No, impacts high conservation value vegetation in northern portion of study area and issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
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- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
- Yes, however issues with tying in to poor alignment in the south potentially transferring crashes.
<table>
<thead>
<tr>
<th>Option</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10 Avoid Gulaga NP</th>
<th>11</th>
<th>12</th>
<th>13 = preferred with stage 2 included</th>
<th>14 DCCG option</th>
<th>15 Alternate community option</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Parks (only the length of the impact is shown)</td>
<td>Direct impacts (-615\ m in Kooralbyn NP and 550 \ m in Gulaga NP), Same impact options 1-3. Indirect impacts also</td>
<td>Direct impacts (-615\ m in Kooralbyn NP and 550 \ m in Gulaga NP), Same impact options 1-3. Indirect impacts also</td>
<td>Direct impacts (-615\ m in Kooralbyn NP and 550 \ m in Gulaga NP), Same impact options 1-3. Indirect impacts also</td>
<td>Potential impacts on Gulaga National Park</td>
<td>No impacts as no stage 2 alignment</td>
<td>No impacts as no stage 2 alignment</td>
<td>No impacts as no stage 2 alignment</td>
<td>No impacts as no stage 2 alignment</td>
<td>Direct impacts (-1600\ m in Kooralbyn National Park and indirect impacts)</td>
<td>Direct impacts (-530\ m in Kooralbyn National Park. Indirect impacts also)</td>
<td>Direct impacts (-530\ m in Kooralbyn National Park. Indirect impacts also)</td>
<td>Would include around 15 metres of direct impacts to Gulaga National Park. A further 1000 metres of impacts for the stage 2 works through Kooralbyn NP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Social/urban amenity impacts

- **Residences includes visual amenity and noise impacts**
  - High impact on one local residence. Moderate impact on other residences
  - High impact on one local residence. Moderate impact on other residences
  - High impact on one local residence. Moderate impact on other residences
  - High impact on one local residence. Moderate impact on other residences
  - High impact on one local residence. Moderate impact on other residences
  - High impact on one local residence. Moderate impact on other residences
  - High impact on two local residences. Moderate impact on other residences
  - High impact on two local residences. Moderate impact on other residences
  - High impact on two local residences. Moderate impact on other residences
  - High impact on two local residences. Moderate impact on other residences
  - High impact on two local residences. Moderate impact on other residences
  - High impact on two local residences. Moderate impact on other residences

- **Landform**
  - High impact with large fill 20 metres on floodplain
  - High impact to floodplain
  - High impact to floodplain
  - High impact to floodplain
  - High impact with large cut and fill
  - High impact with large cut and fill
  - High impact substantial fill on floodplain
  - Low impact, integrates well with existing landform
  - Low impact, integrates well with existing landform
  - High impact substantial fill on floodplain
  - High impact substantial fill on floodplain
  - High impact to floodplain
  - High impact with large cut and fill

Upgrade of the Princes Highway, Dignams Creek
Review of Environmental Factors
2.5 Preferred option

As outlined in Section 2.4.3, when considering option 13 against the proposal objectives, it was found that this option would:

- Improve road safety due by realigning the tight curves in the north and providing a road safety treatment in the south to address the common crash types as part of the Stage 1 works, while providing a plan for future works to realign the entire study area to a 100 kilometres/hour design standard.
- Provide a continuous 100 kilometre/hour travel speed environment.
- Provide increases in economic efficiency including improved freight transport as the alignment would be shortened by around 279 metres and there would be an increase in road design speed.
- Provide a well-engineered road.
- Entail moderate impacts to the environment.
- Provide a value for money solution by reducing the height of cuts and fills required, has a smaller scale bridge and would cost substantially less to construct than comparable options. As it can be constructed in two stages it would also assist in obtaining funding for construction.

Option 13 meets all the proposal objectives and was the best performing option at the Value Management Workshop. Accordingly it was selected as the preferred option. It is described in further detail in Chapter 3.

2.6 Design refinements

Following selection of the preferred option the recommendations of the value management workshop have been considered during the development of the concept design, where appropriate. Some further refinements have also been included in the concept design of the preferred option to address issues identified as part of the environmental impact assessment process. The refinements and the rationale for these refinements are discussed in further detail in the following sections.

2.6.1 Main alignment

Following the recommendation of the value management workshop (RMS 2012), the last curve included at the southern end of the main alignment of the preferred option has been removed. The main alignment has been shifted to the west and tied back into the existing Princes Highway around two kilometres from the start of the proposal (chainage 96750), refer to Figure 2-9. Additional road safety improvements have been included into the design for the 1.4 kilometre stretch of the Princes Highway (between chainages 96750 to 98150) as part of the stage 1 works. The additional safety improvements include:

- Increasing the sight distance around the transition curve between the realignment and the road safety treatment to AUSTROADS road design standards.
- Steepening batters on the western side of the alignment.
- Widening the north-bound shoulder to three metres.
- Provision of a painted central median one to 3.5 metres wide.

The removal of the curve eliminates the need to construct large and expensive fill batters along the 400 metre length of the curve, subsequently reducing construction costs in stage 1. The realignment of the main alignment to the north facilitates a
simple tie in to the future stage 2 alignment that extends through a further one kilometre section of Kooraban National Park. Further details of the tie in to the stage 2 alignment are included below.

Figure 2-9 Modification to design

2.6.2 Inclusion of stage 2 alignment

Following the recommendations of the value management workshop the preferred option was modified so that the vertical and horizontal alignments of the preferred option are compatible with a future tie in to a stage 2 alignment through Kooraban National Park. The stage 2 alignment would be constructed at a future date and is included as part of this proposal. The stage 2 alignment is based on the southern 1.5 kilometres of the alignment proposed for option 10. The stage 2 alignment includes two curves each with a 600 metre radius that allows for a 100 kilometre per hour design speed. The provision of the stage 2 alignment allows for the upgrade and realignment of the full 3.7 kilometres of the Princes Highway identified for upgrade in the preliminary corridor study to current road design standards. Separating the proposal into two stages would assist RMS in securing funding to construct a realignment in the northern section of road identified in the corridor study that is most deficient in terms of road design standards while providing a road safety treatment on the existing alignment in the south and providing a plan for future works.
The stage 2 works would extend from about two kilometres to 3.5 kilometres south of the start of the proposal and would be located to the west of the existing alignment along the southern most section of Kooraban National Park (refer to Figure 2-10). Features included as part of stage 2 as stated in the proposal description include:

- Realignment of 1.5 kilometres of single carriageway of the Princes Highway commencing two kilometres south of the northern end of the proposal and extending to the southern end of the proposal. Lanes would be constructed 3.5 metres wide with a three metre shoulder in each direction.
- Tie in works to the stage 1 component of the Princes Highway.
- Tie in works to the existing Princes Highway at the southern end of the proposal.
- Provision of one dedicated fauna underpass containing fauna furniture, one combined drainage culvert/fauna underpass and one rope canopy bridge.
- Removal of the existing Princes Highway between Dignams Creek Road and the access road to Gulaga National Park and then rehabilitating and landscaping the old road alignment.

Figure 2-10 Stage 2 works

2.6.3 Inclusion of a construction access track

Another recommendation of the value management workshop was that further strategies should be investigated to improve constructability. One strategy identified was the potential installation of a construction access track along the northern section of the proposal on the eastern side of the existing Princes Highway. The construction access track would be a single lane track operating under traffic control. It would be about 670 metres in length starting near the northern end of the proposal and extending south. The track would tie back into the existing Princes Highway immediately north of the existing Dignams Creek Bridge (refer to Figure 2-11).
The access track would remove traffic from the Princes Highway during the stage 1 works of the proposal. The first 270 metres of the construction access track would be removed when the stage 1 works are complete. The remaining 400 metres could be retained following completion of the stage 1 works and used as a private property access road for property number 9523 Princes Highway. This property would be used as the primary construction site during the construction of the proposal and is currently owned by RMS. This property would be sold once the works are complete and the offset package with the Office of Environment and Heritage (OEH) has been finalised.

Figure 2-11 Potential design for a construction access track
2.6.4 Private access tracks

Development of the concept design identified that two private property access tracks, into numbers 9526 and 9523 Princes Highway had poor visibility for traffic entering and exiting the highway. Both of these private access roads would be relocated and placed in positions with better sight distances for turning traffic. Additionally two access points into Kooraban National Park at the top of Dignams Hill have been consolidated into one. The following is a description of the changes that have now been included in the concept design for the proposal.

The private property access road into number 9526 Princes Highway is currently located around 287 metres from the start of the proposal (chainage 95250) on the northbound side of the highway. This access road would be relocated about 413 metres to the south of the original access point and would utilise the old Princes Highway alignment (chainage 95450) for around 250 metres. The access road ties into a new 200 metre section of access road which curves to the north where it would tie back into the existing private property access (refer to Figure 2-12). The relocation of the access track to this location is considered an improvement in the existing situation and provides better sight distance for traffic accessing this private access track from the Princes Highway.

![Figure 2-12 Private property access for 9526 Princes Highway, Dignams Creek](image)

The private property access road into number 9523 Princes Highway is currently around 300 metres from the start of the proposal on the southbound side of the existing Princes Highway. This access road would be relocated to the eastern side of Dignams Creek Road around 200 metres from the existing intersection with the Princes Highway (refer to Figure 2-13). The access track would pass underneath the new Dignams Creek Bridge, running adjacent to the creek and then link into the existing Dignams Creek Road and Princes Highway alignments. The access road would cross Dignams Creek on the existing Princes Highway alignment using the
existing Dignams Creek Bridge. It would then use the western section of the construction access track if constructed as described in Section 2.6.3 to access the main residential property. In the event that the construction access track is not constructed, the existing access north of the bridge would be utilised. The reasons for this substantial relocation are as follows:

- The property runs on both sides of the Princes Highway and can be accessed from the Princes Highway and Dignams Creek Road.
- Dignams Creek Road has less traffic and has a slower design speed (80 kilometres per hour) than the Princes Highway (100 kilometres per hour).
- There would be better visibility for traffic entering and exiting the access track.
- Currently RMS is the owner of this property.
- The access track may also be used as a construction track during the stage 1 works of the proposal.

Figure 2-13 Private property access for 9523 Princes Highway, Dignams Creek

The fire trail access into Kooraban National Park at the top of Dignams Hill currently has two access points located around 640 metres and 740 metres from the end of the proposal on the northbound side. The southern access point would be removed and the northern access formalised to reduce conflict points and improve road safety on the existing Princes Highway in stage 1 (refer to Figure 2-14). The northern access point was chosen as it maximises the sight distance available at this location. This access point would need to be relocated as part of stage 2 works to connect to the realignment.
2.6.5 Steepening of road batter along Dignams Creek Road and extending down to Blind Creek

During the concept design two options were considered for the road batters along the western side of the realigned Dignams Creek Road. Initially the concept design included a 2:1 batter, that impacted on Blind Creek and sensitive remnant vegetation located along the creek, including sections of the River-flat Eucalypt Forest on Coastal Floodplains which is recognised as a Threatened Ecological Community (TEC), refer to Section 6.1. As a result a second option was considered in which the batter slope would be steepened to 0.6:1 to confine the footprint of the works in this location and avoid impacts to Blind Creek. The two options considered are shown on Figure 2-15 with the preferred option shown in white). Figure 2-16 shows a cross section of the 60 degree road batter proposed. It should be noted that this figure is provided for illustrative purposes only as the method for constructing the batter is still being reviewed and would be defined during the detail design phase. All works on the road batter would be included in stage 1 of the proposal.
Figure 2-15 Plan view of the two options considered for the road side batter along Dignams Creek Road and extending down to Blind Creek.

Figure 2-16 Cross section of road side batter along Dignams Creek Road and Blind Creek at chainage 96140 (SMM 2013)