

Corindi to Dirty Creek Range and the other traversing to the north-west in the vicinity of Sherwood Creek. These options are shown in Figure 3.1.

3.3.1 CRW / Option A

In the Bucca Valley Section the CRW / Option A route forms the eastern boundary of the CHCC Preferred Corridor. Passing immediately to the west of the Ulidarra National Park, the CRW route could continue along a north-easterly direction through the Orara East State Forest. The route would pass through the upper reaches of Bucca Bucca Creek and a major ridgeline known locally as Polyosma. From that point, it trends north-east and north through the Lower Bucca Valley adjacent to Settles Road. Two viaducts are proposed at Bruxner Park Road, with a 560m tunnel required through the ridgeline, this is the northern point of the CRW route.

In the course of examining route options in the Corridor, a possible sub-option for the CRW along the eastern edge of the Bucca Valley was identified (refer Figure 3.1). This variation was prompted by the possible advantages of avoiding the rugged terrain associated with Polyosma ridge and hence reducing the very significant (and expensive) engineering features presented in the CRW proposal. Although it has not been developed in detail, it would be similar to the Western Bucca Valley / Option A route (see Section 3.3.2 below) in terms of functionality, cost, economic viability and socio-economic, biophysical and indigenous heritage impacts.

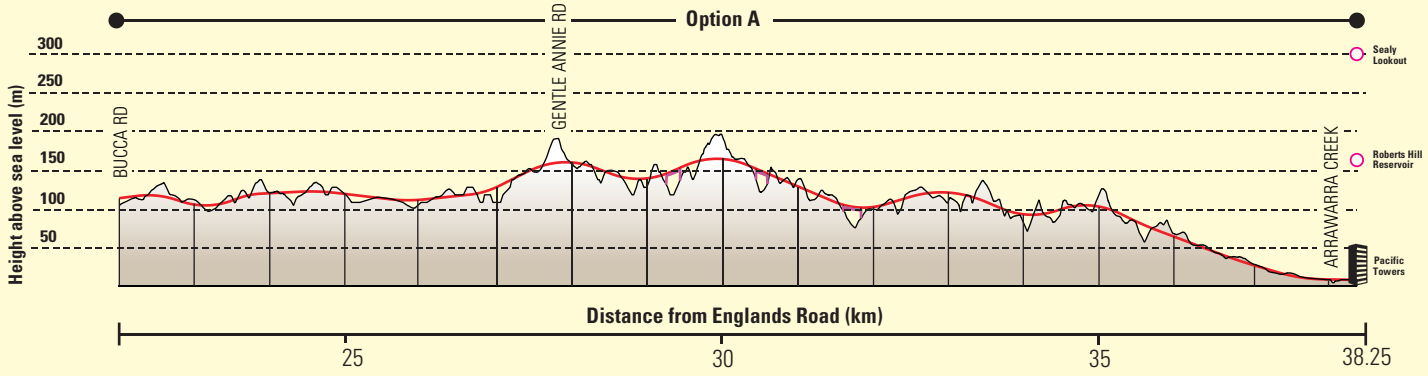
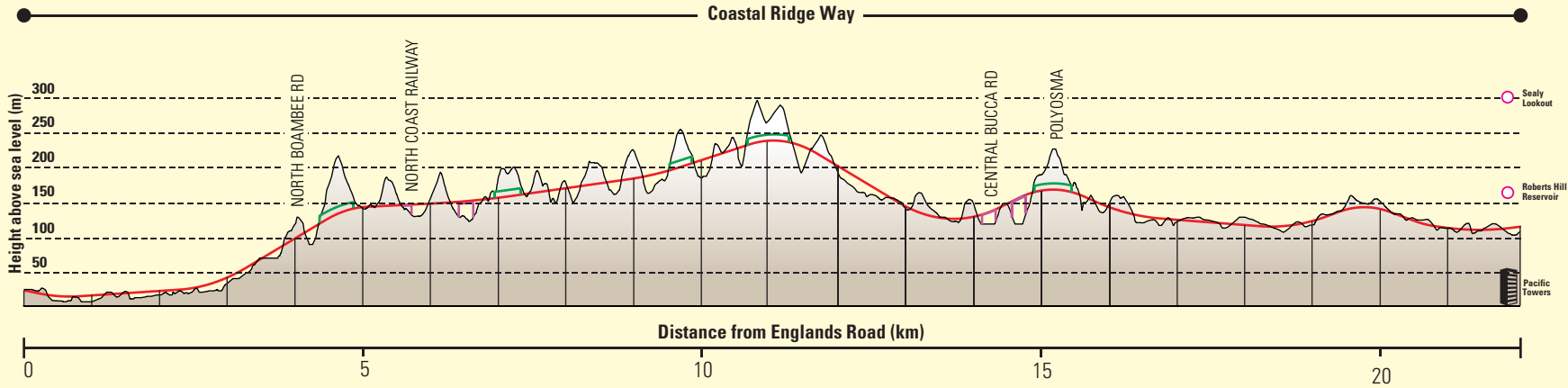
Option A, which was originally a community proposed route from Moonee to Mullaway, left the existing highway in the vicinity of Bucca Road. For the purposes of extending the more recent CRW alignment, a connection to Option A was developed in the vicinity of Maccues Road, advancing in a northerly direction through State Forest lands for most of its length (see Figure 3.1). To the north, the alignment of Option A passes through the eastern low point in the prominent Sherwood Road ridge. Option A would require bridge structures at all major watercourses and at key forestry road crossings. Full details of the Option A alignment can be found in the *Route Options Development Report* (Connell Wagner, 2002d).

The longitudinal section (profile) of the CRW / Option A route option between where it leaves the existing highway at Englands Road south of Coffs Harbour and where it rejoins the highway at Arrawarra Creek north of Woolgoolga is shown in Figure 3.2.

3.3.2 Western Bucca Valley / Option A

The second possible route option (identified as Western Bucca Valley / Option A alignment) passes through agricultural and rural residential land and areas of State Forest on the western side of the Bucca Valley to a point just north of Bucca Road. At this location, the route would veer to the north-east (see Figure 3.1) across the Bucca Valley, Bucca Bucca Creek and some small creeks, before passing through timber plantations within the Conglomerate State Forest. The alignment would rise from the floor of the Bucca Valley, up the slopes of Gentle Annie ridge, converging with Option A just as it enters the eastern low point in the Sherwood Road Ridge and Sherwood Nature Reserve. The route would then follow the Option A alignment back to a tie in with the existing highway at Arrawarra Creek. Whilst the terrain still remains rugged, with maximum elevations of up to 200m no tunnels are proposed along the common alignment with Option A.

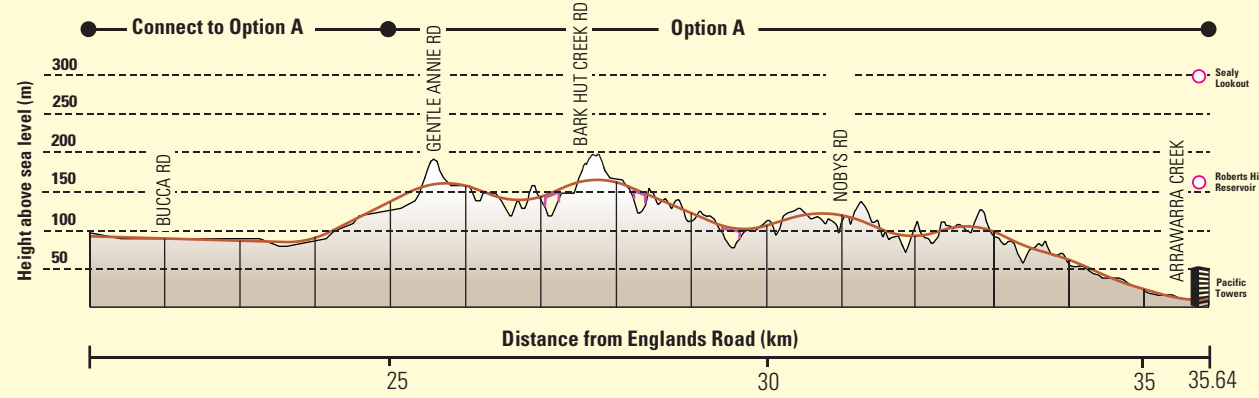
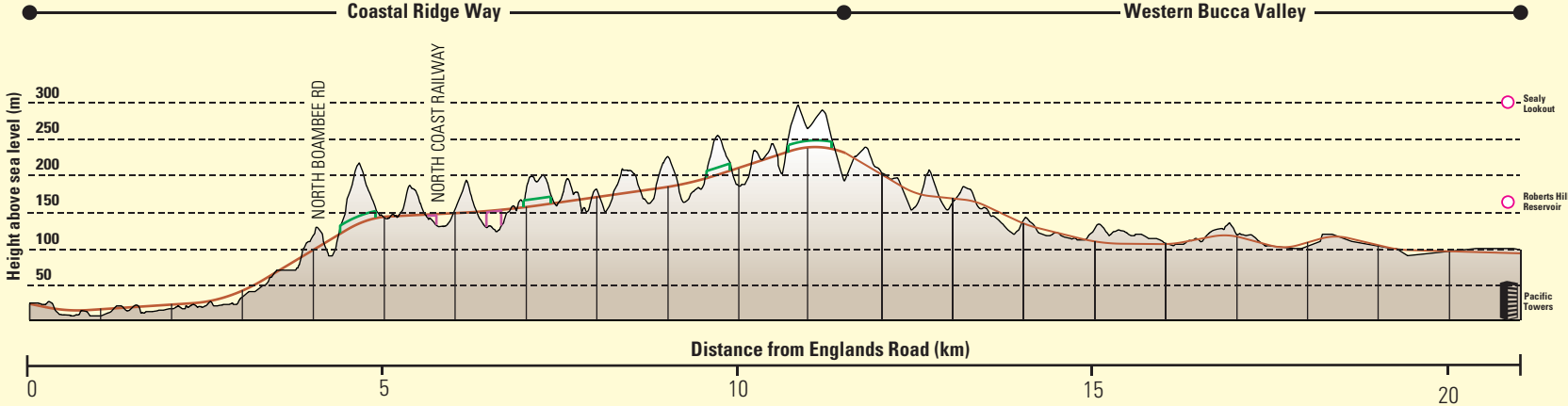
The longitudinal section (profile) of the Western Bucca Valley / Option A route option between where it leaves the existing highway at Englands Road south of Coffs Harbour and where it rejoins the highway at Arrawarra Creek north of Woolgoolga is shown in Figure 3.3.



LEGEND	
	Tunnels
	Viaducts

1:100000H 1:10000V

FIGURE 3.2
COASTAL RIDGE WAY/OPTION A
LONGITUDINAL SECTION (PROFILE) BETWEEN
ENGLANDS ROAD AND ARRAWARRA CREEK



LEGEND	
	Tunnels
	Viaducts

1:100000H 1:10000V

FIGURE 3.3
WESTERN BUCCA VALLEY/OPTION A
LONGITUDINAL SECTION (PROFILE) BETWEEN
ENGLANDS ROAD AND ARRAWARRA CREEK

3.3.3 Western Bucca Valley / Corindi River

The Western Bucca Valley / Corindi River option was identified and developed following discussions with Council representatives. This option follows the same alignment as the Western Bucca Valley / Option A route along the western side of the Bucca Valley and up the slopes of Gentle Annie ridge to the eastern low point in the Sherwood Road Ridge before deviating from Option A near Wedding Bell Creek Road. The route then heads generally in a northerly direction along the eastern side of the Corindi River valley towards Upper Corindi. After crossing Upper Corindi Road approximately 2km east of its intersection with Rufus Road, it then continues in a northerly direction before rejoining the highway near Dirty Creek Range.

The longitudinal section (profile) of the Western Bucca Valley / Corindi River option between where it leaves the existing highway at Englands Road south of Coffs Harbour and Halfway Creek is shown in Figure 3.4.

3.3.4 Western Bucca Valley / Sherwood Creek

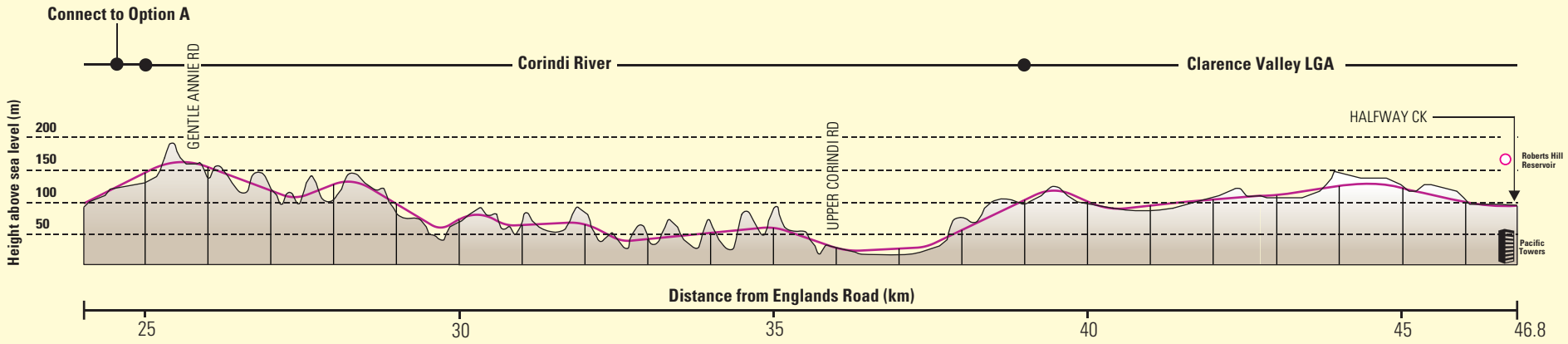
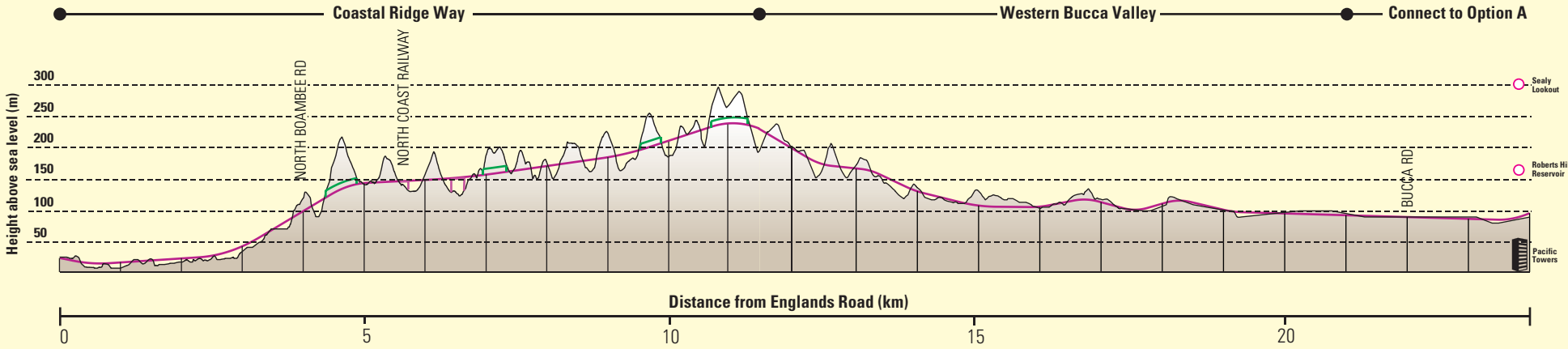
The Western Bucca Valley / Sherwood Creek option would initially follow a common alignment along the western side of the Bucca Valley to a point just to the north of Bucca Road (see Figure 3.1). At this location it would veer off in a north-west direction crossing Bucca Creek to the base of the western low point in the Sherwood Road ridge. Here a 1.4km tunnel would be required through the ridge, which has a maximum elevation of approximately 340m at this location. The tunnel would have a maximum design grade of 6%. On the northern side of the tunnel, a 40m high viaduct would be required, followed by another viaduct 700m long to negotiate a 70m deep valley. This would then be followed by a 1.1km tunnel. Further cuttings and viaducts would be required through to Sherwood Creek, whereupon the route would continue through into the Clarence Valley LGA on its way to the Pacific Highway near Dirty Creek Range.

The longitudinal section (profile) of the Western Bucca Valley / Sherwood Creek route option between where it leaves the existing highway at Englands Road south of Coffs Harbour and where it rejoins the highway near Dirty Creek Range south of Halfway Creek is shown in Figure 3.5.

3.4 Sherwood / Corindi Section

The Western Bucca Valley / Sherwood Creek route exits the CHCC Preferred Corridor in the vicinity of Sherwood Creek. Numerous crossings of the meandering Sherwood Creek would be required within the valley formed by the two prominent north/south ridges. The western-most of these ridges is located within Sherwood Nature Reserve (see Figure 3.1). North of Sherwood Creek, the route would require numerous cuttings and viaducts as it climbs up to Hutleys Pass, where a 1.3km long tunnel would be required through Hutleys Knob, which has an elevation of 290m above sea level. This tunnel would also need to have a maximum design grade of 6%. The terrain through the Upper Corindi area eases to hilly and undulating conditions approaching the coast, however, substantial cut and fill formations would still be required to allow reconnection with the Pacific Highway at Dirty Creek Range.

The Western Bucca Valley / Corindi River route leaves the CHCC Preferred Corridor further to the east close to where the former Coffs Harbour LGA boundary crosses Bark Hut Creek Road. The option follows an alignment to the east of the Corindi River where the terrain is less rugged than the Western Bucca Valley / Sherwood Creek option further west.



LEGEND	
	Tunnels
	Viaducts

FIGURE 3.4
WESTERN BUCCA VALLEY/CORINDI RIVER
LONGITUDINAL SECTION (PROFILE) BETWEEN
ENGLANDS ROAD AND HALFWAY CREEK UPGRADE

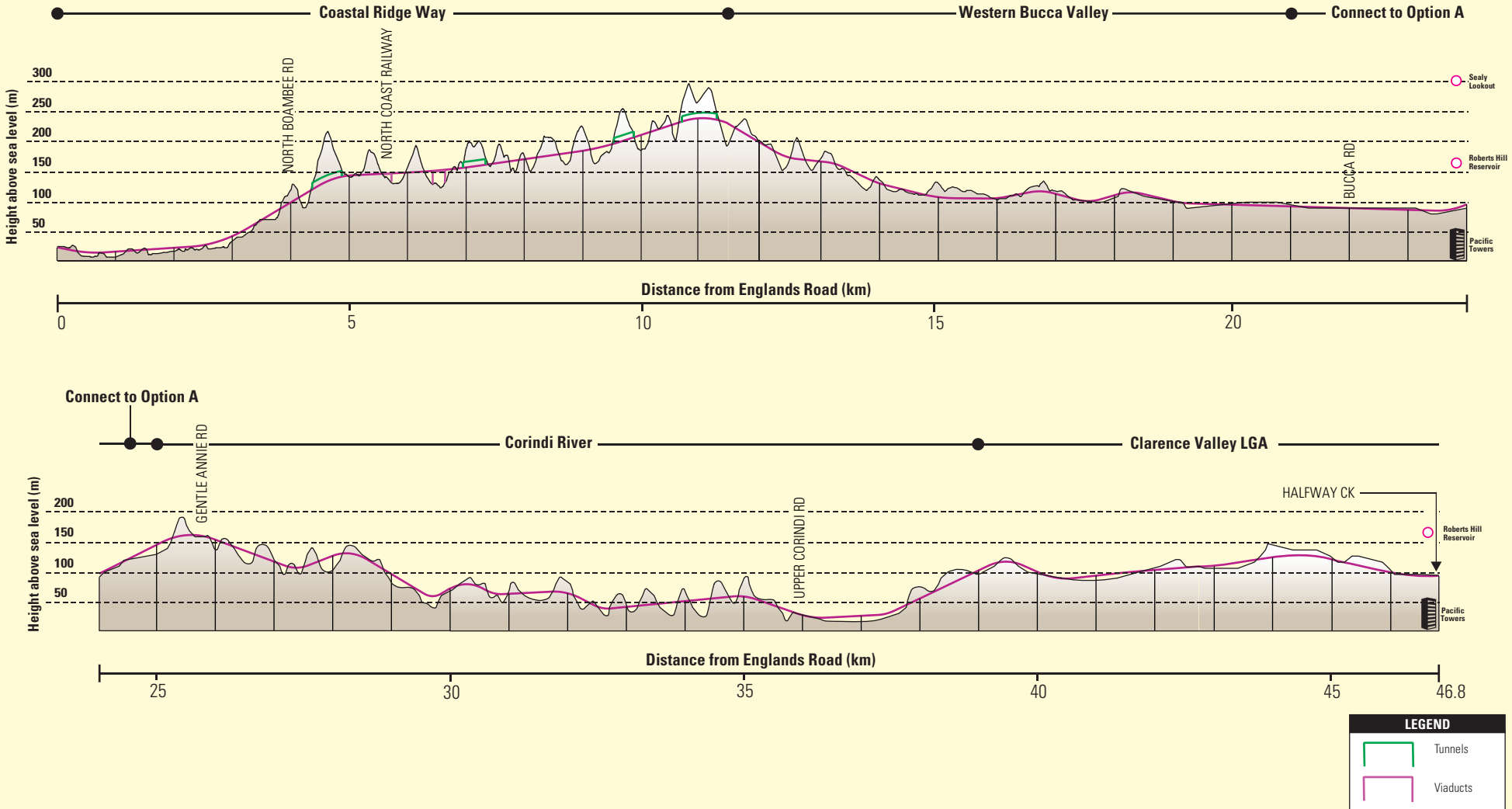


FIGURE 3.4
WESTERN BUCCA VALLEY/CORINDI RIVER
LONGITUDINAL SECTION (PROFILE) BETWEEN
ENGLANDS ROAD AND HALFWAY CREEK UPGRADE

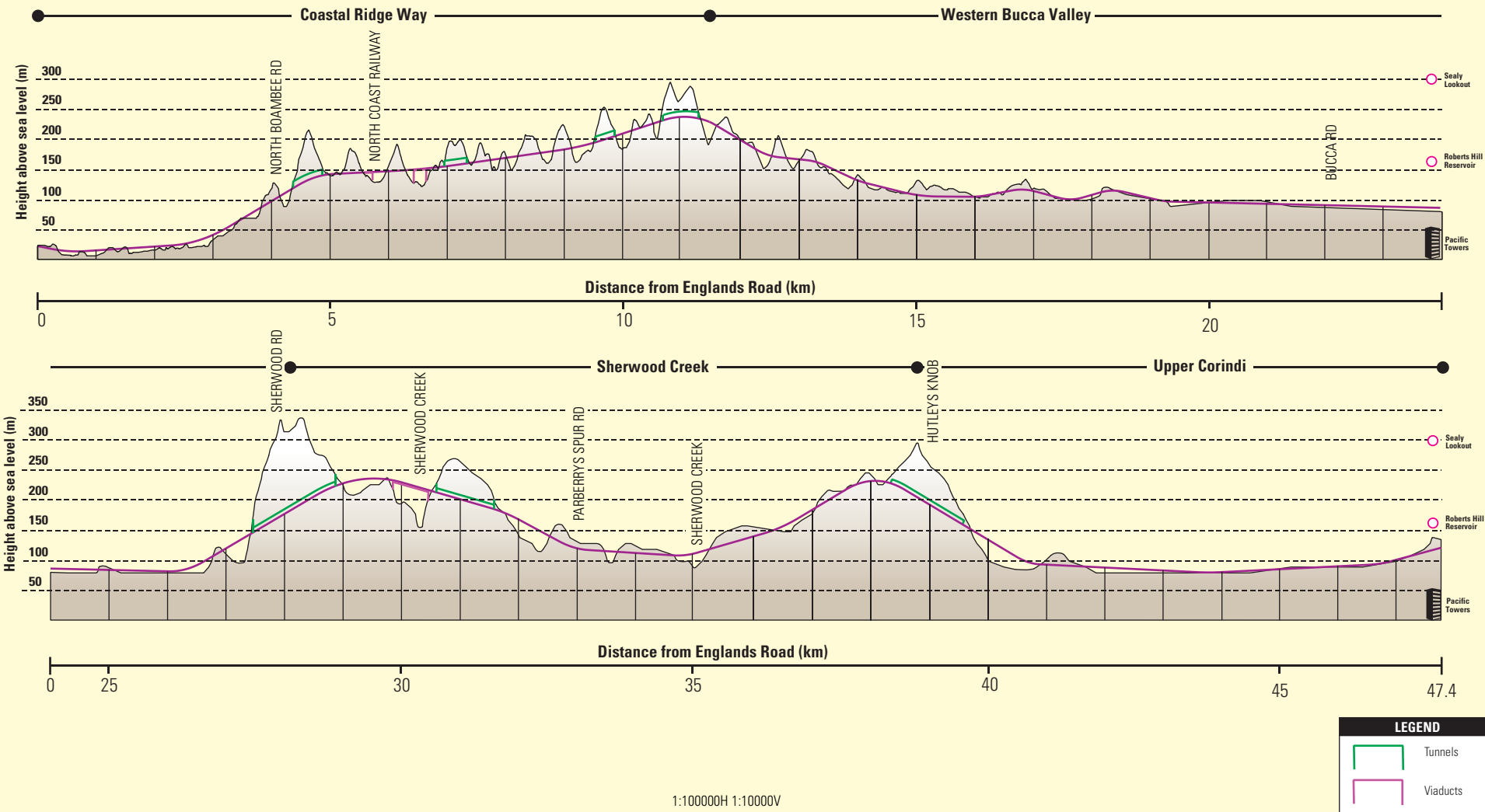


FIGURE 3.5
WESTERN BUCCA VALLEY/SHERWOOD CREEK
LONGITUDINAL SECTION (PROFILE) BETWEEN
ENGLANDS ROAD AND DIRTY CREEK RANGE

3.5 Comparative Assessment

From the southern end of the CHCC Preferred Corridor in the Upper Bucca Valley, the above four broad alignment options are differentiated in terms of their component sections and overall length. The lengths of the sections of these alignment options are outlined in Table 3.1.

Table 3.1 Section Lengths and Combined Alignment Options

Section	CRW / Option A	Western Bucca Valley/ Option A	Western Bucca Valley/ Corindi River	Western Bucca Valley/ Sherwood Creek
Southern Section				
Common Length of CRW - Englands Road to Ulidarra National Park	11.4km	11.4km	11.4km	11.4km
Bucca Valley Section				
Ulidarra National Park to Arrawarra Creek	27.1km	-	-	-
Western Bucca Valley Alignment – Ulidarra National Park to Lower Bucca	-	10.1km	10.1km	10.1km
Connection to Option A at Sherwood Nature Reserve	-	4.0km	4.0km	-
Sherwood Nature Reserve to Arrawarra Creek	-	10.1km	-	-
Sherwood / Corindi Section				
Existing Highway – Arrawarra Creek to Halfway Creek	16.5km	16.5km	-	-
Sherwood Nature Reserve to Halfway Creek	-	-	21.3km	-
Northern Tunnel Extension - Lower Bucca to Halfway Creek	-	-	-	29.8km
Total Length	55.0km	52.1km	46.8km	51.3km

Table 3.2 provides a summary of notable design features of the possible options from Englands Road through to Halfway Creek. Details of the first 11.4km for the CRW alignment, which forms the southern part of the CHCC Preferred Corridor, are contained in *Review of the Coastal Ridge Way Proposal* (Connell Wagner, 2004c).

Table 3.2 Features of Alignment Options

	Common Southern Section of CRW	CHCC Corridor and Sherwood / Corindi Sections			
		CRW / Option A	Western Bucca Valley / Option A	Western Bucca Valley / Corindi River	Western Bucca Valley / Sherwood Creek
Common Length of CRW - Englands Road to Ulidarra National Park	11.4km	11.4km	11.4km	11.4km	11.4km
Additional Length to start of Halfway Creek Upgrade	-	43.6km	40.7km	35.4km	39.9 km
Highest point above sea level	242m	170m	170m	170m	240m
Maximum grade	6%	6%	6%	6%	6%
Longest uphill section	11km	4km	4km	3.5km	6km
Highest Embankment					
- no viaducts	48m	40m	40m	30m	70m
- with viaducts	30m	25m	26m	25m	40m
Deepest cutting					
- no tunnels	81m	60m	30m	35m	150m
- with tunnels	45m	35m	35m	N.A.	35m
Number of tunnels	4	1	0	0	3
Length of individual tunnels	0.5km, 0.38km, 0.34km, 0.6km	0.56km			1.4km, 1.0km, 1.2km

4. Key Issues and Impacts

4.1 Traffic and Transport

This section examines traffic issues in relation to the CHCC Preferred Corridor Options in terms of daily traffic volumes and heavy vehicle traffic volumes. The descriptions of the proposed bypass options are as follows:

- CRW / Option A combination – This option would divert traffic from the Pacific Highway south of Englands Road and reconnect at Arrawarra Creek.
- Western Bucca Valley / Option A – The connection points with the highway are the same as for the CRW / Option A but the alignment of the bypass is different through the Bucca Valley.
- Western Bucca Valley / Corindi River - This option would divert traffic from the Pacific Highway south of Englands Road and reconnect at Dirty Creek Range.
- Western Bucca Valley / Sherwood Creek - The connection points with the highway are the same as for the Western Bucca Valley / Corindi River option but the alignment at the northern end of the bypass is different in the Sherwood / Corindi section.

4.1.1 Daily Traffic Volumes

A preliminary examination of the options indicates that, since the end connection points to the CRW / Option A and Western Bucca Valley / Option A routes are the same, the bypassable traffic volumes are expected to be similar. It might also be expected that the volumes of traffic attracted to either of these routes would be a little higher than that attracted to the Western Bucca Valley / Corindi River and Western Bucca Valley / Sherwood Creek routes, due to the substantially longer length of bypass associated with these options. However, the difference in volumes between the routes is likely to be small due to the limited amount of development along the existing highway between Arrawarra (the connection point for two of the options) and the northernmost connection at Dirty Creek Range.

In order to assess the traffic volumes that could potentially be attracted to each of the bypass options in the CHCC Preferred Corridor, two alternative approaches have been taken based on work previously undertaken. The approaches differ in their assumptions about the effectiveness of the connection between the bypass options and the existing Highway provided by Bucca Road. The resulting volumes predicted for each option are expressed as a range, to represent the upper and lower bounds of traffic that could be attracted to each option.

The following documents have been used to predict the ranges of bypassable traffic volumes for each option in 2021:

- *Coffs Harbour Highway Planning Strategy, Working Paper No 2, Traffic and Economics Report, March 2002* (Connell Wagner, 2002g). The traffic volumes derived using this report are based on the through traffic identified from the origin-destination surveys conducted in 2001, with a compound growth rate of 3% per annum applied to determine the future bypassable traffic volumes for each option in 2021. Importantly, the methodology assumes that there would be no connections provided between the bypass options and the local road network. This is equivalent to assuming that any connections, if provided, would be ineffective at attracting additional traffic to the bypass corridors. The traffic volumes predicted using this approach represent the lower bound limits of the traffic that would be attracted to each of the route options in the Corridor.
- *Coffs Harbour Highway Planning Strategy, Review of the Coastal Ridge Way Proposal, February 2004* (Connell Wagner 2004c) and *Sapphire to Woolgoolga Route Options, Working Paper No 8, Traffic and Transport Assessment, November 2002* (Connell Wagner 2002h). The traffic volumes predicted to use each of the bypass options on the sections between Englands Road and Bucca Road have been extracted from the Coastal Ridge

Way report, while volumes on the sections north of Bucca Road for each option have been extracted from the results for Option A presented in the Sapphire to Woolgoolga report. The traffic assessment in both reports assumed that the options (CRW and Option A respectively) had a direct connection to the existing highway in the vicinity of Bucca Road.

In the case of the Western Bucca Valley /Corindi River and Western Bucca Valley / Sherwood Creek options, traffic volumes on the section between Bucca Road and Halfway Creek have been estimated by adjusting the predicted traffic volumes north of Bucca Road by the ratio of the Halfway Creek / Arrawarra Creek traffic volumes obtained from traffic surveys undertaken at these locations by the RTA.

The traffic volumes predicted using this approach assume that the connection provided from each of the bypass options to the existing Highway by Bucca Road would be as effective at attracting traffic as the direct connections provided for in the original analyses. In reality, the length of Bucca Road that would need to be traversed by traffic accessing the CHCC Preferred Corridor options, particularly for the Western Bucca Valley alignments and the topography associated with this connection, would be expected to limit the effectiveness of Bucca Road in attracting traffic to these options. The traffic volumes extracted from these documents therefore represent the upper bound limit for traffic that would be attracted to each of the options in the Corridor.

Based on these two alternative approaches, the range of predicted traffic volumes on each option in 2021 are shown in Table 4.1.

Table 4.1 Predicted Total Daily Traffic Volumes in 2021

Location	CRW/ Option A	Western Bucca Valley/ Option A	Western Bucca Valley / Corindi River	Western Bucca Valley/ Sherwood Creek
Englands Road to Coramba Road	6,500 - 9,234	6,500 - 9,234	5,500 - 9,234	5,500 - 9,234
Coramba Road to Bucca Road	6,500 - 7,647	6,500 - 7,647	5,500 - 7,647	5,500 - 7,647
Bucca Road to Arrawarra Creek	6,500 - 9,698	6,500 - 9,698	N/A	N/A
Bucca Road to Halfway Creek	N/A	N/A	5,500 - 8,971	5,500 - 8,971

Note: The higher volumes reported within each range in the above table assume that a high standard, effective connection is provided between the proposed bypass options and the existing highway by Bucca Road.

By comparison, 2021 total daily traffic volumes on the existing highway, without a bypass, are predicted to be:

- North of Bray Street, Coffs Harbour 45,074
- North of Headland Road, Sapphire 31,745
- North of Clarence Street, Woolgoolga 24,291

4.1.2 Heavy Vehicle Traffic Volumes

The methodology for predicting heavy vehicle traffic volumes in 2021 for each bypass option is similar to that used for assessing the daily volumes, with a range of values derived for each location based on differences in the assumed effectiveness of the local connection at Bucca Road. The lower bound heavy vehicle volumes were derived from the lower bound daily traffic volumes estimated in the previous section by applying the heavy vehicle-to-daily vehicle

proportional factor calculated in accordance with the methodology set out in the *Review of Coastal Ridge Way Proposal*, (Connell Wagner, 2004c).

The upper bound heavy vehicle volumes were extracted from Connell Wagner 2004c and Connell Wagner 2002h for the sections from Englands Road to Bucca Road and north of Bucca Road respectively (ie. in the same way as the upper bound total daily volumes were previously derived). To assess heavy vehicle volumes for the Western Bucca Valley / Corindi River and Western Bucca Valley / Sherwood Creek options on the section between Bucca Road and Halfway Creek, the Halfway Creek / Arrawarra Creek proportional factor previously applied to the total volumes predicted from Option A was also assumed to apply to the heavy vehicle volumes predicted from Option A.

The resulting predicted heavy vehicle volumes on the bypass section for each option in 2021 are shown in Table 4.2:

Table 4.2 Predicted Daily Heavy Vehicle Traffic Volumes in 2021

Location	CRW/ Option A	Western Bucca Valley/ Option A	Western Bucca Valley / Corindi River	Western Bucca Valley/ Sherwood Creek
Englands Road to Coramba Road	1,050 - 1,493	1,050 - 1,493	890 - 1,493	890 - 1,493
Coramba Road to Bucca Road	1,050 - 1,364	1,050 - 1,364	890 - 1,364	890 - 1,364
Bucca Road to Arrawarra Creek	1,050 - 1,972	1,050 - 1,972	N/A	N/A
Bucca Road to Halfway Creek	N/A	N/A	890 - 1,824	890 - 1,824

Note: The higher volumes reported within each range in the above table assume that a high standard, effective connection is provided between the proposed bypass options and the existing highway by Bucca Road.

These heavy vehicle volumes are included in the total daily traffic volume estimates.

By comparison, 2021 daily heavy vehicle traffic volumes on the existing highway, without a bypass, are predicted to be :

- North of Bray Street, Coffs Harbour 4,462
- North of Headland Road, Sapphire 3,365
- North of Clarence Street, Woolgoolga 2,301

Long steep gradients are unavoidably associated with each of the above options. The resultant impact on travel times and operating costs for heavy vehicles would potentially reduce the attractiveness for all the options in the CHCC Preferred Corridor to such vehicles. None of the options overcome the travel time and operating costs issues for heavy vehicles identified in the review of the CRW proposal (Connell Wagner, 2004c). On this basis, there is a risk that some of the heavy vehicle traffic that would otherwise be attracted to the above bypasses may choose to remain on the existing highway.

4.2 Cost and Economic Evaluation

A preliminary cost estimate of the three newly identified routes has been completed to enable broad comparison with the CRW / Option A proposal. Table 4.3 provides a summary of the cost details of the four options.

Table 4.3 Strategic Cost Estimates

	CRW / Option A	Western Bucca Valley / Option A	Western Bucca Valley/ Corindi River	Western Bucca Valley / Sherwood Creek
Southern Section				
Common Length of CRW - Englands Road to Ulidarra National Park	11.4km road at \$25M/km ⁽¹⁾ = \$285M 1.82km tunnel at \$135M/km ⁽¹⁾ = \$246M	11.4km road at \$25M/km ⁽¹⁾ = \$285M 1.82km tunnel at \$135M/km ⁽¹⁾ = \$246M	11.4km road at \$25M/km ⁽¹⁾ = \$285M 1.82km tunnel at \$135M/km ⁽¹⁾ = \$246M	11.4km road at \$25M/km ⁽¹⁾ = \$285M 1.82km tunnel at \$135M/km ⁽¹⁾ = \$246M
Bucca Valley Section				
Ulidarra National Park to Arrawarra Creek	10.2km road at \$25M/km ⁽¹⁾ = \$255M 0.56km tunnel at \$135M/km ⁽¹⁾ = \$76M 16.9km road at \$18M/km ⁽²⁾ = \$304M	-	-	-
Western Bucca Valley Alignment – Ulidarra National Park to Lower Bucca	-	10.1km road at \$14M/km ⁽³⁾ = \$141M	10.1 km road at \$14M/km ⁽³⁾ = \$141M	10.1 km road at \$14M/km ⁽³⁾ = \$141M
Connection to Option A at Sherwood Nature Reserve	-	4.0km road at \$14M/km ⁽³⁾ = \$56M	4.0km road at \$14M/km ⁽³⁾ = \$56M	-
Sherwood Nature Reserve to Arrawarra Creek		10.1km road at \$18M/km ⁽²⁾ = \$182M	-	-
Sherwood / Corindi Section				
Existing Highway – Arrawarra Creek to Halfway Creek	14.5km duplication at \$6M/km ⁽⁴⁾ = \$87M 2km realignment at \$14M/km ⁽³⁾ = \$28M	14.5km duplication at \$6M/km ⁽⁴⁾ = \$87M 2km realignment at \$14M/km ⁽³⁾ = \$28M		-
Sherwood Nature Reserve – Corindi Valley			17.3km road at \$18M/km ⁽³⁾ = \$311M 4.0km road at \$6M/km ⁽¹⁾ = \$24M	

Table 4.3 Strategic Cost Estimates (cont'd)

	CRW / Option A	Western Bucca Valley / Option A	Western Bucca Valley/ Corindi River	Western Bucca Valley / Sherwood Creek
Western Bucca Valley / Sherwood Creek - Lower Bucca to Halfway Creek	-	-		6.0km road at \$14M/km ⁽³⁾ = \$84M 13.8km road at \$25M/km ⁽¹⁾ = \$345M 3.04km tunnel at \$135M ⁽¹⁾ = \$410M 10.0km road at \$14M/km ⁽³⁾ = \$140M
Total Strategic Cost Estimate	\$1,281M	\$1,025M	\$1,064	\$1,652M
Total Length	55.0km	52.1km	46.8km	51.3km
Average Rate \$M per km	\$23M	\$20M	\$23M	\$32M

Unit Rate Notes

1. As per Coastal Ridge Way
2. As per Sapphire to Woolgoolga Option A
3. As per Sapphire to Woolgoolga Option E
4. As per upgrade of existing Pacific Highway from Sapphire to Woolgoolga Route Options Development Report (Dec 2002)

The cost summary indicates that the Western Bucca Valley / Option A route would be the lowest cost option. However, as with the previous findings for the CRW proposal, the ability to fund this magnitude of investment (\$1,025M) in a single rural highway project is doubtful, particularly as the construction staging opportunities would be limited.

A strategic economic assessment has been completed for the route options which indicates that all options have poor economic viability. Of the options investigated, the Western Bucca Valley / Corindi River route is the most viable mainly due to the reduced travel distance and cost. Benefit cost ratios and other economic parameters for the options are detailed in the spreadsheet in Appendix B and summarised in Table 4.4. The results are based on the upper limit traffic volumes calculated in Table 4.1, thereby providing the most optimistic result for the purposes of the economic assessment. In practice, the volumes and hence benefits may well be lower, due to limitations on the extent to which Bucca Road could provide an effective local connection between the bypass options and the existing Highway.

Table 4.4 Benefit Cost Assessment

	CRW / Option A	Western Bucca Valley / Option A	Western Bucca Valley / Corindi River	Western Bucca Valley / Sherwood Creek
Benefit Cost Ratio (BCR)	0.30	0.44	0.49	0.25
Net Present Value (NPV)	-\$762M	-\$493M	-\$467M	-\$1060M
First Year Rate of Return (FYRR)	1.54%	2.29%	2.72%	1.36%

Notwithstanding the better economic performance of the Western Bucca Valley / Corindi River route, it still represents a poor economic proposition in terms of new highway infrastructure.

4.3 Socio-economic Issues

The assessment of socio-economic impacts in previous CHPS documents have typically considered a range of issues including community cohesion, amenity effects, visual impact, access and movement patterns, land use and property impacts, effects on business and effects on tourism

Assessment of the socio-economic impacts for Option A and the CRW are contained in the *Route Options Development Report* (Connell Wagner, 2002d) and *Review of the Coastal Ridge Way Proposal* (Connell Wagner, 2004c) respectively. By drawing on the findings in those reports, an overview of potential impacts for the Western Bucca Valley / Option A, the Western Bucca Valley / Corindi River and the Western Bucca Valley / Sherwood Creek has been prepared as a comparison to CRW / Option A. The results are shown in Table 4.5.

Visual impacts for options within the CHCC Preferred Corridor would be likely to be high adverse due to the number of residential receptors within the Bucca Valley. The impacts of the CRW (Southern Section) would be lower than for the CHCC Preferred Corridor as there are fewer residential properties along the route. The tunnels included in the CRW proposal would also reduce its visual impact.

Table 4.5 Comparison of Socio-Economic Impacts

Socio-economic Factor	Common southern section of CRW	CHCC Corridor and Sherwood / Corindi Section			
		CRW/ Option A	Western Bucca Valley/ Option A	Western Bucca Valley/ Corindi River	Western Bucca Valley/ Sherwood Creek
Visual impact	Moderate adverse	High adverse	High adverse	High adverse	High Adverse
Community Cohesion	Low adverse	Low to moderate beneficial	Low adverse	Low adverse	Low adverse
Amenity Effects	Moderate adverse	Low adverse	Moderate adverse	Moderate adverse	Moderate adverse
Access and Movement Patterns	Low beneficial	Low to moderate beneficial	Low to moderate beneficial	Low beneficial	Low beneficial
Rural Land Use and Property	Moderate adverse	Moderate adverse	High adverse	High adverse	High adverse
Effects on Passing Trade	Low adverse	Low adverse	Low adverse	Low adverse	Low adverse
Effects on Tourism	Low beneficial	Low beneficial	Low beneficial	Low beneficial	Low beneficial

In terms of community cohesion, the CRW / Option A alignment would have moderate beneficial impacts as it would improve cohesion within the Coffs Harbour urban area, minimising severance within residential areas by taking a route predominantly through State Forests. The CRW in the Southern Section, whilst improving cohesion in the Coffs Harbour urban area, could cause severance within the North Boambee Valley while the West Bucca Valley alignment would have a significant adverse impact on community cohesion within the Bucca Valley itself.

Amenity effects including traffic noise and visual alteration would be greater for the Western Bucca Valley / Option A, the Western Bucca Valley / Corindi River and the Western Bucca Valley / Sherwood Creek routes than for the CRW / Option A. This is due to the fact that these options are situated mainly on private property within the Bucca Valley rather than in the State Forest.

Access and movement patterns within the study area are similar for all options, with potentially reduced benefits for the Western Bucca Valley / Corindi River and Western Bucca Valley / Sherwood Creek options due to the fact that they do not readily service Woolgoolga. Impacts on passing trade and tourism are considered to be comparable for all options.

The three Western Bucca Valley alignments would have greater negative impacts than the CRW / Option A proposal on agriculture and rural residential properties, as these options traverse substantial freehold lands through the Bucca Valley (refer Figures 2.4 and 2.5). The CRW / Option A alignment has minimal impacts on agriculture and rural residential properties by passing predominantly through State Forest on the eastern side of the valley

4.4 Biophysical and Heritage Issues

4.4.1 Coastal Ridge Way

Ecological studies conducted as part of the *Review of the CRW Proposal* (Connell Wagner, 2004c), identified that the CRW alignment passes through twelve vegetation types, including a number of rainforest, wet and dry sclerophyll eucalypt forests and a swamp forest, all of which have the potential to contain a number of threatened species. The CRW passes almost exclusively through areas supporting vegetation classified as being of high and very high ecological status within the VMS (see Figures 2.3 and 2.4). There are pockets of protected vegetation within the State Forest that would be affected, comprising Forestry Management Zones (FMZ) 1, 2 and 3a. In addition the area traversed provides a number of local and regional wildlife and koala movement corridors that would be severed by the CRW as well as impacts on key habitats as defined by the Department of the Environment and Conservation (DEC, which includes the former National Parks and Wildlife Service).

The *Review of the CRW Proposal* report concluded that, if adopted, the CRW would require extensive and expensive mitigative measures due to the nature of the environment traversed. It is considered unlikely that the road design or alignment could be altered such that impacts can be effectively avoided or minimised. As such, approval of the CRW would be highly dependent on mitigative measures to address impacts (eg. fauna overpasses and underpasses, compensatory habitat etc). It was also considered likely that contemporary mitigation measures would only be partially effective in mitigating the impacts along much of the road.

The CRW is likely to result in a significant impact on a number of threatened species listed under the *Threatened Species Conservation Act* and the *Commonwealth Environment Protection & Biodiversity Conservation Act*. On this basis, it would require approvals from both DEC and DEH. The proposal would require very extensive and detailed ecological studies. Mindful of the probable high level of habitat impact, the limited opportunities to avoid or minimise the impact, the high reliance on mitigation measures, the poor prospect of achieving effective impact mitigation (even assuming that best practice measures are implemented) and the presence of viable alternative routes for the Highway, the approval process would be complicated with no certainty that approval could be achieved.

4.4.2 CRW / Option A

It was concluded within *Working Paper No 5 Ecological Assessment* (Connell Wagner, 2002f) that Option A has the potential to have a significant impact in terms of the extent of native

vegetation clearing required. It would also have a significant impact on poorly and inadequately preserved plant communities and flora species of conservation significance within the area, including threatened species. Vegetation removal of this scale and the potential severance caused by the road increases the risk that one or more locally viable populations of threatened species may become extinct. The proposal also has the potential to isolate or significantly impede movement or the exchange of genetic material between occurrences of threatened species

Removal of vegetation for the proposal is likely to require the consent of both the NSW DEC and the Commonwealth DEH. Considering the extent of fragmentation and loss of habitat that would accompany routes within this area, mitigative measures aimed at avoiding, minimising and mitigating impacts (such as fauna underpasses revegetation, provision of compensatory habitats) are unlikely to be sufficient to negate the impacts.

One of the key impacts for this route is the requirement to construct the road through the Sherwood Nature Reserve. In order to do this a number of processes would need to be followed, generally including the concurrence of the Minister for the Environment and the passage of an Act of Parliament to revoke the required section of the Nature Reserve. The RTA would be required, at that time, to consider the availability of suitable alternative routes and proposals to minimise/mitigate and /or compensate for the environmental impacts of the proposal on DEC estate.

Option A also traverses a culturally sensitive landscape which is well-known and highly valued by the Aboriginal community. At least two natural sacred sites and an historic camping place are located in the vicinity of the option. Further details are available within the *Route Options Development Report* (Connell Wagner, 2002d). Previous consultation undertaken with the local Aboriginal groups has identified that this option would not be supported by the Aboriginal community.

4.4.3 Western Bucca Valley / Option A

The Western Bucca Valley alignment begins at the broader southern end of the CHCC Preferred Corridor and proceeds through to the Bucca Road area. The route is situated on the western side of the Bucca Valley and passes in and out of the Lower Bucca State Forest and through isolated pockets of low through to very high status vegetation, as designated within the Coffs Harbour VMS (see Figure 2.3). The route then veers off in an easterly direction across Bucca Valley and up the slope of Gentle Annie Ridge. The route of the proposal over Gentle Annie Ridge avoids the steeper terrain of the Sherwood Road Ridge to the west and thus the requirement for a tunnel. However, this route still traverses rugged terrain at its northern end, through to the common alignment with Option A and significant volumes of cut and fill would be required with the consequent removal of significant areas of native vegetation within the State Forest. Depending on the final alignment, this option could affect a smaller area of State Forest than the CRW/Option A alignment.

Significant negative impacts are anticipated in terms of biodiversity where the route converges with Option A, as it crosses through Sherwood Nature Reserve. This section of the Nature Reserve would need to be revoked to allow construction of a highway. The statutory process for development of a road through a Nature Reserve has been described previously in Section 4.4.2. Constructing the route through this Nature Reserve has likely severance issues and will require extensive mitigation measures to allow continued east/west movement of wildlife along this corridor.

No additional indigenous heritage assessments have been undertaken at this stage. However, due to the known culturally sensitive nature of this area and the similarity with Option A, impacts on areas of Aboriginal heritage significance are likely to be high. At least two natural sacred sites and an historic camping site are located in the vicinity of Option A and the proposal traverses a number of ridgelines known to have been used as travelling routes through the forests. Open artefact scatters are also likely on at least some of the previously unsurveyed ridgelines. Further details can be found in the *Route Options Development Report* (Connell Wagner, 2002d).

4.4.4 Western Bucca Valley / Corindi River

As stated above for the Western Bucca Valley / Option A route, the common alignment through the southern CRW section, the Western Bucca Valley and the Sherwood Nature Reserve would have significant negative biodiversity impacts. Construction of a road through the Nature Reserve has statutory as well as ecological limitations and would require extensive mitigation measures.

In the section north of the CHCC Preferred Corridor, the route generally follows the Corindi River which lies between the Conglomerate and Wedding Bells State Forests. It traverses vegetated land on the eastern side of the Corindi River valley and crosses a number of small water courses leading off the Corindi River. The route also crosses the Corindi River where it runs in an east/west direction to the south of Red Ridge.

There are no impacts on State Forests or Nature Reserves from the Western Bucca Valley / Corindi River option in the Sherwood / Corindi section of the study area. The area is not included in the Coffs Harbour *Draft Vegetation Management Strategy* as it was previously in Pristine Waters Shire. Nevertheless, the slopes along the river are heavily vegetated in places and impacts on wildlife movement corridors are likely.

Although no indigenous heritage assessments have been undertaken, there are possible areas of Aboriginal heritage significance along the river. The area near Gentle Annie ridge is known to have a high cultural significance to the Aboriginal community and impacts from this option are likely to be high.

4.4.5 Western Bucca Valley / Sherwood Creek

This new option traverses the most rugged topography of all of the options - even greater than that experienced along the CRW alignment through the southern section of the study area (see Table 3.2 above). Due to the nature of the topography traversed, extensive tunnels and viaducts would be required to enable the construction of a road to appropriate engineering design parameters.

The common alignment for the Western Bucca Valley / Sherwood Creek and the Western Bucca Valley / Option A proposals begins at the broader southern end of the CHCC Preferred Corridor and proceeds through to the divergence point just north of Bucca Road. The common alignment is situated on the west side of the valley and passes in and out of Lower Bucca State Forest and through isolated pockets of low through to very high status vegetation, as designated within the Coffs Harbour VMS (see Figure 2.3). As the route climbs up the base of the Sherwood Road Ridge escarpment it cuts through a 2km stretch of vegetation designated as being of very high value (see Figure 2.3) before entering a tunnel beneath the Sherwood Nature Reserve.

On emergence from the tunnel the route passes through a large area of Conglomerate State Forest within Clarence Valley LGA. However, biophysical impacts have been minimised in this area as the route avoids lowland areas, with protected Forestry Management Zones and the Sherwood Nature Reserves which is generally located on the higher slopes. Impacts on the Sherwood Nature Reserve and neighbouring vegetation within private lands on the south side of the ridge have been minimised through the use of a 1.4km tunnel. This option has multiple crossings of Bucca Bucca Creek and Sherwood Creek. Bridges would be necessary for these creek crossings to minimise impacts on the aquatic environment.

Of the four options considered, the Western Bucca Valley / Sherwood Creek option would require clearing of the greatest area of vegetation, due primarily to the length of the route through forested areas. Without detailed investigations it is reasonable to assume that these areas would support one or a number of threatened species. The route would also impact on west to east wildlife movement. Extensive mitigation measures, including flora and fauna over and underpasses, would be required to attempt to mitigate impacts. However, such measures provide a poor prospect of achieving effective impact mitigation (even on the assumption that best practice measures are implemented).

No indigenous heritage assessment for the route has been undertaken at this stage. However, this area is known to be culturally sensitive (Connell Wagner, 2002d) and it is expected that open artefact scatters would be present on at least some of the ridgelines traversed by the route. These are likely to be of high Aboriginal social significance.

4.5 Comparative Assessment

All options within the CHCC Preferred Corridor would need to be accessed from the south via the common southern section of the CRW. Previous investigations have identified that the likely road geometry of the CRW may be a deterrent to heavy vehicles in terms of travel time and operating costs. The economic analysis shows that all of the routes investigated would represent a very poor investment in highway infrastructure with a Benefit Cost Ratio of less than 0.5, a negative Net Present Value and a First Year Rate of Return less than 2.5% (Connell Wagner, 2004c).

Traffic volumes using the CRW / Option A and the Western Bucca Valley / Option A routes would be comparable, while the Western Bucca Valley / Sherwood Creek and Western Bucca Valley / Corindi River routes would potentially attract slightly lower traffic volumes. The situation is the same in terms of heavy vehicles, however, due to the unavoidable long steep gradients associated with all of the bypass options, the travel times and operating costs for heavy vehicles would potentially reduce the attractiveness of such a bypass option for these vehicles.

In cost terms, the Western Bucca Valley / Sherwood Creek option would be the most expensive option, due to the significant engineering works required, whereas Western Bucca Valley / Option A would have the lowest cost as it is relatively shorter, requires fewer tunnels and utilises the existing highway infrastructure between Arrawarra Creek and Halfway Creek.

Table 4.6 provides a comparative assessment of the socio-economic, biophysical and heritage factors assessed for the options.

Table 4.6 Comparative Assessment

Assessment Factor	Common Southern Section of CRW	CHCC Corridor and Sherwood / Corindi Sections			
		CRW /Option A	Western Bucca Valley/ Option A	Western Bucca Valley/ Corindi River	Western Bucca Valley/ Sherwood Creek
Socio-economic	Low adverse	Low adverse	Low to moderate adverse	Low to moderate adverse	Low to moderate adverse
Topography	High adverse	Moderate to high adverse	Moderate to high adverse	Moderate adverse	Very high adverse
Flora and fauna	Very high adverse	Very high adverse	Very high adverse	Very high adverse	Very high adverse
Heritage	Possible adverse	High adverse	High adverse	High adverse	Probable adverse

In terms of the socio-economic comparison, the Western Bucca Valley / Option A, Western Bucca Valley / Corindi River and Western Bucca Valley / Sherwood Creek routes provide a worse outcome than the CRW / Option A alignment. Impacts in terms of amenity effects would also be greater for these three options with no measurable improvements on CRW / Option A for any of the socio-economic parameters assessed.

In terms of biophysical impacts the CRW south of Council's preferred corridor has been identified as having significant adverse impacts upon flora and fauna, including potential loss of threatened species and severance of wildlife movement corridors, to the extent that mitigation is unlikely to be effective. The CRW / Option A, the Western Bucca Valley / Option A and the and Western Bucca Valley / Corindi River routes all bisect the Sherwood Nature Reserve and the two former routes also pass through numerous protected zones within the Wedding Bells State Forest. Construction of a highway through the Sherwood Nature Reserve would also generally require the concurrence of the Minister for the Environment and an Act of Parliament. The high level of biophysical impact associated with these options, the difficulties associated with providing effective mitigation measures and the availability of alternative options with lesser impact are major impediments to obtaining this statutory approval.

By comparison, the Western Bucca Valley / Sherwood Creek option avoids the Sherwood Nature Reserve by tunnelling beneath it and traverses the State Forest, avoiding most of the Forestry Management Zones by staying on lower terrain. Overall, however, this option would be likely to result in the most amount of clearing of native vegetation as it passes through forested areas for a greater length than the other options.

All four options are likely to have adverse impacts in terms of Aboriginal heritage. Further investigations would be necessary to provide a reliable comparison with CRW / Option A.

5. Conclusions

The CHCC Preferred Corridor was adopted by Council in late 2003. The corridor covers much of the Bucca Valley and would require construction of the section of the Coastal Ridge Way (CRW) between Englands Road and the Ulidarra National Park. *The Review of the CRW Proposal* (Connell Wagner, 2004c) previously identified significant constraints associated with that route, primarily the result of the very rugged topography, which would require tunnels and viaducts to provide an alignment suitable for use as a major highway. The engineering requirements of such a route significantly increase construction costs, reducing the benefit cost ratio to a level well below that which construction would usually be considered by the RTA. The length and gradient of the route would be likely to deter its use by heavy vehicles which may continue to use the existing highway through Coffs Harbour. In addition to the topographical constraints, the CRW would cause significant adverse impacts on biodiversity and, despite the incorporation of mitigation measures, it is unlikely that irreversible adverse impacts could be avoided.

A constraints analysis was undertaken for the study area and three options have been developed within the CHCC Preferred Corridor (in addition to the CRW / Option A proposal). The Western Bucca Valley / Option A option takes a route along the western side of the Bucca Valley to Bucca Road, crossing the northern end of the valley to join the alignment of Option A near Gentle Annie ridge. The Western Bucca Valley / Corindi River option follows the same alignment as the Western Bucca Valley / Option A route to the eastern low point in the Sherwood Road ridge before heading along the eastern side of the Corindi River valley towards Upper Corindi, then continuing in a northerly direction to rejoin the highway near Dirty Creek Range. The Western Bucca Valley / Sherwood Creek route follows the same alignment as the other two Western Bucca Valley options before departing at Bucca Road and advancing via a tunnel through the Sherwood Road Ridge. The alignment then takes a route through the southern part of the Clarence Valley LGA before rejoining the existing highway at Dirty Creek Range.

Table 5.1 overleaf provides a summary comparison of the options considered in terms of functional, cost, socio-economic and biophysical issues.

North of the Bucca Valley, the CRW / Option A, Western Bucca Valley / Option A and Western Bucca Valley / Corindi River routes all pass through the eastern low point in the Sherwood Road ridge at a maximum elevation of 170m above sea level. However, the Western Bucca Valley / Sherwood Creek route takes a more westerly route through more rugged terrain across the Sherwood Road ridge. A number of tunnels and viaducts would be required to provide a feasible route through for traffic with this option. The requirement for traffic to negotiate steep terrain provides a poor functional performance for the three routes through the eastern low point in the Sherwood Road ridge and an even worse performance for the Western Bucca Valley / Sherwood Creek route. Due to their shorter length, the Western Bucca Valley / Option A and Western Bucca Valley / Corindi River routes provide some improvement on CRW / Option A in functional terms. However, all routes share the disadvantages associated with the long steep grades of the Coastal Ridge Way south of Council's preferred corridor.

The previous investigations conducted for the CRW and Option A identified that the cost would be extremely high for a major rural highway project and, as a result, this option did not represent an attractive investment in highway infrastructure. The Western Bucca Valley / Option A and Western Bucca Valley / Corindi River routes would be lower in cost and provide higher road user benefits than the CRW / Option A route, however, they still represents a poor economic investment. As a result of the significantly higher cost of the Western Bucca Valley / Sherwood Creek route, this option is the least economically viable.

The CRW / Option A alignment was favoured by sectors of the community as it locates the highway away from existing urban development, taking a route primarily through State Forest. A reduction in

socio-economic impacts was the key driver behind the development of this proposal. The three Western Bucca Valley routes would have significant socio-economic impacts upon rural residential and agricultural properties within the Bucca Valley, reducing the key perceived benefits of an alignment to the west of Coffs Harbour and Woolgoolga.

Table 5.1 Summary Comparison of Possible Options

	CRW / Option A	Western Bucca Valley / Option A	Western Bucca Valley / Corindi River	Western Bucca Valley / Sherwood Creek
Design				
Total Route Length	55km*	52.1km*	46.8km	51.3km*
Highest point above sea level	242m	242m	242m	242m
Highest potential embankment	48m	48m	48m	70m
Deepest cutting				
- no tunnels	81m	81m	81m	150m
- with tunnels	45m	45m	45m	45m
Tunnels				
- No of tunnels	5	4	4	7
- total length	2.38km	1.82km	1.82km	5.42km
Traffic & Transport				
Traffic function	Poor	Poor	Poor (lower than Option A routes)	Poor (lower than Option A routes)
Cost				
Total Strategic Estimate	\$1,281M	\$1,025M	\$1,064M	\$1,652M
Average rate \$M per km	\$23M	\$20M	\$23M	\$32M
Economic viability	BCR 0.30	BCR 0.44	BCR 0.49	BCR 0.25
Socio-economic				
Socio-economic	Low adverse	Low to moderate adverse	Low to moderate adverse	Low to moderate adverse
Biophysical				
Biodiversity	<ul style="list-style-type: none"> • passage through NR • removal of SF • severance of wildlife corridors • impact on threatened species <p>Very high adverse</p>	<ul style="list-style-type: none"> • passage through NR • removal of SF • severance of wildlife corridors • impact on threatened species <p>Very high adverse</p>	<ul style="list-style-type: none"> • passage through NR • removal of SF • severance of wildlife corridors • impact on threatened species <p>Very high adverse</p>	<ul style="list-style-type: none"> • removal of larger area of veg within SF • severance of wildlife corridors • impact on threatened species <p>Very high adverse</p>
Heritage				
Indigenous	High adverse	High adverse	High adverse	Probable adverse

* From Englands Road to a common end point at the start of the Halfway Creek Upgrade
NR = Nature Reserve
SF = State Forest

One of the most significant issues identified in the review of the CRW / Option A option is its impact on biodiversity. This option passes primarily through State Forest and would require the removal of several protected areas within the State Forests. The current route also passes through the Sherwood Nature Reserve which represents a significant constraint. In addition, the Nature Reserve would need

to be revoked to allow construction of this option. To undertake this, the concurrence of the Minister of the Environment and the passage of an Act of Parliament would generally be required. Due to the availability of alternative feasible options, an alignment through the Nature Reserve would be difficult to justify. Although the Western Bucca Valley / Option A and Western Bucca Valley / Corindi river alignments reduce the extent of State Forest lands affected, they take similar routes through the Sherwood Nature Reserve and would offer no significant advantage over CRW / Option A.

A significant advantage of the Western Bucca Valley / Sherwood Creek route is that it avoids the Sherwood Nature Reserve through the use of a tunnel through the Sherwood Road Ridge. However, a preliminary design assessment of similar tunnel concepts for the CRW / Option A, Western Bucca Valley / Option A and Western Bucca Valley / Corindi River routes through the Sherwood Road ridge showed that the Sherwood Nature Reserve could not be avoided with these options. In addition, even with a tunnel, there would still be significant adverse impacts on biodiversity, including severance of wildlife corridors and impacts upon threatened habitats and species due to the extensive removal of native vegetation along each route both within the State Forest and on private land (as identified within CHCC Draft Vegetation Management Strategy).

All proposals would result in a significant area of natural habitat and a number of threatened species being impacted, requiring approvals from NSW DEC and the Commonwealth DEH. Extensive flora and fauna mitigation measures would be necessary for all routes, which are likely to be only partially effective. Due to the presence of viable alternative routes for the upgrade and the difficulties associated with providing effective mitigation measures, the approvals process would be complicated with no certainty that approval could be achieved. Options within the CHCC Preferred Corridor (all of which include the CRW Proposal from Englands Road) have a number of very significant biophysical impacts with the associated risk that approval of the proposal may not be able to be achieved.

Significant negative impacts on sites of Aboriginal heritage significance were identified in the vicinity of the eastern low point in the Sherwood Road Ridge. Without further consultation with local Aboriginal groups it is likely that there is the potential for similar impacts on items of Aboriginal heritage significance with the Western Bucca Valley / Sherwood Creek route.

Based on this review, it is concluded that none of the options within the CHCC Preferred Corridor (including the necessary connections back to the existing highway) would be viable and do not merit further consideration for the future upgrading of the Pacific Highway due to:

- the significant topographical constraints and engineering challenges associated with locating the alignment outside the coastal plain and into the steep and mountainous terrain associated with the coastal ridge
- their poor functional performance
- their high cost and poor economic viability
- their significant adverse impacts on flora and fauna
- their significant impacts upon a landscape of Aboriginal importance .

6. References

Coffs Harbour City Council 2003, *Draft Vegetation Management Strategy*.

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Connell Wagner, 2002b, *CHHPS Sapphire to Woolgoolga Section, Working Paper No 1: Preliminary Concept Design Report*.

Connell Wagner, 2002c *CHHPS Sapphire to Woolgoolga Section, Working Paper No 3: Environmental Planning Overview Report*, March 2002.

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