Appendix F

Strategic Review Noise Assessment

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Coffs Harbour Highway Planning
Coffs Harbour Section

Strategic Noise Assessment
Coastal Ridge Way

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Report No 02122-CR
Version B

PACIFIC HIGHWAY, COFFS HARBOUR

COASTAL RIDGE WAY

STRATEGIC REVIEW - NOISE ASSESSMENT

Report No 02122-CR
Version B

February 2004

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1. INTRODUCTION

This report presents a strategic overview of the Coastal Ridge Way option from a road traffic noise perspective. For the purpose of this paper, the following bypass options have been compared:-

- "Do Nothing". No bypass or major upgrade of the existing Highway. Upgrade of some intersections on the existing Highway to cater for increasing traffic volumes. In terms of this Strategic Review intersection upgrades are assumed to have no impact on traffic noise levels.

- Coastal Ridge Way Bypass. This would deviate from the existing Pacific Highway alignment just south of Englands Road and extend north to the Bucca Road area to either rejoin the existing highway or Option A developed as a result of the Sapphire to Woolgoolga Pacific Highway project north of Bucca Road.

The approach taken for this study has been to undertake a SWOT analysis (strengths, weaknesses, opportunities and threats) in relation to potential noise impacts for both the options. Technical information including traffic flow volumes, road surface and traffic speed details have been provided by Connell Wagner. For both scenarios, a marginally conservative approach has been adopted. This is considered valid when drawing comparisons between the different options.

One of the complications of this comparative study is that a high proportion of daytime traffic on the existing Pacific Highway is relatively short journeys from people in the local area driving to and from Coffs Harbour. If the Coastal Ridge Way option was selected as the preferred Strategy, considerable volumes of traffic would reman on the existing highway. The residual traffic volumes on the existing highway may still require some upgrade of the existing highway at some intersections, although this report assumes they will be negligible and have no impact on traffic noise levels. This report therefore considers potential noise impacts along the existing highway in addition to impacts on the proposed new bypass.

We have made reference (Chapter 3) to the current Department of Environment and Conservation (DEC) *Environmental Criteria for Road Traffic Noise (ECRTN)* in order to provide the reader with some information in relation to distances from the proposed highways where current noise level criteria would be achieved. A sensitivity analysis, assuming 20% higher growth in traffic, is also considered. Reference has also been made to the RTA *Environmental Noise Management Manual (ENMM)*.

The following scenarios have been considered:-
- Road at ground level
- Road on low to medium fill (between 1m and 5m)
- Road on medium to high fill (greater than 5m)
- Road in shallow cut or with low mound (between 1m and 3m)
- Road in deep cut or with high mound (greater than 6m)
- Road with 4m barriers

Predictions have been assuming gradients of 0% (level), 2%, 4% and 6%.

In addition, the distances at which barriers and/or mounds of different heights achieve the *ECRTN* criteria have also been provided. This information is useful in determining a preferred road profile in order to include as much natural shielding as possible through the use of cuttings. Lowering the road level through cuts creates the benefits of reducing the height of noise barriers and the creation of fill material that may be used to construct earth mounds for noise mitigation, as opposed to noise walls.

Given that every residential receiver has a slightly different aspect to the road, information regarding the influence of the elevation of receivers on noise levels has also been provided. This information considers receivers at ground level (ie. up to 2.5m in height) elevated (receivers up to 5-6m in height where the ground is still relatively flat) or super elevated (where receivers sit at much higher elevations than the road (at least 20-30m) irrespective of their height above local ground level with clear line of sight to the road below).

Based on the traffic flow volumes for the Coastal Ridge Way option, it is clear that the night time period, which includes a high percentage of heavy vehicles, is by far the most sensitive. This report therefore focuses on the night time period. However, for the residual volumes on the existing highway, the daytime period is the most sensitive.

2. DESCRIPTION OF OPTIONS

The location of residential receivers along the existing Highway is summarised in Table 2-1 below.

Table 2-1 Receiver Types Adjacent to Existing Highway

Highway Section	Receivers and Distance to Road		
	To West	Road Description	To East
South of Englands Rd	-	Flat	90m
Englands Rd to Halls Rd	Caravan Park, 40m	Flat	Base Hospital, 100m
	Residential, Motel, Commercial	Flat	Residential, 160m (shielded by commercial)
Halls Rd to Combine St	Residential 40-80m (Low down), motels	Uphill then downhill (quite steep)	Residential, (40m high up), Commercial
Combine St to Coff St	Res 55m (on service road) Motel (10m), Hotel, Commercial	Flat	Motels 40m (service road), Commercial
Coff St to Bray St	Res 15m (multi storey) Commercial, Residential, 20m	Flat Flat	Caravan Park, Showgrounds, Commercial
Bray St to Arthur St	Commercial	Flat	Shopping Centre, Commercial
Arthur St to James Small Dr	Res, 30m (high), Big Banana, Motel, 50m Caravan Park and Res, 45m (higher)	Uphill then Downhill Undulating	Res 20m (behind wall and lower), 40-60m (lower, no wall) 60m (lower, no wall), Resort
North of James Small Dr	Res 60-200m (higher)		Res 50-150m (higher), School (behind wall)

2.1 Do Nothing

The traffic volumes for 2021 are summarised in Table 2-2 below. Speeds are typically 60-80km/hr. It is assumed that a dense grade asphalt surface exists throughout this section.

Table 2-2 Range of Traffic Volumes 2021

Period	Volume (v.p.d.)[1]	% Heavy Vehicles
Daytime (7am – 10pm)	24,000 – 41,300	9
Night time (10pm – 7am)	2,600 – 3,800	23 - 34

1. All volumes rounded to nearest 100 vpd.

2.2 Coastal Ridge Way

This option passes through the North Boambee urban release area and then through State Forest, rural 1B living areas, environment protection 7A habitat and catchment zone, to the west of the West Coffs urban release area (500m) and then through more rural 1A agricultural zones.

The traffic volumes (2021) for this option and the Existing Highway options are shown in Table 2-3 below.

For this option, a speed of 110km/hr is assumed with a concrete road surface.

Table 2-3 Range of Traffic Volumes 2021

Period	Coastal Ridge Way		Residual on Existing Highway	
	Total[1]	% of Heavy Vehicles	Total[1]	% of Heavy Vehicles
Daytime (7am-10pm)	6,400 – 7,900	9	17,600 – 38,500	9
Night Time (10pm-7am)	1,300 – 1,400	59 – 64	1,300 – 2,800	2 - 4

1. All volumes rounded to nearest 100 vpd. Residual volumes are for the bypassed section of the highway.

For the Coastal Ridge Way, it is assumed that a speed limit of 110km/hr would apply. A concrete road surface with a hessian drag finish and transverse tining (surface correction of +1dBA compared to dense grade asphaltic concrete) is also assumed. It is anticipated that by the time this road may be constructed quieter concrete road surfaces will have developed to such an extent that lower noise levels could be achieved. However, a conservative approach is adopted at this stage.

3. CURRENT DEC NOISE LEVEL CRITERIA

The DEC's *Environmental Criteria for Road Traffic Noise (ECRTN)* takes into account the road's classification and any proposal for upgrade works. Since the proposed works relate to the Pacific Highway, they all fall under the Freeway and Arterial Road category for which criteria apply over the 15 hour daytime (7.00am – 10.00pm) and 9 hour night time (10.00pm – 7.00am) periods.

The criteria also depend on whether a new road is being built or an existing road is being redeveloped. Clearly the Coastal Ridge Way would constitute a new road. Any minor upgrade of the existing highway would constitute a redevelopment of an existing Freeway. The criteria from the *ECRTN* are therefore summarised as follows:

- New Freeway / Arterial Road $L_{Aeq,15hr}$ = 55dBA
  $L_{Aeq,9hr}$ = 50dBA

- Redeveloped Freeway / Arterial Road $L_{Aeq,15hr}$ = 60dBA
  $L_{Aeq,9hr}$ = 55dBA

These noise levels are termed the *Base Criteria* that should be achieved where feasible and practicable. However, the DEC accept that it may not be possible to achieve these *Base Criteria* and also recommend an *Allowance Criteria* which limits any increases in noise level to no more than 2dBA above the existing L_{Aeq} level for a redeveloped road and 0.5dBA for a new road. This assessment is normally conducted 10 years after the road project has opened.

4. ASSESSMENT OF NOISE LEVELS

This section provides an assessment of both options from a road traffic noise perspective.

4.1 Do Nothing

At the range of typical (40m-80m) residential set backs, L_{Aeq} noise levels (dBA) would range as shown in the Table 4-1 below.

Table 4-1 Predicted Night time L_{Aeq} Noise Levels 2021

Period	Traffic Volumes (v.p.d.)			
	Minimum 24,000 Day, 2,600 Night)		Maximum (41,300 Day, 3,800 Night)	
	40m	80m	40m	80m
Daytime (7am – 10pm)	70.5	66.5	72	68
Night time (10pm – 7am)	66.5	62.5	68	64

These noise levels are all typically 10dBA or more above the Base Criteria for Redeveloped Roads of 60dBA daytime and 55dBA night time (refer Chapter 3 of *ECRTN*) and would therefore fall into the category where the RTA would define traffic noise levels as "acute" (refer *ENMM*).

For this reason any upgrade of the existing highway will need to address noise control. Consequently, if the Coastal Ridge Way option was selected as the preferred Strategy, the existing highway may need upgrading in order to cope with the residual traffic volumes that remain on it. These upgrade works may require further consideration of noise control measures. This is discussed in more detail in Section 4.2.

Strengths

The least total number of residences would be affected since traffic noise would be confined to the one corridor. Only those residences already affected by traffic noise would be subjected to increases in traffic noise.

Weaknesses

Noise levels would remain above the Base Criteria as the *ECTRN* would be unlikely to require the provision of noise mitigation measures. If noise mitigation measures were provided in association with minor improvements to a section of the existing highway, it is unlikely that it would be reasonable or feasible to reduce the noise levels to below the Base Criteria.

Opportunities

With the inclusion of this section of the Pacific Highway in the RTA's commitment to treating "loud spot", barriers could be provided to mitigate noise where practicable. At most receivers, noise levels could be reduced to lower than current noise levels.

Threats

The main threat is that the road system will eventually provide such a low level of service it will fail to meet the needs of a national highway and local backbone and some traffic, with associated noise impacts, could divert to local streets.

4.2 Coastal Ridge Way

Table 4-2 summarises the approximate range of distances to achieve the *ECRTN* criteria for a new road at night time (50dBA), based on the assumption discussed in Section 2 for a concrete road surface for the Year 2021. Table 4-2 contains typical options for noise control to show the effect these have on the distance (buffer zone) to meet *ECRTN* criteria.

Traffic noise modelling is based on the "angle of view" which relates to how much of the road can be seen from a residence. At a residence close to the road the angle of view is typically 170^0. Once distances above approximately 500m are reached the angle of view would reduce since the road would most likely pass through sections of cut, or does not maintain a high gradient over the angle of view assumed in the calculations.

For this reason the distances nominated in the Table 4-2 have only been included if they are considered likely to occur. In addition those figures that are quoted are considered to be conservative, although they could occur in specific circumstances if all the assumptions eventuated.

Table 4-2 Approximate Distances to Achieve *ECRTN* Criteria at Night Time

Scenario	Approximate distance to achieve *ECRTN* night time criteria of $L_{Aeq,9hr}$ = 50dBA (m)											
	Elevation of Receiver											
	At Ground Level (up to 2.5m above ground level)				Elevated (5m to 6m above ground level)				Superelevated (much higher than road)			
	Avg Road Gradient				Avg Road Gradient				Avg Road Gradient			
	0%	2%	4%	6%	0%	2%	4%	6%	0%	2%	4%	6%
Road at Ground Level												
No noise mitigation	500	575	650	-	550	625	800	-	600	675	775	-
4m Barrier or Mound	100	120	140	170	120	140	120	200	300	350	400	450
4m Mound with 4m Barrier	50	60	70	80	60	70	80	90	150	190	230	280
Road on Low to Medium Fill												
No noise mitigation	500	625	700	-	600	675	750	-	650	725	825	-
4m Barrier or Mound	100	120	140	170	120	140	170	200	300	350	400	450
4m Mound with 4m Barrier	50	60	70	80	60	70	80	90	150	190	230	280
Road on Medium to High Fill												
No noise mitigation	600	675	750	-	650	725	800	-	700	775	875	-
4m Barrier or Mound	100	120	140	170	120	140	170	200	300	350	400	450
4m Mound with 4m Barrier	50	60	70	80	60	70	80	90	150	190	230	280
Road in Shallow Cutting												
No noise mitigation	250	280	310	350	320	350	390	450	600	675	775	-
4m Barrier	100	120	140	170	120	140	170	200	300	350	400	450
Road in Deep Cutting												
No noise mitigation	100	120	140	170	120	140	170	200	250	280	310	350

For increase in traffic numbers of 20% noise levels would increase by approximately 1dBA. This is equivalent to increasing these distances by approximately 20%.

In noise sensitive locations, the use of quieter road surfaces could result in at least a 2-3 dBA reduction in noise levels which would typically reduce the distance to achieve *ECRTN* night time criteria of $L_{Aeq,9hr}$ = 50dBA to two thirds or one half of the distances shown above.

Without any noise mitigation and assuming any receiver has a relatively large angle of view to the road with typical gradient conditions, the *Base Criteria* of 50dBA at night time (the most sensitive period) could typically be achieved at 500m – 800m from the edge of the alignment depending on the topography, gradient and receiver elevation. Theoretically, distances of 1km could be achieved in specific situations as can be seen from aerial photography and zoning maps, residential areas already encroach this distance and land release also extends into these areas. In reality, due to the likely location and depth of cuts and intervening shielding provided by surrounding topography could reduce these distances to more typically one half to two thirds, which reduces the zone of potential impact.

Apart from the southern section south of Coramba Road and the northern end near Bucca Road this alignment would affect few receivers currently and it is unlikely to affect significantly more following land release.

Noise mitigation measures such as barriers and/or mounds would be required to allow residential development closer to the bypass. Figure 1 shows the approximate night time 50dBA noise contour that could be achieved with feasible noise mitigation measures. This contour is indicative only and should only be used for broad planning purposes. More accurate noise contours would require detailed modelling of the proposed alignment. High barriers may not be acceptable or suitable in this semi rural/rural residential environment. Landscaped mounds, possibly incorporating a low barrier, would be a more suitable arrangement in this environment from an urban design perspective. In addition, quieter road surfaces could be used in noise sensitive locations to either eliminate the need for barriers and/or mounds or to reduce their height.

The current land use zonings should also be reconsidered where possible in the section south of Coramba Road in order to provide a buffer zone to the nearest residences, either through open land, commercial or light industrial, although the impacts of industrial uses close to residences also need to be addressed.

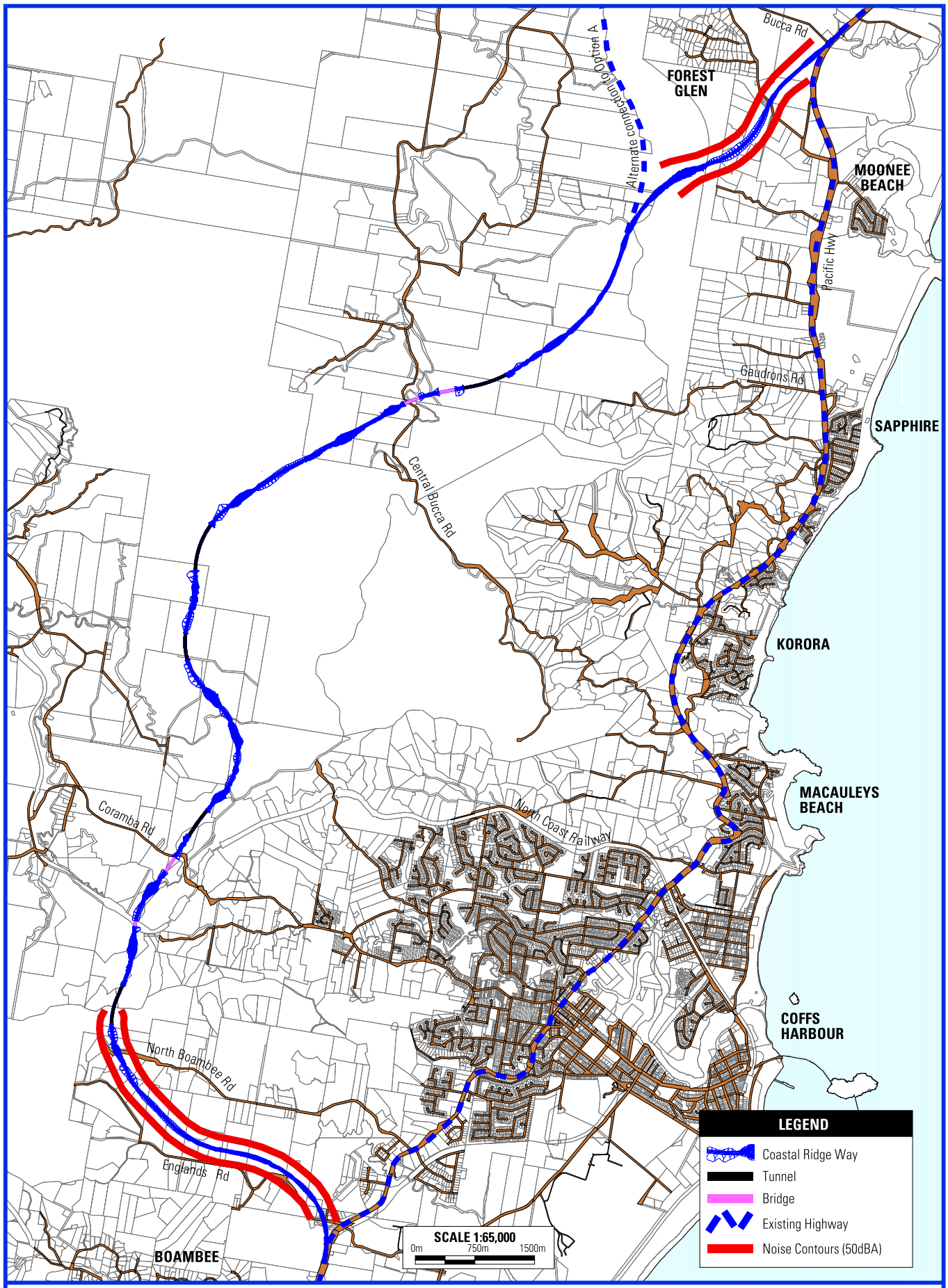
The range of noise levels for the residual volumes on the existing highway if the Coastal Ridge Way option was built is shown in Table 4-3 below.

Table 4-3 Noise Levels from Residual Traffic on Existing Highway

Period	Traffic Volumes (v.p.d.)			
	Minimum (17,600 Day, 1,300 Night)		Maximum (38,500 Day, 2,800 Night)	
	40m	80m	40m	80m
Daytime (7am – 10pm)	68	64	71	67
Night time (10pm – 7am)	60	56	63	59

In comparison to the "Do Nothing" scenario, these L_{Aeq} noise levels show only a marginal reduction of 1-2dBA for daytime noise levels, however a greater reduction of 4-6dBA for night time. Given the main source of complaint is often night time, heavy vehicle movements this is considered of some benefit to residents along the existing highway.

These noise levels on the existing highway indicate that residences within 130m from the alignment, which have direct line of sight would remain above the *Base Criteria.*



COFFS HARBOUR HIGHWAY PLANNING
COASTAL RIDGE WAY
STRATEGIC OVERVIEW - NOISE ASSESSMENT

FIGURE 1
NOISE CONTOURS $L_{Aeq\ 9hr}$ NIGHT TIME (WITH MITIGATION)

Strengths

Few existing residences would be affected and due to the topography, there are not likely to be many more in the future, although this option does pass through the North Boambee urban release area. The terrain for much of this alignment would also mean many deep cuts that would provide shielding.

This option could remove a high proportion of heavy vehicles at night time from the existing highway where it passes close to a higher number of residences. Fewer total residences may be affected by these night time heavy vehicle movements.

Weaknesses

This option would affect some residences currently exposed to little or no traffic noise. There may be acoustic impacts in some National Park areas, including the impacts on fauna. Increased noise would result from heavy vehicles negotiating the long climbs and descents on the Coastal Ridge Way. As a result, either increased separation distances or more extensive noise mitigation measures would be required to achieve the *Base Criteria* of 50dBA.

Since a high number of vehicles would still use the existing highway at daytime, the total number of residences exposed to traffic noise would increase and, without the provision of noise mitigation, the number of residences where noise levels are above the *Base Criteria* would increase.

Opportunities

The topography traversed by the Coastal Ridge Way could be utilised to help shield the road from the adjacent residential development. Tunnels also provide high levels of noise attenuation although particular attention needs to be given to the tunnel portals.

Lowering the profile of the road would help shield road traffic noise from adjacent development and generate extra spoil material that may be used to provide earth mounding rather than barriers. The road corridor would need to be wide enough to accommodate the roadway, proposed noise mitigation measures and landscaping.

Noise control in the form of barriers and/or mounds can be used to control noise to existing receivers. In suitable locations, barriers and/or mounds could be designed at the time the detail road design is undertaken, but only provided when required to protect new residential areas being developed near the bypass.

Noise control in the form of buffer zones or land use planning allowing less sensitive uses such as industrial, commercial or sporting facilities could be used to provide separation to new residential areas.

Threats

Barriers are unlikely to be cost-effective since many existing residences would be isolated. Urban design concerns with barriers would also exist in these predominantly rural areas.

5. CONCLUSIONS

This report has provided a strategic review of the Coastal Ridge Way option for a bypass of the Coffs Harbour urban area.

Existing noise levels at the closest residential receivers along the existing highway are already above the DEC *Base Criteria* for Redeveloped Roads. If the existing highway was upgraded, noise mitigation could be provided to ensure noise levels for the vast majority of residences could be controlled to below levels prior to the commencement of construction. However, there may be some areas where barrier heights may not satisfy urban design requirements.

For the Coastal Ridge Way option, road traffic noise would be introduced to areas that currently experience little or no traffic noise, although in comparison to the numbers located along the existing highway, few residences would be affected.

Noise mitigation in the form of barriers may not satisfy urban design requirements for these rural residential areas. Consideration should be given to lowering the vertical alignment to allow the cuts to be deeper, thus generating more fill material to provide shielding in the form of earth mounding which may better suit the surroundings.

The use of noise and planning controls to manage development in the vicinity of the Coastal Ridge Way option could dramatically reduce the number of residences where road traffic noise levels exceed the *Base Criteria*.

Version	Date	Status	Prepared by	Checked by
A	26 June 2003	Draft	Neil Gross	Rob Bullen
B	30 January 2004	Final	Neil Gross	Rob Bullen

APPENDIX A

NOISE DESCRIPTORS

NOISE DESCRIPTORS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}). The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1}. The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10}. The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

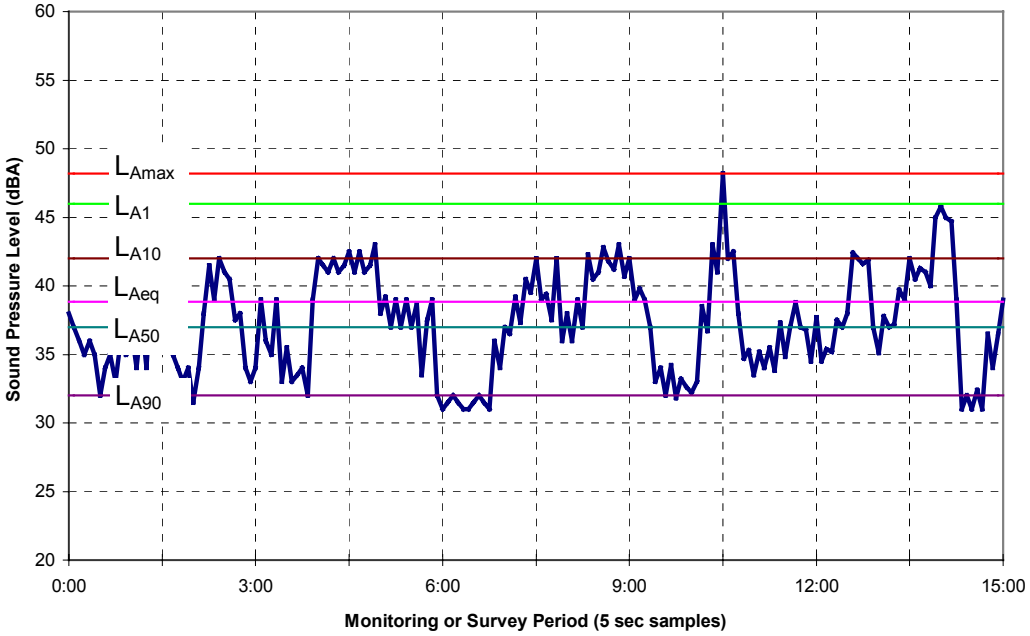
L_{Aeq}. The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50}. The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90}. The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL. The Assessment Background Level is the single figure background level representing each assessment period (day, evening and night) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL. The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period, day, evening and night.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)

Appendix G

Urban Design and Visual Assessment

Coffs Harbour Highway Planning
COFFS HARBOUR BYPASS

Working Paper
Urban Design and Visual Assessment – Coastal Ridge Way Option
Prepared for Connell Wagner
February 2004

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Contents

01 Overview

The objectives of the Design and Landscape Assessment Working Paper are to undertake a comparative assessment of the visual impacts, user experience and urban impacts for the Existing Highway and the Coastal Ridge Way route options. The assessment of these attributes will help guide the evaluation of the Coastal Ridge Way Option and introduce key landscape and urban design issues to the project.

The study area, located in the mid north coast of New South Wales, extends from Coffs Harbour to Emerald Beach, a distance of approximately 25 kilometres. It extends approximately 8 kilometres inland.

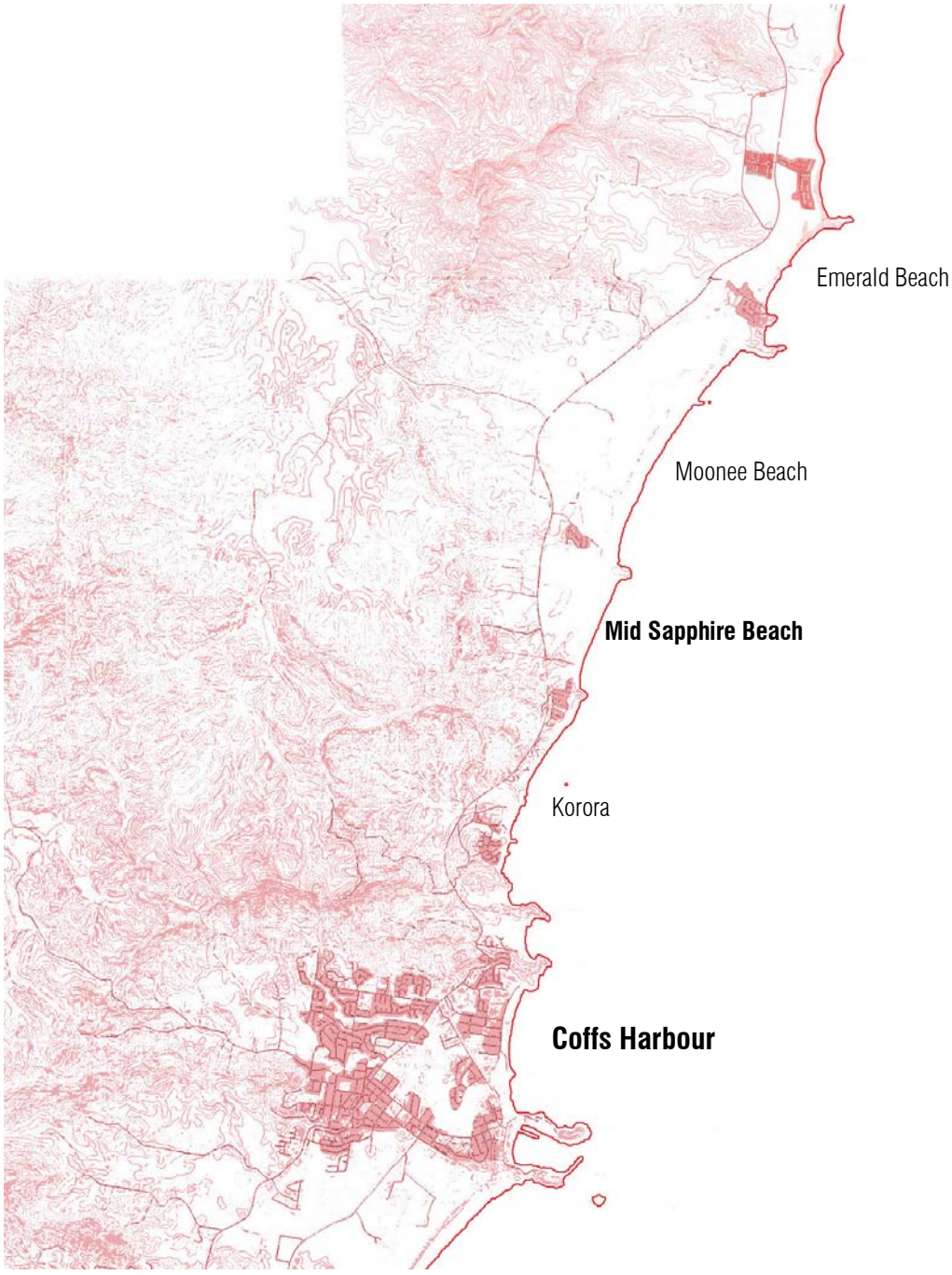
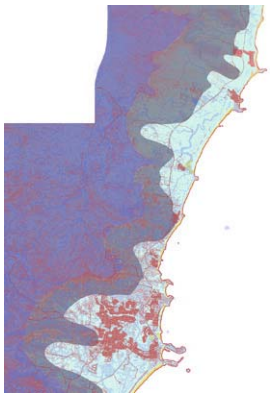


Figure 1 – The Study Area

03 Existing Visual and Urban Environment



The existing visual environment is a combination of natural and cultural attributes that make up the landscape setting. Four main components of the existing visual environment are identified which will form the basis of the urban design and visual assessment. These are:

- land form;
- vegetation types;
- land use; and
- urban structure.

3.1 Landform

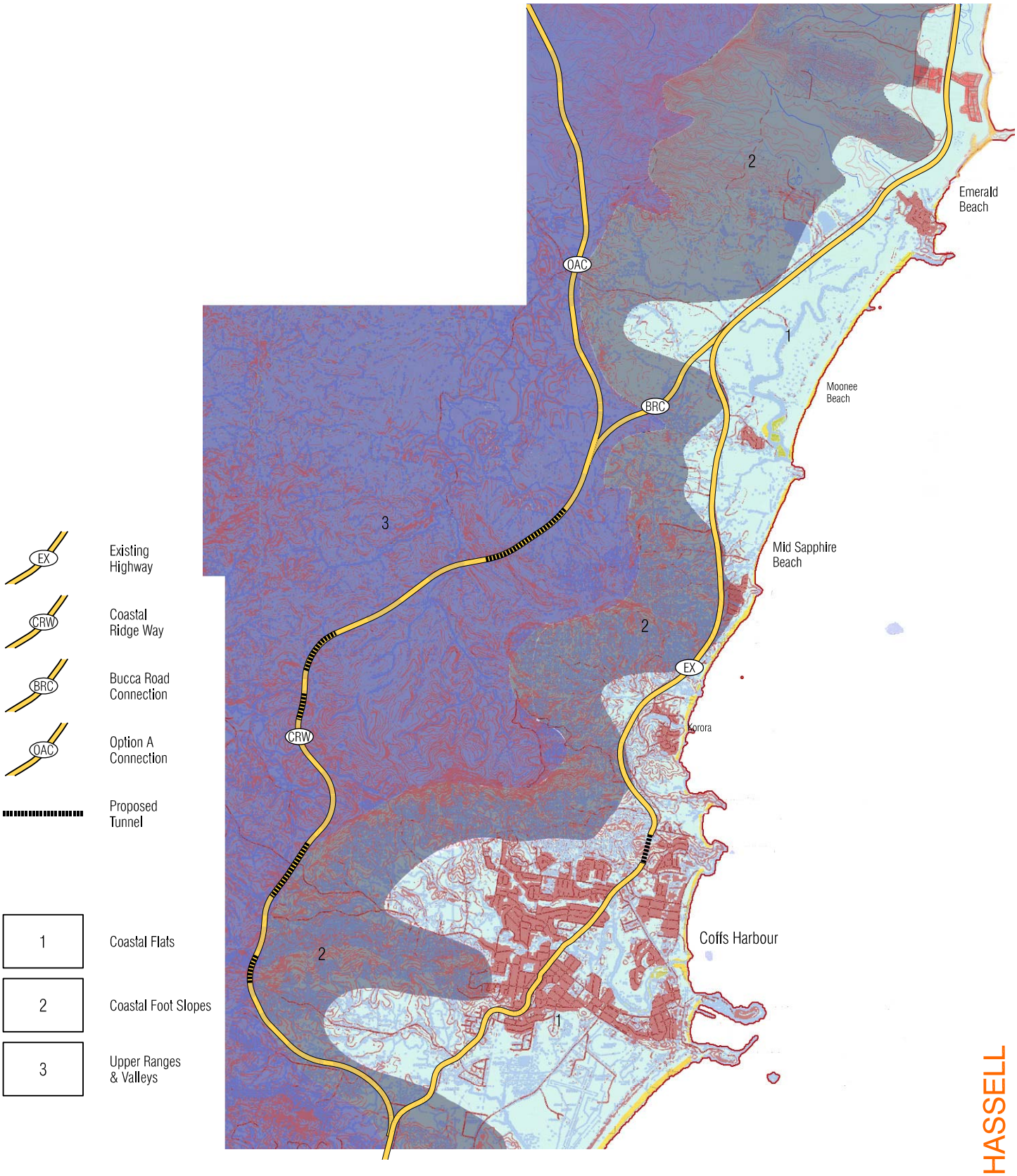
Landform types contribute to the visual and scenic character of a landscape and determine the visual catchment of the study area.

3.3.1 Principles

- Undulating landscapes have a greater diversity of visual experience than flat landscapes.
- Higher undulating landscapes may be more visually prominent and are therefore more visually sensitive than flat landscapes.

Three broad landform classes are identified within the study area, as shown in Figure 3.1 Land Form Types over page. These are:

- coastal flats - low and gently undulating coastal strip;
- coastal footslopes - undulating spur and valley landform; and
- upper ranges and valleys - steep and rugged topography.



HASSELL

COFFS HARBOUR
HIGHWAY PLANNING STRATEGY,
COFFS HARBOUR SECTION,
ROUTE OPTIONS

FIGURE 3.1 - Land Form Types

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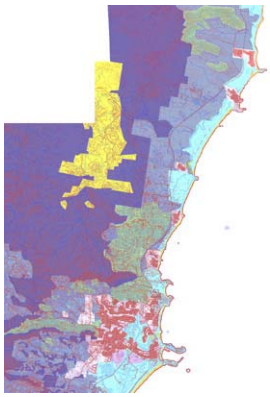


3.2 Vegetation

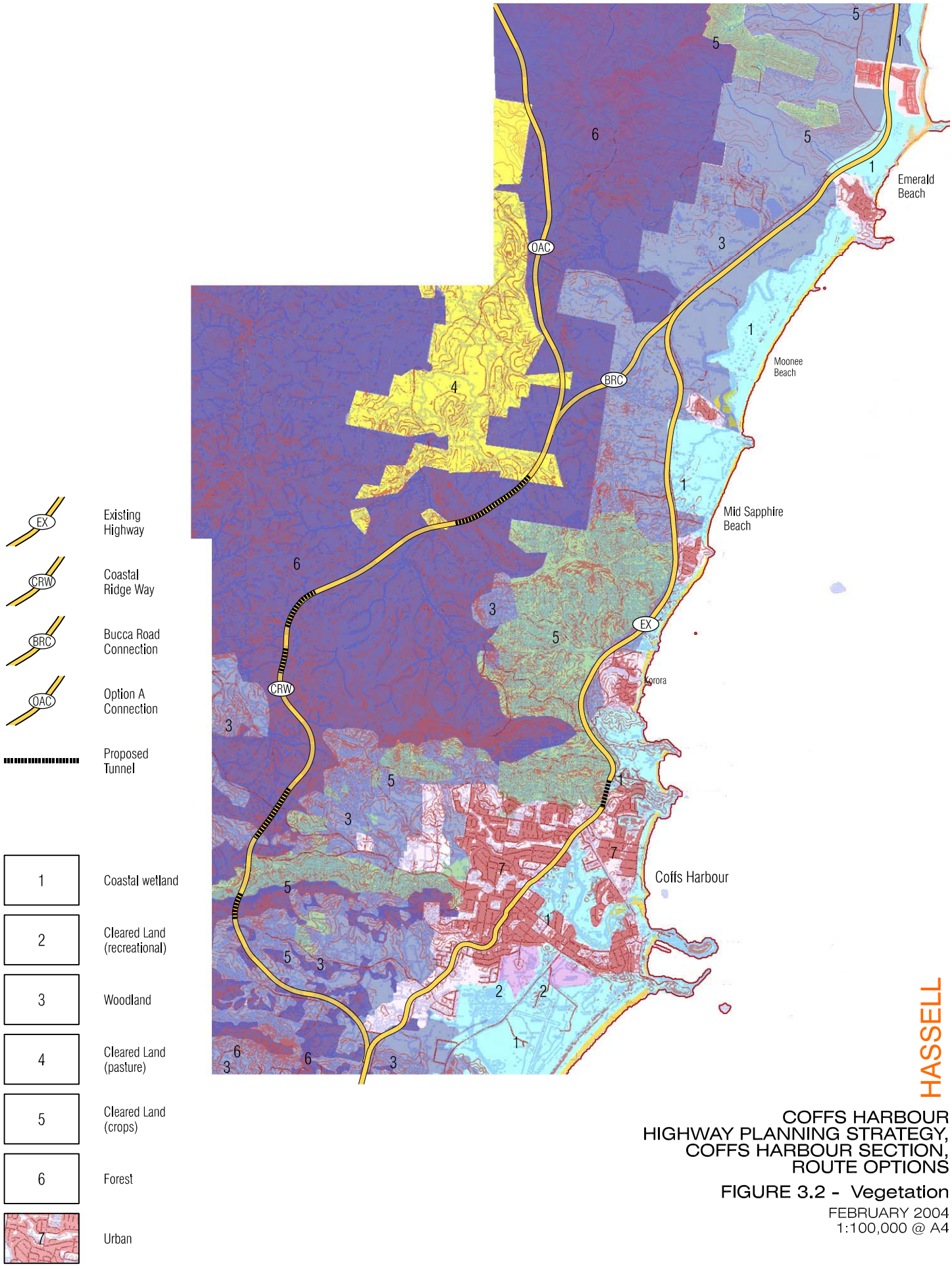
Vegetation characteristics contribute to the visual and scenic character of a landscape. Vegetation often forms the secondary or local view shed and can provide a visual buffer to adjacent areas.

3.2.1 Principles

- Homogenous vegetation types strengthen the landscape character of an area.
- Forest has a greater screening capacity than open grassland.

Seven broad vegetation classes are identified within the study area, as shown in Figure 3.2 Vegetation. These are;

- coastal wetland;
- open woodland;
- forest;
- cleared land (recreational);
- cleared land (pasture);
- cultivated land (crops).and
- urban



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COFFS HARBOUR HIGHWAY PLANNING STRATEGY, COFFS HARBOUR SECTION, ROUTE OPTIONS

FIGURE 3.2 - Vegetation

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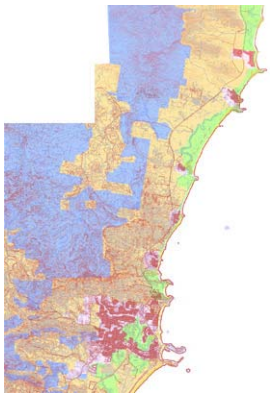
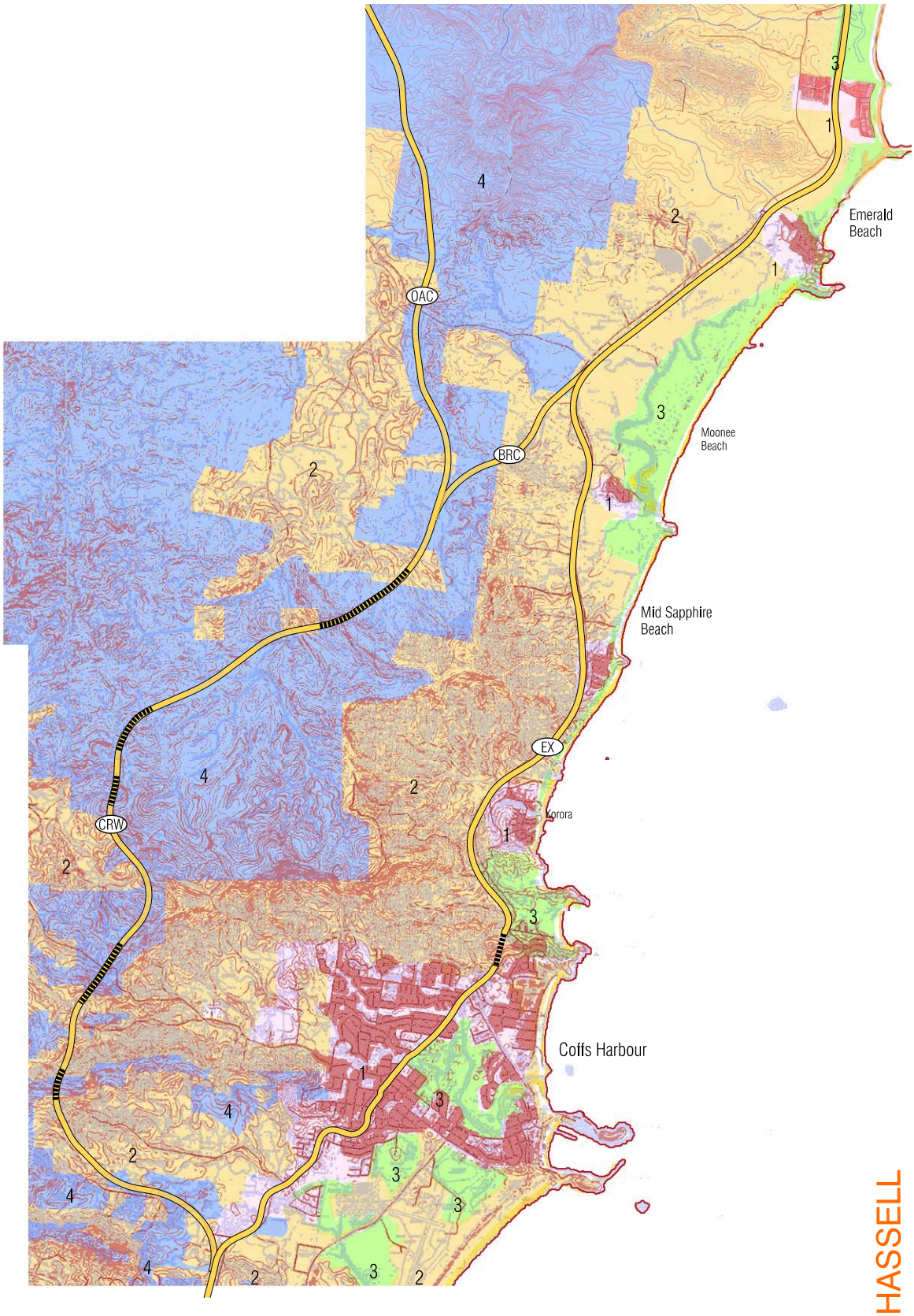


3.3 Land Use

Land use characteristics contribute to the visual character of a landscape and are important in the analysis of visual impact. Land use types are often closely associated to landform types and influence vegetation cover.

Four broad categories of land use are identified within the study area, as shown in Figure 3.3 Land Use. These are;

- natural (forested);
- urban area (residential / industrial / commercial);
- rural area (farmland); and
- recreation and conservation.



EX Existing Highway

CRW Coastal Ridge Way

BRC Bucca Road Connection

OAC Option A Connection

Proposed Tunnel

1 Urban Area

2 Rural / Cleared Land

3 Recreation / Conservation

4 Forest

Major Roads

HASSELL

COFFS HARBOUR HIGHWAY PLANNING STRATEGY, COFFS HARBOUR SECTION, ROUTE OPTIONS

FIGURE 3.3 - Land Use

FEBRUARY 2004
1:100,000 @ A4

0 1000 5000m