

3. Route options development and assessment

3.1 Key characteristics of the study area

A summary of the biophysical and socio-economic characteristics of the Proposal study area and the major constraints to highway planning and development is presented below. The broad study area identified for the Sapphire to Woolgoolga project extends from the end of the existing dual carriageways at Campbell Close, Sapphire to Upper Corindi Road, Arrawarra. The study area is illustrated in Figure 3.1.

Landform and Topography

The topography and relief of the study area is illustrated in Figure 3.2. The topography of the hillside areas (areas above the 50m contour) is characterised by an initial steep slope facing east, which rises up to approximately 150-200m AHD. The area to the west of the initial steep slope is characterised by ridges and steep sided valleys. Numerous drainage channels that typically flow east to the lowland area incise the hillside area. A few minor creeks on the far-western boundary of the area flow to the west to join Bucca Creek and the Orara River.

The topography of the lowland areas (areas below the 50m contour) is characterised by low undulating residual hills with gentle gradients and alluvial floodplains including back-swamps and dunes.

Geology and Soils

Regional geological maps indicate that the Coffs Harbour (Dorrigo area) is subdivided into three geological units. The two primary units comprise Coramba Beds, consisting of metamorphosed sedimentary rocks, Brooklana Formation comprising mudstone and siltstone and finally alluvial deposits.

The geology and soils generally provide suitable building foundations, but are limited by the substantial erosive potential of the area and its steepness in many parts of the study area. The Acid Sulphate Soils (ASS) mapping shows there to be a low risk of ASS within the study area with the exception of areas on the floodplain between Moonee and Woolgoolga and surrounding the existing highway at Arrawarra.

Surface Water

From south to north, the main creeks crossing the study area from the upland area in the west to the sea are Skinners, Moonee, Double Crossing, Woolgoolga and Arrawarra Creeks. Numerous drainage channels incise the hillside area and typically flow east from the coastal range to the lowland area in the coastal plain.

Biodiversity

The study area is in the NSW North Coast Bioregion on the north coast of New South Wales. This Bioregion is part of a zone known as the Macleay – McPherson overlap, which covers an area from Barrington Tops in New South Wales to Lamington National Park in South East Queensland. This zone is characterised by an overlap in distribution of tropical and temperate species from the south east of the eastern seaboard. The environmental characteristics allied with this overlap are associated with a highly diverse array of species (NPWS 1994).

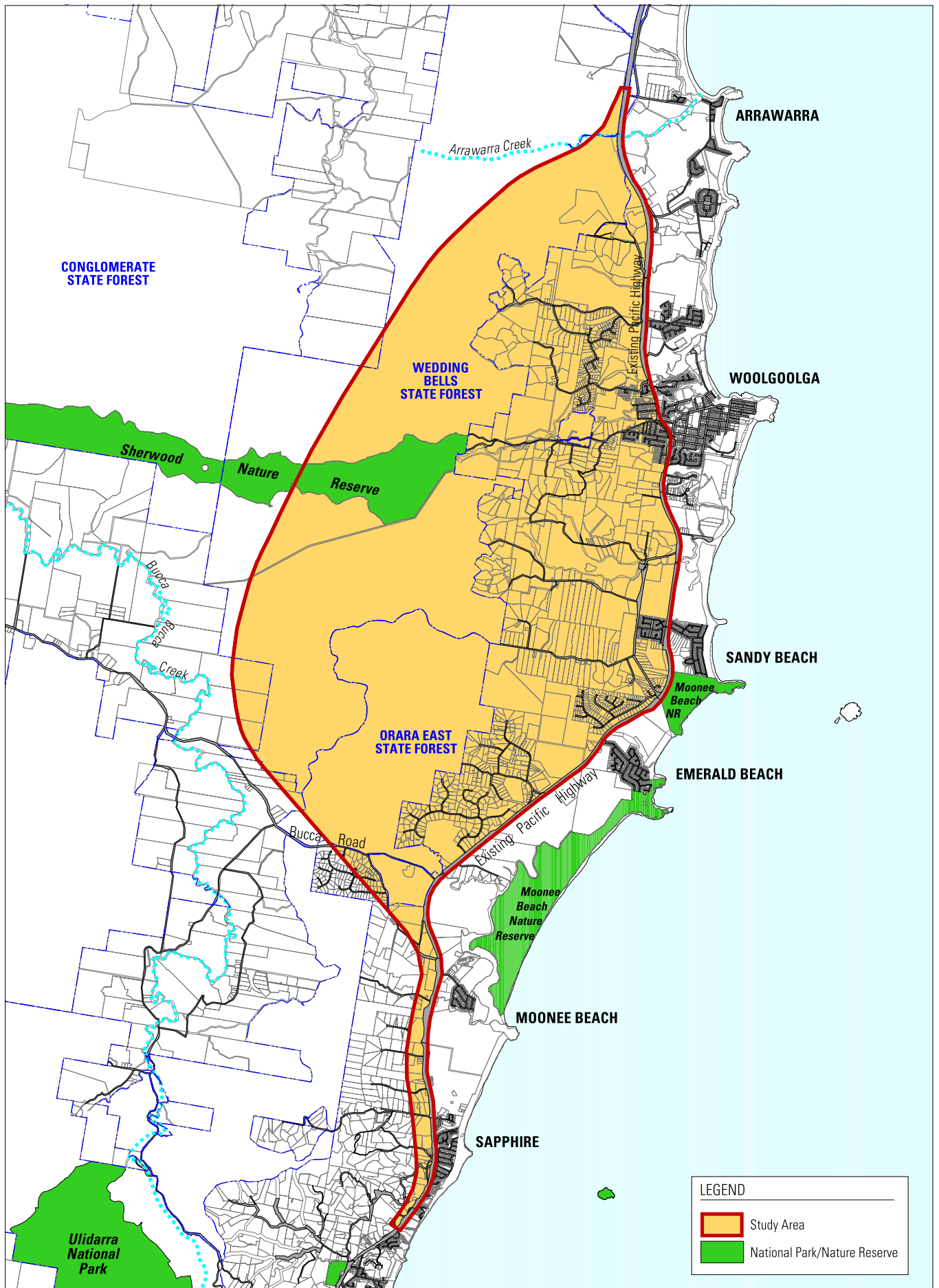
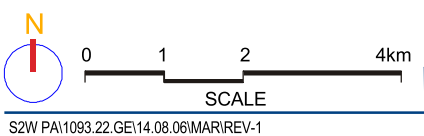
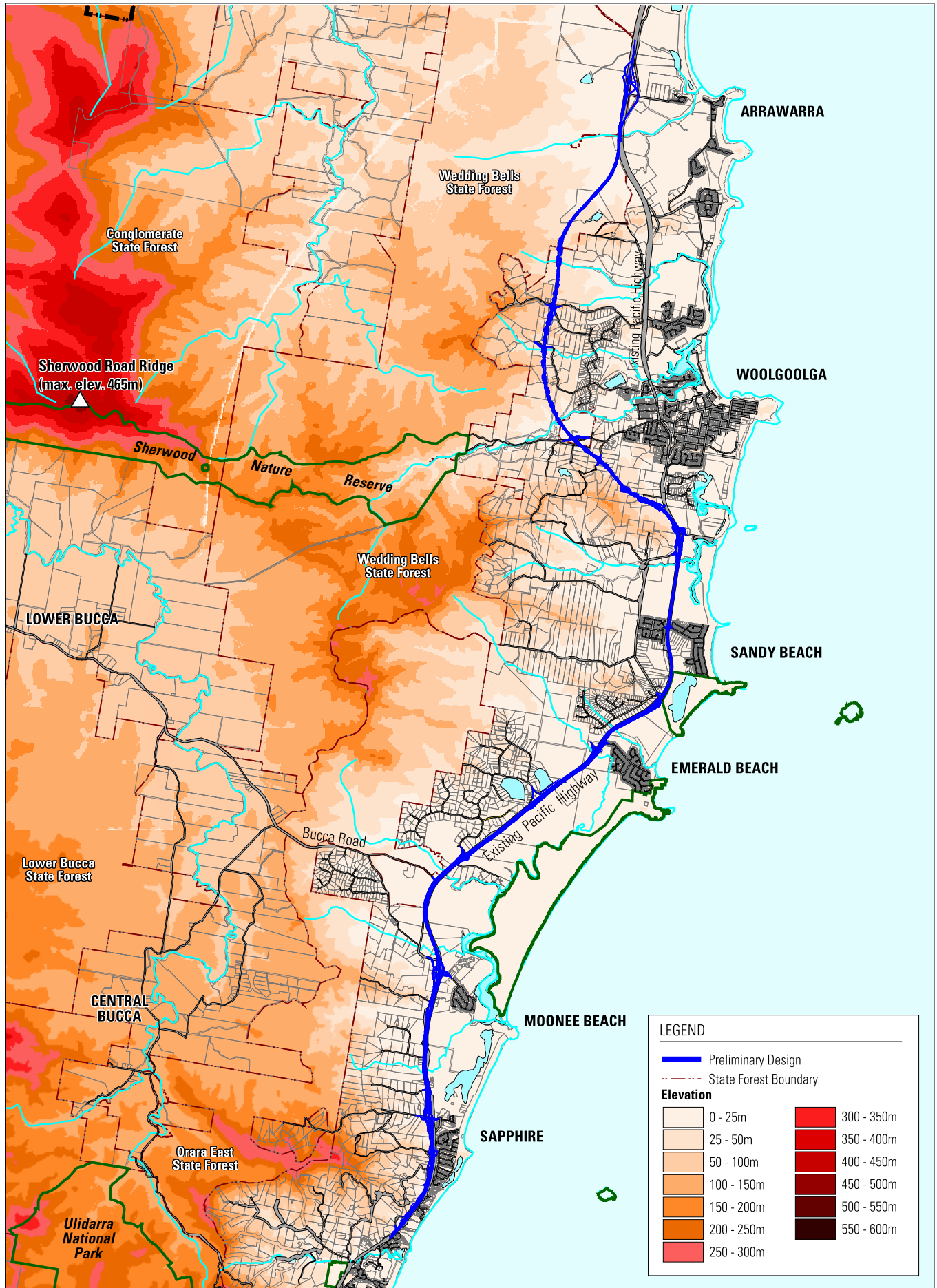


Figure 3.1
Study Area



Source: derived from 2m/10m contour information
 (2000/2002) - Connell Wagner P/L
 State Forest - custodian DIPNR (2003)

Figure 3.2
 Topography

Flora and fauna surveys completed to date for the project have confirmed an assortment of biodiversity values along and near the preferred route including:

- Threatened flora species listed under the *Threatened Species Conservation (TSC) Act* including Slender Marsdenia (*Marsdenia longiloba*), Rusty Plum (*Amorpha whitei*), Narrow-leaved Quassia (*Quassia sp. B*) and *Lindsaea incisa*
- Threatened fauna species listed under the *Threatened Species Conservation (TSC) Act* including Eastern Pygmy-possum, White-bellied Sea-Eagle, Powerful Owl, Glossy Black Cockatoo, Spectacled Monarch, Little Bent-wing Bat, Large Bent-wing Bat, Common Blossom Bat, Rufus Fantail, Squirrel Glider, Yellow bellied Glider, Greater broad-nosed Bat, Osprey, Yellow-bellied Glider, Barred Cuckoo-shrike, Southern Myotis, White-throated Noddletail, Grey-headed Flying-fox and the Green-Thighed Frog
- Endangered Ecological Communities (EEC) including Swamp Sclerophyll Forest, Swamp Oak Floodplain Forest, Lowland Rainforest on Floodplain, Littoral Rainforest and Coastal Saltmarsh
- Koala/fauna movement corridors

Visual and acoustic amenity

The existing visual environment is a combination of natural and cultural attributes that make up the landscape setting. The main components that contribute to the generally high visual quality of the study area are landform types, vegetation types and land use.

The acoustic amenity of the study area is dominated by the Pacific Highway where existing traffic noise levels at the closest residential receivers already exceed DEC base criteria for Redeveloped Roads.

Land use and development

Within the study area the land use pattern is quite variable with substantial residential, rural residential and agricultural development. The land use along the corridor changes from predominantly medium density tourist facilities and residential development in the southern area to lower density rural residential and rural uses interspersed by the urban settlements of the Northern Beaches (eg. Moonee, Emerald Beach, Sandy Beach and Woolgoolga). Agricultural development and rural residential estates dominate the Woolgoolga bypass section. The main agricultural activities are banana growing, other cultivation and grazing, or combinations of these. Banana growing is the major enterprise likely to be affected by the Proposal. Bananas in the area were generally healthy, being grown on the steeply sloping lands. The northernmost section of the route from north west of Woolgoolga and up to Arrawarra Creek is mainly State Forest.

Substantial urban development is planned in the study area over the next 25 years with a potential population of approximately 100, 000 by the year 2030. All of the existing and potential urban lands identified by CHCC in the study area currently rely on the Pacific Highway as the sole north – south arterial road within the LGA.

Aboriginal heritage

The study area lies in an area administered by the Coffs Harbour and District Local Aboriginal Land Council and it is also an area of cultural interest to the Yarrowarra Land Corporation and the Garby Elders.

The ridgelines on the western flank of the study area provide a culturally sensitive landscape which is well known and highly valued by the Aboriginal community. The ridgelines are known to have been used as travelling routes through the forests and for access between the ridge country and the coastal plain.

Archaeological surveys along/near the preferred route have not found large numbers of sites or high densities of artefacts but several sites of Aboriginal social interest have been identified near the preferred route. This includes stone artefact scatters in numerous locations adjacent the route and several sites especially near creek lines with potential for subsurface evidence of Aboriginal occupation. The spur occupied by the Coffs Harbour Gun Club on the eastern side of the highway reserve is of high cultural heritage significance as one of the last known traditional camping places of the Moonee people.

Non-Aboriginal heritage

There are no formally protected sites or areas of non-Aboriginal heritage significance located in proximity to the proposed highway corridor. However, many 'relics' within the meaning of the *Heritage Act* (being features over 50 years old that are evidence of prior settlement and land use) could exist in the study area.

Road network

The road network in the study area consists of a hierarchy of roads mainly serving the rural and residential precincts in this northern beaches part of the LGA. As previously noted, the highest function road is the Pacific Highway which is the major north-south spine, connecting Coffs Harbour to Arwarra (and ultimately Grafton).

Between Sapphire and Arwarra, the Highway is a two-way, two-lane road with a number of passing lanes. It is the only arterial road available to serve the existing residential and rural settlements located at Sapphire, Moonee, Emerald Beach, Sandy Beach, Woolgoolga, Mullaway and Arwarra and hence to provide access to the town centres at Coffs Harbour and Woolgoolga. Key collector roads along this section of the highway servicing these communities include Headland Road, Split Solitary Road, Gaudrons Road, Moonee Beach Road, Killara Road, Smiths Road, Fiddaman Road, Graham Drive (north and south), Arwarra Beach Road and Upper Corindi Road. Bucca Road is the only route joining the highway which provides an east west connection to the rural hinterland of the LGA.

Based on surveys undertaken in 2005, annual average daily traffic volumes within the study area range from about 19,700 vehicles per day south of Headlands Road at Sapphire, to about 10,100 vehicles per day north of Mullaway Drive. Considerable variation in traffic volumes occurs through the year due to the recreational nature of the route, with traffic volumes higher during school holidays and on long weekends. At the southern end of the proposed upgrade, through traffic between Sapphire and Arwarra accounts for approximately 28% of the total traffic volume, while at the northern end it accounts for approximately 54% of the total traffic volume.

Heavy vehicle movement surveys indicate that while the percentage of heavy vehicles in the traffic stream gradually increases from Sapphire to Woolgoolga for both the daytime and night-time periods, the number of heavy vehicles actually decreases. The data also indicates that heavy vehicles make up a significantly higher proportion of the total night-time traffic when compared to the equivalent proportions for the daytime traffic.

Surveys undertaken in 2005 at both Opal Cove Resort and Mullaway Drive indicate that at each location, heavy vehicle hourly volumes are relatively constant over a 24 hour period, while the total traffic volume varies significantly with much greater vehicle movements per hour during the day, with peaks around 8am and 4pm.

Socio-economic characteristics

On the mid-north coast of NSW, the Coffs Harbour region is one of the fastest growing areas in NSW. Important characteristics of the mid-north coast include its popularity as a tourist destination, its growing attraction for retirees and others migrating from large urban areas in NSW, Victoria and

Queensland, its historic reliance on agriculture as a mainstay of the regional economy and its sensitive biophysical environment.

The Coffs Harbour LGA is located 554 km north of Sydney and covers an area of 960 km². The estimated resident population of the LGA in 2001 was 61,770 people, with the great majority of the population (approximately 90%) located east of the Great Dividing Range along the coast. Major urban centres include Coffs Harbour, Sawtell and Woolgoolga. Major industries in the LGA include tourism, primary production, manufacturing, government, commercial and retail services. A large proportion (approximately 44%) of the LGA is State Forest land and National Park (CHCC, 2004a).

The study area comprises a number of discrete urban settlements, rural residential development and rural/agricultural development. Key features of the community structure of the study area are as follows:

- The number of people employed in agriculture has steadily declined over the last decade, while the construction, retail and tourist related industries have played a significant role in employment within the Coffs Harbour LGA in recent years.
- As a tourist destination, the study area experiences a substantial increase in population during peak holiday periods. Maximum use of facilities and resources is reached during these periods.
- Sapphire and Moonee are two discrete, but proximate, coastal settlements located to the north of Coffs Harbour with the population located predominantly on the eastern side of the highway. In 2001, the combined population of these two areas comprised approximately 5.5% of the LGA population.
- Between Moonee and Woolgoolga, the coastal settlements of Sandy Beach and Emerald Beach comprised approximately 6% of the total population of the LGA in 2001.
- Woolgoolga is the third largest urban settlement after the Sawtell / Toormina / East Boambee area with approximately 7.5% of the population of the LGA in 2001. It is an important hub providing key services for the surrounding smaller beachside villages (CHCC, 2004b).
- Arrawarra, Mullaway and Safety Beach are three discrete, but proximate coastal settlements located north of Woolgoolga on the eastern side of the Pacific Highway. In 2001, the combined population represented approximately 4% of the LGA total.

3.2 Development of corridor options

This section provides an overview of the process and activities that led to the identification of four potential highway corridors for the highway upgrade from Sapphire to Woolgoolga. These corridors include three that deviate from the existing highway and one which encompasses the existing highway. For the purposes of highway planning, a corridor was interpreted to typically comprise a broad strip of land within which one or more specific highway route alignments could be subsequently identified. Section 4 presents a summary of the route options that were developed in each of the four corridors.

3.2.1 Constraints analysis

A constraints analysis was carried out at both the corridor and route identification stage of developing highway upgrade options. The preliminary analysis relied on a range of data sources mainly from government agencies and CHCC as well as local knowledge provided by the community. Using aerial photography and ground contour maps a range of constraints were identified. These included:

- current and proposed urban and rural residential development
- existing agricultural land use – including banana lands and forestry activities
- watercourses and wetland areas
- areas of ecological sensitivity
- items / locations of Aboriginal and non-Aboriginal heritage significance
- topographical / terrain aspects
- existing infrastructure such as schools, roads and railways.

Constraints mapping was developed to provide input to the ongoing engineering concept development of possible highway corridors and route options. The constraints were presented in the Route Options Development Report (Connell Wagner, 2002) and the Supplementary Options Report (Connell Wagner, 2004).

A composite constraints map that combines the key constraints is presented in Figure 3.3. This map shows that there are many, often severe, constraints to route planning (and ultimately to highway development) in the study area. There is no realistic route option that is not influenced by substantial constraints of one form or another.

3.2.2 Sapphire to Moonee section

In the southern section of the study area from the existing dual carriageways (near Pelican Beach Resort, Sapphire) to Moonee, the existing highway corridor was identified as the only potentially feasible and suitable corridor option for upgrading the highway. From the preliminary constraints analysis in that area (especially the land use pattern and steep terrain immediately to the west of the highway), there were no realistic alternatives that warranted further consideration. This finding was examined and accepted by the CFG representing the Sapphire to Moonee area.

As a consequence of this initial assessment phase, it was concluded that a broad corridor along the present highway (nominally 150 metres wide) would be the subject of the subsequent route planning efforts. In effect, this meant that the overall highway upgrade from Sapphire to Woolgoolga would necessarily include upgrading / amplification along the 4 km of existing route from the southern limit of the study area to Moonee.

3.2.3 Moonee to Woolgoolga section

Corridor opportunities

In the area north of Moonee, the preliminary constraints assessment showed there were still many substantial constraints that would influence corridor planning. However, in contrast to the southern section, the east-west extent of potentially suitable corridor options was increased due to the wider strip of coastal plain and the less intensive existing development.

Engineering feasibility

The existing highway in its present position has served the State road function for many years and was identified as a realistic corridor option for this assessment.

A large number of indicative alignments were produced from the Quantm route location and optimisation computer package and the design team then delineated the corridors where there was an obvious concentration of these alignments. The resultant corridors were as much as 1.0 to 1.5km wide in some places but also very narrow in locations where one or more severe constraints restricted the alignments generated by Quantm.

3.3 Description of corridor options

The four preliminary corridor options presented in Information Sheet No 2 in March 2002 were developed during this stage (refer Figure 3.4). They include three deviation options north of Moonee (Options A, B and C) that variously bypass urban areas including Woolgoolga and major rural residential areas. The fourth corridor is one that would accommodate a major upgrading / amplification of the existing highway along its full length from Sapphire to north of Woolgoolga (Option D).

The four corridor options are shown in Figure 3.4.

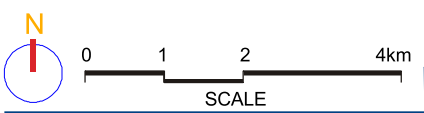
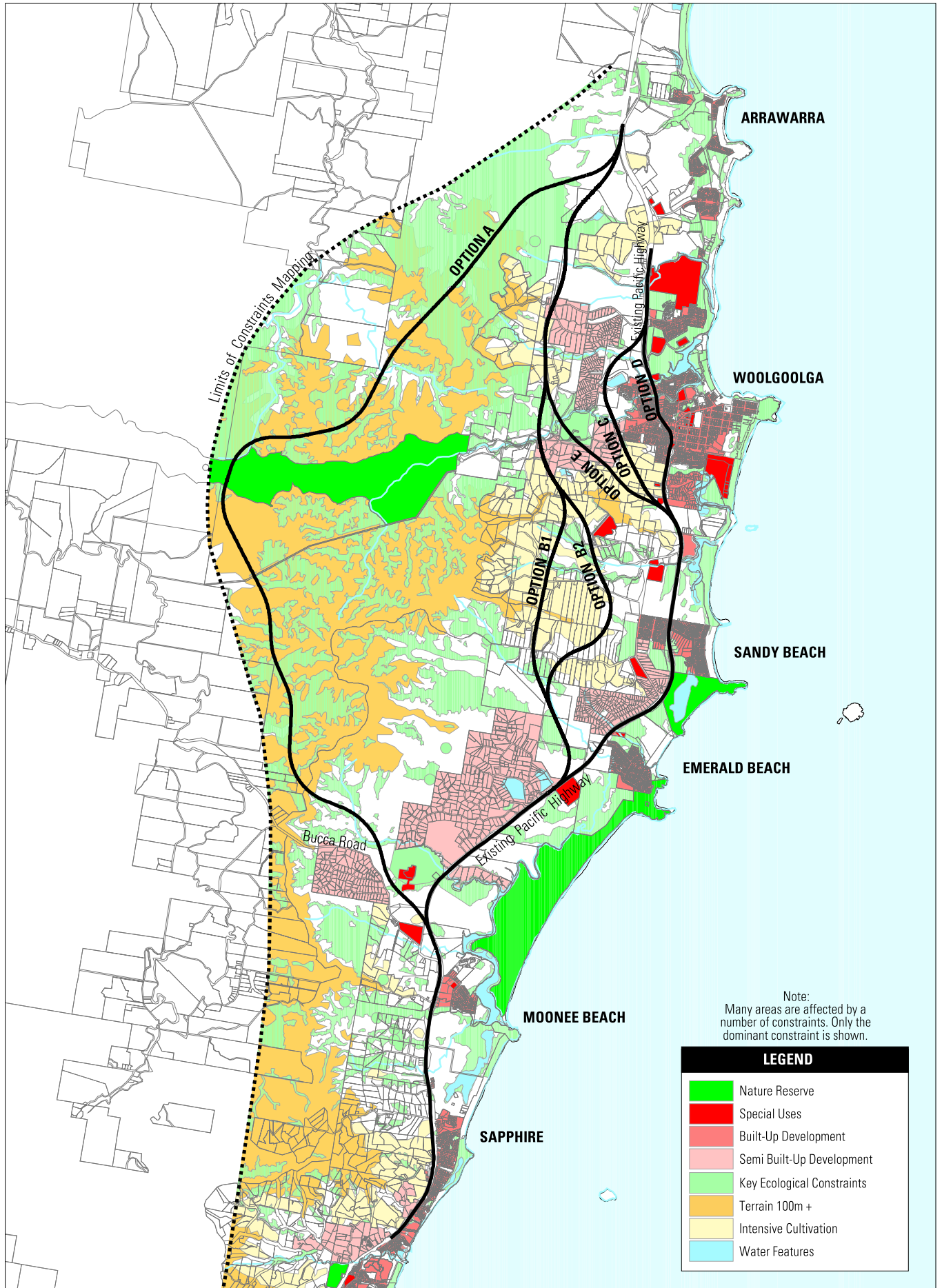


Figure 3.3
Composite Constraints Map

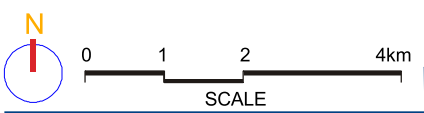
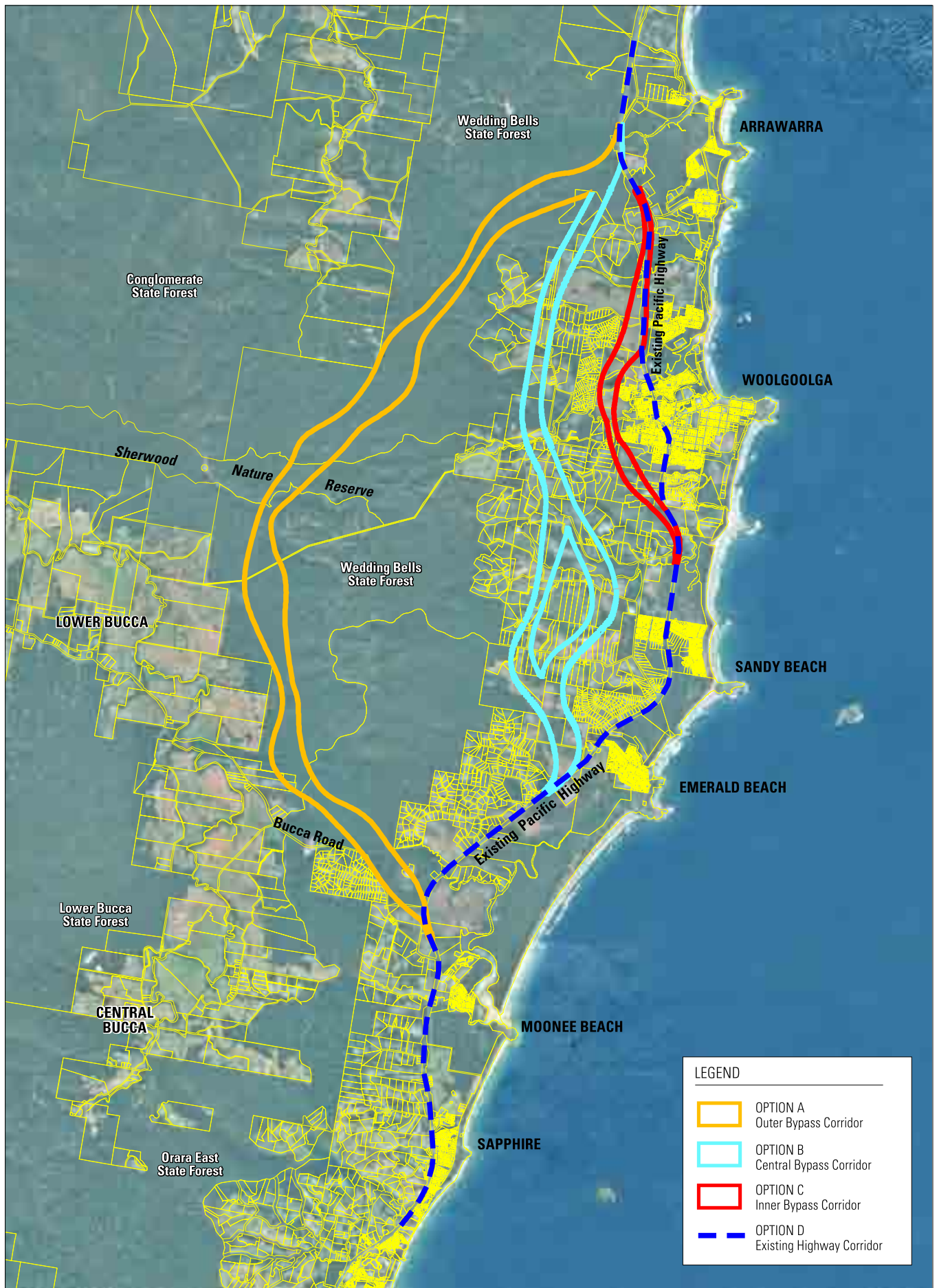


Figure 3.4
Corridor Options

3.4 Development of route options

For the southern section from Sapphire to Moonee where the existing highway corridor was the only realistic option, the option development task was essentially one based on the preparation of urban and engineering design concepts. This required a particular focus on examination of access arrangements and alternatives in what is a highly constrained corridor. The activity included development of a strategic access plan for the highway from Sapphire to Woolgoolga (see below) as well as various traffic analyses to determine the expected traffic volumes along this part of the Pacific Highway in the planning horizon for the project. Two main design options were based around major interchanges centred at either Headland Road or Gaudrons / Split Solitary Roads in the more intensively developed southern section of the route.

For the section north of Moonee, the process of option identification for each of the four corridors involved the integration of the concept designs with more detailed constraints analysis arising from the diverse site investigations into relevant socio-economic and biophysical factors as well as feedback received through the community consultation process. The findings from these investigations were presented in the Working Papers accompanying the Route Options Development Report released in December 2002.

For the section north of Arrawarra Creek where the bypass rejoins the Highway, the existing highway corridor was the only realistic option. This section includes a design that allows for a full grade separated interchange that services land use in the Arrawarra area as well as providing all access to and from Woolgoolga.

3.5 Highway access strategy plan

A vital input into the development of options for this section of the Pacific Highway was the development of a coordinated access strategy that ensures the provision of major junctions along the route to cater for both local and through trips while also meeting high standards of safety and travel efficiency on the highway. The strategy was developed to provide for the planned land use change in the study area over the next 20-30 years.

3.6 Description of route options

Five route alignments (A, B1, B2, C and D) were identified for the Sapphire to Woolgoolga highway upgrade and released as part of the route options development information in December 2002. The five alignments are shown in Figure 3.5.

3.7 Evaluation of route options

3.7.1 1st value management workshop

A Value Management (VM) Workshop was held on the 31st March and 1st April 2003 to provide input into the process of assessing and selecting the preferred route for the project. The workshop was attended by a range of Government, council and community stakeholders (ACVM, 2003). The VM exercise required the stakeholders to identify and rank the functional, environmental and socio-economic performance of the five route options (A, B1, B2, C and D).

The workshop participants agreed that Options C and D performed better than the other options against the triple bottom line evaluation of functional, environmental and socio-economic criteria. Option A was assessed to have severe environmental (biophysical) and Aboriginal heritage impacts, poor functional performance, high cost and poor value for money and both Options B1 and B2 had an adverse impact on agricultural land. Overall, Option C was preferred over Option D as the option to be further progressed - subject to further investigations regarding biodiversity impacts, noise mitigation and review of Council's strategic plan.

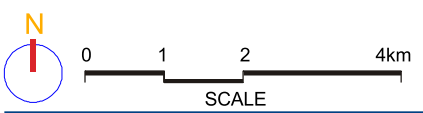
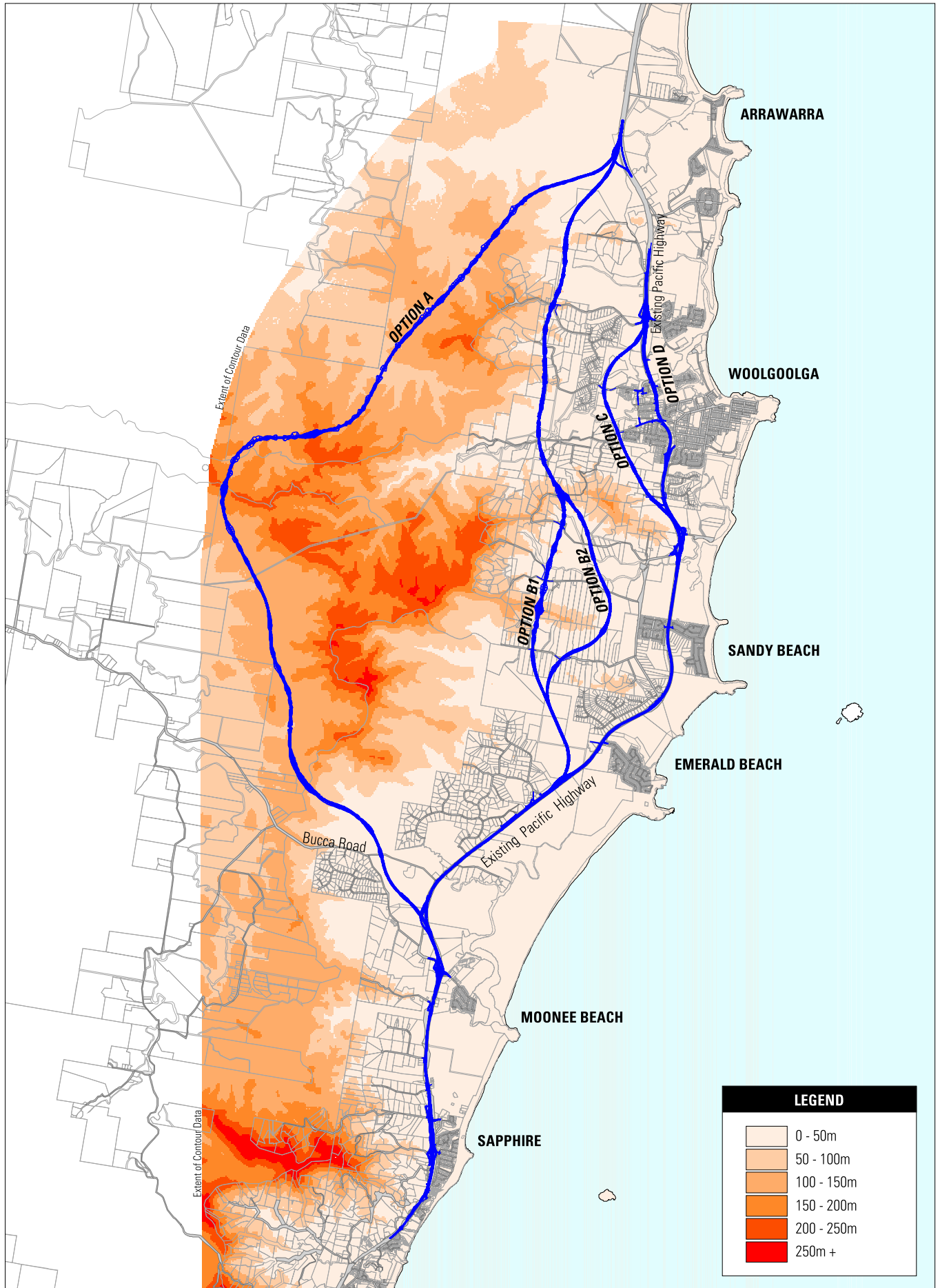


Figure 3.5
Route Alignments

Investigations subsequent to the April 2003 Value Management Workshop led to the conclusion that Option C was the only option that warranted further consideration if a Coastal Corridor was adopted for the overall CHHPS.

3.7.2 Revised corridor options

Following the VM Workshop, CHCC requested the RTA investigate the realignment of Option C to minimise the impact on the South Woolgoolga Urban Investigation Area and to facilitate the future expansion of the township.

Two new route options were subsequently developed in response to the request from CHCC. They were:

- Option C1 - a realignment of Option C at its northern and southern ends, and
- Option E - a new alignment that uses parts of the initial Options B and C. Initial alignments for this route were further refined based on the results of ecological investigations.

The new routes are shown in Figure 3.6 and described in the Supplementary Options Report (Connell Wagner, 2004).

3.8 Selection of preferred option

3.8.1 2nd Value management workshop

A second Value Management Workshop was held on 4 August 2004 to evaluate the remaining route option from the April 2003 Value management Workshop (Option C) and the two options developed in response to the request from CHCC (Options C1 and E).

The same assessment criteria and importance weightings developed at the April 2003 workshop were adopted by agreement for the evaluation of Options C, C1 and E in the 2nd workshop.

The majority of workshop participants recommended Option E as the preferred option as it was considered to:

- deliver the best overall socio-economic outcome
- better provide for future urban growth and provide greater flexibility for future land use planning decisions
- result in less severance of existing and future communities
- provide safety and noise improvements for Mullaway and Safety Beach
- be likely to have a higher degree of community acceptance

3.8.2 Selection of preferred route

Following the 2nd Value Management Workshop, senior representatives of the RTA, regional representatives of DIPNR and the project team further reviewed the work undertaken to date and recommended a preferred option for the Strategy. The review was based on the technical investigations undertaken, the outcome of the value management workshops and the results of the community consultation activities.

Although it is \$15M more expensive, the review recommended Option E as it:

- provides the best overall socio-economic benefits
- better provides for future urban growth and with greater flexibility in planning decisions
- results in less severance of existing and future communities
- provides safety and amenity (including noise) benefits for Mullaway (including Mullaway Public School) and Safety Beach
- is likely to have a higher degree of community acceptance

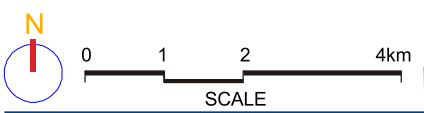
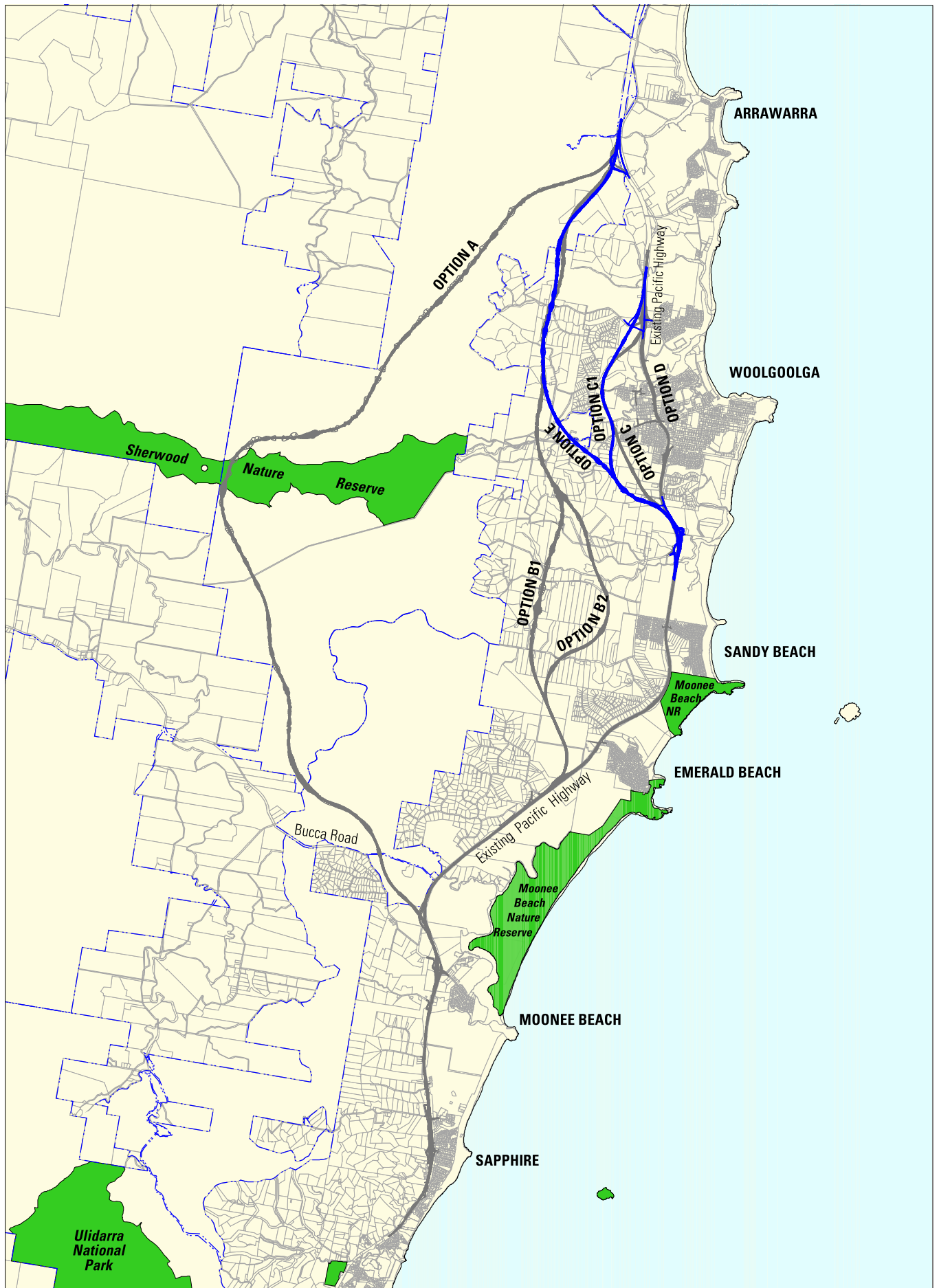


Figure 3.6
Route Options C1 & E

The preferred route for the Sapphire to Woolgoolga upgrade was announced on 7 December 2004.
The announced preferred route involves:

- an upgrade of the existing highway to dual carriageway between Korora and south Woolgoolga,
and
- the Option E bypass of Woolgoolga.