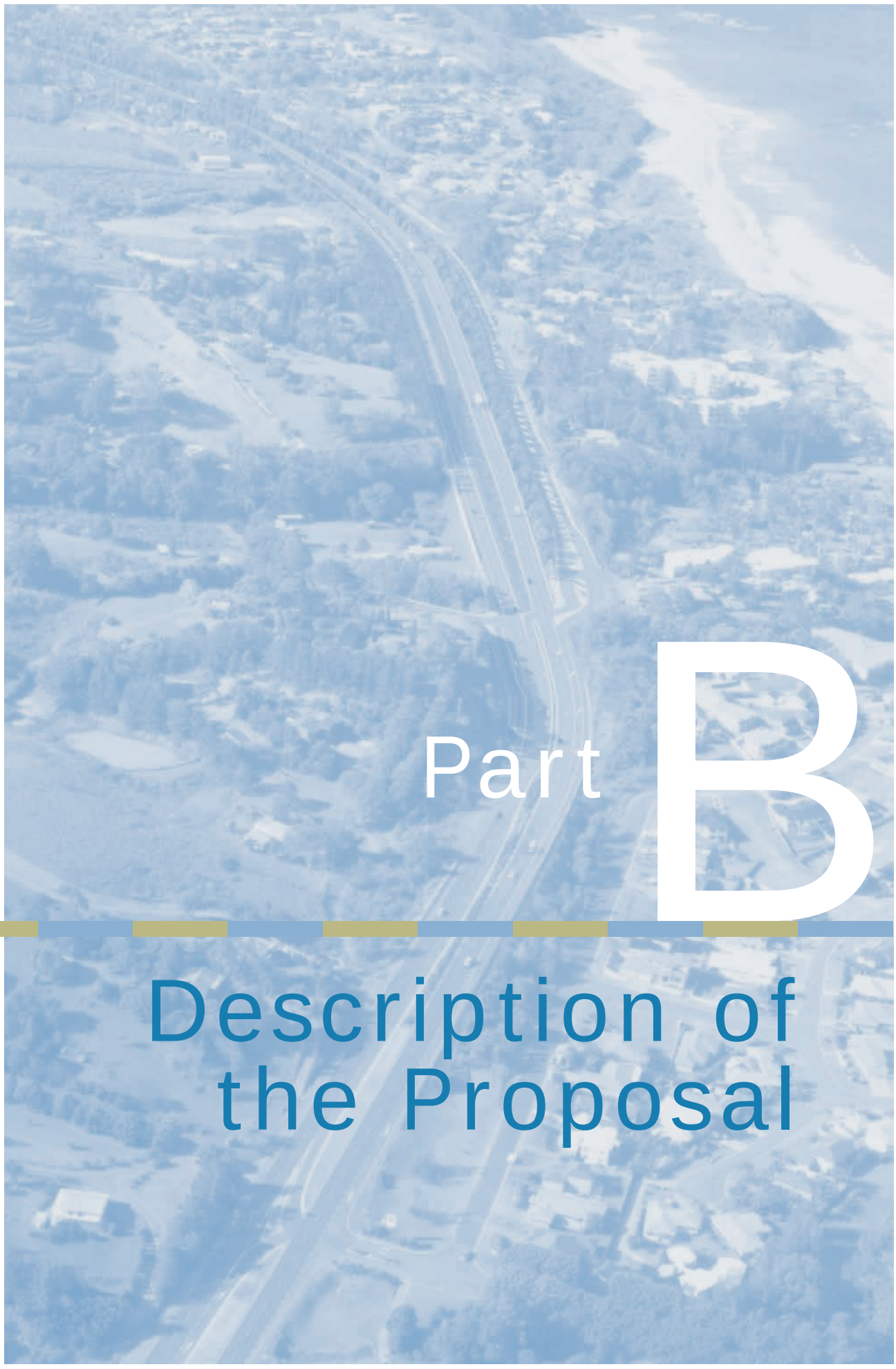

Part B

Description of the Proposal

7 The Proposal

This chapter discusses key inputs and considerations in the development of the design for the Proposal and provides a description of the Proposal in terms of the main design features including alignment, bridges and structures, roadside furniture, safety features, pavement and property acquisition.

7.1 Introduction

The description of the Proposal contained in this chapter is based on the concept design prepared during the design development phase which followed the announcement of the preferred route in December 2004. The concept design incorporates the *Pacific Highway Design Guidelines* (NSW Roads and Traffic Authority (RTA) 2005) and addresses many relevant issues identified during the preceding route selection phase and the environmental assessment phase of the Proposal.

The total length of the Proposal is approximately 25 kilometres, extending from approximately eight kilometres north of Coffs Harbour at Sapphire though to the reconnection to the existing Pacific Highway in the vicinity of Arrawarra Beach Road, north of Woolgoolga. The Proposal incorporates a 15 kilometre upgrade or redevelopment of the existing highway between Sapphire and south Woolgoolga and a 10 kilometre bypass of Woolgoolga that commences at south Woolgoolga and deviates to the west of the township before reconnecting with the existing highway near Arrawarra Beach Road at the northern end of the bypass. The upgrade and bypass sections of the Proposal, which will be described as such throughout this environmental assessment, are illustrated in Figure 7.1.

7.2 Influences on design

The general standard of design for the Proposal is consistent with the *Pacific Highway Design Guidelines* (RTA 2005) to ensure that there is a consistency of form and quality along the whole Pacific Highway corridor from the F3 Freeway near Newcastle to the Queensland border. Other major design influences include environmental opportunities and constraints, requirements for local road and property access connections and diverse issues raised through the community consultation process.

7.2.1 Proposal objectives

The objectives for the Sapphire to Woolgoolga Proposal as they relate to the objectives of the Pacific Highway Upgrade Program are identified in Chapter 3.

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Refer Figure 7.1

7.2.2 Key design standards

The main design standards adopted for the Proposal are:

- Dual carriageway highway meeting the criteria for a 110 km/h design speed for the horizontal alignment and 100 km/h design speed for thevertical alignment unless approved otherwise for specific locations by the RTA.
- The horizontal and verticle alignments of the southern connection of the Proposal to the existing highway at Sapphire meeting the criteria for a 100 km/h design speed.s
- Curvilinear horizontal alignment with a desirable minimum curve radius of 1200 metres, and an absolute minimum curve radius of 750 metres unless approved otherwise for specific locations by the RTA.
- Maximum vertical grade of six per cent.
- Lane width of 3.5 metres with minimum width of outside shoulder of 2.5 metres and minimum width of median shoulder of 0.5 metres.
- Controlled access conditions.

7.2.3 Other influences on the refinement of the concept design

The concept design has been developed in accordance with the above key design principles, but has also responded to a range of other more specific influences, including:

- Input into design criteria by council, government departments and the local community (via meetings and interviews, planning focus meetings, community focus groups and submissions made to the project team).
- Provision of connections to the local road network to ensure safe and efficient road access for local communities in the study area.
- Continued access for local landowners or land managers, especially where landholdings are severed by the Proposal.
- Minimisation of disruption to local and through traffic during construction.
- An immediate reduction of conflict between local and through traffic at opening.
- Maximum use of the existing highway road reserve and existing road infrastructure where possible.
- Provision for safe movement of fauna across the proposed highway alignment where fauna movement corridors exist.
- Avoidance or minimisation of the extent of physical impact on state forests, nature reserves and the Solitary Islands Marine Park.
- Alignment considerations to mitigate effects on future land use, Aboriginal and non-Aboriginal heritage sites, visual amenity and property boundaries where possible.
- Geotechnical, soil, hydrology and water quality considerations.

7.3 Design refinement and construction staging

7.3.1 Detailed design

The concept design on which this environmental assessment is based is an initial functional layout developed as part of the project development process. It addresses and responds to the constraints and principles identified and established as part of this study. The concept design is intended to define a sustainable highway development proposal that provides:

- A definition of property acquisition requirements sufficient to allow the project to be implemented.
- A clear description of design principles.
- An understanding of the nature and extent of likely impacts and impact mitigation measures.

- A sound and clear basis for the later development of detailed designs to support the construction of the proposed project.

The detailed design phase of the project would involve further detailed survey, geotechnical, flora and fauna and Aboriginal heritage investigations (the latter including sub-surface investigations of potential archaeological deposits) leading to refinement of the design prior to construction. The alignment of the Proposal within the road corridor would be refined during the detailed design phase. The RTA would also commence negotiations with affected landholders with regard to property acquisition and property adjustments.

Detailed design would be undertaken after project approval is achieved and it would further develop all aspects of the concept design. The detailed design would take into account matters raised in submissions, adjustments to the design as required by conditions of approval and the results of any further investigations. In addition, alternative approaches derived from the greater knowledge of detailed design, safety refinements, innovation, new standards and technologies or the passage of time may be incorporated in relation to elements of the concept design.

To ensure that the design development process adequately incorporates the key principles established during the study and inherent in the concept design, the development of the detailed design would:

- Be consistent with the design criteria and design principles on which the concept design is based, as described in this environmental assessment and any subsequent submissions report.
- Consider opportunities for refinement of the project footprint within the road corridor for safety, engineering and functional reasons, taking into account the presence of environmentally sensitive areas.
- Address any unresolved issues associated with the development of the concept design as described in this environmental assessment and any subsequent submissions report.
- Meet any conditions of approval arising from the environmental assessment approval process, unless changes to the conditions of approval are subsequently agreed.
- Incorporate opportunities for innovation.
- Incorporate community and government agency requirements by the implementation of a consultation plan aimed at identifying and resolving issues of concern to agencies, the community and other groups.
- Wherever possible, avoid identified environmentally sensitive areas and significant species.
- Develop and refine impact management measures.
- Appropriately develop and incorporate the urban design strategy and landscape concept developed in the environmental assessment.
- Establish detailed proposals for the construction delivery method and construction staging addressing buildability, traffic capacity and safety during construction, geotechnical issues, all relevant RTA specifications and design requirements, current guidelines and policies and practicality / cost effectiveness.
- Incorporate the construction concepts and environmental management measures presented in this environmental assessment and any subsequent submissions report.
- Address risk management during construction and operation.
- Allow for safe and cost effective maintenance of the Proposal during operation in accordance with occupational health and safety requirements and relevant RTA specifications.

The concept design and construction methods proposed in this and the following chapter are proposed as a functional solution to the project objectives and constraints. They may be refined by the RTA and its construction contractor within the limits of any conditions imposed and the design constraints, principles and standards presented in this chapter.

7.3.2 Staged construction

Construction of the Proposal could be staged in a number of ways and include:

- Construction of interchanges as a series of early works packages. This would provide for safe and efficient entry to and exit from the existing main residential precincts located at Sapphire, Moonee, Emerald Beach, Sandy Beach and south Woolgoolga and to the future residential areas envisaged in the Moonee and Hearnes Lake / Sandy Beach development control plans.
- Construction of the dual carriageway upgrade in distinct sections (e.g. Sapphire to Moonee Beach, Moonee Beach to south Woolgoolga, Woolgoolga bypass).
- Construction of the dual carriageway upgrade without the local access roads, or with priority sections of the local access roads.
- A combination of the above staging options.

These staging options could be delivered either as single contracts or as separate concurrent or sequential contracts across a range of delivery methods, providing the RTA with flexibility in terms of timing and budgetary control.

Staging the construction of the Proposal would be likely to increase the overall duration of construction compared to a single phase of construction. There would be extended access and traffic management implications for a staged construction process. However these would likely be in discrete locations, such as at interchanges or within distinct upgrade sections as described above. General amenity affects (ie. noise, air quality and visual) would also be compromised for the extended period of construction; however this would also be at discrete locations along the alignment. Staging of construction could also provide substantial community and social benefit by focussing on upgrading traffic black spot areas, thereby improving road safety for not only local residents but also for through traffic using the highway.

At this time, no decision has been made with regard to the staging of the construction of the Proposal. Staging would be determined during the pre-construction stage and would be dependant on a range of factors including availability and timing of funding, construction industry resources etc.

Construction staging impacts considered in this environmental assessment relate to the construction of a full Class M facility. A Class M facility is defined as:

- A freeway designed to 110 km/h freeway standard, and requires alternative routes to be available for local traffic through the provision of service roads or local arterial road networks.
- A freeway is defined as a special form of controlled access road specifically defined in the State *Roads Act* as "*Generally a divided road with no access for traffic between interchanges and with grade separation at all intersections.*"

If the Proposal is delivered in stages, it is acknowledged there would be some different construction phase impacts to those assessed in this report. In order to adequately address any such potential impacts, the RTA would prepare a staging report.

The RTA has confirmed its commitment to produce a staging report within the draft Statement of Commitments (Appendix A) should the Proposal be staged. The RTA will submit the report to the Director-General of the Department of Planning at least four weeks prior to the commencement of construction (or within any other time agreed to by the Director General). The report would:

- Describe the proposed staging arrangements.
- Identify and assess any potential environmental impacts associated with the proposed staging arrangements.
- Identify any additional management measures (commitments) that would be implemented as a result of the staging process.
- Describe how the Statement of Commitments and any other planning conditions will be addressed in each stage.

7.4 Description of the Proposal

7.4.1 Upgrade section

Sapphire to Moonee Beach

The southernmost section of the Proposal from Sapphire to just north of Moonee Beach Road is approximately five kilometres long and would involve an upgrade along the existing highway to a high standard dual carriageway (refer Figures 7.2a to 7.2c). Over the majority of this length, the existing highway would be upgraded in a very tightly constrained corridor where the rugged terrain extends to the coast. As a consequence, this section through Sapphire would feature high cuttings and retaining walls on the western side of the proposed alignment.

Between the southern end of the Proposal and Gaudrons Road / Split Solitary Road, the existing highway would be retained as a two-way local access road along the eastern side of the new highway. North of Gaudrons Road / Split Solitary Road, the existing highway would become part of the dual carriageway and a new, separate local access road would be provided on the western side of the proposed upgrade.

Key features of the Sapphire to Moonee Beach section include:

- A left-in / left-out only intersection at Campbell Close on the western side of the proposed highway to provide safe entry and departure movements.
- Modification of the existing highway between the southern end of the Proposal and Split Solitary Road into a local access road to provide access for the existing and future development along the eastern side of the highway.
- An intersection between the proposed dual carriageway highway and the eastern local access road (the existing highway) at the southern end of the Proposal to provide safe entry and departure movements for existing and future development along the eastern side of the highway between the southern end of the Proposal and Gaudrons Road / Split Solitary Road. This intersection would have restricted traffic movements, right-in / left-out only, to / from the eastern local access road.
- A new local access road connecting Hunter Close, Old Coast Road and Mountain Way on the western side of the proposed dual carriageways via an overpass to Headlands Road.
- The proposed dual carriageway highway located up to 2.5 metres lower than the existing highway to provide visual and acoustic screening to the residences on the eastern side of the Proposal.
- Two retaining walls and a cutting are proposed where the proposed upgrade would cut through existing ridge lines.
- Grade-separated interchanges at Gaudrons Road / Split Solitary Road and at Moonee Beach Road / Hoys Road to provide safe entry and departure movements to / from the local road network. The interchanges have been designed to cater for the predicted traffic volumes associated with existing development and with the future development in the Moonee Beach development control plan area.
- Roundabouts at both the Gaudrons Road / Split Solitary Road and Moonee Beach Road / Hoys Road interchanges and at the Headlands Road / Crystal Drive intersection to provide safe movement between proposed interchange ramps and local road connections east and west of the proposed highway alignment.
- A new local access road north from Gaudrons Road on the western side of the proposed dual carriageway, connecting Sugarmill Road, Wakelands Road and Maccues Road through to Hoys Road and the Moonee Beach interchange.

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Refer Figures 7.2a to 7.2c

Moonee Beach to south Woolgoolga

The next section of the upgrade extends from just north of the Moonee Beach interchange through to south Woolgoolga (refer Figures 7.2c to 7.2h). This section is approximately 10 kilometres in length and includes the duplication of the existing highway to a high standard dual carriageway and the provision of a local access road adjacent to the new highway.

An interchange would be provided at Emerald Beach / Graham Drive South to facilitate access to / from the highway. A local access road from Emerald Beach, located to the east of the highway alignment, would provide an off-highway connection to Emerald Heights and Sandy Beach and the Sandy Beach Public School via an overpass to Graham Drive South.

At the northern end of this section a full grade-separated interchange would be located between Graham Drive North and Hearnes Lake Road. This interchange would provide for all turning movements to and from the highway and local access to Graham Drive North and Hearnes Lake Road.

Key features of the Moonee Beach to south Woolgoolga section include:

- Grade-separated interchanges at Emerald Beach / Graham Drive South and at Graham Drive North / Hearnes Lake Road to provide safe entry and departure movements to / from the local road network.
- Intersections such as roundabouts at both Moonee Beach Road and Hoys Road to provide safe movement between proposed interchange ramps and local road connections east and west of the Proposal.
- A new local access road to the west of the proposed dual carriageways from the Moonee Beach interchange located along the existing Hoys Road alignment.
- From the northern end of Hoys Road, a new local access road would connect through to Bucca Road and Killara Avenue along the western side of the dual carriageway upgrade. The local access road would connect the Coffs Harbour hinterland and Heritage Park to the Moonee Beach interchange.
- The Proposal would be primarily in embankment conditions over the length between Bucca Road and south Woolgoolga, with some short sections requiring cuttings up to approximately four metres deep.
- At Killara Avenue, an overpass would be provided to connect to a continuation of the local access road to the north, on the eastern side of the dual carriageway upgrade. This would include a connection back to Tiki Road south of Killara Avenue.
- Another overpass would be provided to connect Smiths Road and the Avocado Heights sub-division to the local access road.
- Private property accesses would be provided off the local access road for the former Coffs Harbour zoo site, the Coffs Harbour Clay Target Club and isolated residences south of Emerald Beach.
- At Emerald Beach a northbound off-load ramp would connect to the eastern service road via an overpass south of Fiddaman Road. A southbound on-load ramp would connect to the highway upgrade from Fiddaman Road.
- The local access road would continue along the eastern side of the upgrade, past the existing service station at Emerald Beach and would cross to the western side of the upgrade via an overpass at the southern end of Graham Drive.
- The southern end of Graham Drive would be converted to a left-in / left-out intersection to the northbound carriageway of the proposed upgrade. This would allow northbound traffic travelling to Emerald Heights and Sandy Beach to stay on the highway as far as Graham Drive South.
- North of Graham Drive South the proposed dual carriageway would be continued as a duplication of the existing highway through Sandy Beach, continuing further north to the Double Crossing Creek / Hearnes Lake Road interchange south of Woolgoolga.
- The existing Diamond Head Road overbridge would be replaced with a new overbridge crossing both carriageways of the new highway.
- At the northern end of this section a full interchange would be provided for all turning movements to / from the highway upgrade at Graham Drive North / Hearnes Lake Road, south Woolgoolga.
- The interchange would include roundabouts at both Graham Drive North and Hearnes Lake Road to provide safe movement between proposed interchange ramps and local road connections east and west of the Proposal.

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Refer Figures 7.2d to 7.2h

7.4.2 Woolgoolga bypass section

The Woolgoolga bypass section of the Proposal deviates from the existing highway just north of the interchange at south Woolgoolga and reconnects with the Pacific Highway near Arrawarra Beach Road (refer Figures 7.2h to 7.2m). The south Woolgoolga interchange would provide an entirely new connection for local movements between Woolgoolga and Graham Drive North without any need for access onto the proposed new highway.

North of the interchange, the bypass would veer in a north westerly direction through rural lands and past the south west corner of the South Woolgoolga urban investigation area. It would then traverse a variety of rural and rural residential properties and a section of Wedding Bells State Forest before rejoining the existing highway near Arrawarra Creek Road. The proposed bypass section is approximately 10 kilometres long and would be fully access controlled, with no connections to the local road network or any private properties, other than provision for access by emergency vehicles.

Key features of the Woolgoolga bypass section include:

- The south Woolgoolga interchange to provide a main southern access to Woolgoolga.
- North of the interchange, in the vicinity of Unwins Road, an underpass is proposed for property access to the south-west of the bypass.
- North of Unwins Road, the highway passes through the deepest cutting on the bypass section (approximately 30 metres).
- In many locations along the bypass section, the two highway carriageways have been located at different heights to minimise the depth of cuttings and the overall width of the highway.
- South of Woolgoolga Creek, two highway overpasses for Greys Road and Woolgoolga Creek Road would be provided.
- North of Woolgoolga Creek, the bypass would be located on the western side of a ridgeline to provide visual and acoustic shielding for the southern part of the Country Club Estate.
- Immediately south of Newmans Road, the bypass would cross a deep creek and gully in which a major structure is proposed to limit the extent and volume of embankment fill.
- At Newmans Road, an underpass is proposed for property access to the west of the bypass.
- Immediately north of Newmans Road, an emergency vehicle access to the northbound highway carriageway would be provided. Emergency access to the southbound highway carriageway would be via a median crossover that is also proposed at this location.
- At Bark Hut Road, an overpass is proposed over the bypass alignment.
- North of Bark Hut Road, the bypass would cross agricultural and partially cleared land on the approach to Wedding Bells State Forest.
- Through the state forest the alignment would generally be in a low embankment to reduce the width of the Proposal and the amount of clearing required.
- Four fauna underpasses would be provided through the state forest section.
- The bypass would rejoin the existing Pacific Highway near Arrawarra Beach Road. At this location, a directional interchange is proposed and it would serve as the main northern access for Woolgoolga.
- On the eastern side of the highway, Eggins Drive would be redeveloped to provide a connection between the existing highway at Arrawarra Creek, the interchange and the existing local road network north to the Darlington Park area.
- A rest area for both heavy and light vehicles would be provided on the eastern side of the Arrawarra interchange (refer Figure 7.7). Access to the rest area for both northbound and southbound vehicles would be via the interchange. Further detail regarding the proposed rest area is provided in Section 7.5.11.
- As the Proposal would involve the closure of several existing direct accesses from the existing highway into the Wedding Bells State Forest, a forestry operations track would be extended between the existing tracks near Arrawarra Creek and Upper Corindi Road.
- The Proposal would finish at a temporary connection to the existing highway north of Arrawarra Beach Road with provision made for the future continuation of the dual carriageway upgrade to the north as part of the Woolgoolga to Wells Crossing project.

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Refer Figures 7.2i to 7.2m

7.4.3 Access and local roads

The Proposal would have controlled access, with direct highway access being available only at the following locations:

- At the southern end of the Proposal, a left-in / left-out intersection at Campbell Close, Sapphire on the western side and a right-in / left-out intersection with the eastern local access road (the existing highway) opposite Campbell Close.
- Grade-separated interchanges at:
  - Gaudrons Road / Split Solitary Road, Sapphire.
  - Moonee Beach Road / Hoys Road, Moonee Beach.
  - Fiddaman Road (Emerald Beach) / Graham Drive South (Emerald Heights).
  - Graham Drive North / Hearnes Lake Road, south Woolgoolga.
  - Arrawarra Beach Road, Arrawarra.

The five grade-separated interchanges would provide for access to the dual carriageway highway via on/ off-ramps with design speed merging and diverging facilities.

A description of the functionality of each of the accesses and the new and upgraded sections of local access road is provided in the following sections.

Left-in / left-out access at Campbell Close

The existing Campbell Close intersection would be converted to a left in / left out only access on the northbound highway carriageway. Access to the south or from the north would be via the Gaudrons Road / Split Solitary interchange and the existing Opal Cove seagull intersection, respectively.

Right-in / left-out access to eastern local access road

The existing highway through Sapphire would become the eastern local access road. At the southern end, the local access road would connect with the new southbound highway carriageway via a right-in / left-out only intersection with an acceleration facility for the left turn movements toward Coffs Harbour. This intersection would effectively define the start of the Proposal.

Gaudrons Road / Split Solitary Road interchange

This interchange would accommodate the traffic generated by the Sapphire area to the east of the existing highway and rural / residential properties to the west of the highway. It would also become the southern access point to the southern part of the Moonee development control plan area. The interchange would be situated at approximately three kilometres from the start of the Proposal.

The interchange would provide for all traffic movements, with intersections such as roundabouts are proposed to the west and east of the main highway carriageways to connect to Gaudrons Road and Split Solitary Road respectively. The western intersection would provide access from the northbound off-ramp, Gaudrons Road, a new western local access road to Moonee Beach, the northbound on-ramp and the interchange bridge. The eastern intersection would provide access from the southbound off-ramp, Split Solitary Road, the existing highway through Sapphire (which becomes the local access road), the southbound on-ramp and the interchange bridge.

Moonee Beach Road / Hoys Road interchange

This interchange would accommodate traffic generated by Moonee Beach to the east of the existing highway and rural / residential properties to the west of the highway. It would become the main access point for the urban development envisaged in the Moonee development control plan area. The interchange would be situated approximately five kilometres from the start of the Proposal.

The interchange would provide for all traffic movements, with intersections to the west and east of the main highway carriageways to connect to Hoys Road and Moonee Beach Road respectively.

The western intersection would provide access to the northbound off-ramp, the western local access road from Gaudrons Road, Hoys Road, the northbound on-ramp, and the interchange bridge. The eastern intersection would provide access to the southbound off-ramp, Moonee Beach Road, the southbound on-ramp and the interchange bridge.

Fiddaman Road / Graham Drive South interchange (Emerald Beach / Emerald Heights)

The proposed Emerald interchange would extend over a 1.6 kilometre length from south of Fiddaman Road to Graham Drive South. The interchange would incorporate a section of local access road between Fiddaman Road and Graham Drive South to eliminate the need for local travel on the proposed highway. The start of the interchange would be located approximately 11 kilometres from the start of the Proposal.

Because of the distance between Fiddaman Road and Graham Drive South, the proposed loading and unloading facilities for the interchange would be separated. A northbound off-ramp and the southbound on-ramp would be located near Fiddaman Road. A second northbound off-ramp and the southbound on-ramp would be located at the existing intersection of the highway and Graham Drive South. The southbound off-ramp, which would be located opposite Graham Drive South, would connect onto the local access road on the eastern side of the highway.

Because of the elongation of the interchange over the Emerald Beach / Emerald Heights section, two interchange bridges are proposed. The first is for the northbound off-ramp south of Fiddaman Road and the second is for the local road connection between Emerald Beach and Emerald Heights.

On the eastern side of the proposed upgrade, a roundabout would be located at the intersection of Fiddaman Road, the proposed access road to the overbridge south of Fiddaman Road, the proposed southbound on-ramp and the proposed local access road between Emerald Beach and Graham Drive South. On the western side of the proposed upgrade, a roundabout would be located at the intersection of Graham Drive South, Emerald Heights Drive and the proposed local access road.

Graham Drive North / Hearnes Lake Road interchange

This interchange would be located at the transition of the Proposal from an upgrade of the existing highway to the Woolgoolga bypass. This interchange would be located approximately 15 kilometres from the start of the Proposal.

On the western side of the Proposal, the northbound off-ramp would meet Graham Drive North at a roundabout. The roundabout would also provide access to Woolgoolga via a bridge over the highway and the northbound on-ramp.

The eastern portion of the interchange would include a southbound on-ramp, which would diverge from the two-way access road near the Hearnes Lake Caravan Park. A roundabout is proposed at the relocated intersection with Hearnes Lake Road. As well as facilitating access to / from the proposed highway, the eastern portion of the interchange would connect with existing and proposed residential development in the Hearnes Lake area. The existing highway north of the interchange would become the main southern entry point for Woolgoolga, catering primarily for internally generated and service level traffic.

To the north of the south Woolgoolga interchange near Unwins Road, a southbound off-ramp is proposed that would allow traffic from the bypass to access the town near the Bosworth Road industrial area. To accommodate this off-ramp, the existing Unwins Road intersection would be relocated to the north to form a four-way intersection with the existing highway and Bosworth Road.

Arrawarra interchange

This interchange would provide for all traffic movements to and from the proposed bypass and would also be the main northern entry point for Woolgoolga. The proposed temporary connections to the existing highway would occur immediately north of the interchange.

West of the proposed upgrade, the interchange would feature a northbound off-ramp as a reversing loop that would connect with a northbound on-ramp and an interchange bridge over the highway. East of the highway, an elevated roundabout would allow movement from a southbound off-ramp, the connection to Woolgoolga, a southbound on-ramp and the interchange bridge. The interchange design would also incorporate a local access road connection from Woolgoolga to the Darlington Park area north of the Proposal, via the existing Eggins Drive.

Local access road network

In order to increase road safety, separate local access roads have also been incorporated into the Proposal to remove the need for local traffic to access the highway for movement along the northern beaches of Coffs Harbour (but not to prevent highway use by local traffic). This local access road network would allow travel from Sapphire to Woolgoolga in a lower speed environment, more amenable to pedestrian, cyclist and bus traffic. There would be complete grade-separation of all cross highway movements. Figures 7.3a and 7.3b provide an overview of the proposed local access road network along the length of the Proposal.

Although there would be a substantial length of the local access road that would be newly constructed, existing road infrastructure would be included in the access road scheme where possible. These sections include the existing highway at Sapphire, Hoys Road at Moonee Beach; Graham Drive, the existing Pacific Highway between Hearnes Lake Road Woolgoolga and Arrawarra Creek and Eggins Drive at Arrawarra.

Except for some possible temporary access arrangements, properties and local roads which currently have direct access to the highway would no longer have continued access to the new dual carriageways. The proposed local road network would connect these properties and roads with the highway at the five proposed interchanges and two at-grade intersections at the southern end of the Proposal. Local traffic would also have the choice of accessing the highway at these access points or continuing along the local access road for north / south travel.

The local access road network would be independently (vertically) graded from the highway to meet local constraints and to provide for local road crossings at interchanges and overpasses. A summary of the proposed local access road network within discrete sections, and the strategy for the provision of each section, is provided in Table 7.1.

Possible temporary left-in / left-out access arrangements

A number of properties located within the Moonee development control plan and Korora rural residential development control plan areas currently have direct access onto the existing highway. Both development control plans provide for alternative access to these properties when either the property or adjacent properties are developed.

The Proposal would provide temporary access onto the highway for these properties. While temporary access arrangements would be the subject of consultation between individual land owners and the RTA, access would be limited to left-in / left-out movement onto the highway. An exact timeframe of the operation of these access arrangements cannot be determined at this time. These temporary property accesses would be located where existing property accesses are adjacent to a future highway carriageway, not the proposed local access road (ie where the new local access road is on the opposite side of the highway upgrade to the affected property, direct access is required for an interim period). This is the case in the following locations:

- Western side of the northbound carriageway at Sapphire, specifically between Campbell Close and the southern end of Hunter Close.
- Eastern side of the southbound carriageway between Split Solitary Road and Moonee Beach Road.
- Eastern side of the southbound carriageway between Moonee Beach Road and Skinners Creek.

TABLE 7.1 LOCAL ACCESS ROAD STRATEGY

LOCAL ACCESS ROAD LOCATION	LOCAL ACCESS ROAD STRATEGY [1]
Sapphire to Split Solitary Road	
Two-way local access road east of upgrade	Existing highway through Sapphire with new line marking and landscaping, incorporating new highway intersection at Sapphire and existing intersections retained at Nautilus Resort, Sapphire Pines, Sapphire Crescent, Sapphire service station and Headlands Road.
Gaudrons Road to Moonee Beach	
Two-way local access road west of upgrade	New local road between Gaudrons Road / Split Solitary Road interchange and Moonee Beach Road / Hoys Road interchange to incorporate new intersections with Sugarmill Road, Wakelands Road and Maccues Road.
Moonee Beach to Killara Avenue (Heritage Park)	
Two-way local access road west of upgrade	Connection of interchange to existing Hoys Road and an upgrade over its length, including upgrade of existing intersection with Old Bucca Road. Connection to new section of local road with new intersections at Bucca Road and Killara Avenue.
Killara Avenue (Heritage Park) to Graham Drive South (Emerald Heights)	
Two-way local access road east of upgrade	Local road overpass at Killara Avenue and southern connection to Tiki Road. North of the Killara Avenue overpass, new intersections with the Coffs Harbour Zoo property (now closed), Coffs Harbour Clay Target Club, Emerald Seniors Living, Fiddaman Road (Emerald Beach) and the Emerald service station. Overpass connections to Smiths Road and Graham Drive South.
Emerald Heights and Sandy Beach	
Existing Graham Drive, west of upgrade	Use of existing Graham Drive for local traffic between Emerald Heights and south Woolgoolga with connection to Sandy Beach. Existing Diamond Head Road overbridge replaced with a new overbridge crossing both carriageways of the new highway.
Woolgoolga bypass	
Existing highway between Hearnes Lake Road and Arrawarra Creek.	Use of existing highway from Hearnes Lake Road to Arrawarra Creek, with significantly reduced traffic volumes though Woolgoolga.
Arrawarra interchange	
Two-way local access road east of upgrade	Connection of existing highway from Arrawarra Creek to an existing local road (Eggins Drive) that runs between Arrawarra Beach Road and Darlington Park.

[1] The local access road network would be further refined during the detailed design of the project and may vary from that nominated in the table.

Approximately eight temporary intersections for single and multiple property accesses are proposed in these locations. Ultimately, all of these would be removed as planned urban development occurs in the West Korora and Moonee Beach development control plan areas.

Adjustments to access tracks within the Wedding Bells State Forest

The Proposal also includes some adjustments to access tracks within the Wedding Bells State Forest to rationalise access into the state forest and to improve road safety at the junctions with the highway.

Source: Aerial photography August 2000 (LPI NSW)

FIGURE 7.3a PROPOSED LOCAL ACCESS ROAD NETWORK

Source: Aerial photography August 2000 (LPI NSW)

FIGURE 7.3b PROPOSED LOCAL ACCESS ROAD NETWORK

7.5 Design components

As noted in Section 7.2, all components of the Proposal would be designed to be consistent with the *Pacific Highway Design Guidelines* (RTA 2005). These guidelines provide minimum geometric standards and treatments in relation to cut and fill batters, bridge widths, typical pavement designs, drainage and water quality requirements, and roadside furniture details. The various design components, specific to the Sapphire to Woolgoolga concept design, are outlined in the following sections.

7.5.1 Carriageway cross-section and earthworks

The proposed highway upgrade would consist of two carriageways, each with two 3.5 metre traffic lanes, with an inner (or right) shoulder of 0.5 metres (minimum), and an outer (or left) shoulder width of 2.5 metres (minimum). The median separating the two carriageways would be generally 12 metres wide (inclusive of the inner shoulders) and would generally be depressed to facilitate drainage. The median would be landscaped to assist in reducing headlight glare across the respective carriageways. Typical cross-sections of the proposed highway upgrade have been prepared as part of this report. The general location of the cross sections is provided in Figure 7.4a. Cross sections at typical points along the proposed alignment are provided in Figures 7.4b to 7.4h.

Where a new local access road is provided adjacent to the highway upgrade it would generally have a minimum separation of 12 metres from the adjacent carriageway, although this would be reduced in areas where bus bays are proposed. Exceptions to the provision of a 12 metre separation also occur at Emerald Beach service station and at Arrawarra Creek due to width restrictions of the existing road reserve at these locations. The local access road would generally be a two-lane, two-way road with 3.5 metre lanes and two metre shoulders.

Cut and fill batters would be provided where the outer extremities of the highway upgrade and / or the local access road are respectively below or above the natural ground level. Where the proposed highway would be below the existing ground level a cut batter would be established in earthworks to meet desired pavement and sub-grade levels. Where the proposed highway would be on embankment (or fill), the earth formation would be initially wider and then progressively reduced as it is raised to meet the required level of the road surface. Chapter 8 provides further detail regarding earthworks.

A summary of the general variation in cutting depths and fill heights is provided in Table 7.2. These measurements are general only and based on concept design information and are therefore subject to variation as part of the subsequent detailed design process.

TABLE 7.2 PROPOSED CUTTING DEPTH AND FILL HEIGHTS

SECTION	APPROXIMATE CUTTING DEPTH [1]		APPROXIMATE FILL HEIGHT [1]	
	MAXIMUM	TYPICAL	MAXIMUM	TYPICAL
Sapphire to Moonee Beach	23 metres	10 metres	14 metres	5 metres
Moonee Beach to South Woolgoolga	19 metres	7 metres	13 metres	4 metres
Woolgoolga bypass	30 metres	12 metres	16 metres	10 metres

[1] The cutting depth and fill heights would be further refined during the detailed design of the project and may vary from that nominated in the table.

In general terms both cut and fill batters would be sloped at 2:1 horizontal to vertical. Where deeper cuttings are expected to encounter competent rock, or where localised property constraints require a narrow formation, the cut slope could be increased from the 2:1 horizontal to vertical. The extent and locations of increase to cut slope would be confirmed during the detailed design phase to between 0.75:1 and almost vertical. In these areas, special geotechnical treatments may be necessary to stabilise cuttings and / or retaining walls may need to be constructed.

Both cut and fill batters would be revegetated with native trees, shrubs and groundcovers, consistent with clear zone and sight line requirements. For fill batters, this would also assist in the establishment of the aerial fauna crossings at designated points.

7.5.2 Bridges

A total of 30 bridge or bridge sized structures are proposed as part of the concept design, including new or replacement bridges over existing creeks or for underpasses / overpasses associated with grade separations at interchanges, local road crossings or property accesses. The bridges or large box culvert structures required as part of the Proposal are identified in Table 7.3 and can be categorised as follows:

- Transverse bridges at interchanges and local road overpasses that provide safe cross-highway access. Throw screens would be installed on all transverse overpass structures.
- Transverse underpass structures that provide for local road and / or multiple property accesses.
- Longitudinal bridges where the proposed highway upgrade and / or the local access roads cross major creeks.

TABLE 7.3 PROPOSED BRIDGE OR BRIDGE SIZED STRUCTURE LOCATIONS AND TYPE

APPROXIMATE LOCATION	BRIDGE TYPE	DESCRIPTION [1]
Transverse structures		
8.970 km	Overpass	Hunter Close / Old Coast Road connection to Sapphire
9.580 km	Overpass	Interchange bridge from Split Solitary Road to Gaudrons Road
12.300 km	Overpass	Interchange bridge from Moonee Beach Road to Hoys Road
14.700 km	Overpass	Local access road bridge at Killara Avenue
16.340 km	Overpass	Local access road bridge at Smiths Road
17.800 km	Overpass	Interchange bridge south of Fiddaman Road at Emerald Beach
19.340 km	Overpass	Local access road bridge at Graham Drive south
20.700 km	Overpass	Local road bridge at Diamond Head Road
22.290 km	Overpass	Interchange bridge from Graham Drive north to Woolgoolga
23.120 km	Underpass	Property accesses at Unwins Road
23.960 km	Underpass	Property access east of Greys Road
24.410 km	Overpass	Local road bridge at Greys Road
25.060 km	Overpass	Local road bridge at Woolgoolga Creek Road
26.470 km	Underpass	Property access south of Newmans Road
26.890 km	Underpass	Underpass at Newmans Road
27.630 km	Overpass	Local road bridge at Bark Hut Road
31.610 km	Overpass	Interchange bridge at Arrawarra
Longitudinal structures		
12.600 km	Cunninghams Ck	Twin highway bridges
12.800 km	Cunninghams Ck	New bridge on Hoys Road
14.200 km	Skinners Creek	Twin highway bridges plus local access road bridge
21.860 km	Double Crossing Ck	Twin highway bridges plus northbound off-ramp
25.400 km	Woolgoolga Creek	Twin highway bridges
31.050 km	Arrawarra Creek	Twin highway bridges, existing bridge retained for local road

[1] Bridging requirements would be further refined during the detailed design of the project and may vary from that nominated in the table.

Bridge features (both superstructure and substructure) would be consistent with the *Pacific Highway Urban Design Guidelines* (RTA 2005). Abutment areas beyond the bridge deck would, where appropriate and in line with clear zone and sight line requirements, be revegetated with native trees, shrubs and groundcover species. Vegetation would comply with the urban and landscape design plans for the Proposal and, in the case of underpasses, would provide cover for fauna that may use the structures for movement under the highway.

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Refer Figure 7.4a

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Refer Figures 7.4b to 7.4h

The Proposal would require some in-stream (channelisation) works at Arrawarra Creek.

Four existing bridge structures would need to be removed to facilitate construction of the Proposal. The potential impacts resultant from demolition of bridge structures is provided in Chapter 13. The following existing bridge structures would be removed:

- Pacific Highway at Cunninghams Creek.
- Hoys Road at Cunninghams Creek.
- Pacific Highway at Skinners Creek.
- Pacific Highway at Double Crossing Creek.

In addition to these bridge structures, there are numerous drainage and / or fauna crossings that would be incorporated as part of the Proposal. These structures are discussed in Sections 7.5.4 and 7.5.6.

7.5.3 Pavement design

A number of different pavement design types would be applied to various sections of the proposed upgrade. The new dual carriageways would consist of a heavy duty pavement, as outlined in the *Pacific Highway Design Guidelines* (RTA 2005) with a nominal design life of 40 years. Interchange ramps and intersections with connecting local roads, including the sections of new local access road could have a different pavement configuration.

Where the existing highway is to be incorporated into the new dual carriageway or would become the local access road, various treatments are proposed. These are dependent on the assessed residual life of the existing pavement. This could include a series of different designs, ranging from resealing with very fine aggregate, to thin asphalt overlays or more substantial pavement restoration and overlay works.

In all cases a pavement design would be undertaken for the expected traffic composition and foundation conditions.

An integral part of the pavement design is the proposed wearing surface of the respective carriageways and the contribution that it can make to reducing noise from traffic. A low noise pavement surface would assist in reducing road traffic noise to nearby receptors. This is addressed in more detail in Chapter 11, but is summarised as follows:

- The existing highway at Sapphire, which would become the local access road, has an existing stone mastic asphalt surface and would be resealed to enable the road to be re-line marked for its use as a local access road.
- Proposed highway carriageways and interchange ramps in noise sensitive areas would include a low noise wearing surface. The low noise wearing surface would extend from the southern limit of works at Sapphire to approximately 700 metres north of Bark Hut Road, Woolgoolga.
- Interchange ramps and northern temporary connections at Arrawarra Beach Road would be constructed with a wearing surface that would provide cost effective noise attenuation in a lower speed environment.
- All other local road connections and all intersections with local access roads would be constructed with a wearing surface that would provide cost effective noise attenuation in a lower speed environment.

7.5.4 Drainage and water quality treatments

Drainage

Transverse drainage of the highway upgrade would be by bridges and culverts to allow the passage of a 1 in 100 year flood event. The road formation would also be designed to be above the water levels generated by such an event.

The different sections of the Proposal require alternative design treatments for transverse drainage structures. The upgrade section of the Proposal largely requires the extension and / or augmentation of existing culverts and the provision of new bridges at the three major creek crossings. All drainage and bridge structures on the bypass section of the Proposal would be new.

Table 7.4 identifies the main watercourses crossed by the route and the proposed drainage structure for each watercourse. The table also identifies the drainage structures that serve the dual function of both drainage structure and wildlife crossing. There are also a number of minor drainage structures which would require extension and / or augmentation, which are discussed in Section 18.2.1.

TABLE 7.4 SUBSTANTIAL WATERCOURSES AND PROPOSED TRANSVERSE DRAINAGE STRUCTURES

WATERCOURSE	PROPOSED TREATMENT	COMMENTS [1]	FAUNA CROSSING
Campbell Close Creek	Extend existing box culverts	3 Cell 1800 mm x 1500 mm	
Hays Creek	Extend existing box culvert	1 Cell 3000 mm x 3000 mm	
Unnamed at 10.050 km	Extend existing pipe culvert	5 Cell x 1500 mm diameter Re-shape existing dam embankment	
Sugarmill Creek	Augment and extend existing pipe culverts	4 Cell x 1800 mm diameter	Potential
Unnamed at 10.990 km	Augment and extend existing pipe culverts	Additional 1 Cell x 1350 mm diameter and existing 2 Cell × 900 mm diameter	
Unnamed creek at 11.500 km	Extend existing box culverts	3 Cell 2100 mm x 1200 mm and additional 2400 mm x 2400 mm box culvert	Yes
Unnamed at 12.300 km	Extend existing pipe culverts	5 Cell x 1050 mm diameter	
Cunninghams Creek	New twin bridges	Clear span tidal limit	Yes
Skinners Creek	New twin bridges and local access road bridge	Upstream of tidal limit	Yes
Heritage Park floodplain	Extend existing (6) banks of culverts	Numerous large pipe and box culverts up to 2400 mm x 1800 mm	Potential
Moonee Creek floodplain	Extend existing (9) banks of culverts	Numerous large pipe culverts up to 1800 mm	Potential
Moonee Creek	Extend existing box culverts	2 Cell 2400 mm x 1800 mm	Potential
Fiddaman Creek	Augment and extend existing box culverts	5 Cell 2400 mm x 1200 mm box culverts	
Sandy Beach floodplain	Extend existing (9) banks of culverts	Numerous box culverts up to 2440 mm x 1220 mm	Potential
Double Crossing Creek	New twin bridges, plus northbound off-ramp bridge	Clear span tidal limit by highway bridges, minor incursion with off-ramp bridge	Potential
Woolgoolga Creek	New twin bridges	Three span bridge over main creek channel	Yes
Poundyard Creek	New arch structure	Major structure to reduce clearing and earthworks	Yes
Unnamed at 28.380 km	New pipe culverts	3 Cell x 1500 mm diameter	
Darkum Creek	New pipe culverts	3 Cell x 1200 mm diameter	Potential
Little Arrawarra Creek	New box culverts	6 Cell 2440 mm x 1220 mm	Yes
Arrawarra Creek	New twin bridges	Minor channel diversion	Yes

[1] Culvert requirements would be further refined during the detailed design of the project and may vary from that nominated in the table.

The drainage system for the road pavement and the earth formation in cutting has been designed for a 1 in 10 year storm event. This drainage includes longitudinal gutters and kerbs, pits and pipe systems designed to remove water from the travel lanes as quickly as possible. Additional drainage pits would be provided in areas of flat longitudinal grades to prevent ponding of water and to reduce the possibility of vehicle aquaplaning in very flat areas.

Water quality

The concept design has been developed such that run-off from the road formation is directed, collected and treated in water quality control structures. These water quality control structures (erosion and sediment control basins) would be positioned at numerous locations along the Proposal, generally adjacent to culverts at transverse creek lines, both upstream and downstream of the highway formation. The structures would be located so as to provide for the catchment and temporary storage of run-off from all cut batters and associated berms and benches. Runoff from the road pavement would be directed to the structures via pipes and pits that would be constructed through the road cuttings.

The structures allow for retention of sediments and other fine materials that would otherwise enter the natural creek systems. These are subsequently cleaned and sediments removed during routine maintenance operations. The Proposal would include approximately 80 water quality control structures. These are typically 30 metres x 10 metres with a holding capacity of between 100 m^3 and 400 m^3.

The proposed water quality structures would be designed and sized for optimised performance during operation of the Proposal. However, they would also be sized such that they can be used during construction phase earthworks operations to provide erosion and sedimentation control during times of increased exposure to high intensity rainfall events.

The control of water quality released downstream during construction is an important element in the design of water quality control structures, especially at those watercourses that are close to, or form part of, the Solitary Islands Marine Park (ie. Cunninghams Creek and Double Crossing Creek). Soil and surface water management measures have been identified in Chapter 18 and would be confirmed in the detail design phase to safeguard these sensitive receiving waters.

7.5.5 Roadside furniture

On completion of the earthworks, structures, drainage and pavement construction the Proposal would be fitted with a variety of roadside furniture elements to provide for safety, delineation, directional guidance and security along the length of the proposed project. These elements form an integral part of the Proposal and are outlined below. The location and design of these facilities would be refined during the detailed design of the project.

Street lighting

A street lighting scheme would be implemented for all major access and interchange areas, where traffic is leaving or entering the highway. The street lighting would be designed in accordance with the *Pacific Highway Design Guidelines* (RTA 2005) for illumination of major highways.

Specific design treatments are proposed to reduce or eliminate light spill or glare to nearby residential areas, particularly where no street lighting currently exists. This may involve special light fittings or luminares to contain light spill within the required area.

Safety barriers

A range of safety barriers would be provided as part of the Proposal to protect vehicles from potential collision hazards within the clear zone. These safety barriers would be tailored for each

location where they are required and would include:

- Appropriate fencing on fill embankments.
- Appropriate barrier structure where separation between carriageways is necessary.
- A combination of barrier types on the approaches to longitudinal bridges.
- Barriers on embankments where noise barriers are proposed.
- Safety barriers on bridges / parapets for pedestrians and cyclists.

Line marking and signposting

Line marking would be in accordance with RTA standards and would feature painted lines and reflective pavement markers. Additional delineation would also be provided by way of standard reflectors on safety barriers.

A directional signposting scheme for the Proposal would be prepared during the detailed design phase. This would emphasise both sub-regional and regional destinations in accordance with RTA standards and would include information for motorists about key facilities and attractions north of Coffs Harbour. In this regard, Coffs Harbour City Council and tourist authorities would be consulted on the proposed signposting scheme.

The need for other road signposting would also be determined during the detailed design phase and would comply with current RTA practices and standards. These would be applicable to highway facilities such as emergency access points, highway crossovers and u-turn facilities, as well as speed zoning. Other signposting would be geographic in nature, with major creeks and cross roads identified, including places of special interest.

Discussions would also be held with Coffs Harbour City Council regarding signposting requirements for the local access road network, particularly in relation to local destinations, side roads, and provision of signs for bus, pedestrian and cyclist facilities.

Headlight screens

A number of headlight screens are proposed where traffic on the local access road has the potential to cause headlight glare to either highway carriageway, or vice versa. The potential for highway or local access road motorists to experience headlights on their left hand side from the adjoining carriageway has been considered in the context of:

- The separation of the different traffic streams.
- The ability to maintain existing vegetation or provide new vegetation between the conflicting carriageways.

Headlight screens have been deemed particularly necessary where the nominal separation (12 metres) between the proposed dual carriageways and the parallel local service road is reduced because of the provision of intersections and / or bus bays on the local access road. At these locations headlight sight screens are proposed to minimise potential driver confusion and therefore improve safety for both local and through traffic.

Headlight screens are proposed on:

- The western side of the existing highway through Sapphire from the proposed eastern access road intersection near Nautilus Resort through to north of Headlands Road.
- The eastern side of the proposed local access road at Sugarmill Road and Wakelands Road.
- The eastern side of the proposed local access road at Bucca Road.
- The western side of the proposed local access road across the frontage of the existing service station at Emerald Beach.
- The eastern side of the proposed southbound carriageway at Arrawarra Creek.

Headlight screens would comply with RTA requirements relating to the lifespan of the structures. They would be painted in an appropriate colour to blend the barrier into the background. Where practical, low screen planting would also be utilised to blend the headlight screen with the roadscape.

Fencing

As a controlled access road the proposed highway road reserve would be fenced on both sides in a manner consistent with adjoining land uses to prevent unauthorised pedestrian access and inadvertent intrusion by fauna. The Proposal passes through various land use types and a variety of fence types would be installed as follows:

- Barrier type fencing in areas where high pedestrian activity in adjacent areas could generate inappropriate and unsafe pedestrian traffic on the highway.
- Rural or general motorway type fencing adjacent to areas of agricultural production or cleared land.
- Floppy top fauna exclusion fencing to prevent random access of fauna onto the roadway and direct fauna to the fauna underpasses provided as part of the Proposal. The exclusion fencing would be provided where the Proposal crosses fauna corridors and /or passes through heavily vegetated natural habitat, such as the Wedding Bells State Forest (refer Section 17.3.3).

In some locations it would be necessary to provide separation between the highway and the local access road. Examples include localised reductions in the separation distance between local service roads and the dual carriageways, such as at bus bays. In the majority of these instances headlight screens are proposed, which would also act as a physical barrier, separating the local service road and the dual carriageway highway.

7.5.6 Provision for fauna movement

While fauna friendly culverts would be installed where possible at watercourse crossings (see Table 7.5) to provide for both drainage and fauna movement, the Proposal also includes dedicated fauna movement structures that have been positioned in known fauna movement corridors, where a drainage structure is not necessarily required. The fauna movement structures (including combined drainage / fauna friendly structures and dedicated fauna movement locations) are identified in detail in Chapter 17.

Dedicated fauna movements would occur mostly within the bypass section of the Proposal where the alignment traverses Wedding Bells State Forest. These structures would be provided at approximately every 500 metres along the alignment within Wedding Bells State Forest (indicative chainages 29.000 kilometres, 29.500 kilometres, 29.920 kilometres and 30.400 kilometres). In order to encourage the use of these fauna movement structures, fauna exclusion fencing would be erected along the majority of the alignment where it is bordered by native vegetation (where vegetation bordering the highway is 200 metres by 200 metres or greater) to direct fauna movement to appropriate crossing points. Where possible, culverts used would be not less than 2.4 metres x 2.4 metres.

Fauna underpass structures may include the following features:

- Rocks / logs / tree branches may be placed strategically to provide cover for small animals, while ensuring clear views through culverts are maintained.
- Fauna refuge poles may be provided around selected underpasses.
- Fauna exclusion fences would be extended a minimum distance of 200 metres from the entry.
- Native grasses, trees and shrubs would be planted and the area would be mulched with hardwood mulch.
- Tree planting would favour species likely to use the underpass.

For bridge structures, tree and shrub vegetation would continue to the edge of the bridge to afford protection to the animals that may use the riparian habitats. The ground layer would be covered

with a variety of materials (consistent with the local habitat) to provide cover for animals going under the bridges. This could include rocks, logs and mulches as appropriate to the location.

Purpose-designed structures to facilitate glider crossing are proposed through the Wedding Bells State Forest section. These structures facilitate glider movement in locations where the existing gap between the canopy of trees is greater than 60 metres. Glider crossings would incorporate suitably high poles erected in the median or rope structures across the highway.

The location and design of the facilities for fauna movement would be refined during the detailed design of the project.

TABLE 7.5 PROPOSED FAUNA PASSAGE / UNDERPASS FACILITIES

APPROXIMATE CHAINAGE	DESCRIPTION	TYPE OF FACILITY [1]
9.250 km		Small drainage culvert, incidental fauna passage with no additional fauna measures.
10.400 km		Small drainage culvert, incidental fauna passage with no additional fauna measures.
11.500 km	South of Maccues Road	Additional 2400 mm x 2400 mm box culvert for dedicated fauna passage adjacent and higher than, existing major culvert.
12.600 km	Cunninghams Creek	Bridge over Cunninghams Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.
14.200 km	Skinners Creek	Bridge over Skinners Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.
15.660 km	5 cell 2400 mm x 1800 mm box culvert	Potential combined fauna and drainage culvert.
17.100 km to 17.500 km	Moonee Creek floodplain	Large pipe culverts (up to 1800 mm diameter), incidental fauna passage with no additional fauna measures.
17.725 km	Moonee Creek	Extension of existing box culverts (2 Cell 2400 mm x 1800 mm), combined fauna and drainage culvert.
19.600 km to 20.300 km	Sandy Beach floodplain	Numerous box culverts, incidental fauna passage with no additional fauna measures (up to 2440 mm × 1220 mm box culverts).
21.850 km	Double Crossing Creek	Bridges over Double Crossing Creek, incidental fauna passage with no additional fauna measures.
24.960 km	2 cell 2400 mm x 2400 mm box culvert	Combined fauna and drainage culvert.
25.450 km	Woolgoolga Creek	Bridge over Woolgoolga Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.
26.780 km	Poundyard Creek	Large arch structure over Poundyard Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.
29.000 km		Dedicated fauna structure 3050 mm x 3050 mm adjacent to box culverts.
29.380 km		Dedicated fauna structure 3050 mm x 3050 mm.
29.930 km		Dedicated fauna structure 3050 mm x 3050 mm adjacent to box culverts.
30.400 km	Little Arrawarra Creek	Dedicated fauna structure 3050 mm x 3050 mm adjacent to box culverts.
31.100 km	Arrawarra Creek	Bridge over Arrawarra Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.

[1] Fauna passage / underpass facilities would be further refined during the detailed design of the project and may vary from that nominated in the table.

7.5.7 Pedestrian and cyclist facilities

Coffs Harbour City Council is considering proposals for a North Coast cycleway facility along the northern beaches. The Proposal would provide pedestrian and cycle facilities on key overbridges across the proposed highway that would be consistent with this strategy. Provision for pedestrian and cyclist facilities has been included at the following bridges locations:

- Headland Road overbridge.
- Gaudrons Road / Split Solitary Road interchange.
- Moonee Beach Road interchange.
- Hoys Road bridge over Cunninghams Creek.
- Smiths Road overpass.
- Local access road bridge over Skinners Creek.
- Killara Avenue overpass.
- Graham Drive South overpass.
- Diamond Head Road overpass.
- South Woolgoolga interchange.

Pedestrians and cyclists would be able to use the shoulder of the lower speed, lower traffic volume, local access road to access the residential areas, schools and other facilities along the northern beaches area. Ultimately, further development of regional cycleway links would see dedicated shared pedestrian and cycle paths linking the facilities on the bridges that are part of the Proposal. The location and design of pedestrian and cyclist facilities would be refined during the detailed design of the project.

7.5.8 Bus stop arrangements

The existing Pacific Highway is currently used for a number of bus routes, including school bus travel. Currently, buses are required to stop along the highway to either pick up or set down passengers, with no bus bays or bus shelters for passengers. An informal school bus facility is currently operating at the Bucca Road intersection with a large area beside the road used for transfer of passengers between buses for northbound and southbound travel. Subject to the continued use of the informal facility at Bucca Road intersection, the Proposal would ensure the existing school bus connections and transfers at this location are maintained on the new local access road.

The Proposal would see local and school buses utilise the local access road network for north south travel and a number of bus bays are proposed along the local road network. This would reduce the exposure of school children and other bus patrons, waiting for a bus unprotected on the side of the highway. In this regard, the proposed local access road network would increase road safety at and near bus stop sites.

The location and design of the bus stop facilities would be refined during the detailed design of the project.

Although not part of the Proposal, an opportunity to provide further bus safety and school route enhancements by way of a connection between the Heritage Park and Avocado Heights rural residential estates (between Moonee Beach and Emerald Beach) has been identified. A short (200 metre) connecting road between these residential areas would allow for a school bus route within the estates and eliminate the need for bus patrons (including school children) to access the bus at the highway.

7.5.9 Noise management

A noise and vibration assessment has been undertaken and is discussed in Chapter 11. This section describes features of the Proposal that would be introduced to manage the noise issues identified in the noise and vibration assessment.

A multi-layered approach to the management of road traffic noise has been developed and is described as follows:

- Minimising grades to reduce engine and braking noise.
- Situating the Proposal as low as possible in the topography to maximise opportunities to utilise the terrain to provide acoustic shielding for receivers.
- Provide low noise pavement surfacing from Sapphire in the south to a point 700 metres north of Bark Hut Road on the Woolgoolga bypass section.
- Provide noise barriers adjacent to the proposed highway alignment to attenuate noise at locations with clustered receivers where the noise modelling has identified relevant criteria would be exceeded and where the proposed barriers would meet relevant RTA cost effectiveness criteria.
- Provision of architectural or 'on property' noise reduction treatments for individual receivers (subject to discussions between the RTA and individual property owners) where noise criteria would be exceeded, with or without the introduction of a noise barrier.

Noise Barriers

In considering urban and landscape design issues, a noise barrier of up to four metres (above pavement level) could be built with what are considered acceptable visual impacts. Community consultation would be undertaken during the detailed design phase of the project with regard to noise mitigation, including community input into noise barrier design. Where noise modelling has indicated a requirement for a barrier height of greater than four metres, a cost benefit assessment has been carried out to determine a suitable height.

Assessment of future road traffic noise (inclusive of sensitivity analysis for higher traffic speeds) was undertaken based on the proposed design inclusive of the assumed low noise pavement. Based on the results of the noise modelling undertaken, the location and proposed height of noise barriers that form part of the Proposal are detailed in Table 7.6 and illustrated in Figures 7.2a to 7.2m.

TABLE 7.6 PROPOSED LOCATION AND HEIGHT OF NOISE BARRIERS

LOCATION AND APPROXIMATE CHAINAGE [1]	NOISE CATCH-MENT AREA (NCA)	BARRIER / EFFECTIVE TYPE / NOMINAL HEIGHT [1]	COMMENTS
Sapphire (heights are measured "above level of access road")			
6.915 km-7.225 km	NCA 21	Noise barrier – height to 3.5 m	Eastern edge of southbound carriageway
7.400 km-7.605 km	NCA 1	Noise barrier – height to 3 m	Western edge of northbound carriageway
7.395 km-9.125 km	NCA 21	Combined noise barrier / headlight screen – height 2.5 m to 3.5 m	Western edge of local access road
Sandy Beach (heights are measured "above level of highway")			
20.300 km-20.620 km	NCA 6	Noise barrier – height to 4 m	Western edge of northbound carriageway
20.420 km-20.680 km	NCA 15	Noise barrier – height to 4 m	Eastern edge of southbound carriageway
20.740 km-20.970 km	NCA 6	Noise barrier – height to 4 m	Western edge of northbound carriageway
20.750 km-20.970 km	NCA 15	Noise barrier – height to 4 m	Eastern edge of southbound carriageway
Woolgoolga bypass (heights are measured "above level of highway")			
24.490 km-24.655 km	NCA 8	Noise barrier – height to 3.5 m	Western edge of northbound carriageway
24.785 km-25.030 km	NCA 8	Noise barrier – height to 3.5 m	Western edge of northbound carriageway
25.105 km-25.400 km	NCA 8	Noise barrier – height to 4 m	Western edge of northbound carriageway
26.300 km-26.585 km	NCA 11	Noise barrier – height to 3 m	Eastern edge of southbound carriageway
26.600 km-27.065 km	NCA 11	Noise barrier – height to 3 m	Eastern edge of southbound carriageway
27.205 km-27.430 km	NCA 11	Noise barrier – height to 4 m	Eastern edge of southbound carriageway
27.430 km-27.575 km	NCA 11	Noise barrier – height to 2.5 m	Eastern edge of southbound carriageway

[1] Noise barrier heights and location would be further refined during the detailed design of the project and may vary from that nominated in the table.

In addition to the noise barriers identified in Table 7.6, noise mounding and / or barriers are also proposed as part of the landscape treatment at the vehicle rest area to the east of the Arrawarra interchange. A description of the proposed vehicle rest area is provided in Section 7.5.11. Noise mounding and / or barriers would be required to manage noise associated with operation of the rest area, which would be used by both light and heavy vehicles. The potential noise impacts associated with the rest area are addressed in Chapter 11.

To appropriately manage noise impacts, noise mounding to 3.5 metres in height would be required the following locations:

- Adjacent and to the east of the truck parking area (to the west of the local access road to Arrawarra Beach).
- At the northern extent of the rest area for the length of the vehicle access road to the rest area for southbound highway traffic. The mounding would be located to the north of the access road.

The location, design and height of the noise mitigation measures would be refined during the detailed design phase of the proposed project.

Architectural noise reduction treatments

The provision of architectural or 'on property' noise reduction treatments for individual receivers where noise criteria would be exceeded, has been identified as part of modelling undertaken for the operational noise assessment. Architectural treatments that form part of the Proposal are identified in Table 7.7. Further noise assessment undertaken during the detailed design phase of the project may result in changes to the number of architectural noise reduction treatments identified.

TABLE 7.7 PROPOSED ARCHITECTURAL (ON PROPERTY) NOISE REDUCTION TREATMENTS

APPROXIMATE CHAINAGE	NOISE CATCH-MENT AREA (NCA)	RESIDENCES AT WHICH TREATMENT IS PROPOSED [1]	COMMENTS
Sapphire			
6.915 km-9.125 km	NCA 21	4 residences in addition to proposed noise barrier / headlight screen identified in Table 7.6.	To the east of the southbound carriageway.
7.400 km-7.605 km	NCA 1	6 residences in addition to proposed noise barrier identified in Table 7.6.	To the west of the northbound carriageway.
10.100 km-10.400 km	NCA 20	4 residences (no barrier proposed at this location).	To the east of the southbound carriageway.
Moonee Beach			
11.800 km	NCA 20	1 residence (no barrier proposed at this location).	To the east of the southbound carriageway.
Hoys Road			
12.600 km	NCA 3	1 residence (no barrier proposed at this location).	To the west of the northbound carriageway.
Tiki Road			
14.500 km	NCA 18	1 residence (no barrier proposed at this location).	To the east of the southbound carriageway.
Killara Avenue to Smiths Road			
15.300 km-16.500 km	NCA 4	3 residences (no barrier proposed at this location).	To the west of the northbound carriageway.
Emerald Beach			
17.600 km-18.300 km	NCA 5	3 residences (no barrier proposed at this location).	To the west of the northbound carriageway.
18.000 km	NCA 16	1 residence (no barrier proposed at this location).	To the east of the southbound carriageway. Fiddaman Road area.

APPROXIMATE CHAINAGE	NOISE CATCH-MENT AREA (NCA)	RESIDENCES AT WHICH TREATMENT IS PROPOSED [1]	COMMENTS
Sandy Beach			
20.300 km-21.000 km	NCA 6	4 residences in addition to proposed noise barrier identified in Table 7.6.	To the west of the northbound carriageway.
20.420 km-20.970 km	NCA 15	5 residences in addition to proposed noise barrier identified in Table 7.6.	To the east of the southbound carriageway.
Woolgoolga bypass			
23.300 km-24.000 km	NCA 13	3 residences (no barrier proposed at this location).	To the east of the southbound carriageway.
23.800 km-25.400 km	NCA 8	3 residences in addition to proposed noise barrier identified in Table 7.6.	To the west of the northbound carriageway.
24.400 km-24.800 km	NCA 12	3 residences (no barrier proposed at this location).	To the east of the southbound carriageway.
26.100 km-27.575 km	NCA 11	3 residences (no barrier proposed at this location).	To the east of the southbound carriageway.
27.500 km-27.900 km	NCA 9	4 residences (no barrier proposed at this location).	To the west of the northbound carriageway. Bark Hut Road area.
Woolgoolga			
Existing Pacific Highway	NCA 23	6 residences.	Although predicted noise levels would drop by between 5 dBA and 10 dBA along the existing Pacific Highway at Woolgoolga, Safety Beach and Mullaway, 6 residences would still experience noise level above guideline. The need to implement architectural treatments for residences in Woolgoolga would be assessed between six months and one year after opening of the project.

[1] The number of houses requiring architectural treatment would be further refined during the detailed design of the project and may vary from that nominated in the table.

In 2003 the NSW Government commissioned the Northern Pacific Highway Noise Taskforce to investigate and assist in the identification of road traffic noise issues along the northern part of the Pacific Highway from Coffs Harbour to the Queensland border. As a result of these taskforce investigations, the RTA commissioned acoustic consultants to undertake noise studies in affected areas - including at the southern end of the Proposal. From those studies a number of residences at Sapphire were identified for architectural treatments. No additional architectural treatment is proposed for residences previously treated as a result of the noise taskforce investigations.

7.5.10 Urban design including landscape elements

Landscape and urban design objectives and principles

The *Pacific Highway Urban Design Framework* (RTA 2005) sets a vision for the Pacific Highway as follows:

The upgrade should be a sweeping, green highway providing panoramic views to the Great Dividing Range and the forests, farmlands and coastline of the Pacific Ocean; sensitively designed to fit into the landscape and be unobtrusive; and characterised by simple and refined road infrastructure.

This is broken down into the following key objectives:

- Provide a flowing road alignment that is responsive and integrated with the landscape.
- Provide a well vegetated, natural road reserve.
- Provide an enjoyable, interesting highway.

- Value the communities and towns along the road.
- Provide consistency-with-variety in road elements.
- Provide a simplified and unobtrusive road design.

In addition to consideration of the overall Pacific Highway urban design objectives, the following objectives were developed specifically for the Proposal:

- Design the upgraded highway to integrate with immediate context.
- Design for safe, yet convenient, connections to local roads and access to adjacent properties.
- Ensure and enhance visual connections to significant landscape features.
- Integrate the new highway landforms and landscape with adjoining lands where appropriate.
- Provide a positive contribution to the landscape.
- Ensure a safe driving environment.
- Create a quality driving experience that reflects the significance of this motoring route.
- Provide cost effective solutions.

The following descriptors have been used to describe the existing visual environment within the study area:

- Landform – the landform types within the study area (coastal flats, coastal footslopes and upper ranges and valleys) contribute to the visual and scenic character of the landscape and determine the visual catchments of the study area.
- Scenic quality – is a measure of visual variety and interest. The amount and type of landscape character units available within any visual catchment determine scenic quality.
- Landscape character units- are defined from a combination of landform type, vegetation type and land use.

As described in Chapter 19, these qualities determine the landscape and urban design approach taken for the Proposal, and ultimately the landscape plan and urban design features proposed as part of the Proposal.

Urban design elements

Emphasis has been placed on simple, low key unadorned elements which are described below.

Bridges

The Proposal includes 17 transverse bridge or bridge sized structures and 13 longitudinal structures over creeks. The following urban design elements would be applied to each of these structures:

- The bridge decking would be consistent and where possible, clear of any apparent miscellaneous services, pipes, ducts or protrusions. Where stormwater drainage is required, drainage pipes would be located unobtrusively.
- Bridge super structures and substructures would be finished in a "Class 2" concrete grey colour to minimise their obtrusiveness on the landscape.
- Traffic barrier rails would be a standard RTA metal twin rail and post traffic barrier mounted on a concrete upstand.
- Safety 'throw' screens on overpass bridges in accordance with RTA standards.
- Bridge abutments would generally be spill through in style and would be protected in the 'rain shadow' section under the bridge deck. Adjoining abutment areas would be revegetated with native tree, shrub and groundcover species. Abutments are generally shown with a grade of 2:1 vertical to horizontal but would be refined locally to suit the location of each bridge.
- Pedestrian railings on bridges where pedestrian and cycle access across the highway is provided. Pedestrians would be separated from traffic on the bridge via standard RTA barriers.

General approach to noise walls and headlight screens

Noise walls would be provided at locations identified in Table 7.6. Two wall types, urban walls and rural walls are proposed.

The urban wall would consist of panels and designed in a strong linear form, with consideration to its scale, proportion and form relative to the adjacent roadscape and urban areas. They would be plain and simple structures. Where noise walls are highly visible from the road or adjacent areas, wall pattern or texture would be considered to help create interest and reduce the scale of these elements.

The rural walls would consist of panels with all visible surfaces of panels and posts painted in a dark coloured finish such as 'charcoal grey'. Screen planting would be utilised to blend the barrier with the adjacent landscape and soften its visual impact. Wherever possible noise walls would be located away from the highway to minimise "tunnel effects" .

Headlight screens

Headlight screens, which are addressed in Section 7.5.5, would be provided along sections of the route where headlight glare needs to be screened between the highway and adjacent local access roads. Where a constructed physical barrier is not required, fast-growing frangible shrubs may perform a similar function. Headlight screens would conform with RTA requirements relating to the durability of the elements and depending on their location along the alignment, would be of a consistent form and type to either the urban noise wall or rural noise wall. Where practical, low screen planting would be utilised to blend the barrier with the roadscape and surrounding landscape character.

Retaining walls

Facing panels would cover some retaining structures and would be plain and simple. However where retaining walls are highly visible, consideration would be given to pattern or texturing of the structure to help create interest and reduce the scale of these elements, however, this is secondary to the overall form, proportion and colour of the wall.

Road furniture

As noted in Section 7.5.5, various types of road furniture would be required along the Proposal including signs, vehicular barriers, fencing and lighting. They would be designed to be apparent to the motorist but not obvious "features" in the landscape. The following would apply in the detailed design of the road furniture:

- Signs would be limited to those required for information and driving requirements only. Where functional requirements permit, the signs would be located in the least visually sensitive sites (ie. below skyline / against a treed background, etc.). RTA standard poles without embellishment would be used throughout.
- Vehicle barriers would comprise standard RTA wire rope, guardfence, concrete barrier and bridge safety rails. These would be made from aluminium and/or galvanised steel and concrete as appropriate to each element in its location.
- Safety barriers on bridges would have the lowest permitted parapets topped by bridge safety rails to maximise potential views.
- Fencing would mainly comprise standard post, wire and dropper stock proof fencing along the road reserve. Where fauna movements are to be controlled, floppy top fauna fencing would be provided. Where fauna fencing is close to the carriageway, it would be painted black to reduce visual impact in accordance with RTA guidelines.
- Lighting would be located at major access and interchange areas.

Landscape and urban design scheme – upgrade section

Sapphire – landscape design features

Through the Sapphire section the grade of the proposed dual carriageways would vary between approximately one and two metres below that of the existing highway, with the latter to form the new local access road. The local access road would be further visually separated from the new highway by the headlight screen and noise barriers proposed for this area (refer Figure 7.2a).

Screen planting would be used to screen the proposed noise walls and headlight screens from residences, local traffic and highway traffic.

Planting design for this section has been based on the existing woodland / forest character. Planting of batters on the western side of the highway would be designed to achieve integration with the natural landform and in order to minimize the visual impact of the Proposal. Design of this planting would need to take into account long distance views that, where available, would be retained across the highway to the ocean. Planting would occur as either massed plantings in prepared and mulched planting areas or as individual plantings in hydro mulched areas. Median planting would consist of frangible shrubs, grasses and groundcovers. In some areas of the median this planting would act as headlight screening between the two highway carriageways.

Distinctive marker planting would also be used at Sapphire, mindful of its near coastal setting. The design would draw upon the special elements of the area with an emphasis on the use of, for example, clumps of Norfolk Island Pines, which are already a distinctive feature of the local landscape. Planting would be located in accordance with road safety and sight distance requirements. Marker planting is currently proposed in several areas including south of Fernleigh Avenue, at Nautilus Resort, Sapphire Pines and near Headlands Road.

The proposed landscape design for the Sapphire section is illustrated in Figures 7.5a and 7.5b.

Construction of the Gaudrons Road / Split Solitary Road interchange would be done so as to retain significant existing vegetation directly north of the interchange between the new highway carriageways and on ramps and between the northbound on-ramp and the proposed service road on the western side. This would assist in the visual integration of the interchange in the existing landscape.

Sapphire – urban design features

The bridge crossing at Headlands Road would be treated in a manner consistent with that described in the urban design elements section above. A combined headlight screen and noise wall would be provided at Sapphire as identified in Table 7.6 and would be treated as described for urban walls.

The Gaudrons Road / Split Solitary Road interchange is raised above the level of both highway carriageways resulting in a prominent bridge crossing structure. This would be consistent with bridge elements for the Headlands Road bridge. Reinstatement of vegetation on embankments would assist, to an extent in blending the interchange into the surrounding landscape.

Between Gaudrons Road / Split Solitary Road interchange and Moonee Beach Road / Hoys Road interchange the highway is enclosed by tall coastal woodland. The reinstatement of adjacent planting to the highway embankments would be the primary management measure to minimise the presence that the widened highway corridor and service road would have on this landscape. Headlight screens would be required in two locations on the western side of the highway and screen planting would be used to integrate these elements into the highway and local access road landscapes (refer Figure 7.2b).

Moonee

The Moonee Beach Road / Hoys Road interchange is enclosed by tall coastal woodland and reinstatement of adjacent vegetation on embankments would assist, to an extent, in visually integrating the interchange into the surrounding landscape. A description of the Moonee Beach Road / Hoys Road interchange is provided in Section 7.4.3.

Proposed landscape treatments in this location would allow for the retention of significant existing tree planting directly north and south of the interchange between the highway and on ramps and between the western southbound off-ramp and local access road. This would allow the proposed

interchange to be more integrated with the existing woodland landscape at this location. The proposed landscape design for this area is illustrated in Figure 7.5c.

Moonee to Emerald

North of the Moonee Beach Road / Hoys Road interchange the enclosed woodland character of the road opens up to adjoining pastoral landscapes. These views would be retained using grassland and scattered tree planting to help maximise variety and interest for the road user. This generally occurs in low-lying landscapes which have a greater ability to absorb the visual robustness of the Proposal. At Bucca Road near Skinners Creek the highway passes the Orana East State Forest. Adjacent woodland vegetation would be reinstated to ensure the integration of the highway with the existing woodland landscape (refer Figure 7.5d).

At Killara Avenue a bridge over the highway connects to Tiki Road. Landscape design to the west of the highway would include reinstating woodland planting, while to the east views would be maintained and grassland / groundcover planting utilised. This strategy is employed in a variety of locations heading north towards Emerald interchange. The proposed landscape design for between Moonee to Emerald is illustrated in Figures 7.5d to 7.5f.

Emerald Beach

A description of the Fiddaman Road / Graham Drive South interchange is provided in Section 7.4.3. On the eastern side of the highway, screen planting would be introduced to soften the presence of the local access road, while west of the highway woodland planting would be reinstated. Existing vegetation would be retained in the centre of the loop off ramp and woodland planting established with consideration for sightlines. A headlight screen proposed to the north of the Fiddaman Road intersection and to the east of the highway would be screened with vegetation to reduce its visibility in the landscape. The proposed landscape design for the Emerald interchange area is illustrated in Figure 7.5f.

Emerald Beach to South Woolgoolga (including Sandy Beach)

From Graham Drive South, the highway traverses a coastal wetland vegetation community that includes stands of Casuarina and Melaleuca species. The terrain is relatively flat and the reinstatement of the adjacent landscape vegetation would be an appropriate landscape design response to mitigate the visual impact of the highway at this location.

At Sandy Beach, the highway drops below the level of adjacent residential development and passes under the new Diamond Head Road overbridge. Urban noise walls would be required on both sides of the highway, north and south of the bridge. These walls would be suitable to their location in an urban area and screen planting would help integrate them with the landscape.

North of Sandy Beach, grassland planting to highway embankments would help maintain views over the surrounding relatively flat landscape, enhancing the variety of visual experiences for road users. The proposed landscape design for this location is illustrated in Figures 7.5g and 7.5h.

Landscape and urban design scheme – bypass section

South Woolgoolga

The south Woolgoolga interchange at Graham Drive North / Hearnes Lake Road would introduce a large overbridge structure that would be a dominant feature of the landscape. Extensive woodland planting would be introduced at road verges and on embankments. The commencement of the local access road to Woolgoolga would be highlighted with marker planting that would suitably introduce the road user to the township and could include Norfolk Island Pines or Jacaranda species.

Existing vegetation would be retained between the highway and interchange structures and local access roads where possible to retain the woodland character adjacent to the highway. Roadside planting would also be completed in such a way that views south west to the foot slopes and ranges would be retained. The proposed landscape design for this location is illustrated in Figure 7.5i.

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Refer Figures 7.5a to 7.5f

West Woolgoolga

This section of the bypass has substantial cuttings as the highway traverses the foot slopes inland from Woolgoolga. Between chainages 22.500 kilometres to 25.000 kilometres and 29.000 kilometres to 30.500 kilometres, the carriageway would be at varied vertical elevations in order to minimise the extent of cut and fill batters. The grade of batters would be in the order of 2:1 horizontal to vertical to allow for the establishment of vegetation on these batters, which in time would screen the cuttings and integrate the highway into the landscape.

A variety of landscape treatments are proposed. In woodland / forest areas a woodland planting mix would be applied, while in agricultural and plantation areas, a grassland mix would be provided with scattered trees in order to maintain visual connectivity to these land uses. These treatments would be employed in a way that maximises enjoyment of the route and the variety of experience while minimising visual impacts.

A number of bridges or bridge sized structures are proposed to pass under or over the highway in this section. These structures would be visible both from the highway itself and from adjacent lands. The architectural treatment of these structures would be in accordance with the urban design element principles described above, and would help create appealing built form in the landscape. The proposed landscape design for this location is illustrated in Figures 7.5j to 7.5l.

Arrawarra

The Arrawarra interchange would be set within the landscape to minimise the visual obtrusiveness of the structures. The low lying woodland at this location would provide a visual buffer between the interchange and rest area and the surrounding areas. The scale of the interchange is considerable and it would have a strong visual presence once constructed. Reinstatement of the adjacent woodland landscape would be the primary approach taken to soften the presence of the interchange within the low lying woodland landscape. The proposed landscape design for this location is illustrated in Figure 7.5m.

The proposed rest area at the Arrawarra interchange (refer Section 7.5.11) would also have a considerable visual presence, although strategic planting of the perimeter and at locations within the rest area with suitable woodland plant species would assist in reducing the visual presence of the rest area. Consideration of the provision of amenities and shade would be important during detailed design to ensure the rest area provides a comfortable facility for users.

Artist impressions of the Proposal, including the proposed urban and landscape design elements are provided as Figures 7.6a to 7.6f and have been developed based on the concept design.

As with other aspects of the design of the Proposal, the urban design and landscaping would be refined during the detailed design stage.

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7.5.11 Vehicle rest area

In the *Pacific Highway Safety Review 2004* (RTA 2004), a strategic plan for rest areas on the Pacific Highway recognised that additional areas need to be developed in the Coffs Harbour / Woolgoolga area. There are currently no truck or light vehicle rest areas along the existing highway from Sapphire to Woolgoolga. The two closest truck rest areas are situated 50 kilometres north of Coffs Harbour at Halfway Creek (northbound traffic) and 30 kilometres south of Grafton at Halfway Creek (southbound traffic). The two closest light vehicle rest areas are situated 16 kilometres south of Coffs Harbour at Sid Bourke Forest Park or 70 kilometres north of Coffs Harbour at Glenugie. There is one driver reviver facility along the subject section of the highway at Apex Park, Woolgoolga. However, this facility only operates during peak holiday periods and opening times are subject to the availability of volunteers.

A new rest area facility is proposed as part of the Proposal on the eastern side of the proposed Arrawarra interchange. The rest area would cater for both light and heavy vehicles and would provide a place for drivers to stop while travelling on long journeys. Truck drivers would also be able to check their loads and complete log books. The rest area would assist in reducing incidents related to driver fatigue along the highway.

The rest area concept design has been developed to current RTA standards and guidelines and has been located adjacent to the proposed Arrawarra interchange to provide safe entry and departure movements to and from the highway and the local access road to Woolgoolga. The proposed layout of the rest area is illustrated in Figure 7.7.

7.5.12 Arrangements for emergency access

Access for emergency vehicles to the Proposal would be provided at the following locations:

- Sapphire interchange.
- Moonee Beach interchange.
- Emerald interchange.
- South Woolgoolga interchange.
- Dedicated emergency access immediately north of Newmans Road, accessing western side of northbound carriageway with crossover access to southbound carriageway.
- Arrawarra interchange.

Additional traffic management facilities included in the Proposal are:

- Break down bays at approximately 2.5 kilometre intervals or between interchanges.
- U-turn bays at approximately 2.5 kilometre intervals or between interchanges.
- Emergency carriageway cross-over points at approximately five kilometre intervals.

7.5.13 Ancillary facilities

The Proposal includes the land required for ancillary facilities and activities during the construction phase including construction compounds, asphalt and concrete batch plants and stockpile areas. Detailed consideration of ancillary facilities is provided in Chapter 8.

FIGURE 7.7 PROPOSED ARRAWARRA REST AREA

7.5.14 Utility adjustments

A number of utility and service relocations would be required as part of the Proposal. The utilities concerned include high and low voltage overhead and underground power lines, telecommunications (including optical fibre cables), network water mains, reuse water mains, sewer mains and rising sewer mains.

Many of these utilities would require protection or relocation, with the nature and extent of the work to be finalised in consultation with the utility authorities during the detailed design of the project. Potential utility relocations required as a result of Proposal design are summarised in Table 7.8.

TABLE 7.8 POTENTIAL PUBLIC UTILITY EFFECTS

UTILITY TYPE	POTENTIAL EFFECTS [1]
Sapphire to Moonee Beach	
Power	■ Impacts on lengths of above ground 11kV and low voltage power lines servicing Sapphire, Moonee Beach and larger properties west of the highway.
Water	■ Various effects on water mains supplying water for Sapphire, Moonee Beach and nearby properties.
Sewer	■ Impacts on approximately 240 metres of rising sewer main. ■ Several transverse crossings of gravity sewer mains.
Telecommunications	■ Various effects on local telecommunications lines servicing Sapphire, Moonee Beach and larger properties west of the highway. ■ Could require the protection and/or relocation of approximately 350 metres of the Sydney to Brisbane optical fibre link at Moonee Beach interchange eastern ramp embankments.
Moonee Beach to south Woolgoolga	
Power	■ Impacts on lengths of above ground 11kV and low voltage power lines servicing Emerald Beach, Sandy Beach and nearby properties. ■ Impacts on lengths of buried low voltage lines servicing street lighting.
Water	■ Impacts on approximately 1750 metres of existing water main, servicing Emerald Beach and Sandy Beach. ■ Impacts on approximately 2950 metres of reuse water main.
Sewer	■ Impacts on approximately 2495 metres of sewer rising main, including an overhead crossing at Diamond Head Road. ■ Impacts on one transverse crossing of a gravity sewer main.
Telecommunications	■ Various effects on local telecommunications lines servicing Emerald Beach, Sandy Beach and nearby properties. ■ Impacts on approximately 480 metres of the Sydney to Brisbane optical fibre link between Fiddaman Road and Graham Drive North, and additional fibre optic cables servicing Emerald Beach at Fiddaman Road and Sandy Beach at Diamond Head Drive overpass.
Woolgoolga bypass	
Power	■ Impacts on lengths of above ground 11kV and low voltage power lines servicing south Woolgoolga and properties along Greys Road, Woolgoolga Creek Road, Newmans Road and Bark Hut Road. ■ Impacts on lengths of buried low voltage lines servicing street lighting. ■ Conflicts with a 70 metre section of above ground 66kV power line crossing the highway south of Greys Road.
Water	■ Impacts on approximately 520 metres of existing water main, servicing Woolgoolga and properties along Bark Hut Road. ■ Impacts on approximately 720 metres of reuse water main.
Sewer	■ Impacts on approximately 475 metres of sewer rising main, including a crossing at Graham Drive North.
Telecommunications	■ Various effects on local telecommunications lines around Graham Drive North, Bark Hut Road and Arrawarra interchange. ■ Impacts on approximately 410 metres of the Sydney to Brisbane optical fibre link at the eastern embankments of the south Woolgoolga interchange and 525 metres at the Arrawarra Beach interchange.

[1] The requirements for adjustments to public utilities would be further refined during the detailed design of the project and may vary from that nominated in the table.

7.6 Property acquisition

The Proposal would occupy approximately 308 hectares of land. Of this area, approximately 46.4 per cent is situated within the current highway road reserve, while 21.8 per cent is comprised of either state forest land and areas owned by Coffs Harbour City Council and other government departments. Overall, 67.9 per cent of the highway is on land that is publicly owned (ie. RTA, Department of Primary Industry (Forests), Coffs Harbour City Council).

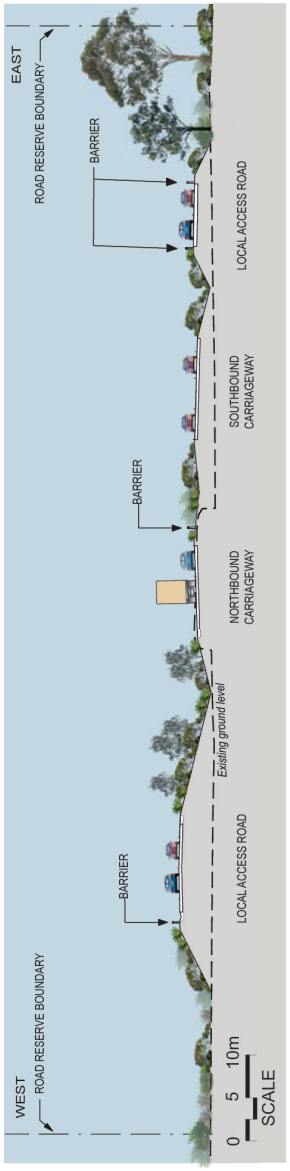
The Proposal would require the partial or total acquisition of 127 property lots (both private and public property). While most of these properties would be subject to partial acquisition, some would require total acquisition. Properties that would be directly affected by the Proposal are identified in the Land use, planning and socio-economic working paper (working paper 4, Appendix F). Any alterations to the design during the detailed design phase of the proposed project may also affect the extent of property acquisition required.

If a property is totally acquired, yet not all of the land is required as part of the Proposal, the excess would be processed through one of the options below:

- Sold at the completion of construction.
- Retained for future usage by the RTA.
- Transferred to council or another government agency.

All land acquisitions would be conducted in accordance with the RTA's *Land Acquisition Policy* (Appendix D) and compensation would be determined in accordance with the *Land Acquisition (Just Terms) Compensation Act 1991*. Acquisition of state forest land would be in accordance with provisions of the *Forestry Act 1916*.

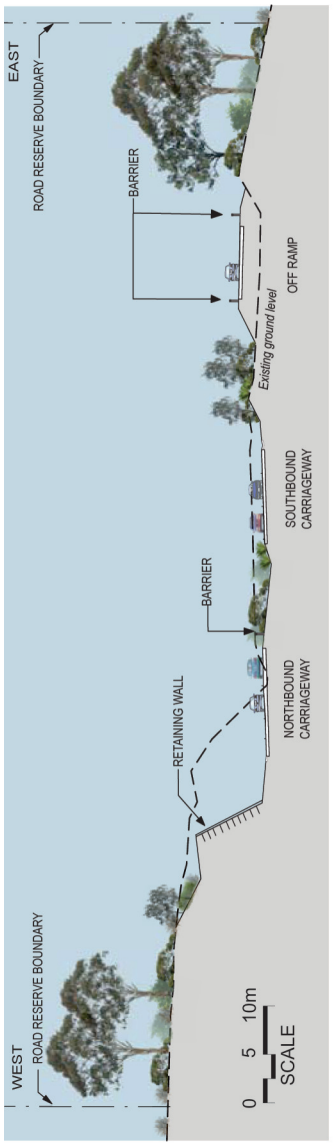
FIGURE 7.4b CROSS SECTIONS OF THE PROPOSAL



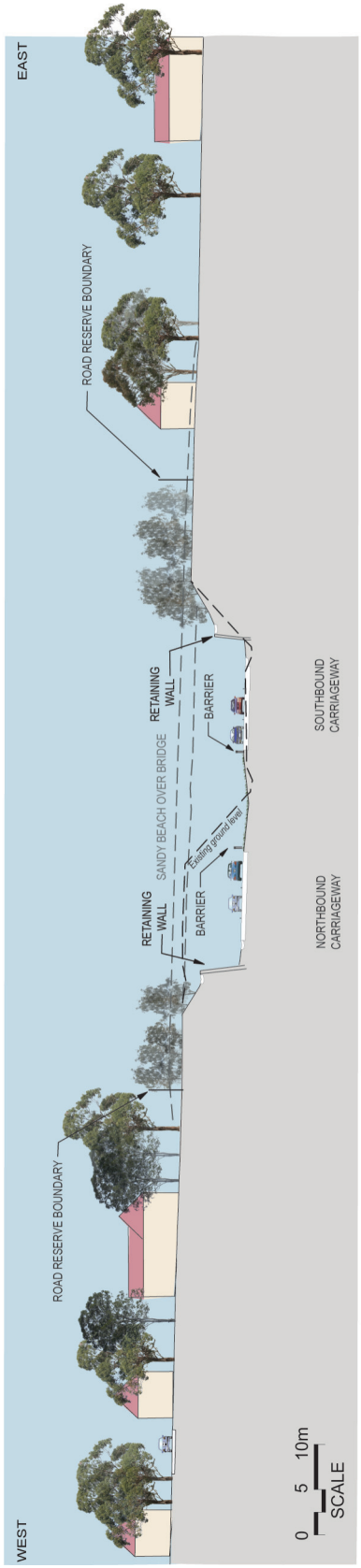
Typical Cross Section near Killara Avenue Looking North (Approximate Chainage 14600)

Typical Cross Section at Emerald Beach Service Station looking north (Approximate Chainage 18200)

FIGURE 7.4c CROSS SECTIONS OF THE PROPOSAL

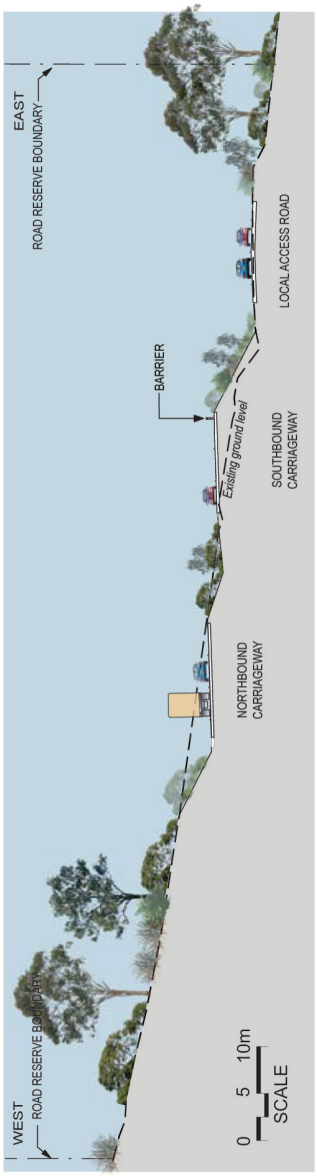


Typical Cross Section at Graham Drive South Looking North (Approximate Chainage 19300)



Typical Cross Section near Sandy Beach Overbridge Looking North (Approximate Chainage 20700)

FIGURE 7.4d CROSS SECTIONS OF THE PROPOSAL



Typical Cross Section north of Hearnes Lake Road Looking North (Approximate Chainage 22600)

FIGURE 7.4e CROSS SECTIONS OF THE PROPOSAL

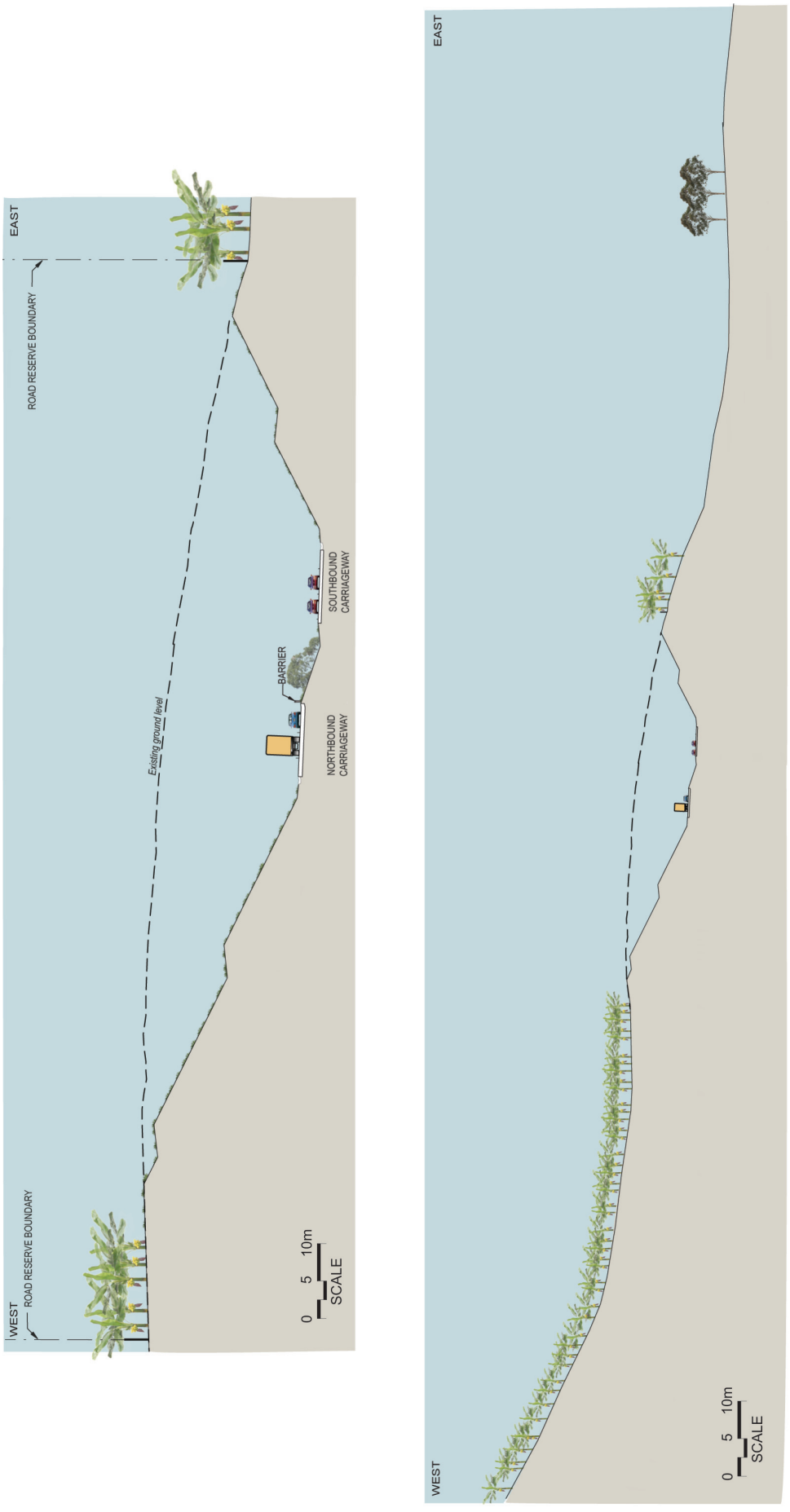


FIGURE 7.4f CROSS SECTIONS OF THE PROPOSAL

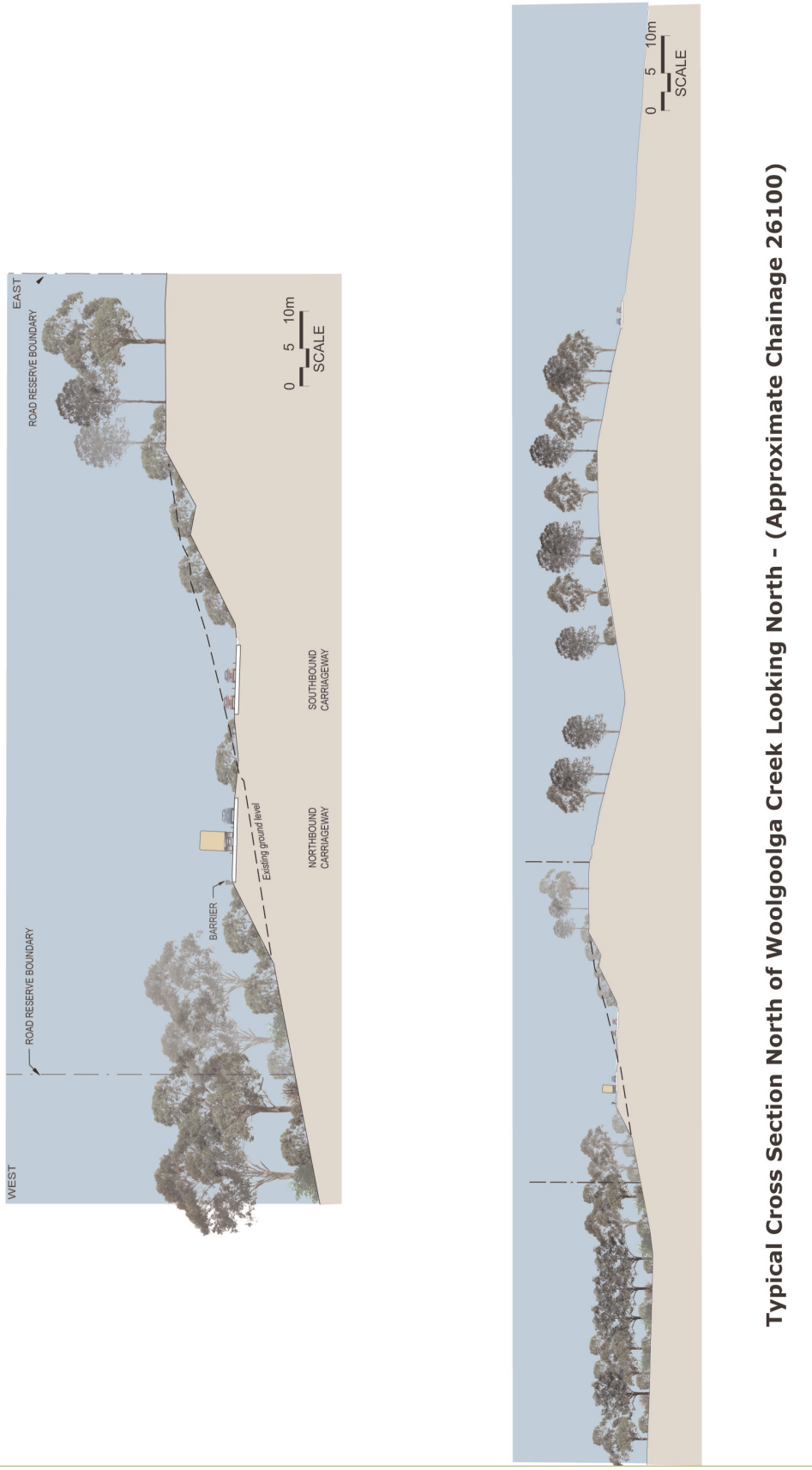
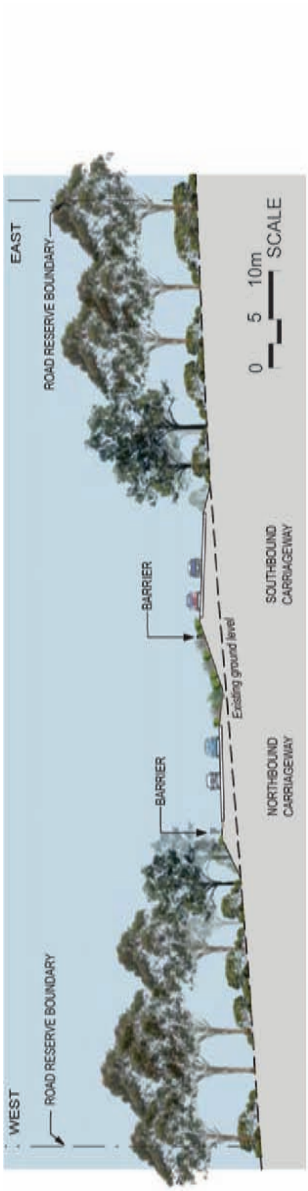
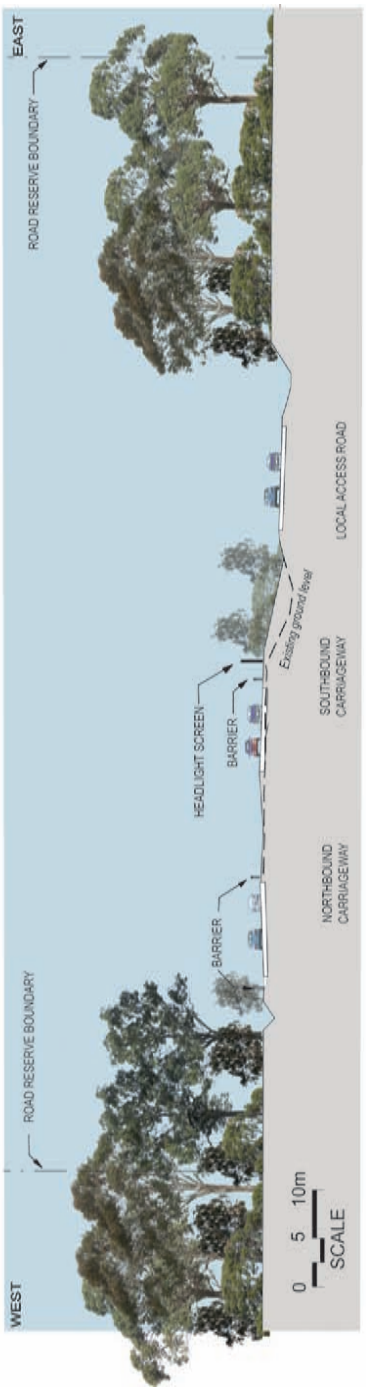


FIGURE 7.4g CROSS SECTIONS OF THE PROPOSAL

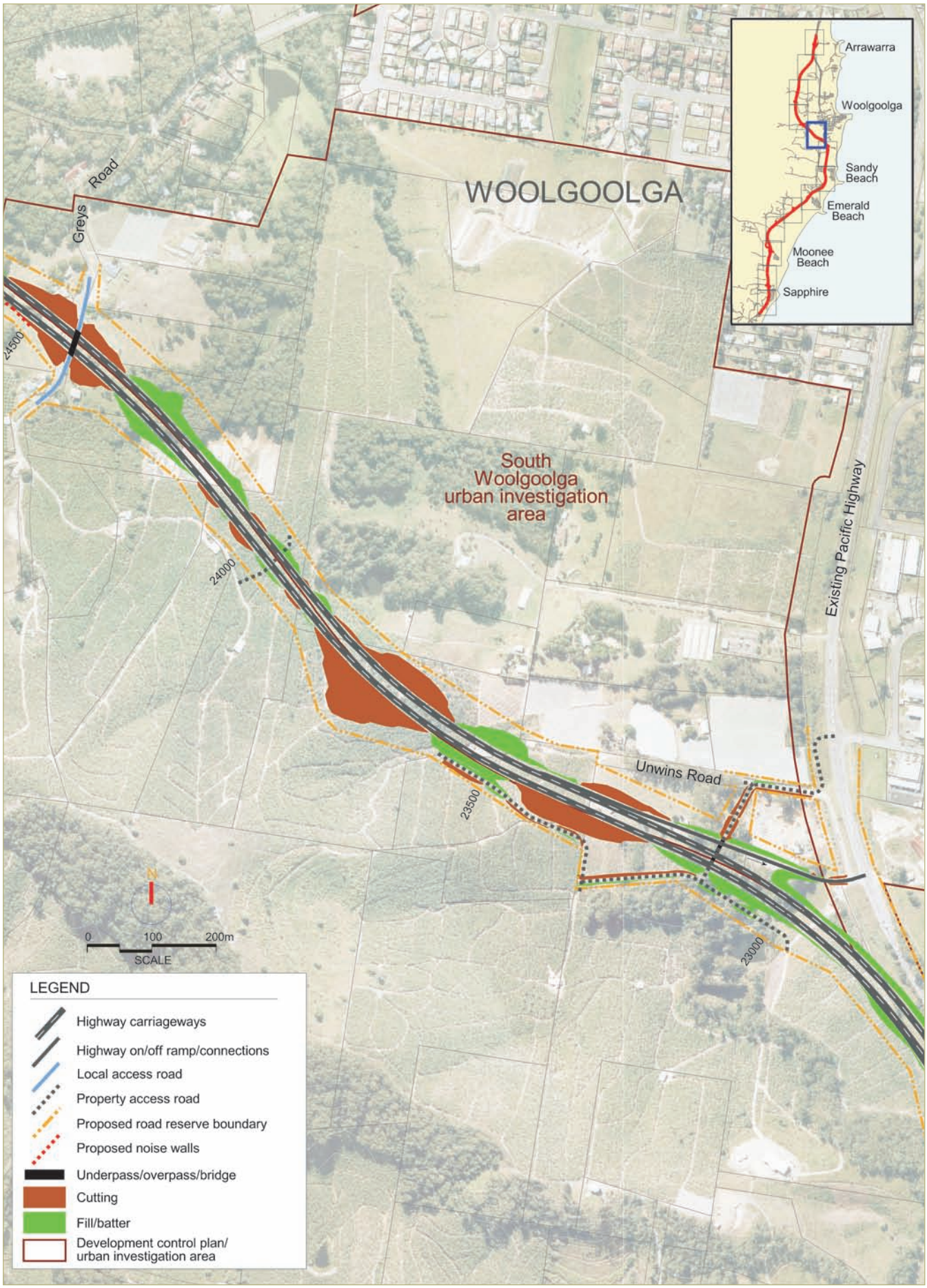


Typical Cross Section through Wedding Bells State Forest Looking North (Approximate Chainage 29800)



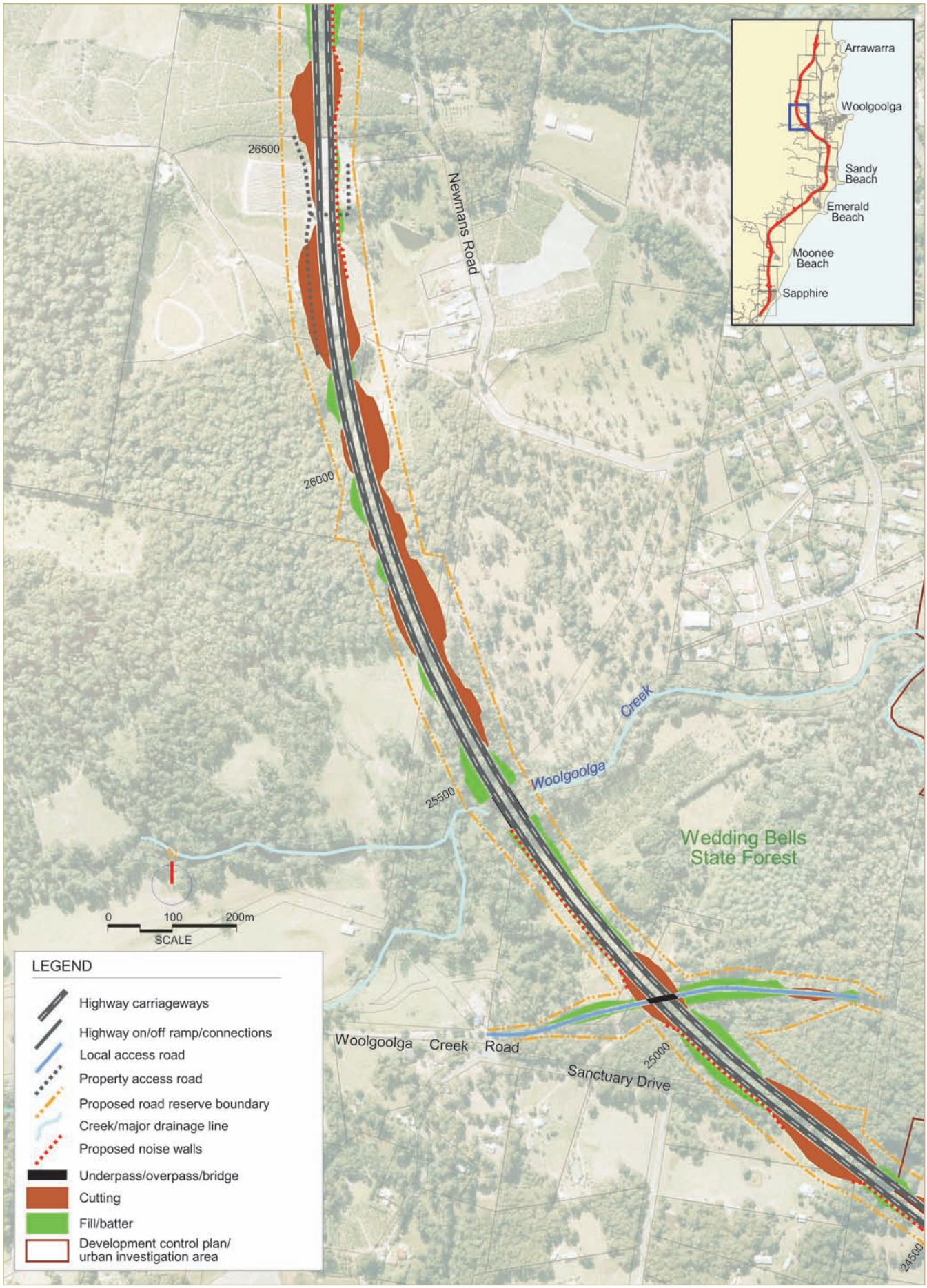
Typical Cross Section near Arrawarra Creek Looking North (Approximate Chainage 31000)

FIGURE 7.4h CROSS SECTIONS OF THE PROPOSAL



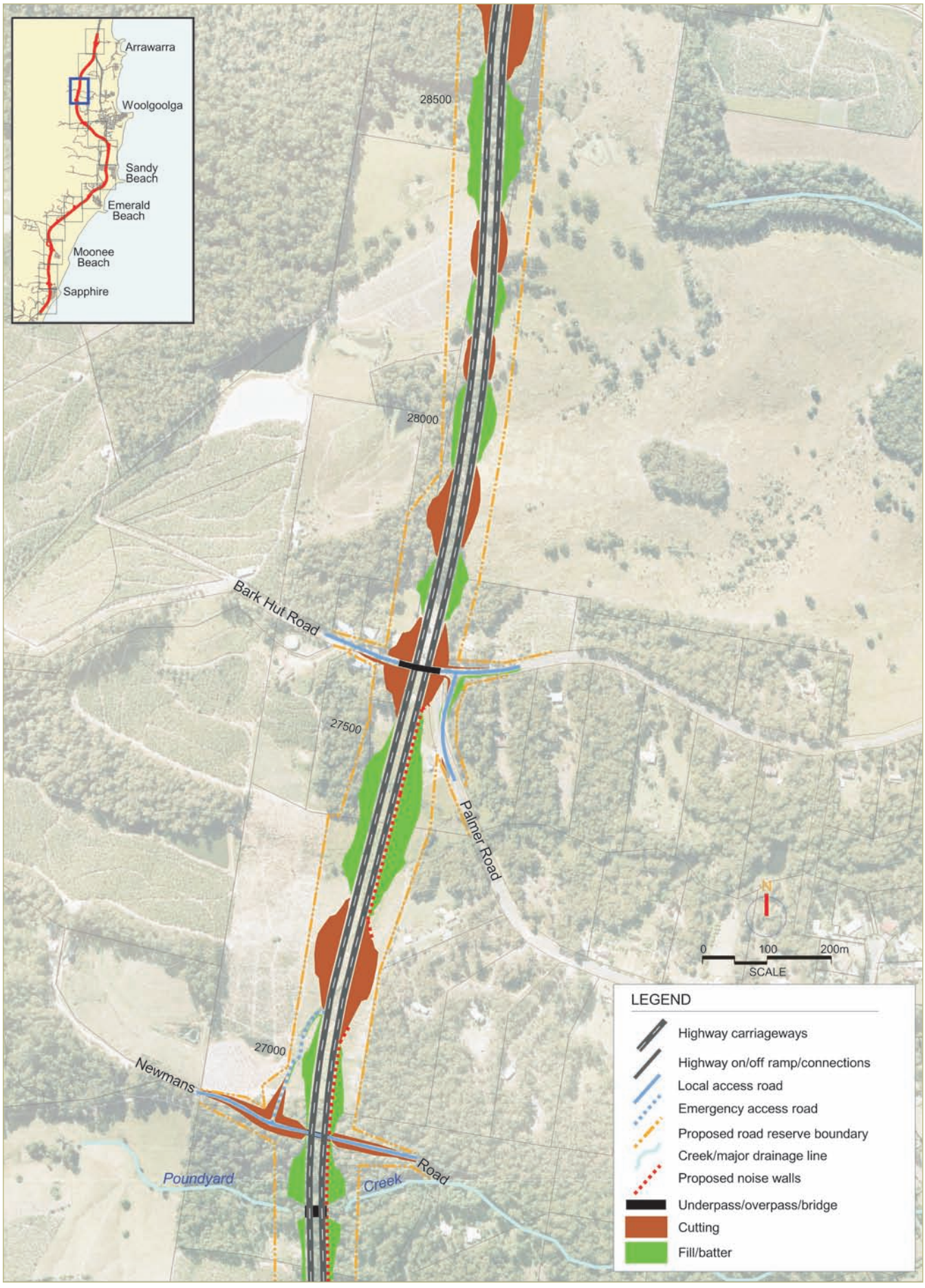
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2i PROPOSED DESIGN



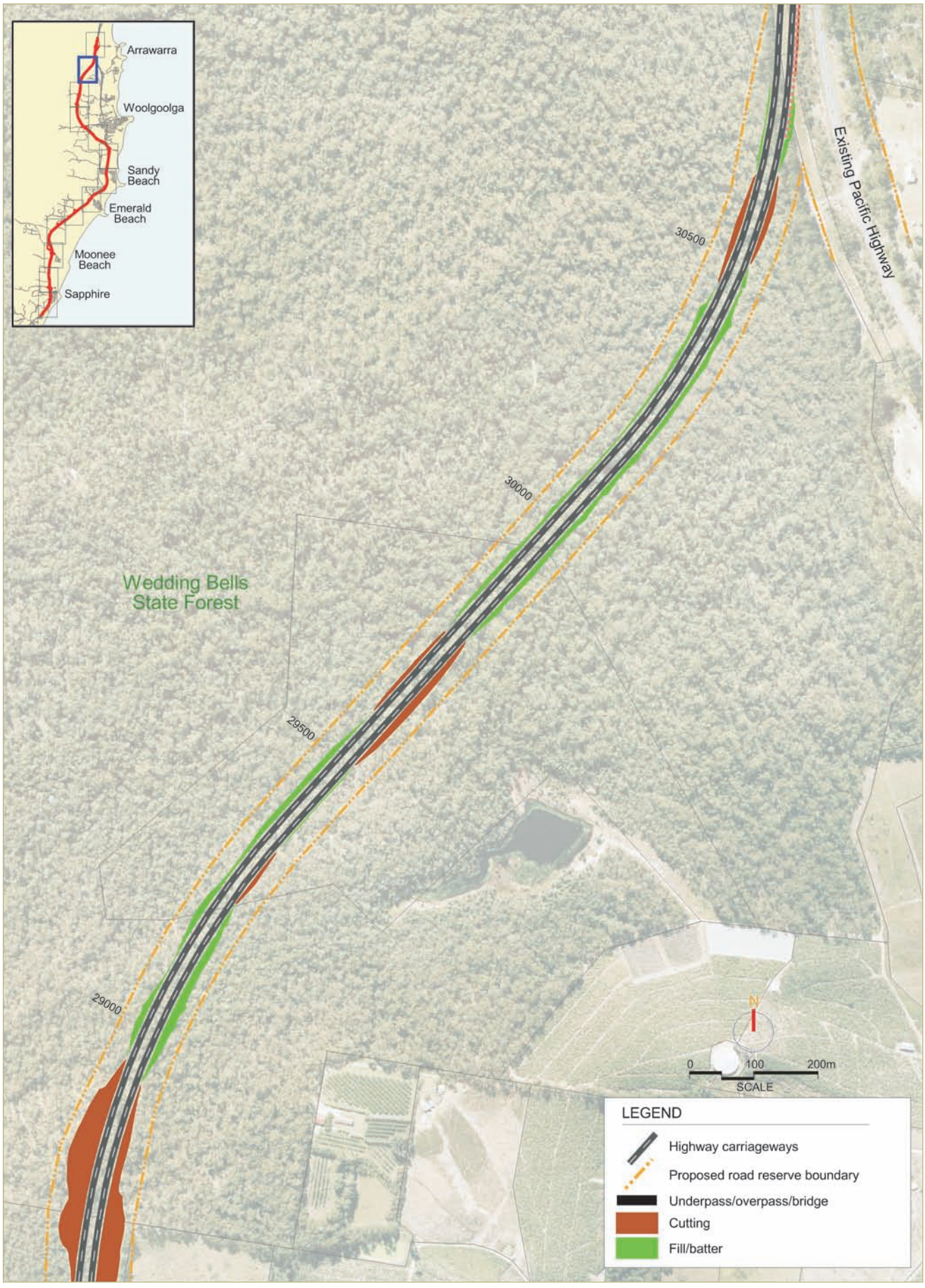
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2j PROPOSED DESIGN



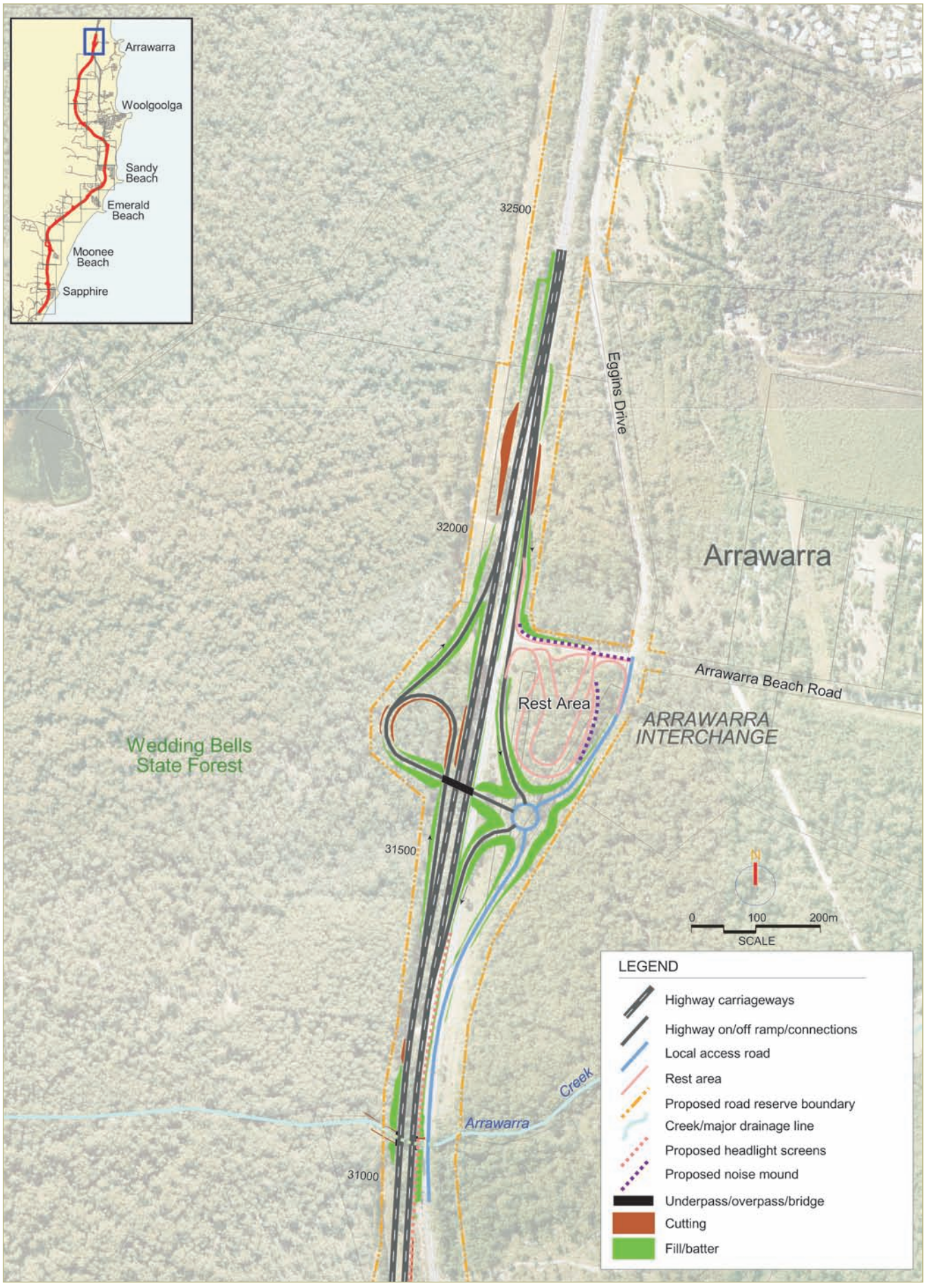
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2k PROPOSED DESIGN



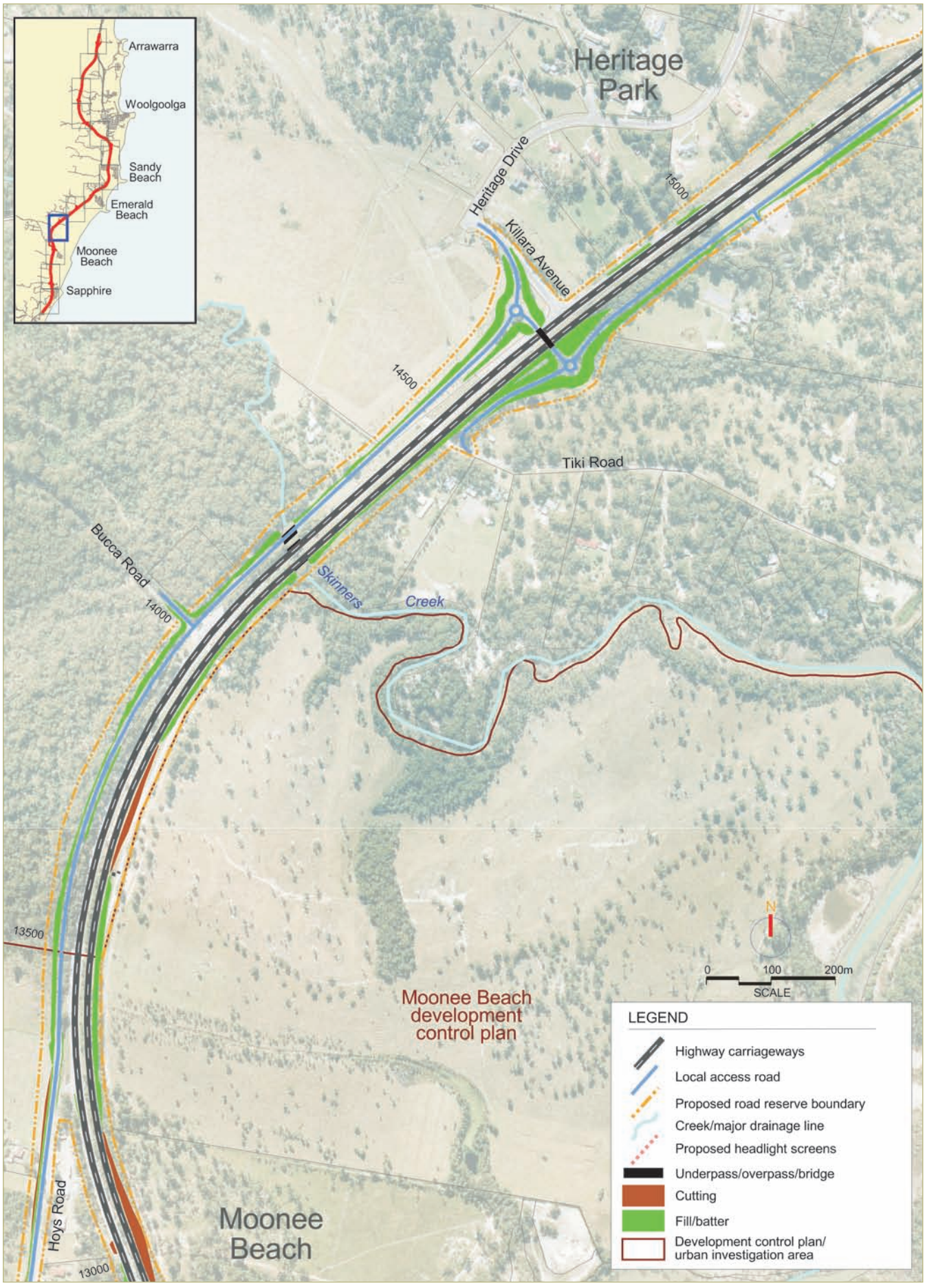
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2I PROPOSED DESIGN



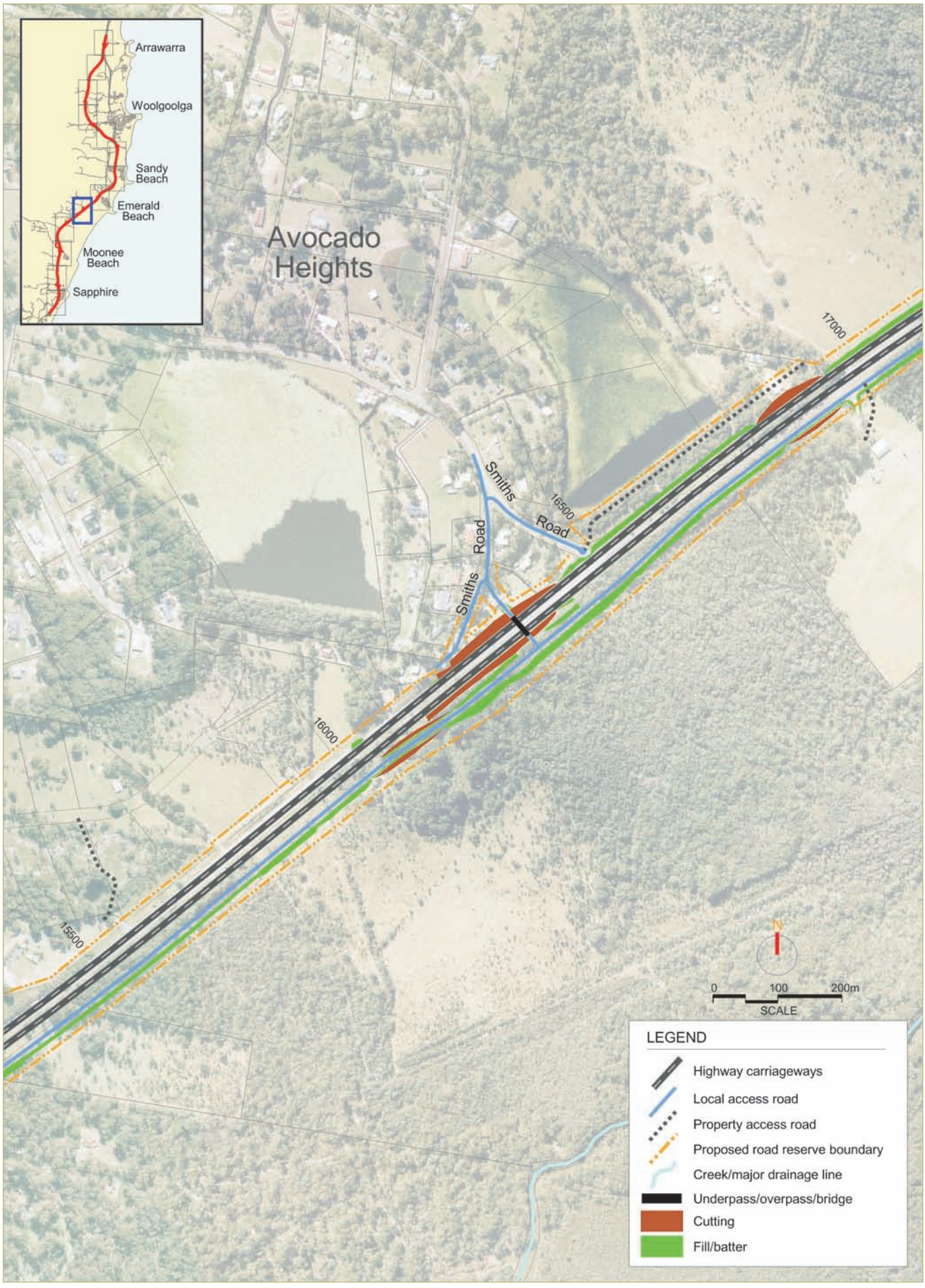
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2m PROPOSED DESIGN



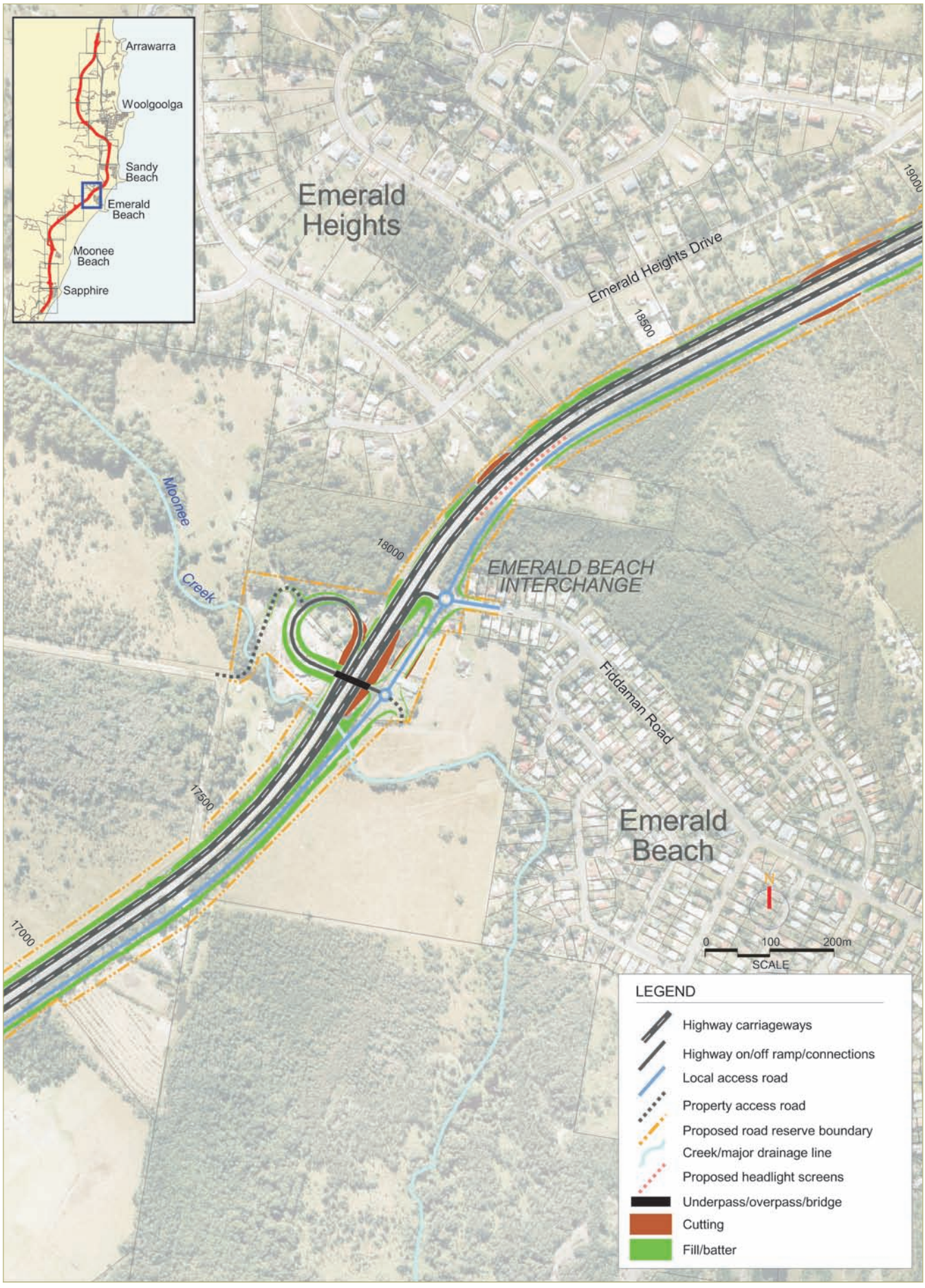
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2d PROPOSED DESIGN



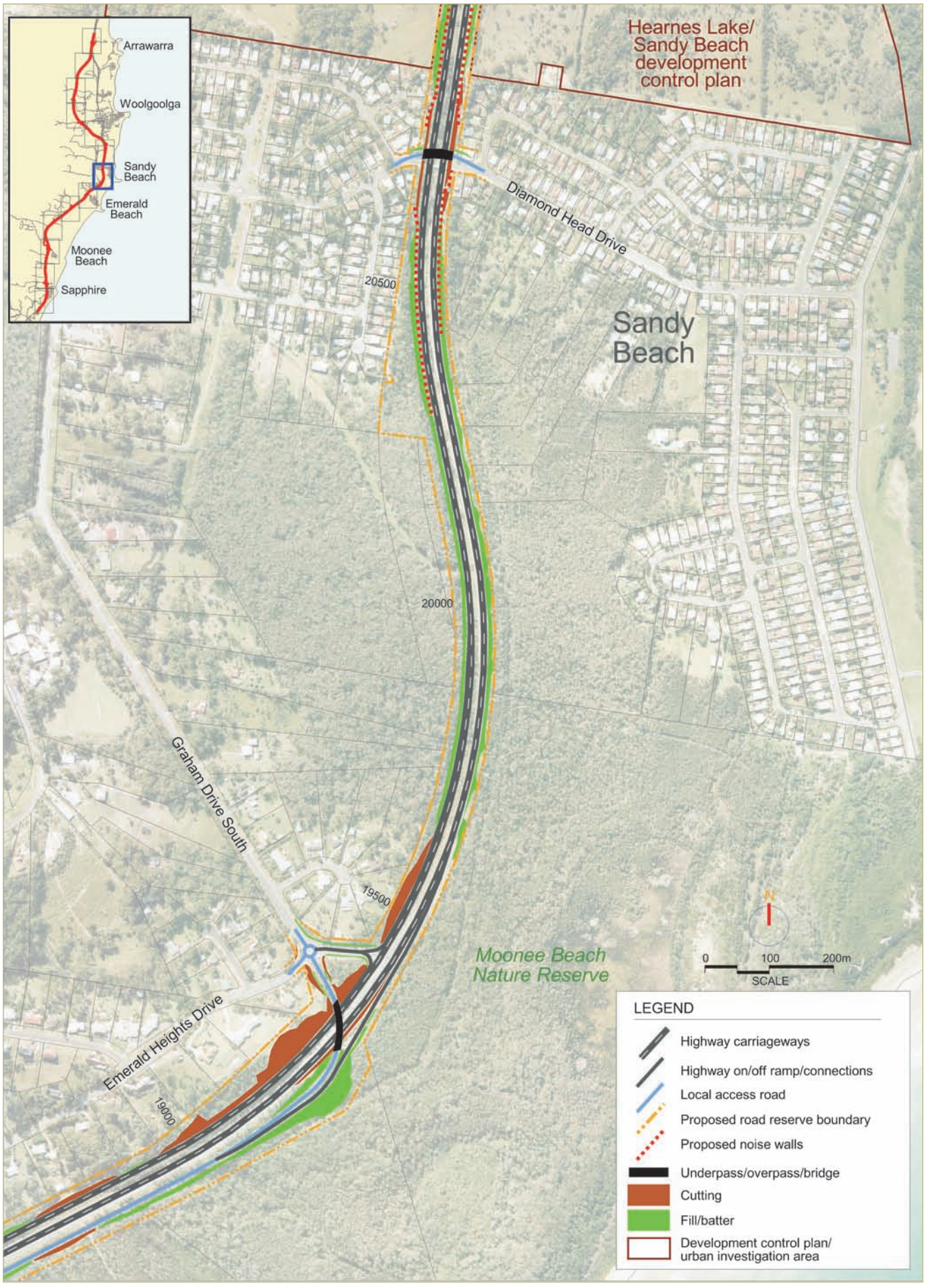
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2e PROPOSED DESIGN



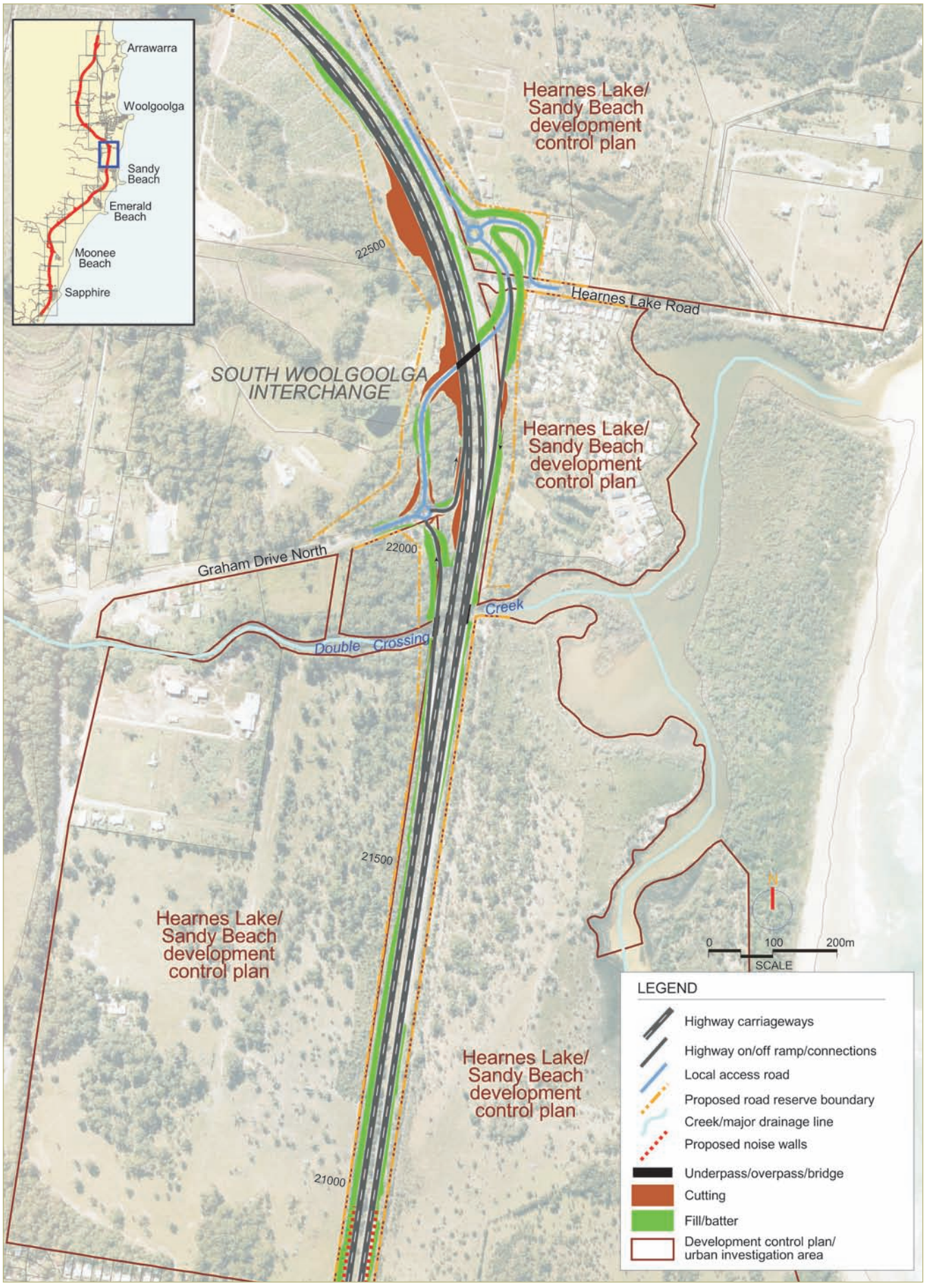
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2f PROPOSED DESIGN



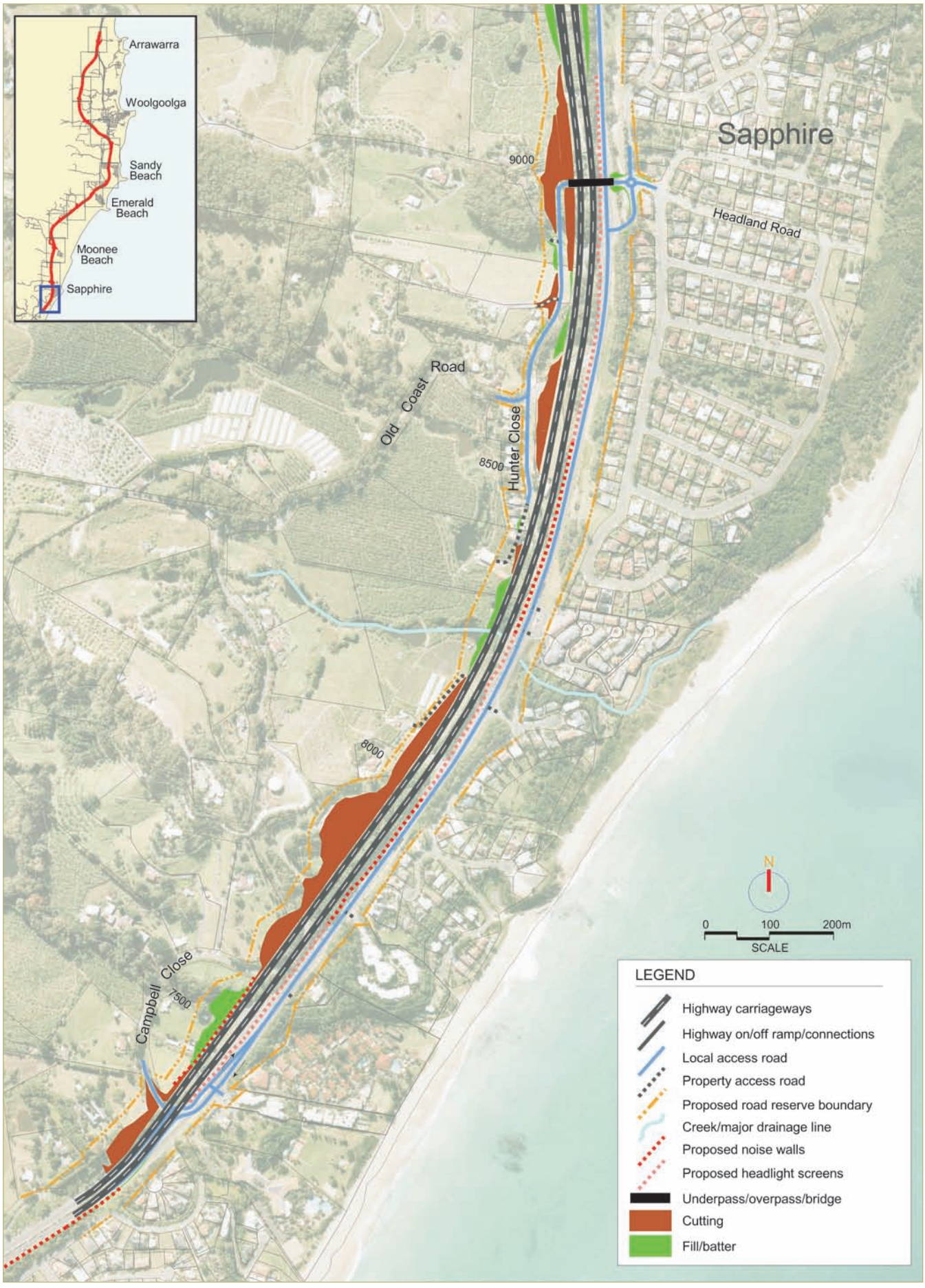
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2g PROPOSED DESIGN



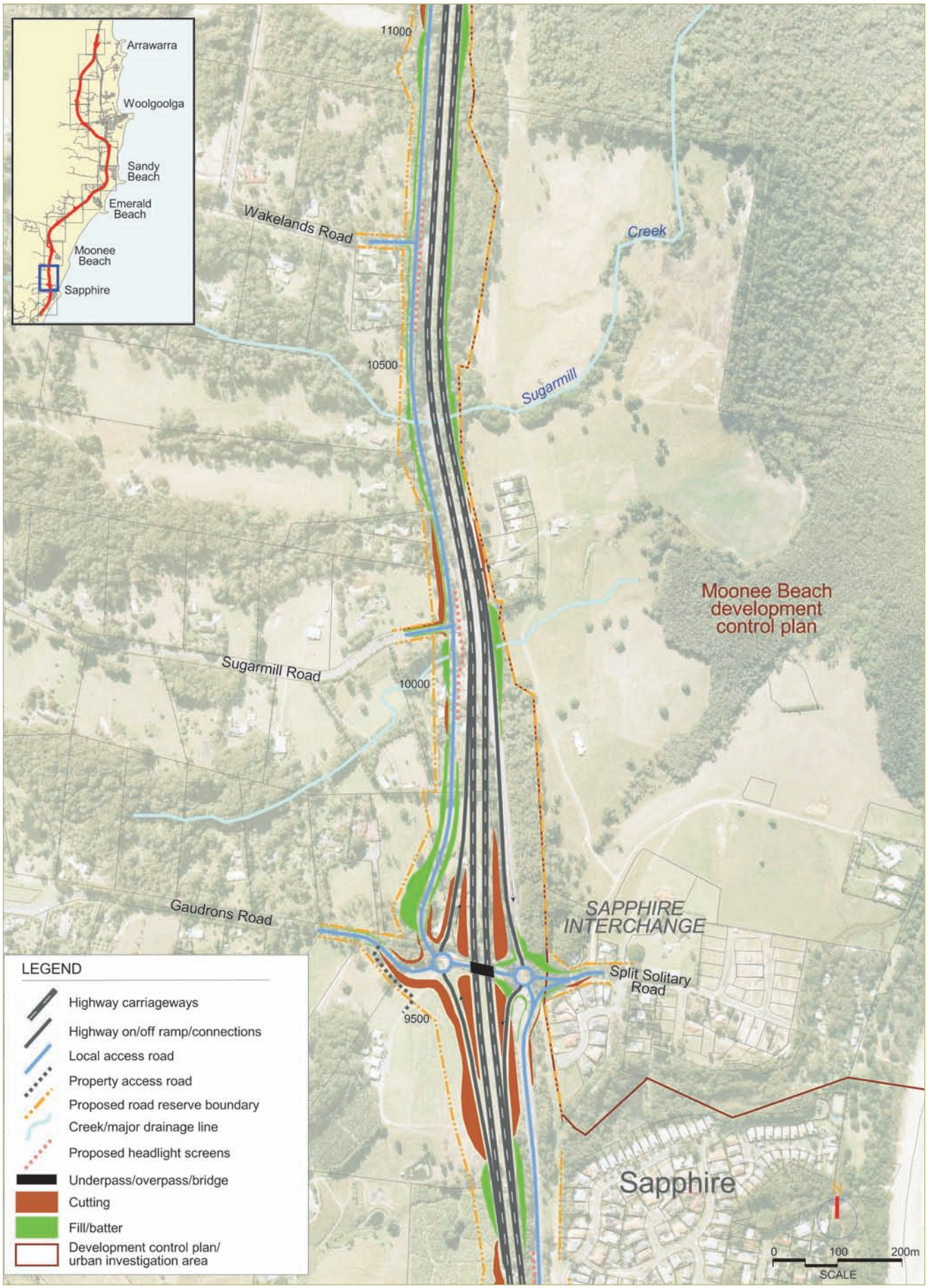
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2h PROPOSED DESIGN



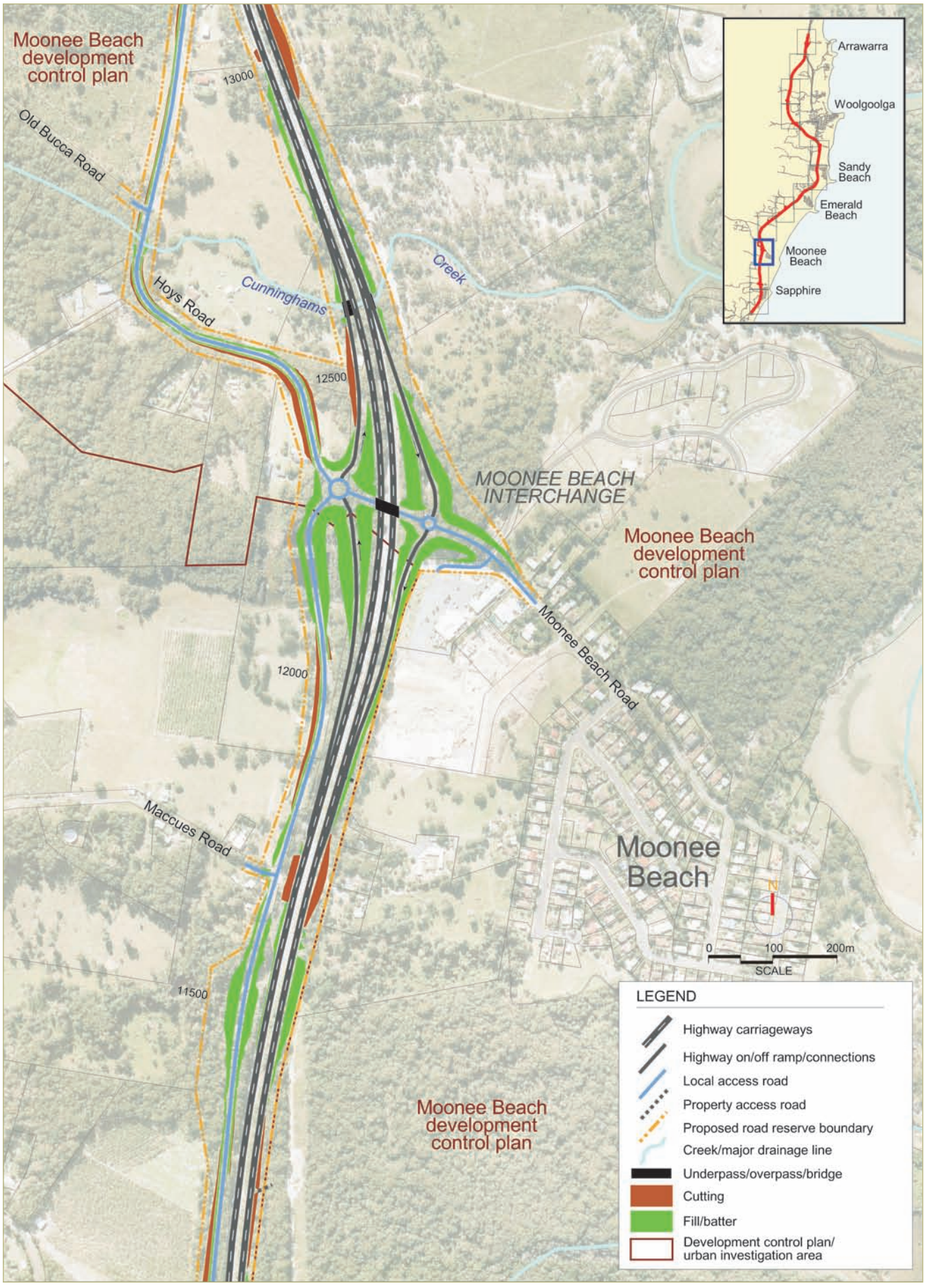
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2a PROPOSED DESIGN



Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2b PROPOSED DESIGN



Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.2c PROPOSED DESIGN

Source: Photo Base – RTA 2003

FIGURE 7.6f ARTIST IMPRESSION OF ARRAWARRA BEACH INTERCHANGE – LOOKING SOUTH

Source: Photo Base – RTA 2003

FIGURE 7.6e ARTIST IMPRESSION OF CONNECTION TO SOUTH WOOLGOOLGA INTERCHANGE – LOOKING NORTH

Source: Photo Base – RTA 2003

FIGURE 7.6d ARTIST IMPRESSION OF EMERALD INTERCHANGE – LOOKING NORTH

Source: Photo Base – RTA 2003

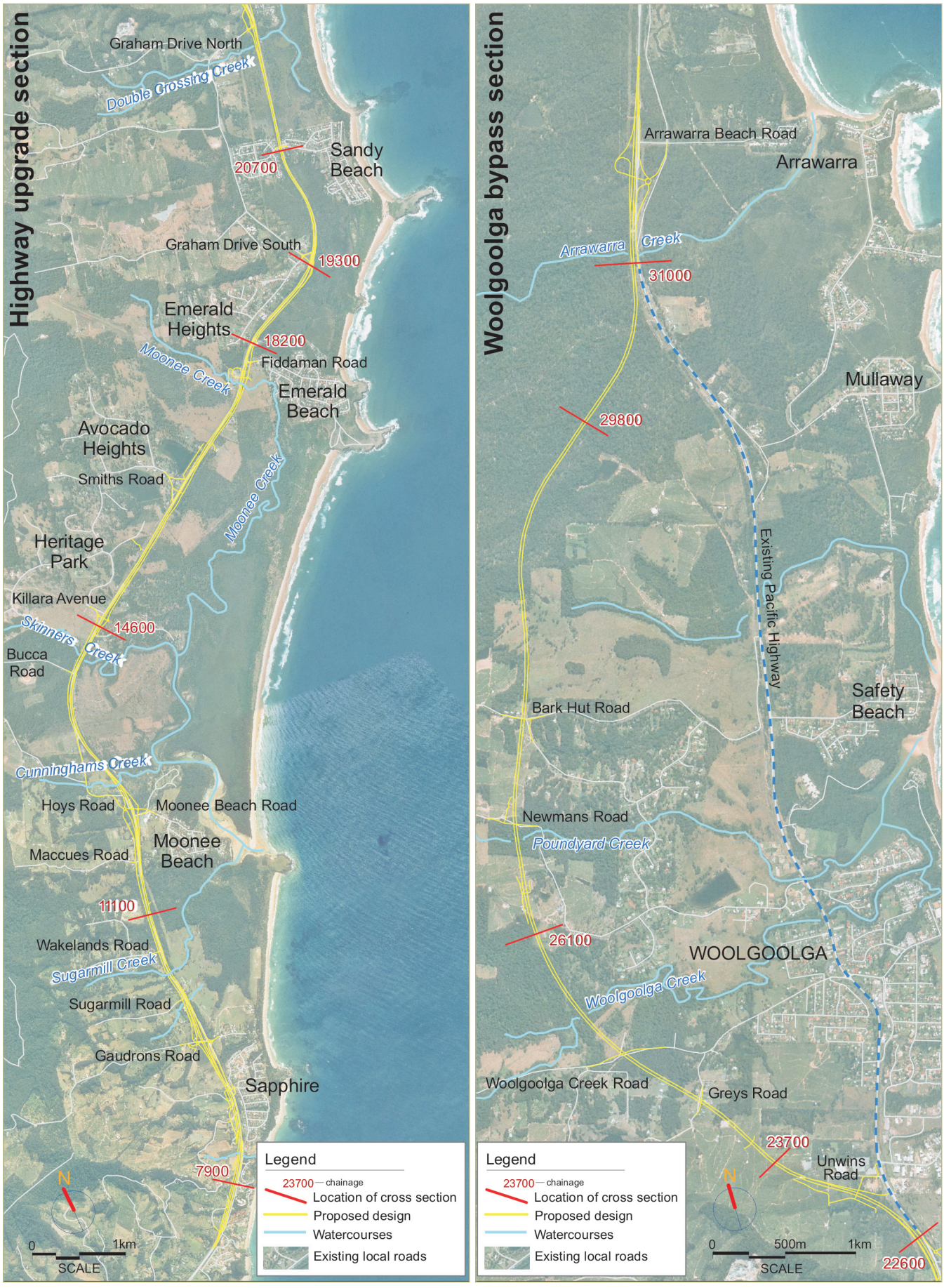
FIGURE 7.6c ARTIST IMPRESSION OF MOONEE BEACH INTERCHANGE – LOOKING NORTH

Source: Photo Base – RTA 2003

FIGURE 7.6b
ARTIST IMPRESSION OF HEADLAND ROAD OVERBRIDGE AND SAPPHIRE INTERCHANGE – LOOKING NORTH

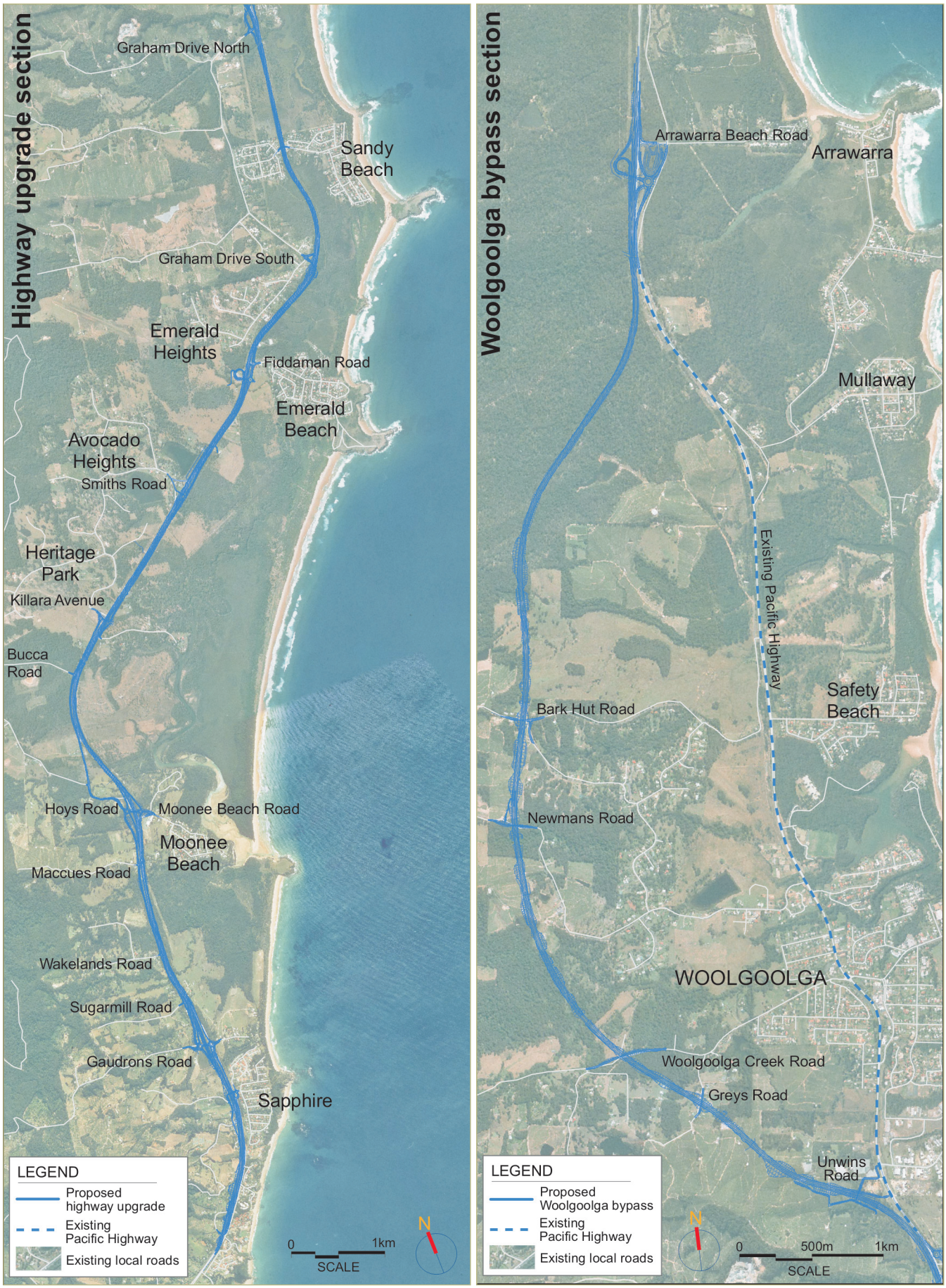
Source: Photo Base – RTA 2003

FIGURE 7.6a
ARTIST IMPRESSION OF CONNECTION TO EXISTING HIGHWAY AT SOUTHERN END OF PROJECT – LOOKING NORTH



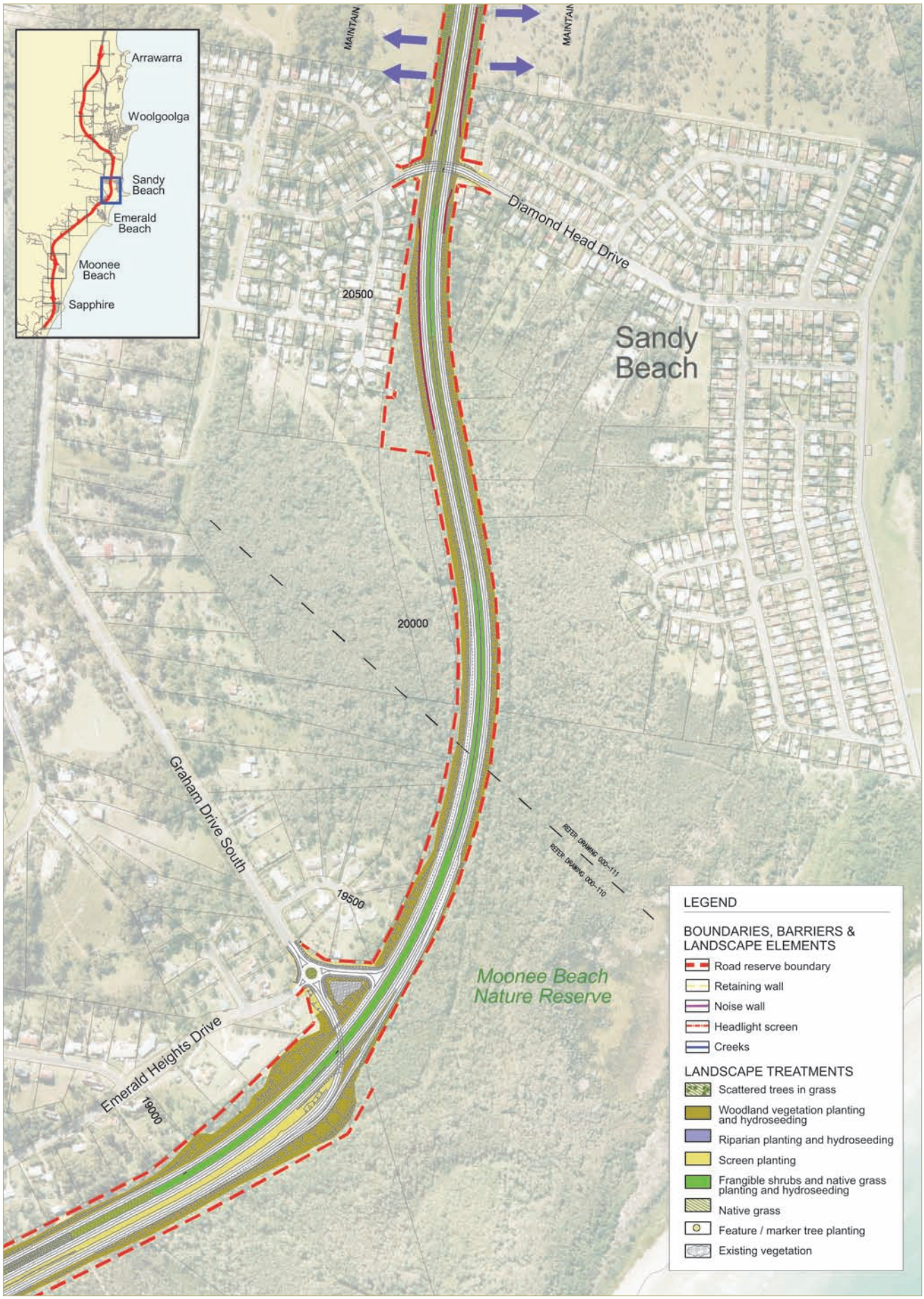
Source: Aerial photography August 2000 (LPI NSW)

FIGURE 7.4a GENERAL LOCATION OF CROSS SECTIONS



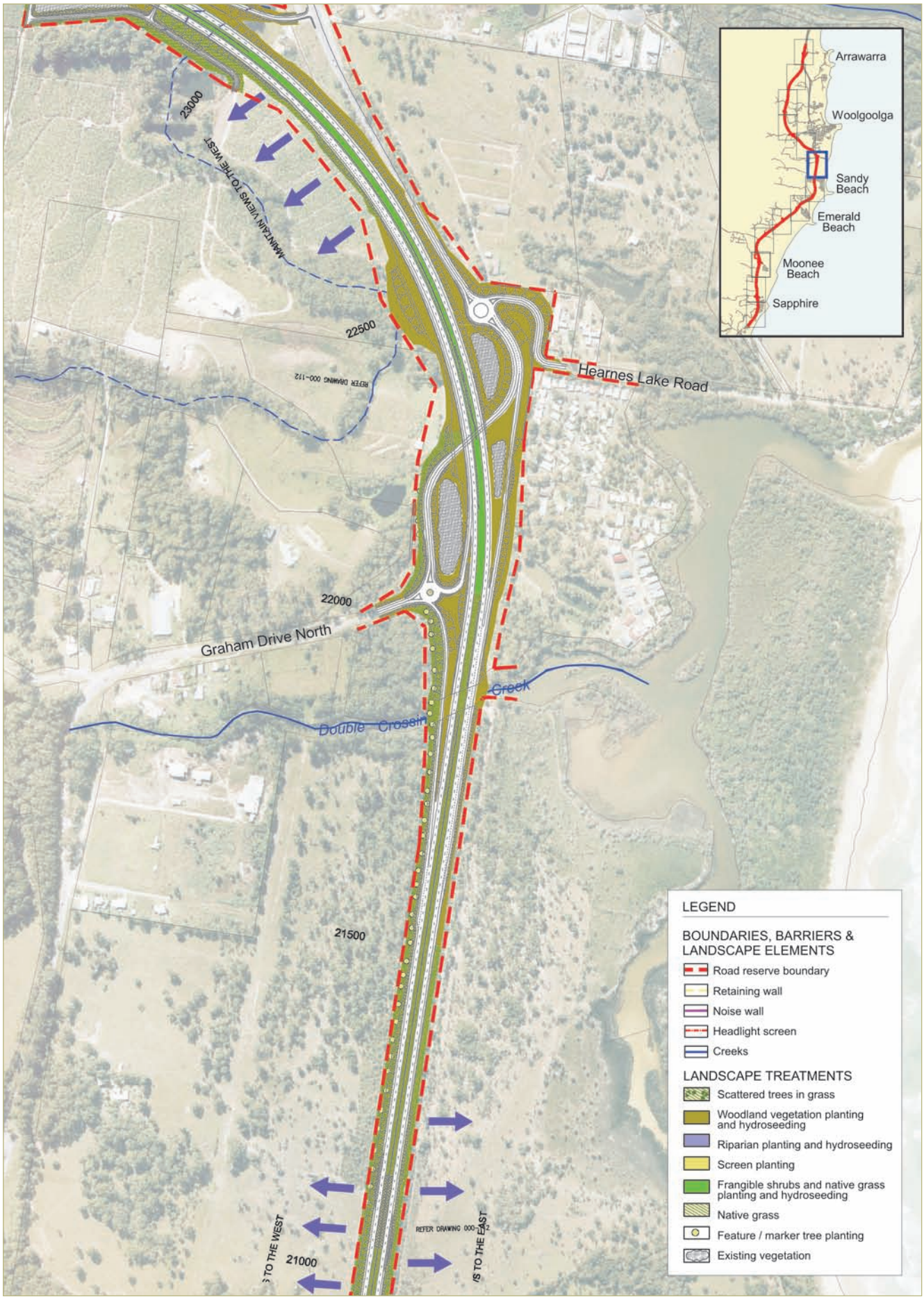
Source: Aerial photography August 2000 (LPI NSW)

FIGURE 7.1 UPGRADE AND BYPASS SECTIONS OF THE PROPOSAL



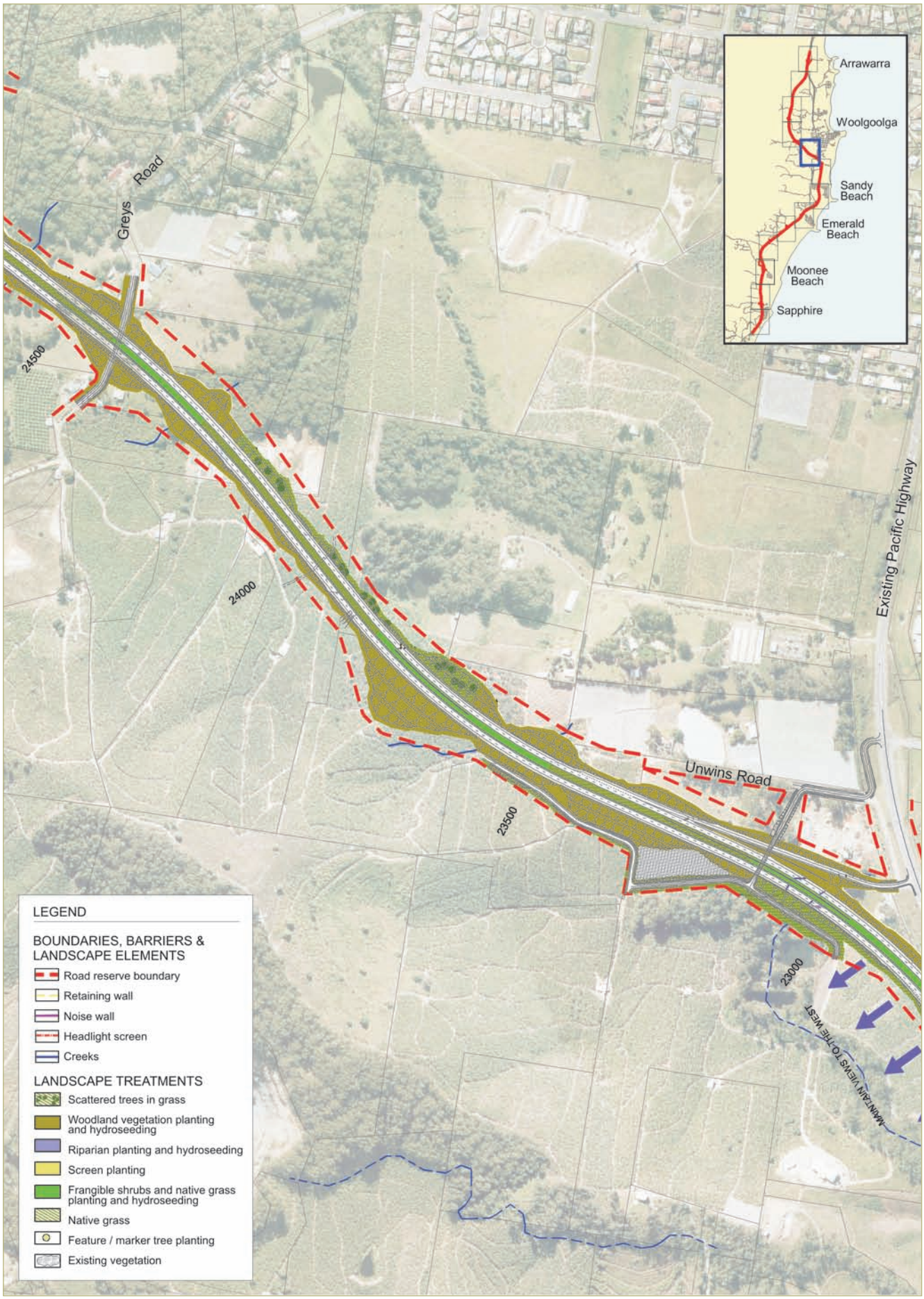
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5g PROPOSED LANDSCAPE DESIGN



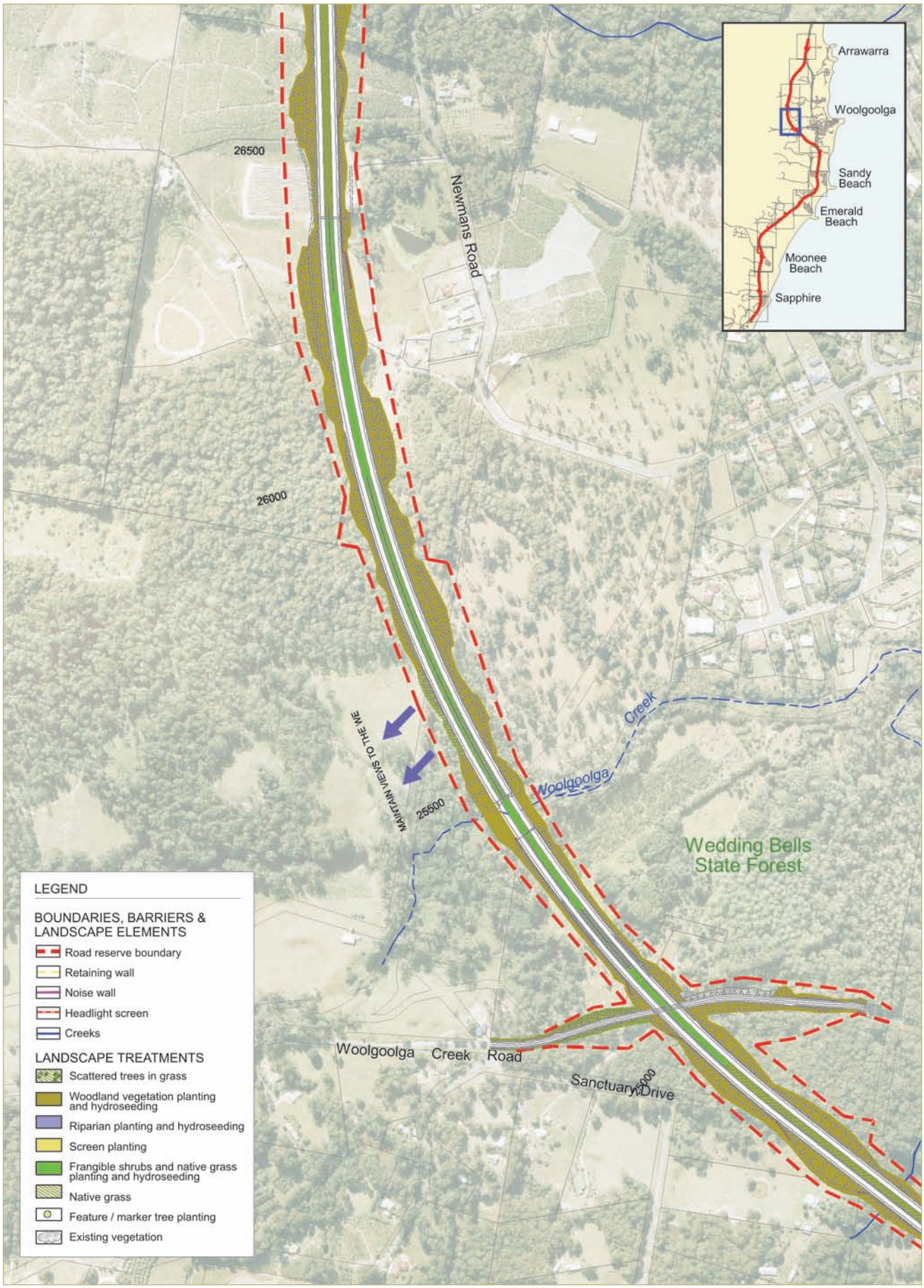
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5h PROPOSED LANDSCAPE DESIGN



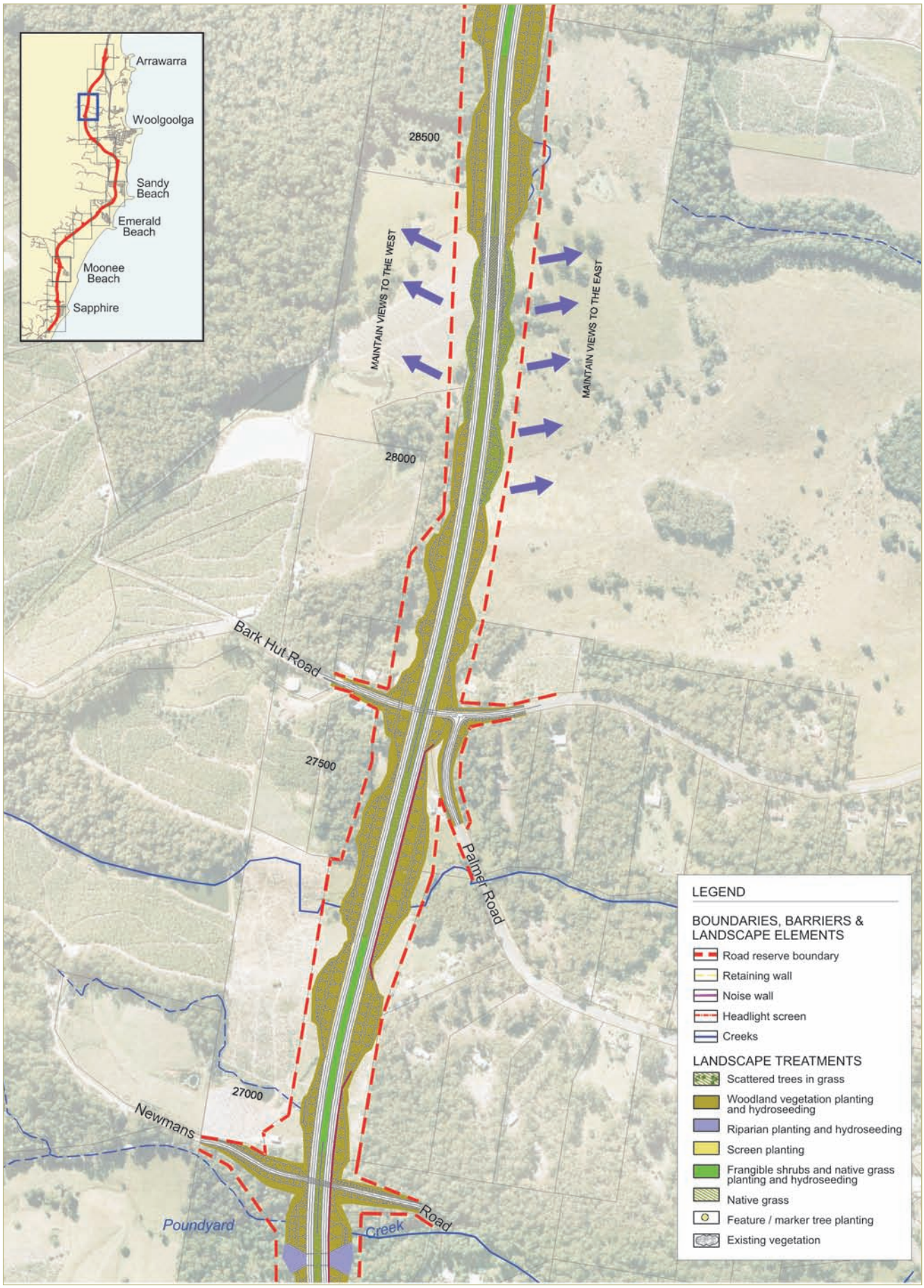
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5i PROPOSED LANDSCAPE DESIGN



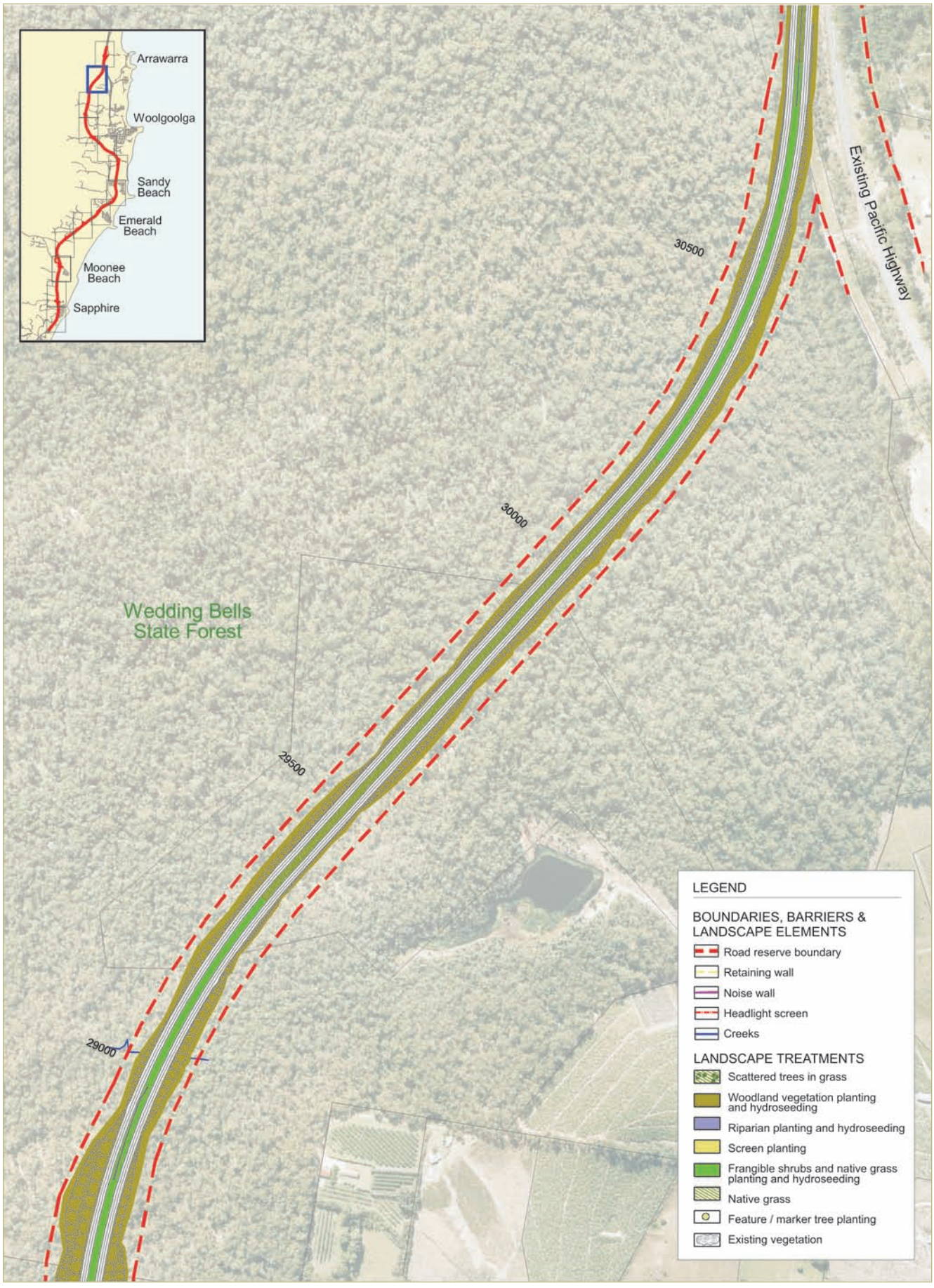
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5j PROPOSED LANDSCAPE DESIGN



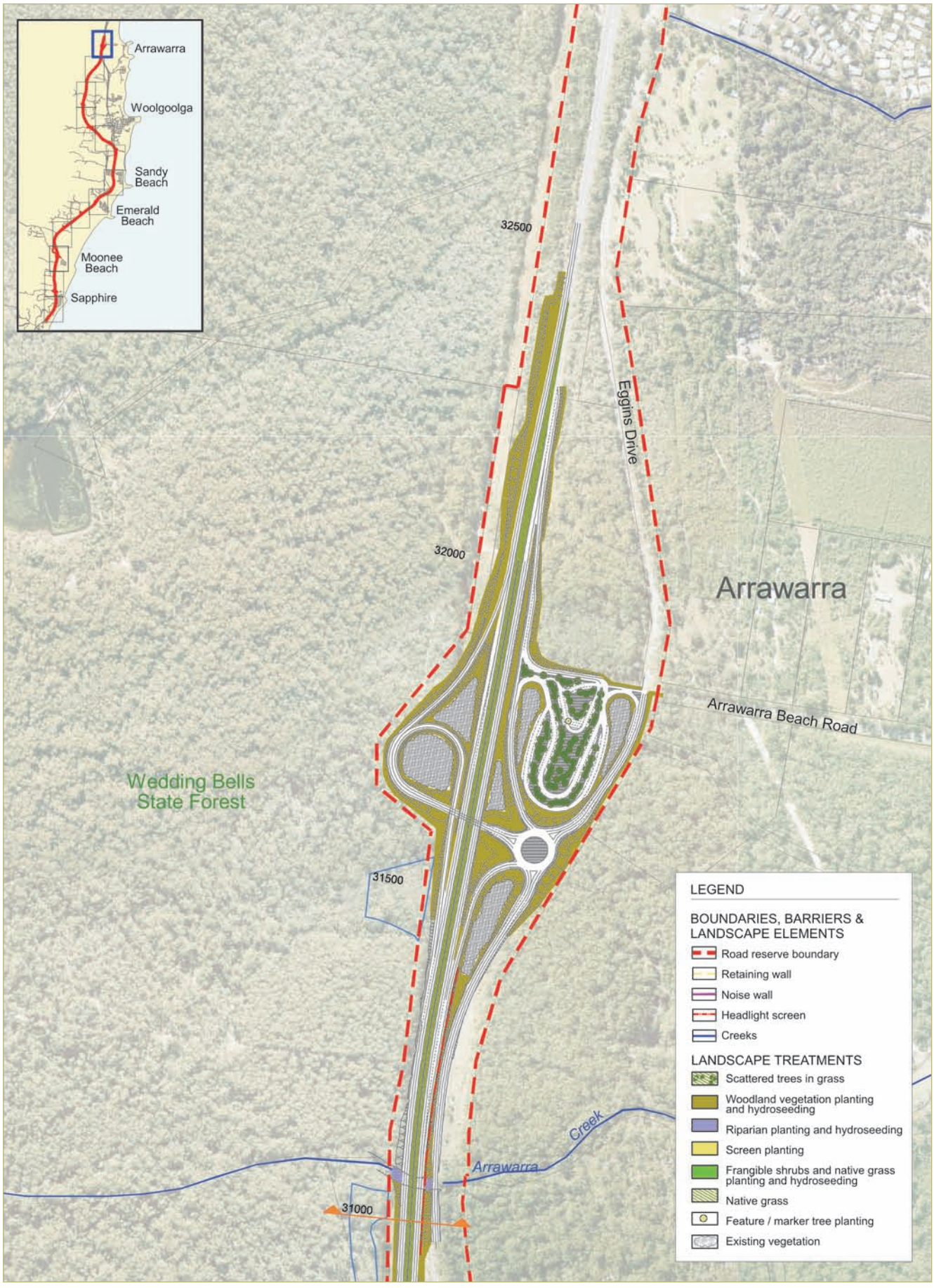
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5k PROPOSED LANDSCAPE DESIGN



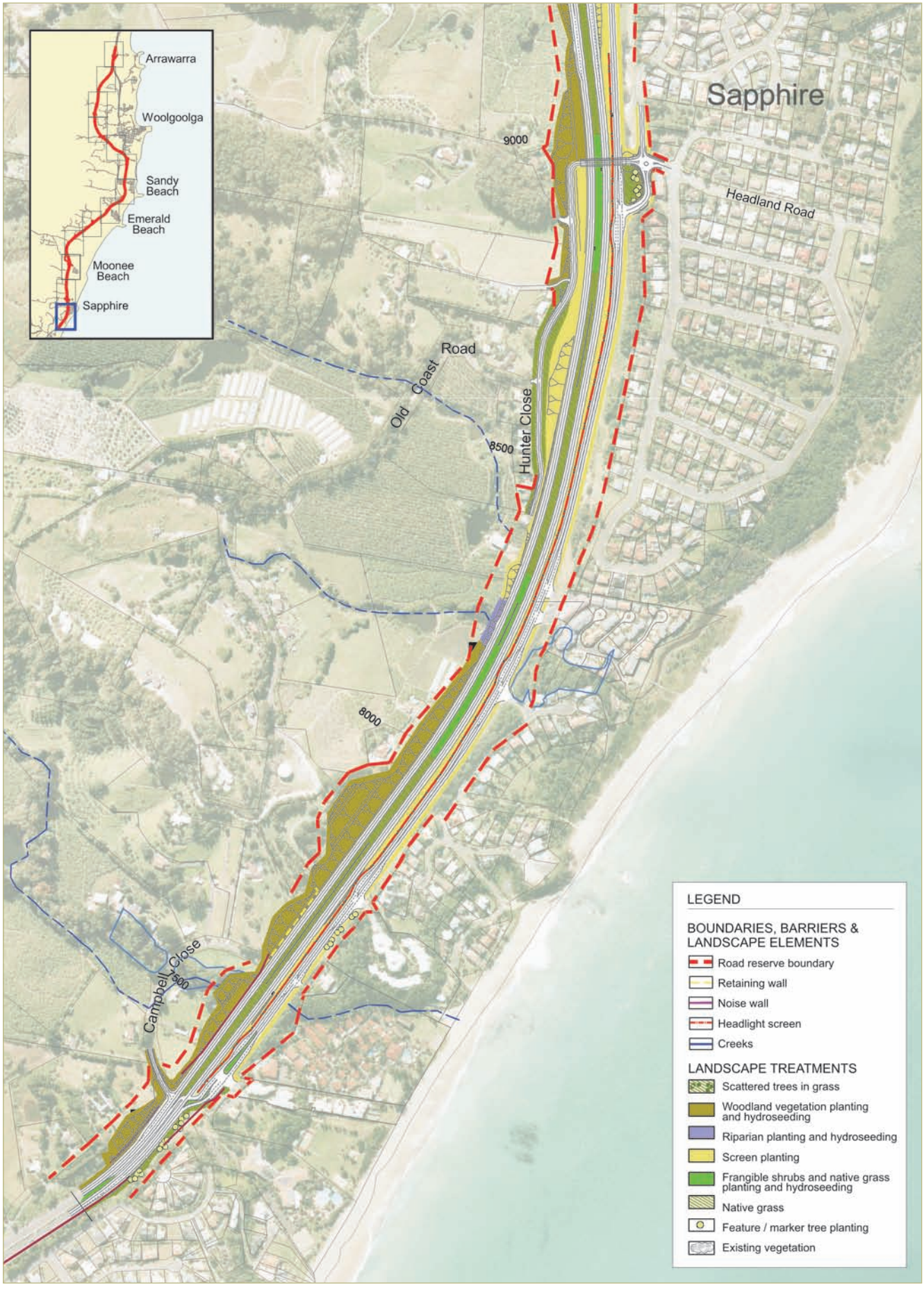
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5l PROPOSED LANDSCAPE DESIGN



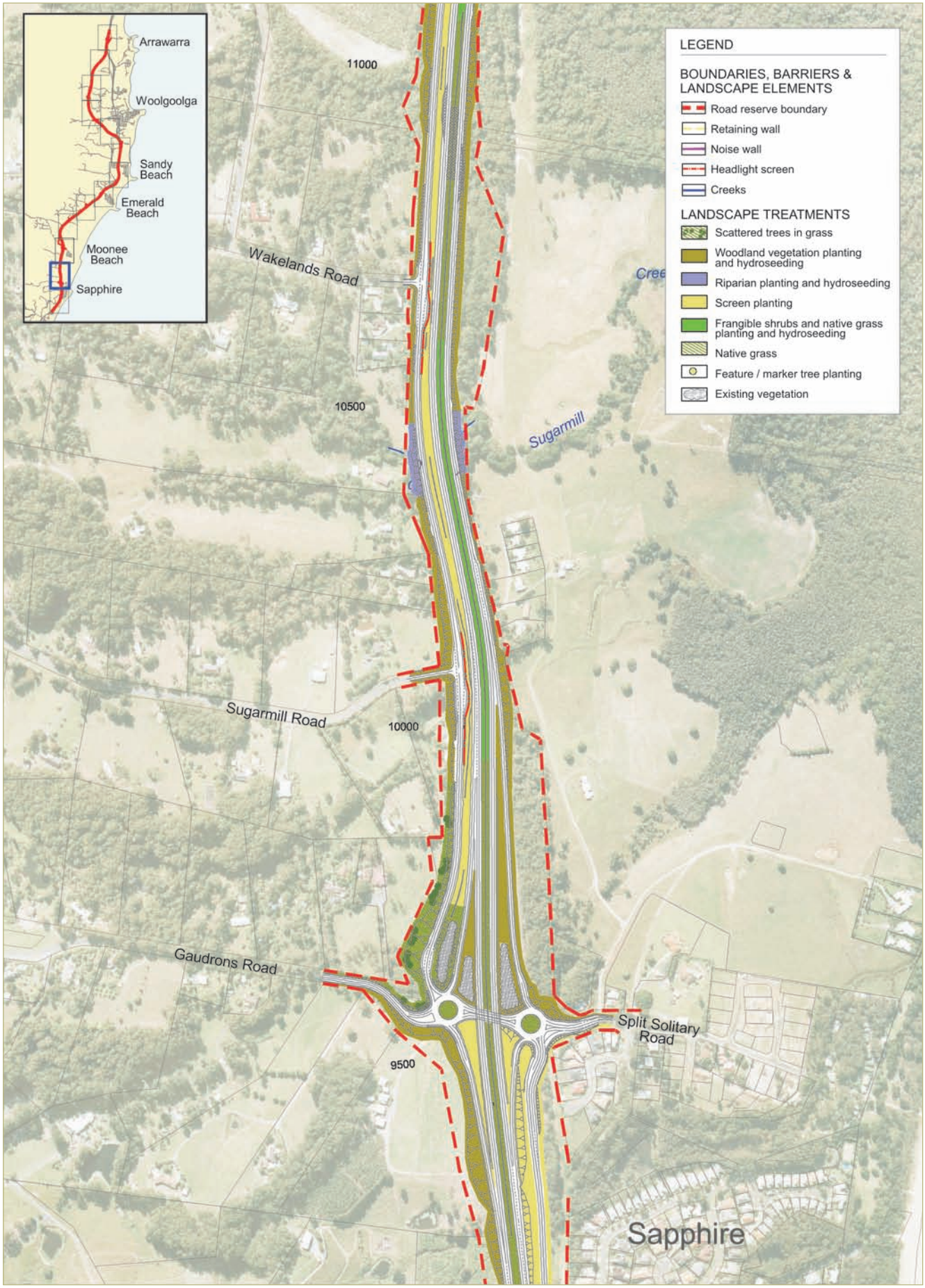
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5m PROPOSED LANDSCAPE DESIGN



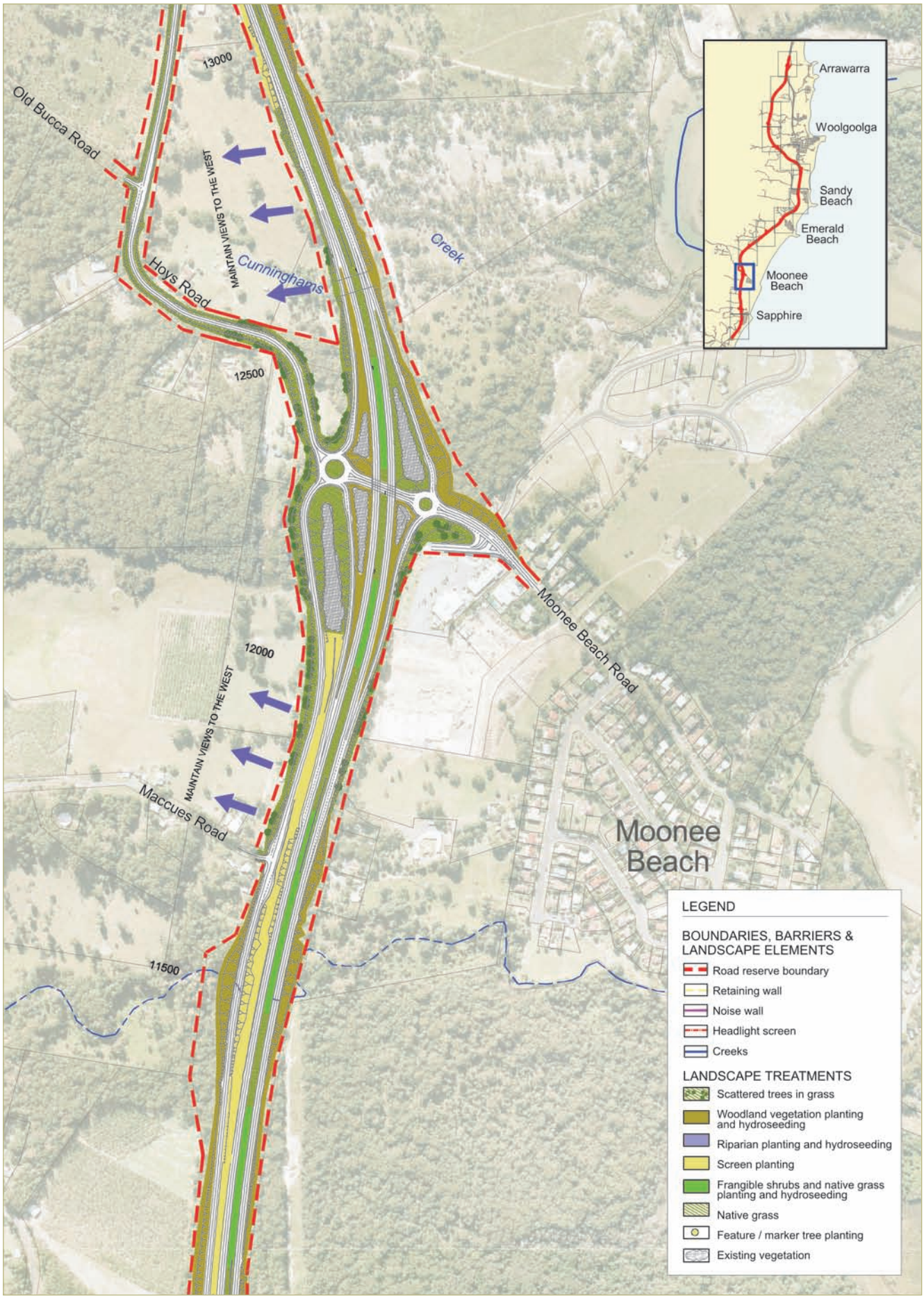
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5a PROPOSED LANDSCAPE DESIGN



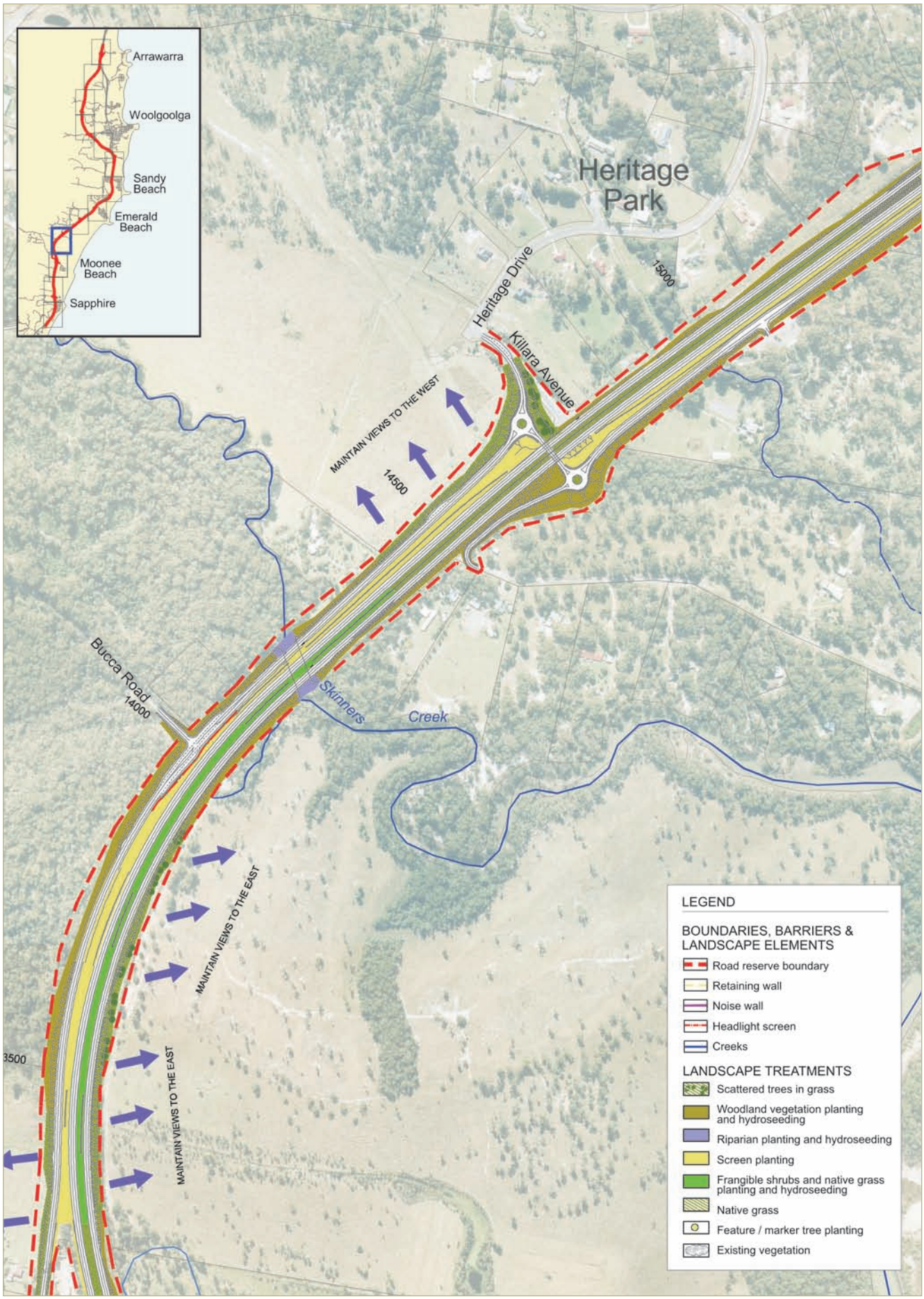
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5b PROPOSED LANDSCAPE DESIGN



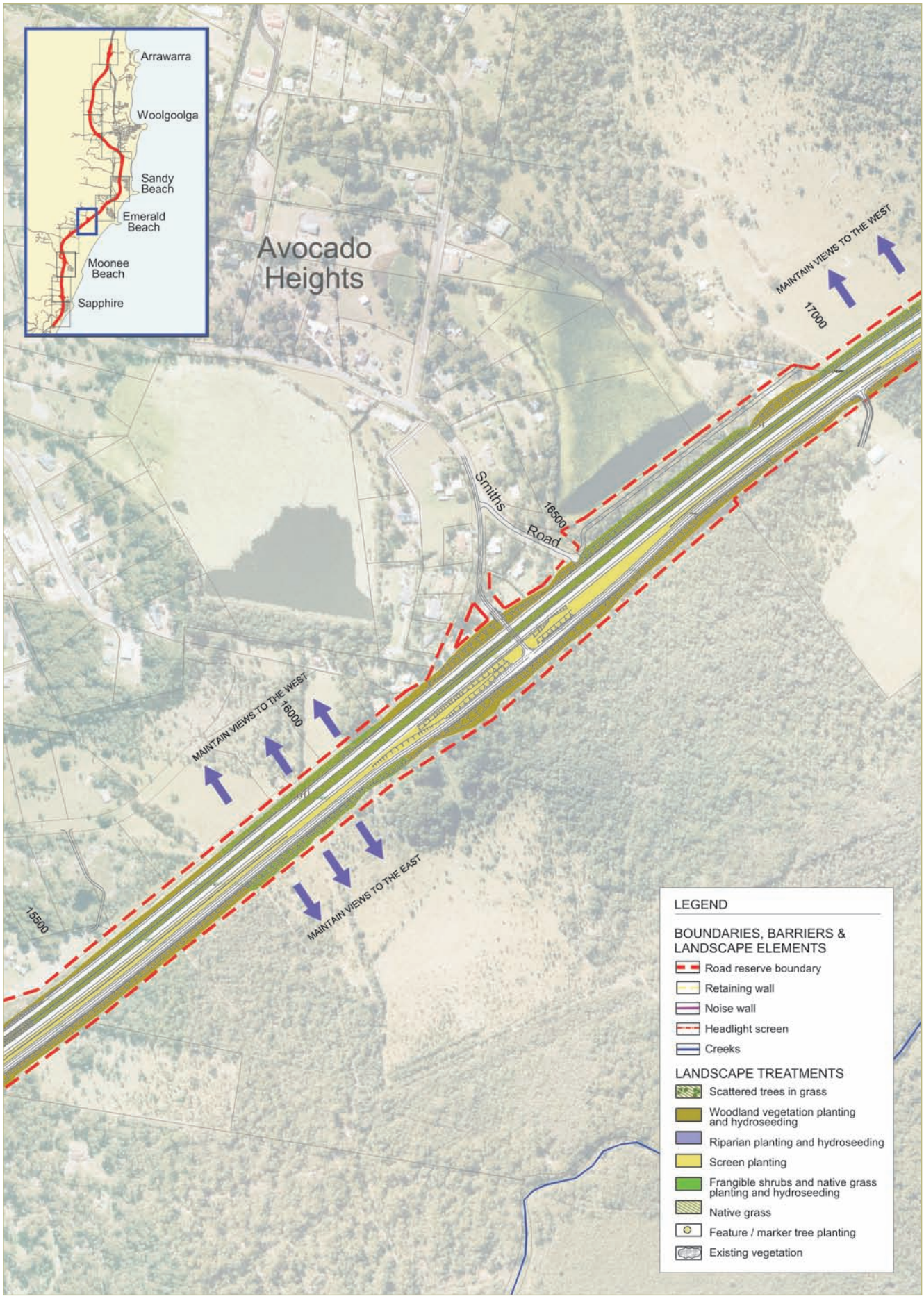
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5c PROPOSED LANDSCAPE DESIGN



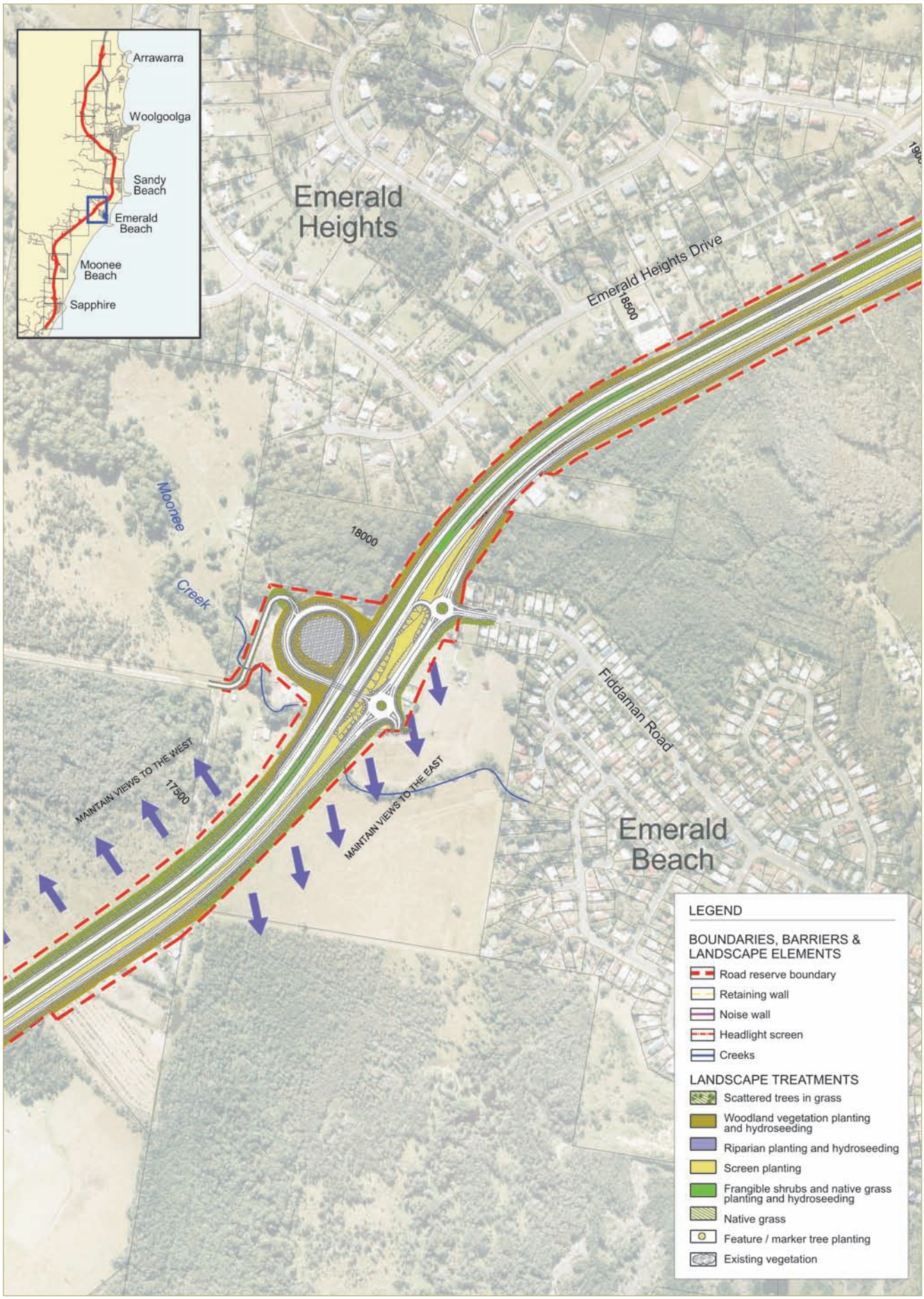
Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5d PROPOSED LANDSCAPE DESIGN



Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5e PROPOSED LANDSCAPE DESIGN



Source: Aerial photography 2005 (Roger Dwyer & Associates) Cadastral boundaries May 2007 (CHCC)

FIGURE 7.5f PROPOSED LANDSCAPE DESIGN