

## ***6. Concept design development***

This section provides an overview of the existing conditions of the highway and the improvements required to meet a Class A standard. It outlines construction issues affecting the design development and presents an overall concept with these issues and requirements in consideration. It also provides a preliminary indication of a possible design layout for a Class M scenario.

### **6.1 Approach to concept design development**

As discussed in **Chapter 5**, it was identified at an early stage in the Iluka Road to Woodburn project that a limited study area would meet the objectives of the highway upgrade. With many other Pacific Highway upgrade projects, many options need to be investigated to identify the best solution for road users, communities and the environment while meeting the functional project objectives. In the case of the Iluka Road to Woodburn upgrade however, the existing road passes through no built-up areas. The surrounding areas provide limited scope for reasonable improvement in alignment without detrimental effect to the environment, visual intrusion on the landscape or significant impact on private property. An alternative route would not necessarily deliver any substantial travel time savings.

The main criteria to consider in the design were thus the functional requirements of the proposed highway, the amount of additional land required to construct the second carriageway and minor realignments, environmental impacts and property impacts. Given the relatively low traffic volumes and limited urban development (but clear need to improve safety), the concept design proposed is for a Class A arterial style four lane divided highway, with a limited number of T-intersections providing direct access on and off the highway. 'Seagull' type T-intersections, with appropriate deceleration lanes, merge lanes and vehicle refuge zones between the opposing main traffic lanes, would be provided to facilitate right turn movements into and out of secondary local roads.

For access to private property, State Forests, National Parks and nature reserves, left-in left-out turn facilities would be provided in order to maintain continued access to and from the highway. To facilitate safe travel to and from private properties in both directions, and to permit safe access across the highway for local traffic, U-turn bays would be provided at regular intervals in both directions (see **section 6.2.5** below).

The corridor runs through several State Forests, and adjacent to nature reserves and a National Park. To minimise impact on these areas, a key design objective is the duplication of the carriageway as close to the existing alignment as possible, subject to RTA design requirements.

Another key of the design is to avoid any resumption or acquisition of land within nature reserves or Bundjalung National Park. However, it may be necessary to acquire narrow strips of land from the edge of State Forest properties, and a number of private properties. Potential impacts on private property are discussed in **Chapter 7**.

### **6.2 Overview of existing conditions and proposed improvements**

Substantial lengths of the Pacific Highway between Iluka Road and Woodburn have already been constructed to a 110 km/h design speed. This potentially facilitates straightforward duplication of the highway on its current alignment, either to the east or west of the existing carriageway. However, there remain a number of locations where the existing alignment is of a relatively poor standard and duplication would not be feasible. These locations are shown in **Figure 6.1**, and described below.

#### ***6.2.1 Near Pine Road for 5 km/Devils Pulpit State Forest***

There are five consecutive horizontal curves in the existing alignment that cannot accommodate a 110 km/h design, and which also vary vertically (see **Figure 6.2c**). It would be difficult to realign the highway while maintaining traffic flow over this length, as most of the existing carriageway would have to be broken up for construction. In anticipation of a future deviation, the RTA had previously acquired a 3 km corridor of land through the Devils Pulpit State Forest

to the east of the Pine Road bends. The proposed route concept therefore incorporates a new section of four-lane highway within this corridor. This has the benefit of moving the main carriageways further away from Bundjalung National Park (situated to the west), while improving the overall highway alignment by eliminating five curves in the road and a number of crests and dips.

### ***6.2.2 Cypress Road***

Cypress Road adjoins a straight section of existing highway that has an acceptable gradient (see **Figure 6.2d**), however, new construction is required because of:

- The need to avoid encroachment into Tabbimoble Swamp Nature Reserve;
- The need to avoid undesirable reverse curves in the new road alignment (ie S-shaped curves); and
- The need to realign with the existing highway at New Italy, which is tightly constrained by land use and heritage issues, on both sides of the highway.

### ***6.2.3 Whites Road***

The existing curve adjacent to Whites Road has too small a radius for the required design speed of 110 km/h (see **Figure 6.2e**). A 1.1 km length of new four-lane road would therefore be required to increase the curve radius and meet the RTA's design standards. The new section of road would be located up to a maximum 100 m west of the existing two-lane highway. It is also anticipated that it can be constructed in a cutting, reducing the level of the road significantly, thus reducing the visual and acoustic impact on the surrounding area. It is anticipated that the redundant piece of existing highway would then be used to provide controlled local access for Redgates Road and Turners Road.

### ***6.2.4 Road geometry - vertical alignment***

#### **New Italy**

The existing Swan Bay New Italy Road intersection (see **Figure 6.2d**) is one of the busier intersections in the study area and has poor visibility to the south. The current intersection is close to the adjacent New Italy Museum Complex buildings, and duplication of the existing traffic lanes would not facilitate an improved intersection with better visibility. It has been identified that four new traffic lanes would need to be constructed in a deeper cutting on a new vertical alignment, (though similar horizontal alignment as the existing roadway). A 'Seagull' type T-intersection would be constructed to provide safe movements to and from the Pacific Highway. The design for the new T-intersection includes an improved vertical alignment, flattening the highway gradient to the north and south of the Swan Bay New Italy Road turnoff, to improve visibility in both directions and maximise safety.

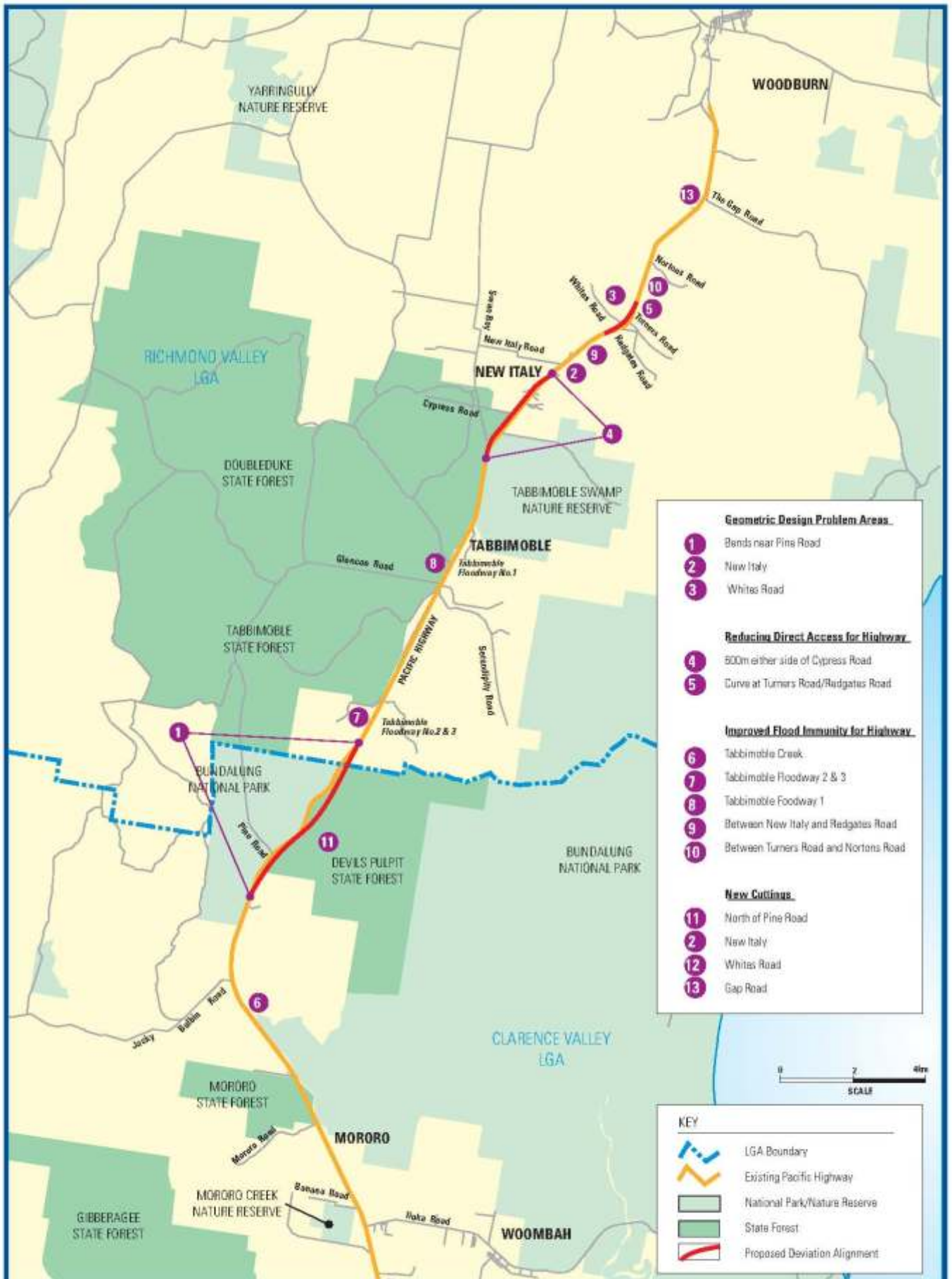
### ***6.2.5 Other opportunities for improvement***

Aside from the areas discussed above, there are few locations where the existing highway alignment and gradient are unsuitable for straightforward duplication adjacent to the existing highway. Other opportunities for possible improvements are listed below and illustrated in **Figure 6.1**.

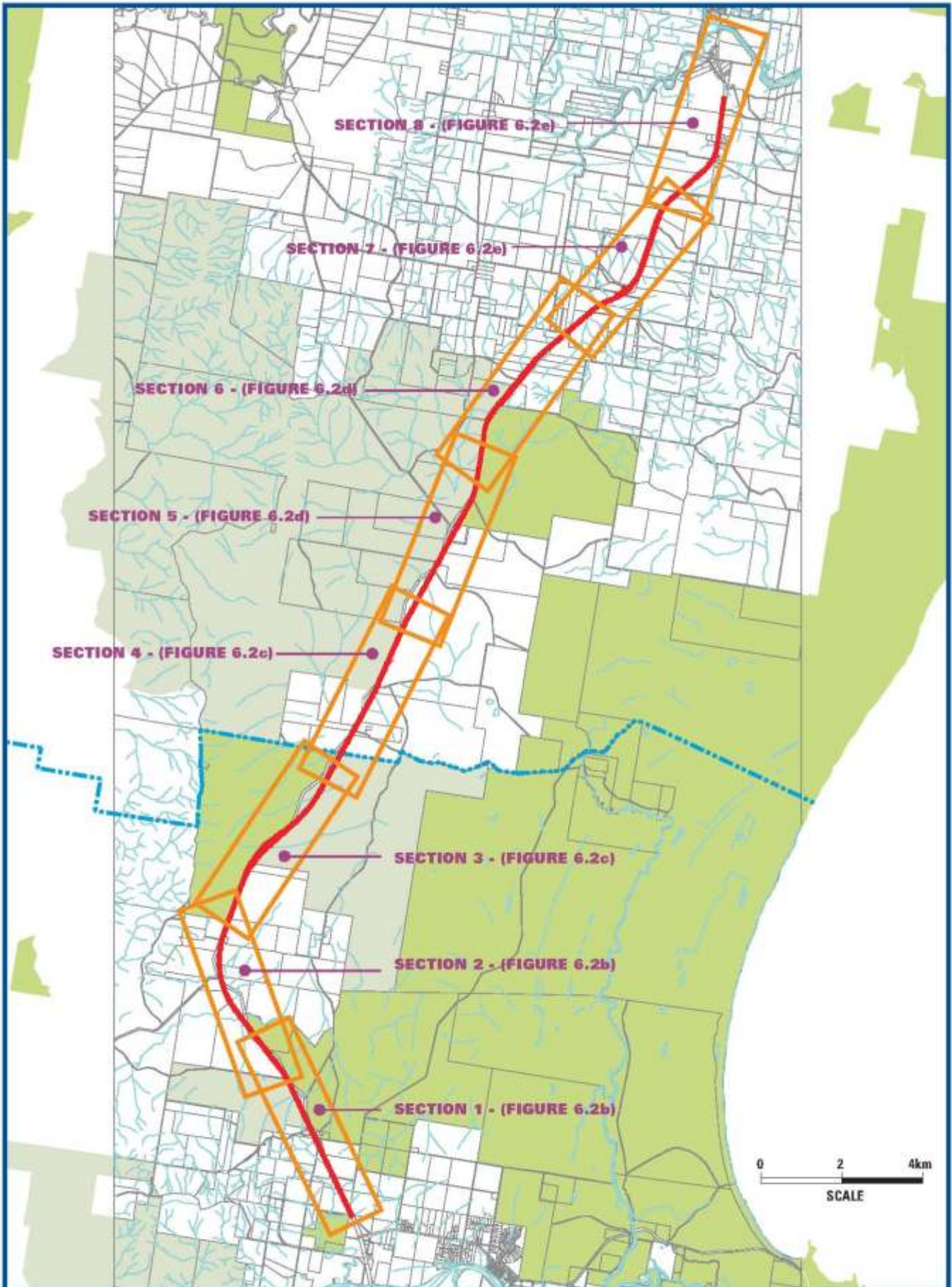
#### **Reducing the number of direct access points**

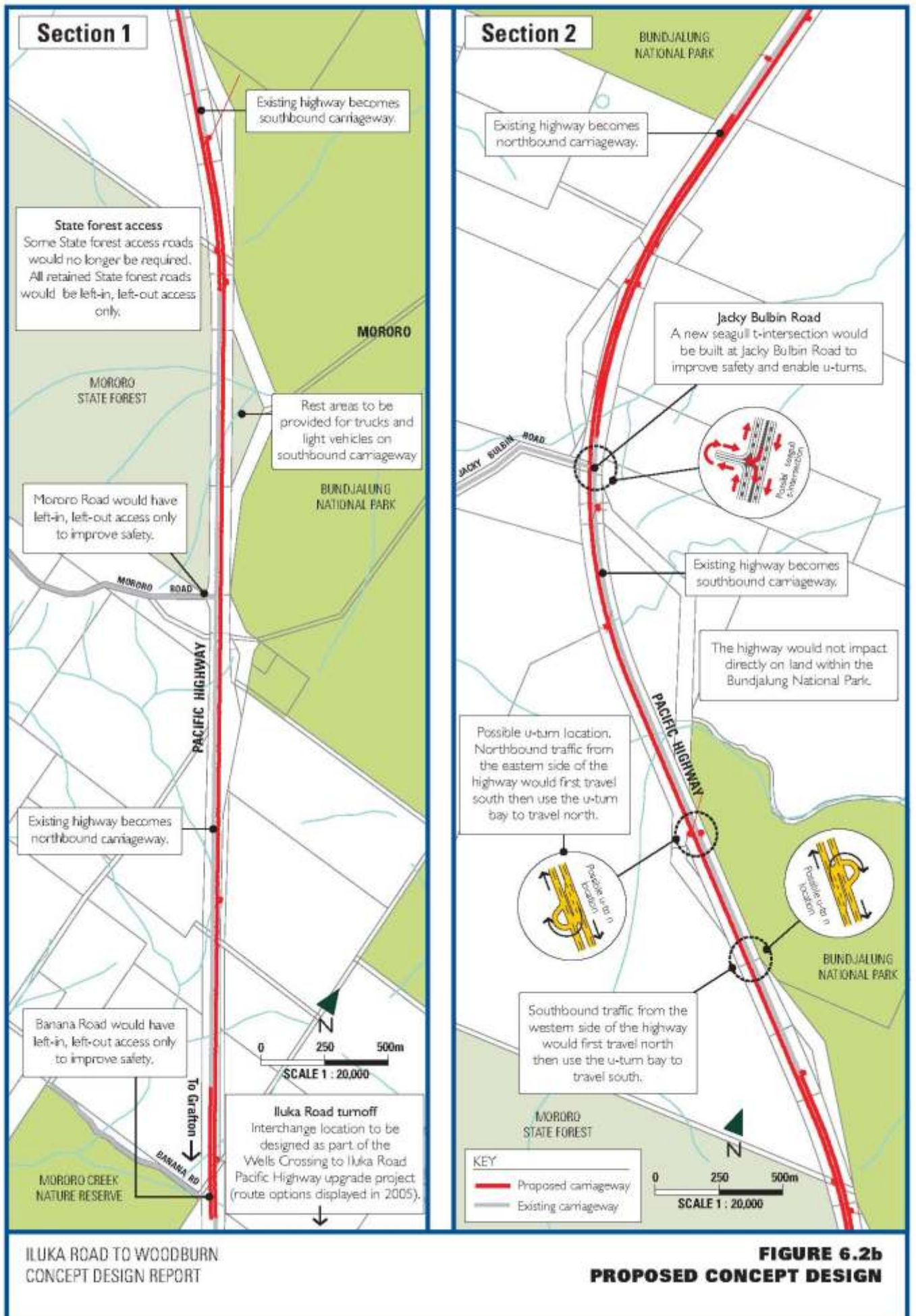
There are two locations where direct access points to the highway can be rationalised by using parallel service roads, either newly constructed or created through the use of residual sections of the existing highway, where new sections of four-lane highway are proposed. The sites include:

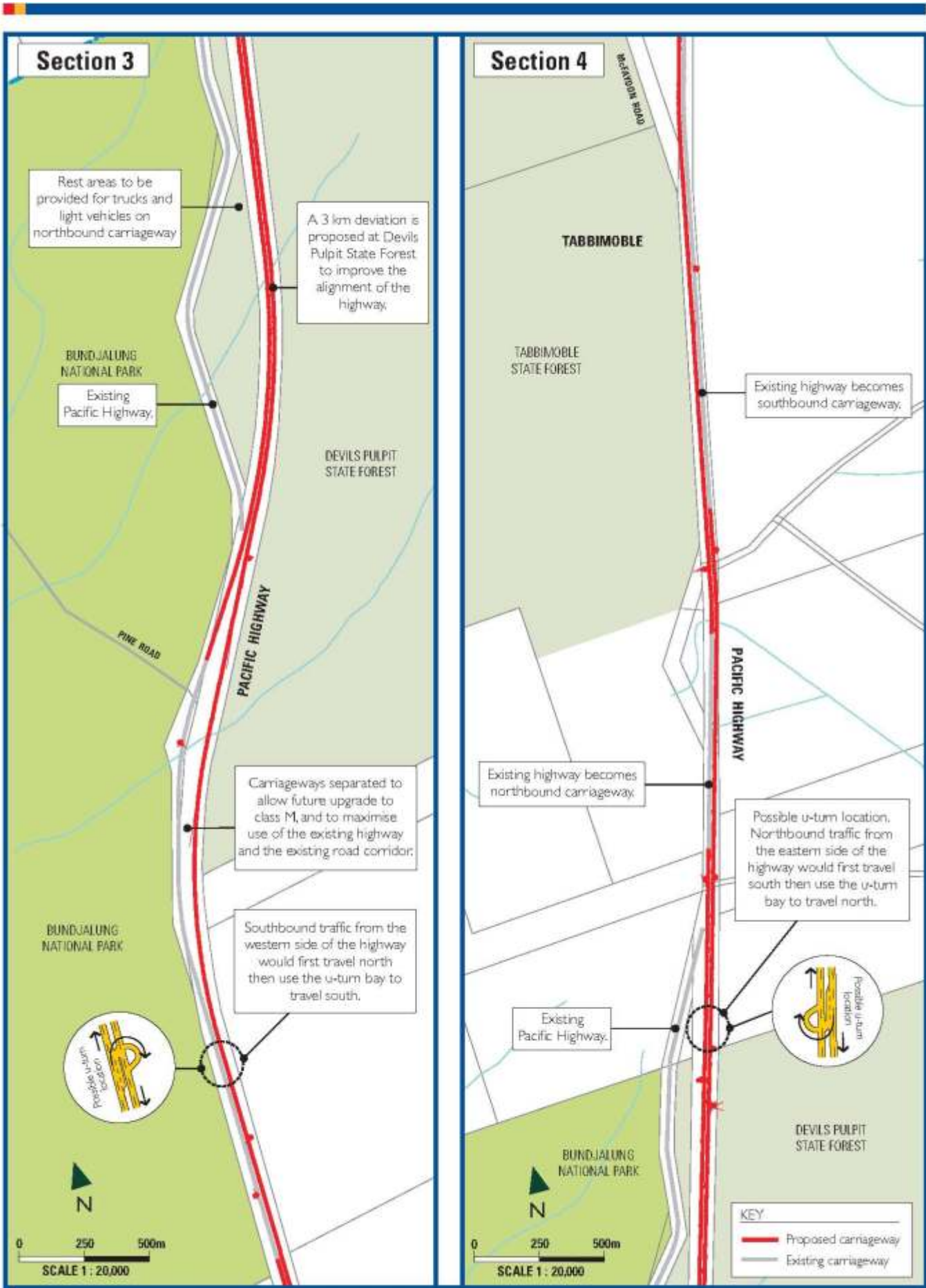
- 600 m either side of Cypress Road; and
- The curve at Turners/Redgates Road

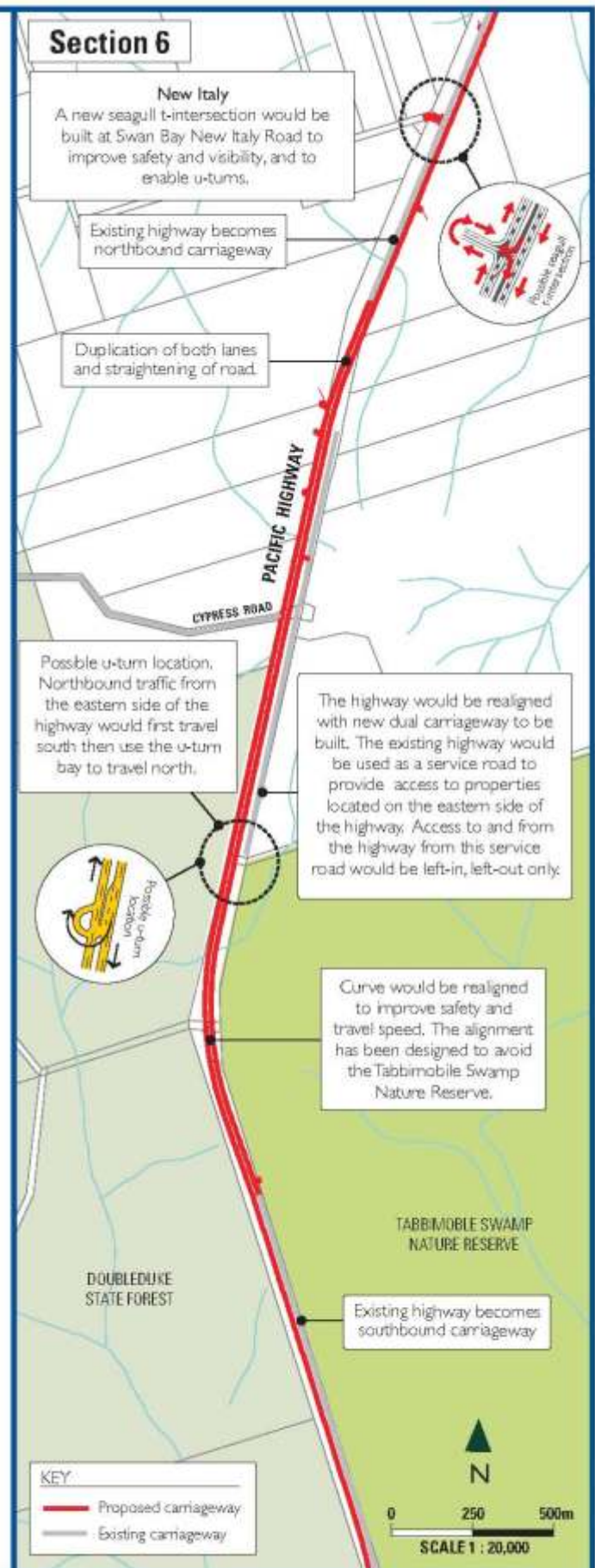
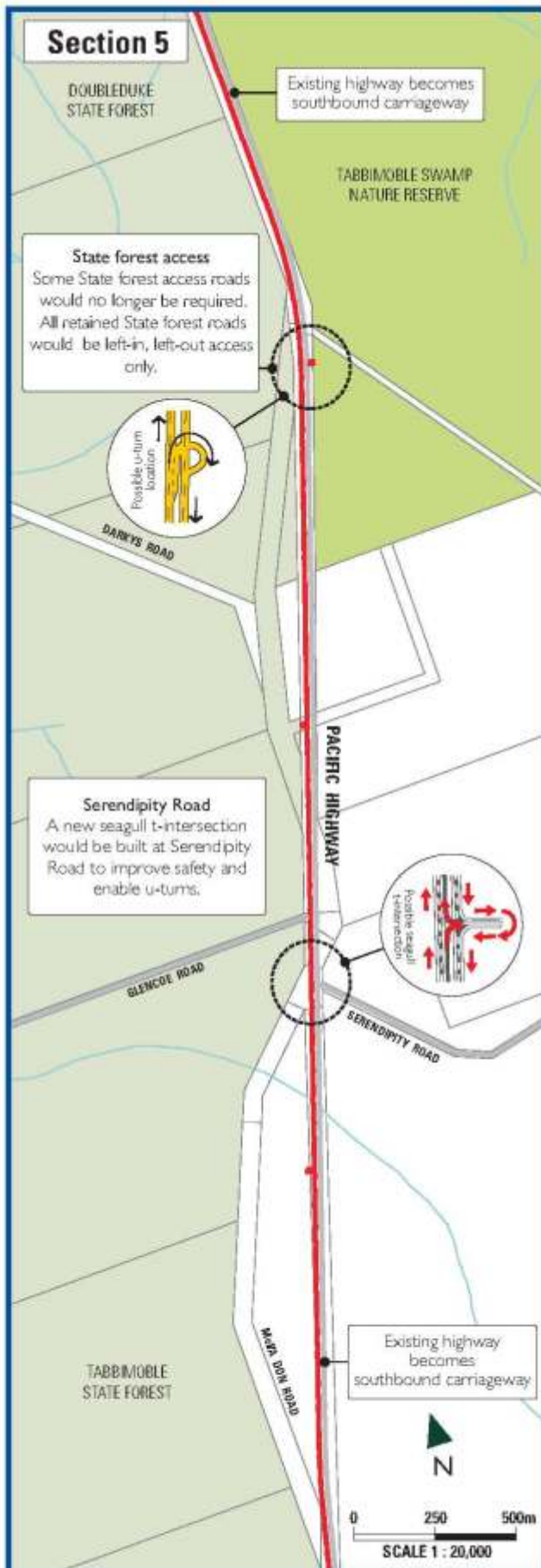


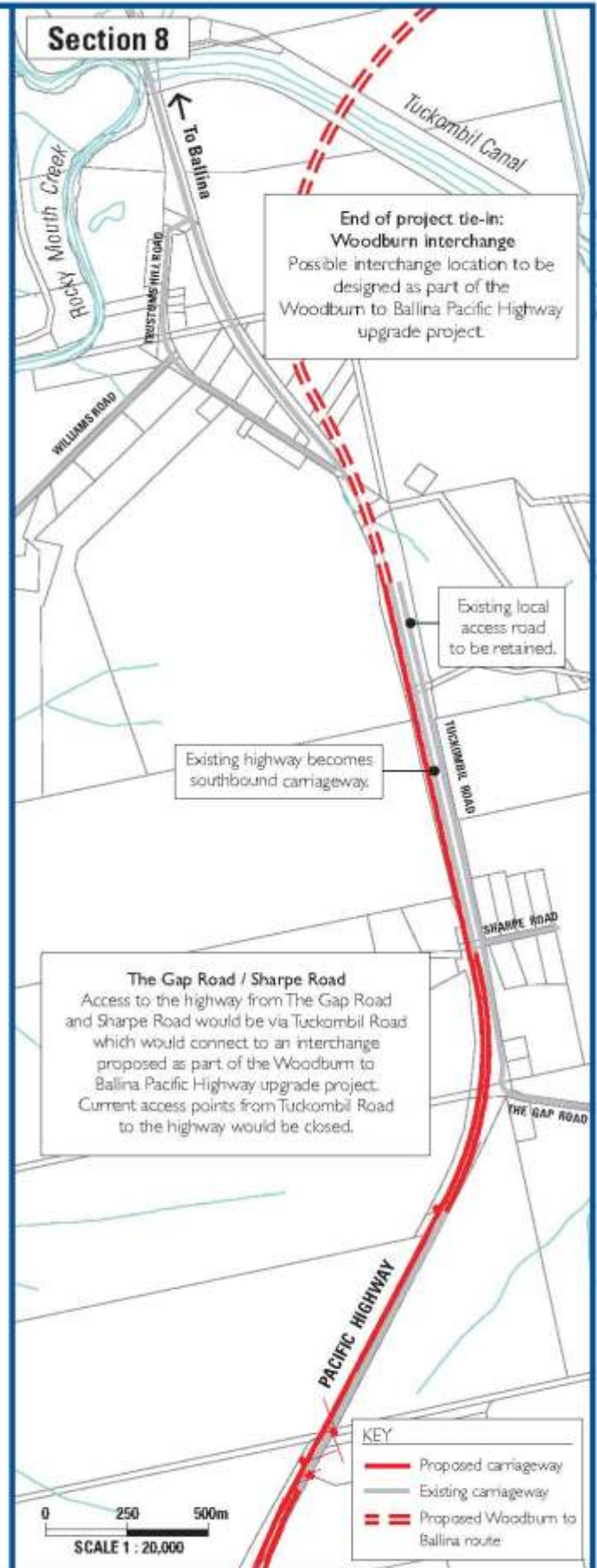
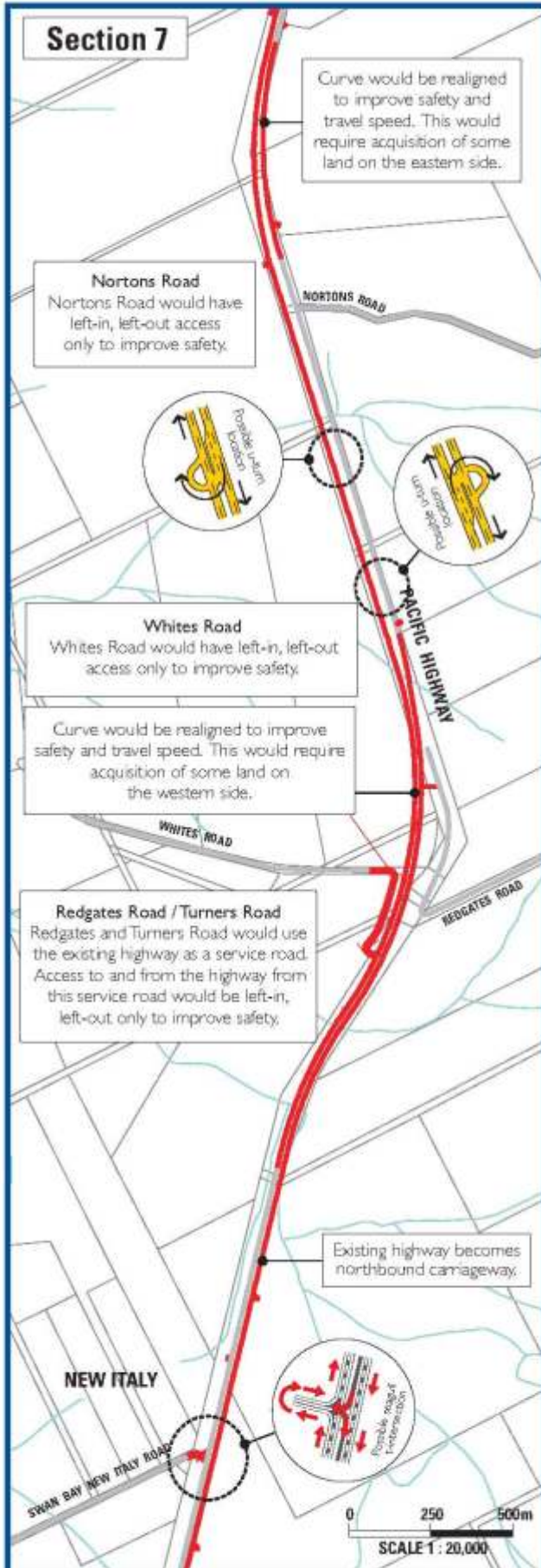
**FIGURE 6.1**  
**EXISTING PACIFIC HIGHWAY**  
**OPPORTUNITIES FOR IMPROVEMENT**











**KEY**

- Proposed carriageway
- Existing carriageway
- - - Proposed Woodburn to Ballina route



### **Improving flood immunity**

The RTA's Pacific Highway design standards require that, if feasible, at least one carriageway should be constructed at or above the 1-in-100 year flood level. If this is not feasible, the design standards require a minimum flood immunity of the 1-in-20 year flood level. The following key locations have been identified (see **Figure 6.1**) as being flood-prone and requiring road levels to be raised:

- Tabbimoble Creek.
- Tabbimoble Floodways 2 and 3.
- Tabbimoble Floodway 1.
- New Italy to Redgates Road.
- Turners Road to Nortons Road.

### **Accesses**

Access onto and off the upgraded highway for private properties and minor local roads would be achieved through provision of left-in and left-out turning facilities, coupled with a small number of strategically placed U-turn facilities (see **Figure 6.3**). Motorists wishing to turn right onto the highway from minor roads and private properties would be required to first turn left, and then travel to the nearest U-turn facility before continuing their journey in the desired direction. It is anticipated that the delay and the extra distance travelled would be off-set by overall reduced journey times, reduced delays and improved safety through eliminating right-turn movements.

A vehicle intending to make a U-turn would move into the right hand lane to access a turning lane for deceleration adjacent to the median. The vehicle would then stop in the median, which would provide safe refuge and good sight distance along the opposite carriageway. When safe to do so, the turning vehicle would proceed across both lanes of the opposite carriageway and into a safe turning bay built into the left side shoulder. When safe, the turning vehicle would enter the main traffic lane from the left side, via a separate acceleration lane.

The maximum distance from a side road or private property entrance to the nearest U-turn bay would be approximately 5 km, though typically the diversion would be much less than this. Some traffic may therefore need to travel this distance to the north before making a U-turn to travel south, or vice versa. The U-turn bays would be designed to cater for all vehicles using the highway including B-Double semi-trailers.

Three intersections have been identified as requiring direct access onto the highway in each direction. The higher standard of intersection is considered justified by the relatively higher numbers of turning movements. 'Seagull' type T-intersections with protected turning lanes are proposed in these cases which are Jacky Bulbin Road, Serendipity Road and Swan Bay New Italy Road. Intersection layouts are illustrated schematically in **Figure 6.3**.

The traffic volumes on these side roads however do not justify the provision of high-standard grade-separated intersections (flyover type).

## **6.3 Construction issues and road user management**

### **6.3.1 Road user delay management**

Widening or duplication of an existing carriageway poses greater construction and road user management challenges than deviation or green field construction. The highway must be kept open to traffic throughout construction, often in circumstances where space is limited and temporary diversions necessary. The potential for conflict between highway traffic and construction traffic is high, and delays may be frequent. Under these conditions, phased construction must be implemented to reduce delay to road users, while maintaining high levels of safety for motorists, residents and the construction workforce.

### **6.3.2 Earthworks, cut and fill**

Earthworks could pose a significant construction issue for this project, with the cut and fill balance having a potentially significant impact on project cost. Large sections of the proposed concept design are flood prone, where the upgraded highway would have to be constructed on embankment at a slightly higher level than the existing carriageway. A majority of suitable fill material would be gained from proposed new cuttings and from the short deviation sections of the project, thus reducing the amount of imported material required.

The proposed concept design incorporates substantial cutting at the following locations, to achieve a suitable road profile and, of equal importance, to reduce the amount of imported fill material required:

- Devils Pulpit deviation;
- Whites Road;
- New Italy; and
- The Gap Road.

At this stage it is estimated that up to one quarter of the required fill material may have to be sourced off-site. Potential external sources of fill have not yet been identified. However, in order to raise road pavement levels by (a hypothetical) 600 mm across all flood-prone areas (eg Tabbimoble and the floodway 1 km north of New Italy), approximately 500,000 cubic metres of fill material would be required in addition to that obtained from the cutting locations listed above.

It must be noted however, that until the detailed hydrology and hydraulic studies are complete, flood levels cannot be accurately predicted. Until this data is available, the desired road pavement levels for flood immunity cannot be determined. Therefore, the 600 mm referred to above is hypothetical only, and does not represent the findings of any technical studies undertaken for this project.

## **6.4 Description of the proposed concept design**

Given the considerations outlined in this chapter, the issues raised by the community and government stakeholders, and the constraints identified through the detailed studies documented in **Chapter 3**, a proposed concept design has been developed that responds to the issues and constraints. The main features of the proposed concept design are listed below:

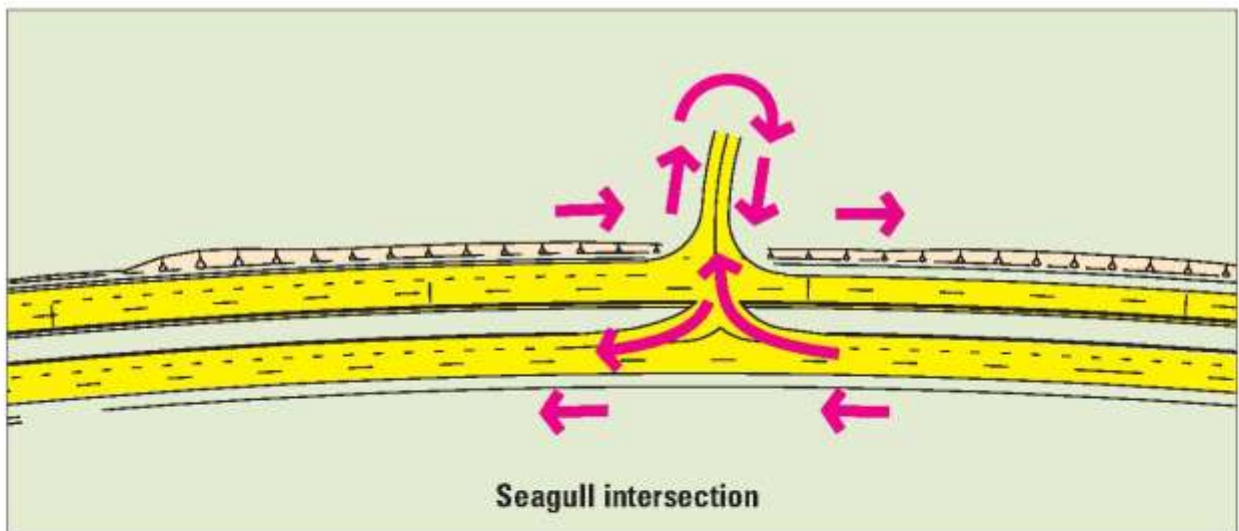
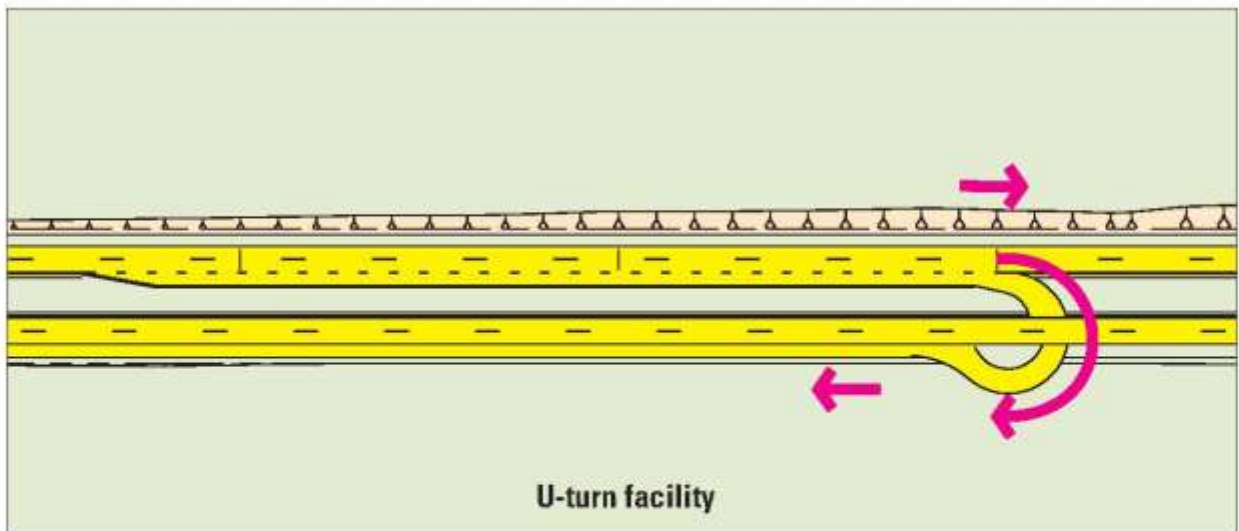
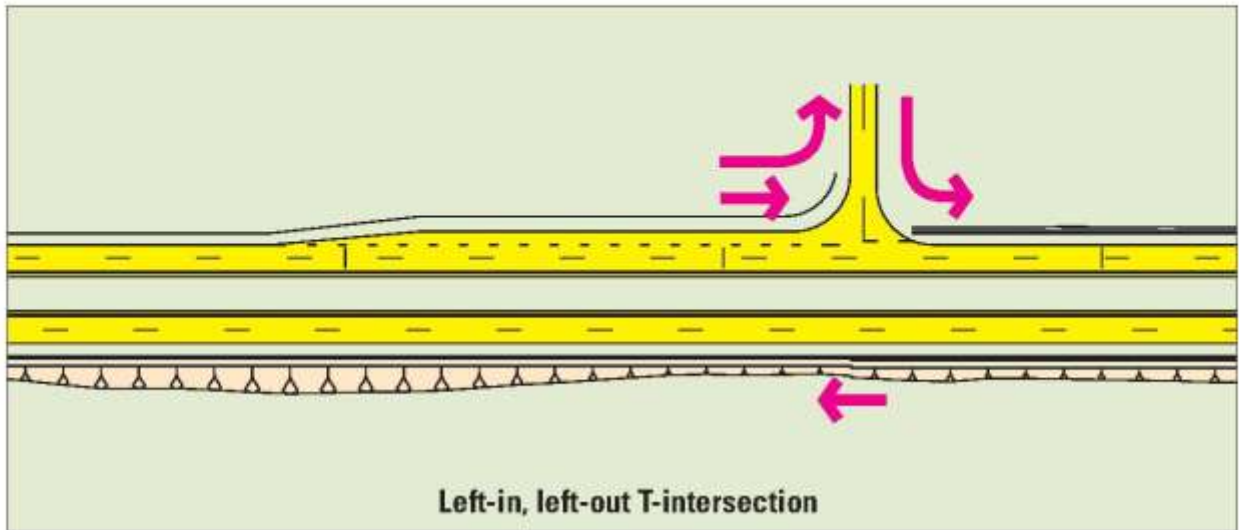
The proposed concept design is presented in **Figure 6.2a** to **6.2e**.

### **6.4.1 Typical cross-section**

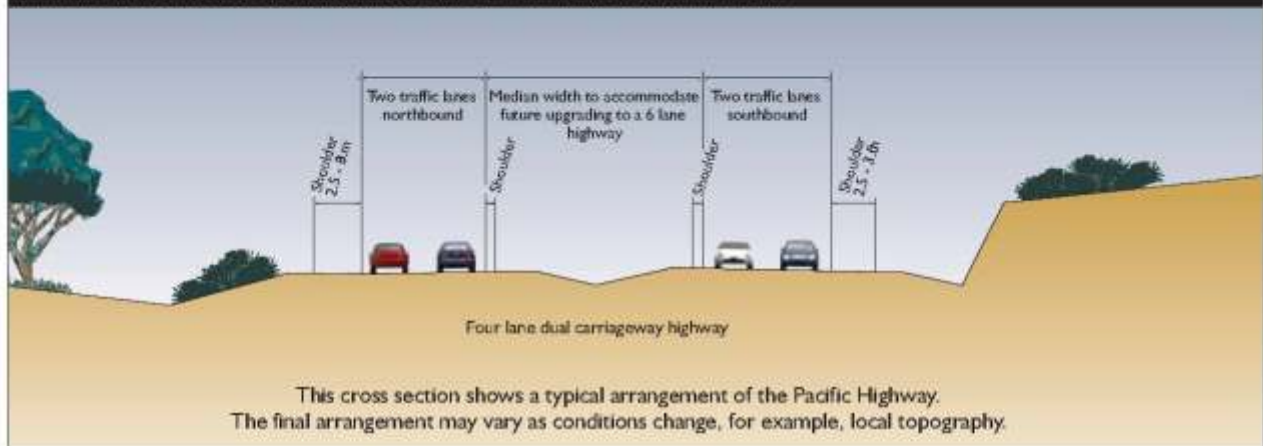
The typical cross-section (see **Figure 6.4**) of the proposed concept design consists of the following:

- Minimum 10 m verge.
- Minimum 3 m shoulder.
- Minimum 2 x 3.5 m traffic lanes.
- Minimum 0.5 m shoulder.
- Minimum 11 m central median reserve.
- Minimum 0.5 m shoulder.
- Minimum 2 x 3.5 m traffic lanes.
- Minimum 3 m shoulder.
- Minimum 10 m verge.

Additionally, a road reserve has been identified to enable future parallel service roads to be provided on either side or both sides of the carriageway under a Class M scenario (also illustrated in **Figure 6.4**).

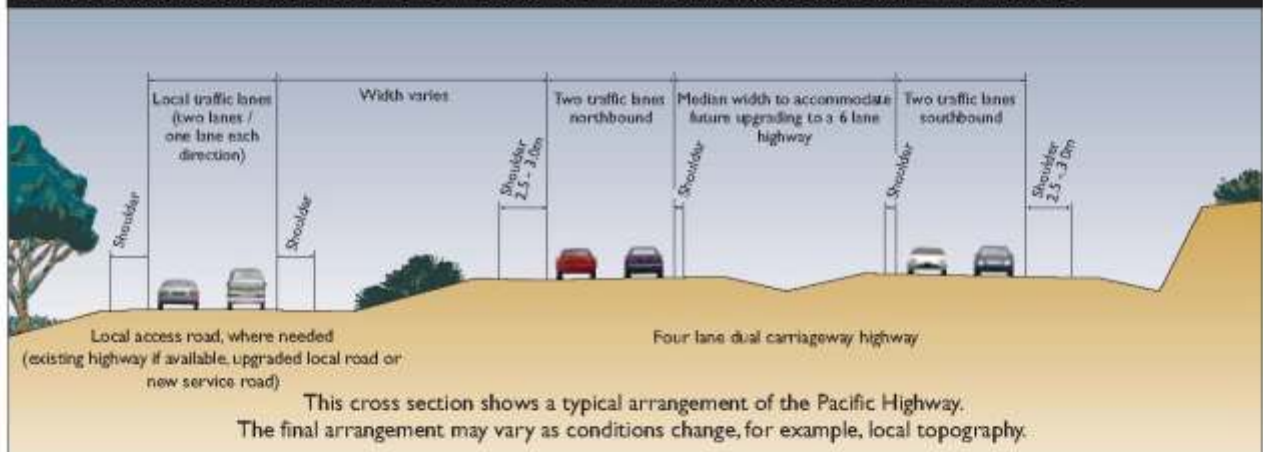


**TYPICAL CROSS SECTION SHOWING AN UPGRADE, DUAL CARRIAGEWAY HIGHWAY**



A new carriageway is to be constructed along side the existing highway for much of this project. Which side of the existing highway the new carriageway will be built on may vary from location to location depending on environmental, engineering or other constraints.

**TYPICAL CROSS SECTION SHOWING THE NEW MOTORWAY WITH A LOCAL ACCESS ROAD RUNNING PARALLEL**



A new carriageway is to be constructed along side the existing highway for much of this project. Which side of the existing highway the new carriageway will be built on may vary from location to location depending on environmental, engineering or other constraints.

#### **6.4.2 Iluka Road to Mororo Road**

At the southern end of the study area, the project will connect to the upgraded Pacific Highway being developed concurrently by the RTA for the Wells Crossing to Iluka Road project (see **Figure 6.2b**). This adjoining project includes a proposed grade-separated interchange (ie flyover) at Iluka Road, and associated north-facing on and off ramps enabling U-turns to be made in both directions. The proposed concept design will therefore connect to the interchange, with the existing highway becoming the southbound lanes, and two new northbound lanes being constructed on the western side. Just north of Banana Road the proposed carriageway switches sides to the eastern side with the existing road forming the northbound carriageway.

Banana Road and Mororo Road would each have left-in, left-out access onto the highway's northbound carriageway.

The terrain rises to a crest in the vicinity of Mororo Road, where the road would be built in a cutting, providing a potential source of fill material for other sections of the project.

#### **6.4.3 Mororo Road to Jacky Bulbin Road**

A U-turn bay is proposed approximately 1 km north of Mororo Road to permit northbound traffic to make a U-turn south.

At the curve north of Mororo Road, the new carriageway would switch sides, with the existing highway becoming the southbound carriageway, and two new lanes being constructed on the western side, and continuing for approximately 4 km. A 'Seagull' type T-intersection is proposed at Jacky Bulbin Road (see **Figure 6.2b**).

A U-turn bay is proposed south of Jacky Bulbin Road to enable southbound traffic to make a U-turn north and gain access to private properties on the western side of the highway.

Jacky Bulbin Road is located on the floodplain of Tabbimoble Creek, where existing highway levels are likely to require raising to achieve the desired flood immunity level. Some fill is therefore likely to be required.

#### **6.4.4 Jacky Bulbin Road to Pine Road**

Approximately 1 km north of Jacky Bulbin Road, the new lanes would again switch sides, with the existing highway becoming the northbound lanes and two new lanes being constructed on the eastern side (see **Figure 6.2b** and **c**). Pine Road, which provides access to Bundjalung National Park, would be limited to left-in, left-out turn movements only.

A U-turn bay is proposed to be located approximately 1.2 km south of Pine Road, to permit northbound traffic to gain access to private properties on the eastern side of the highway.

#### **6.4.5 Pine Road to Serendipity Road (Devils Pulpit State Forest)**

North of Pine Road the existing highway alignment is of a poor standard for approximately 3 km, with a series of bends combined with crests and dips. The proposed concept design therefore deviates near Pine Road, along a 3 km corridor to the east of the existing highway that has been acquired for the purpose. A new section of four-lane highway would be constructed along this corridor, reconnecting with the existing highway (being the northbound lanes) approximately 400 m south of Tabbimoble Floodway No. 3 (see **Figure 6.2c** and **d**).

The median between the two carriageways will increase substantially as the proposed southbound carriageway is on a Class M alignment and the northbound makes use of the existing carriageway where possible. Under a Class M arrangement, a new northbound carriageway could be constructed adjacent to the proposed southbound carriageway and the original highway would revert to a service road.

The reserved corridor ends at the southern end of the Tabbimoble Straight, and provides an opportunity to gain substantial quantities of fill material.

A U-turn bay is proposed to be located approximately 0.5 km south of Tabbimoble Floodway No. 3, to permit southbound traffic to gain access to private properties on the western side of the highway.

To the north of Tabbimoble Floodway No. 2, the new highway lanes switch again to the western side and the existing highway would become the southbound lanes. This configuration would continue for the length of the Tabbimoble Straight.

A 'Seagull' type T-intersection is proposed at Serendipity Road, which would be realigned so that it intersects with the highway approximately 150 m south of the existing intersection. The existing intersection is effectively a four-way junction, with Glencoe Road (a forest access road) making up the fourth arm of the intersection on the western side. Glencoe road would become left-in, left-out only.

Two major rest areas are proposed, one on each side of the carriageway, to serve both north- and southbound traffic. These rest areas would be designed to accommodate overnight parking for B-doubles as well as all other types of heavy and light vehicles. There would also be toilet facilities. For northbound traffic a major rest area is proposed approximately 2 km north of Pine Road, on the west side of the proposed highway deviation adjoining Devils Pulpit State Forest. For southbound traffic a major rest area is proposed approximately 1 km north of Mororo Road on the east side of the highway.

The location for the rest areas has been chosen to satisfy the RTA's rest area strategy, which suggests a maximum spacing of 50 km between major rest areas along the Pacific Highway. The proposed locations would also ensure that the rest areas are not in close proximity to any residences or other noise-sensitive land uses.

#### ***6.4.6 Serendipity Road to Cypress Road***

The proposed carriageway continues on the western side with two new carriageways being required either side of Cypress Road in a cutting at the Cypress Road junction (see **Figure 6.2d**).

The proposed new construction would render a 1.7 km section of existing highway redundant, either side of Cypress Road. This section of road would be utilised as a local access road on the eastern side of the highway, servicing four private properties and the Tabbimoble Swamp Nature Reserve, but requiring only a single left-in, left-out access that would be located approximately 200 m north of Cypress Road.

Between Serendipity Road and Cypress Road, two U-turn bays are proposed. The first would be located approximately 1.5 km north of Serendipity Road, to enable northbound traffic to turn south and access properties on the east side of the highway. The second would be located approximately 1 km south of Cypress Road, and would permit southbound traffic to turn and head north, to access properties on the west side of the highway.

#### ***6.4.7 Cypress Road to Whites Road***

Approaching New Italy, the proposed concept design again adopts the existing highway as the northbound carriageway (see **Figure 6.2d** and **e**). Adjacent to the Swan Bay New Italy Road intersection (which is situated on a crest with poor visibility to the south), the formation would be cut deeper, improving sight distances and gaining further fill materials.

Swan Bay New Italy Road will have a 'Seagull' type T-intersection, similar to the existing intersection, but with the inclusion of a median reserve and acceleration and deceleration lanes.

From New Italy to Whites Road the proposed concept design switches, with the existing highway becoming the southbound carriageway

The existing curve at Whites Road is sub-standard, requiring a larger radius to achieve an appropriate horizontal curvature. A new four-lane road would therefore be constructed on a new alignment approximately 100 m to the west of the existing, which would impact on private properties in this location (refer to **section 7.4** for an assessment of the potential impacts). However, the new curve would be built in cut and would therefore allow the topography to form a natural acoustic barrier.

The existing curve adjacent to Turners Road would become redundant, but would be retained for access to Redgates Road and Turners Road, with a single left-in, left-out entry point approximately 300 m north of Whites Road. Whites Road would become left-in, left-out only.

Between New Italy and Whites Road, the highway reaches its lowest point, with the existing road surface being at an elevation of less than 2 m AHD at the lowest point. Therefore, this length of road (approximately 1.25 km) would require considerable fill material to achieve the desired flood immunity on at least one carriageway.

#### ***6.4.8 Whites Road to The Gap Road***

This section of the existing highway is also low-lying, and would require fill material to improve flood immunity. Between the Whites Road bend and Nortons Road, the existing highway would become the southbound lanes, with new construction on the western side to create the northbound lanes (see **Figure 6.2e**). Two U-turn bays are proposed north of the Whites Road bend, to enable safe turn movements from each of the north and southbound carriageways. Nortons Road would become left-in, left-out only.

The median has additional width on this section to enable the existing road to be converted to a service road and a new southbound carriageway to be constructed in the median under a future Class M arrangement.

Between Nortons Road and The Gap Road, the proposed concept design has a new northbound carriageway on the western side with the existing road forming the southbound carriageway.

#### ***6.4.9 The Gap Road to Tuckombil Canal***

The existing curve adjacent to The Gap Road would need to have a reduced radius to minimise impact on the surrounding residential area to enable the dual carriageway to be constructed around the existing centre line (see **Figure 6.2e**). This would require some private property acquisition on the western side, affecting land that is currently accessed via Wondawie Way. Wondawie Way would retain a left-in, left-out access onto the highway.

The straight section of existing highway north of The Gap Road would incorporate the existing highway as the southbound lanes, and two new northbound lanes would be constructed on the western side, continuing to the project's termination near Trustums Hill on the southern side of the Tuckombil Canal.

Tuckombil Road would remain as a local access road, but the existing connection from Tuckombil Road onto the Pacific Highway adjacent to The Gap Road would be closed. Access from The Gap Road to the Pacific Highway would be via the northern end of Tuckombil Road, where the proposed concept design connects to the adjoining Woodburn to Ballina Pacific Highway upgrade project via a grade-separated (flyover) interchange south of Tuckombil Canal. This would provide a direct connection to Tuckombil Road.

The existing access from the highway into the northern end of Tuckombil Road would also be closed, with traffic diverted to the connection referred to above.

#### **6.4.10 Rest areas**

Major rest areas are proposed with appropriate facilities on both sides of the highway, as referred to in **section 6.4.5** above. They would provide adequate and safe overnight parking for heavy vehicles and other road users. For northbound traffic a major rest area is proposed approximately 2 km north of Pine Road, on the west side of the proposed highway deviation adjoining Devils Pulpit State Forest. For southbound traffic a major rest area is proposed approximately 1 km north of Mororo Road on the east side of the highway.

The proposed major rest areas would ensure that the concept design complies with the RTA's rest area strategy, which suggests a maximum spacing of 50 km between major rest areas. The existing parking facility at New Italy will remain, but will be reduced in size. The remainder of the existing lay-bys and stopping areas are located at sporadic intervals, and vary widely in size and in terms of the facilities offered. These existing stopping areas will not be accommodated within the proposed concept design.

#### **6.4.11 Stopping bays**

In addition to the emergency shoulders, the concept design includes emergency stopping bays at 5 km intervals throughout the scheme. For emergency purposes only, these stopping bays will provide safe emergency stopping off the shoulder, and an emergency telephone.

### **6.5 Class M design layout**

The RTA is planning for a possible future upgrade to a 'Class M' or motorway standard road, with two lanes in each direction, but with the capability of being upgraded to three lanes in each direction when warranted. A Class M road would have 110 km/h posted speed, controlled access, and grade-separated or flyover-type interchange access. Under a future Class M scheme, local traffic would be diverted to a parallel service road, having two lanes and with a posted speed limit of less than 100 km/h.

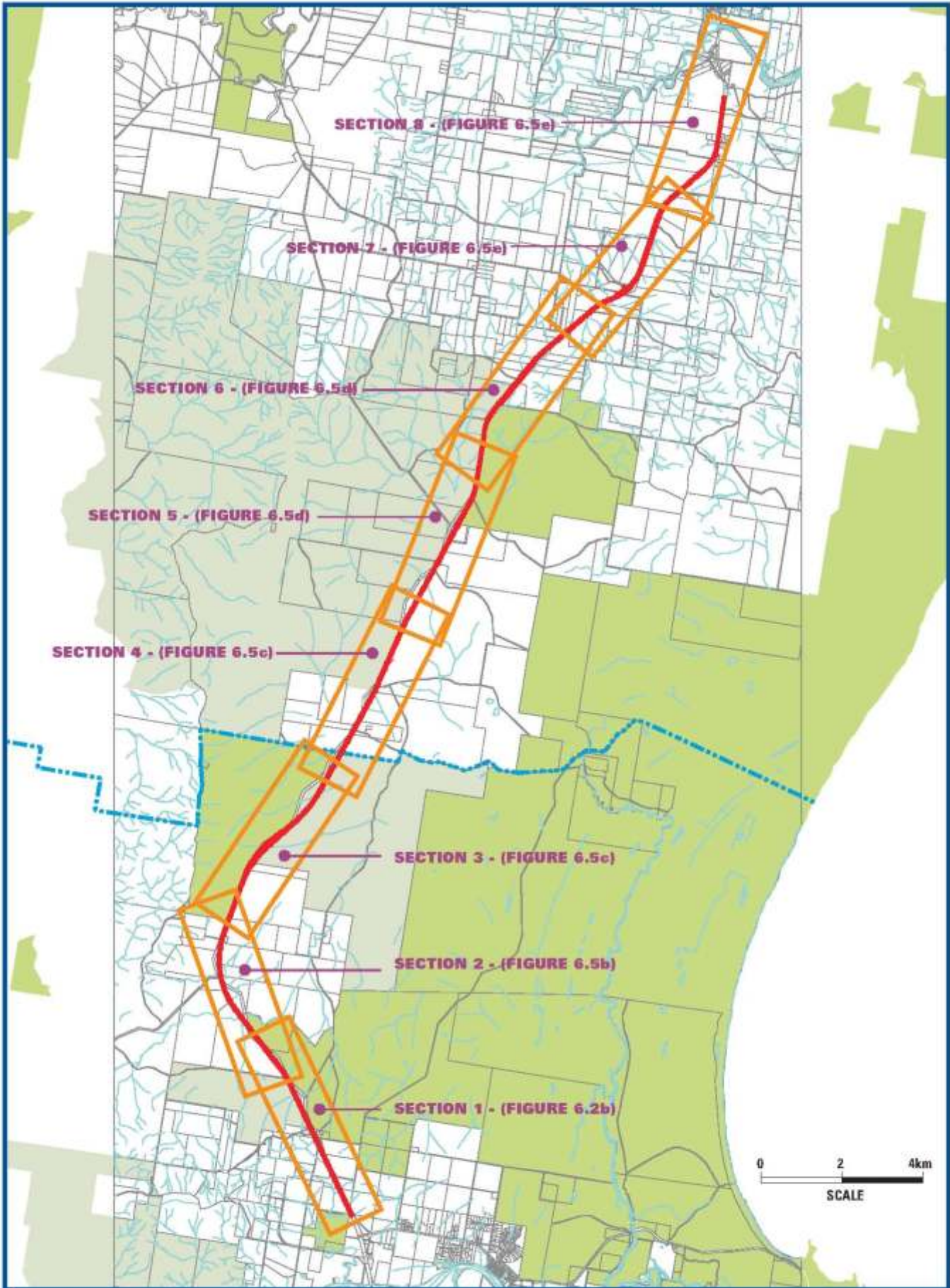
Class M refers to a motorway-standard road, where access is restricted to grade-separated (flyover-type) interchanges, and there is no direct access on or off the highway to local roads or private property.

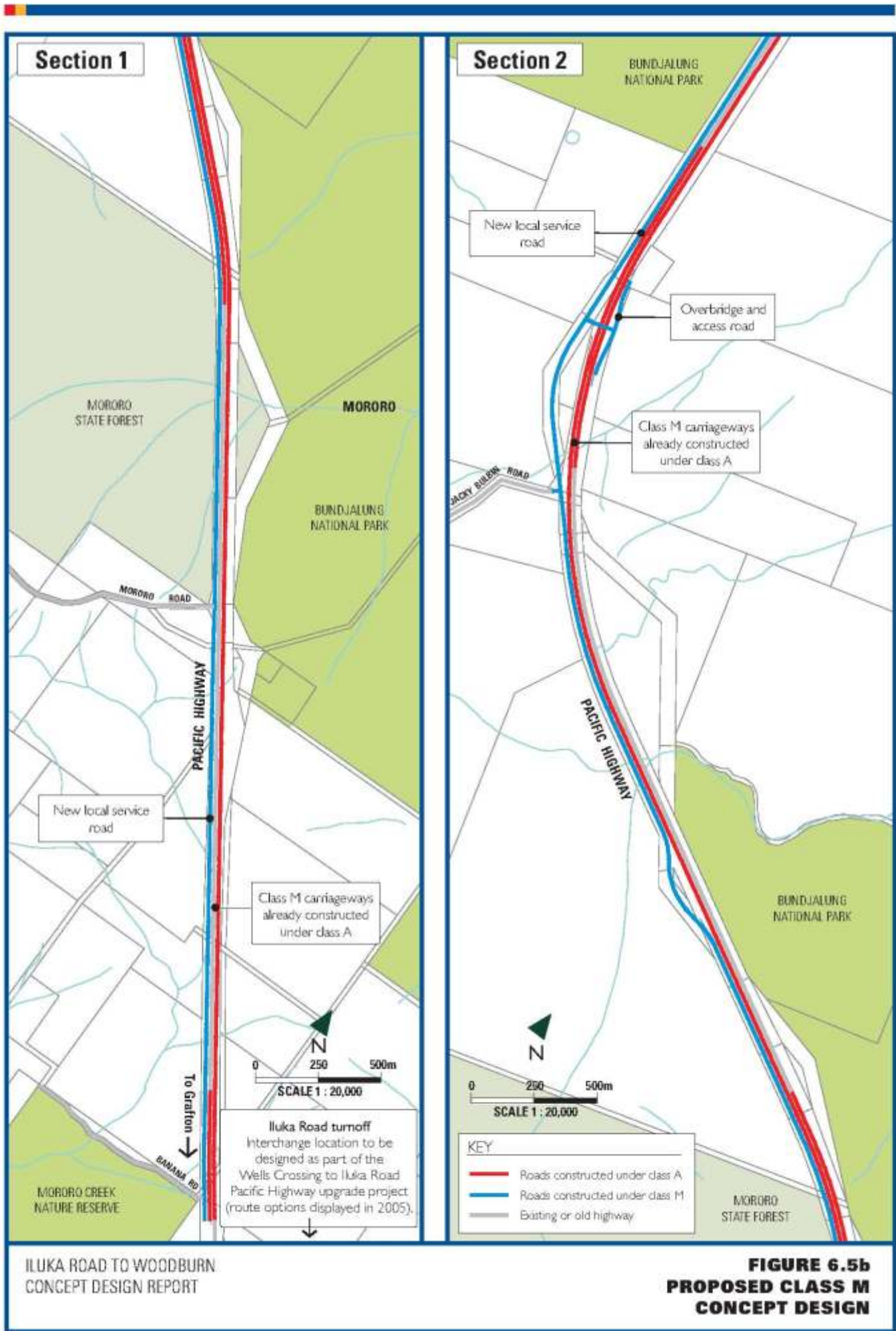
The Class M scenario has not been subject to any detailed design beyond a conceptual, schematic layout as depicted in **Figures 6.5a to 6.5e**. This schematic layout indicates the likely potential extent of land acquisition that would be required in order to implement the ultimate Class M scheme. This 'footprint' for the Class M layout has been adopted by the RTA however, in order to facilitate negotiations for land acquisition for the proposed Class A concept design. The intention behind this strategy is that, should the Class M strategy be implemented at some future time, no further land would be required in addition to that identified on the maps in **Figures 6.5a to 6.5e**.

The Class M strategy includes a possible grade-separated interchange at New Italy, when warranted. An interchange at New Italy would further improve safety at this location, and would also continue to support and promote the cultural heritage values and economic viability of the New Italy Museum Complex. Grade separated interchanges are currently proposed at Iluka Road, and south of the Tuckombil Canal, as part of the adjoining Wells Crossing to Iluka Road and Woodburn to Ballina projects, respectively. A Class M scheme would therefore require construction of a 33 km parallel local service road to provide access to communities between these two interchange locations.

All of the U-turn facilities, left-in and left-out turn facilities, and T-intersections proposed under the Class A concept design would be removed under a Class M scheme.







**Section 1**

**Section 2**

MORORO STATE FOREST

MORORO

BUNDJALUNG NATIONAL PARK

MORORO ROAD

PACIFIC HIGHWAY

New local service road

Class M carriageways already constructed under class A

To Grafton

SAMANA RD

MORORO CREEK NATURE RESERVE

0 250 500m  
SCALE 1 : 20,000

**Iluka Road turnoff**  
Interchange location to be designed as part of the Wells Crossing to Iluka Road Pacific Highway upgrade project (route options displayed in 2005).

BUNDJALUNG NATIONAL PARK

New local service road

Overbridge and access road

Class M carriageways already constructed under class A

JACKY BILBIR ROAD

PACIFIC HIGHWAY

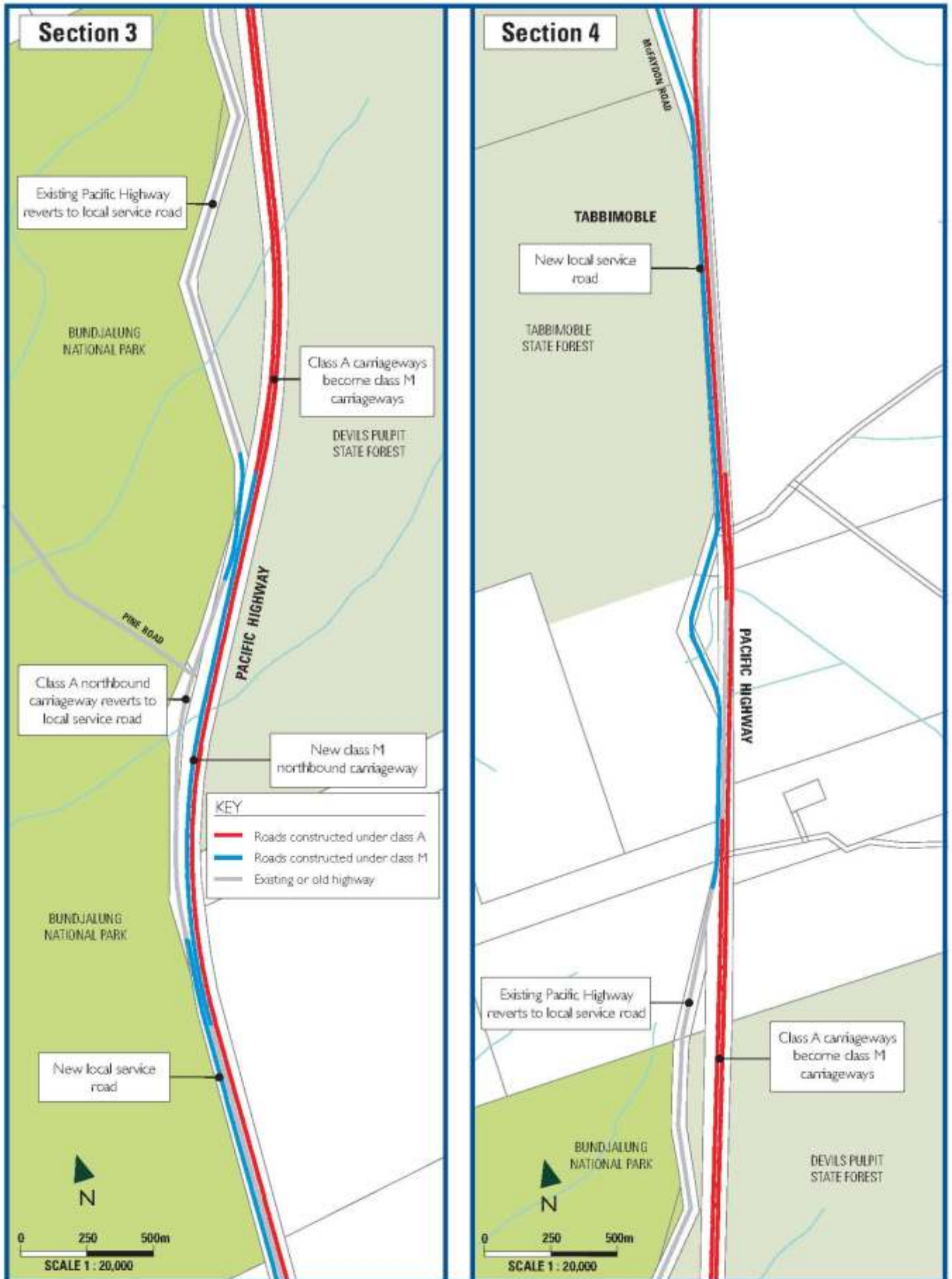
BUNDJALUNG NATIONAL PARK

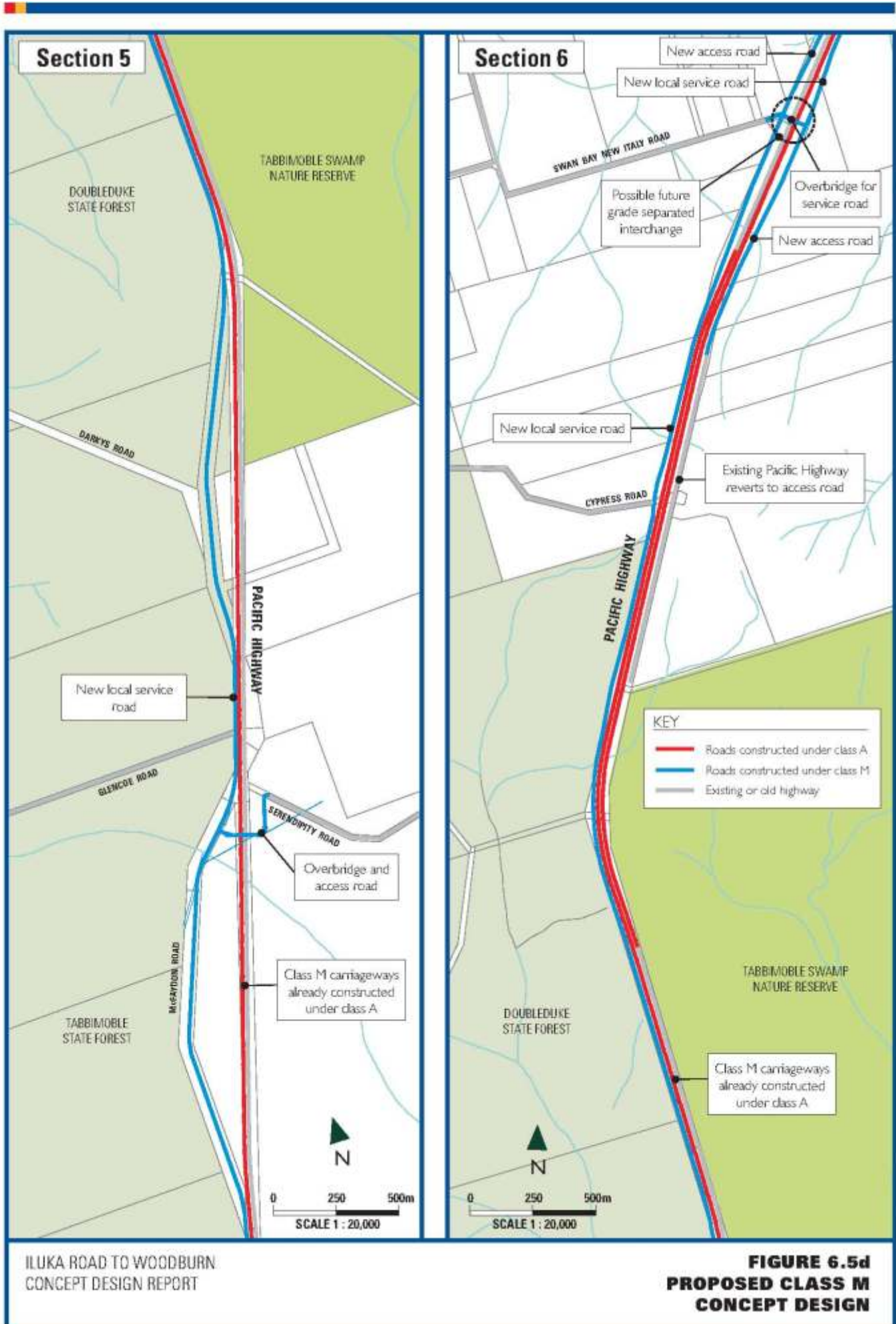
MORORO STATE FOREST

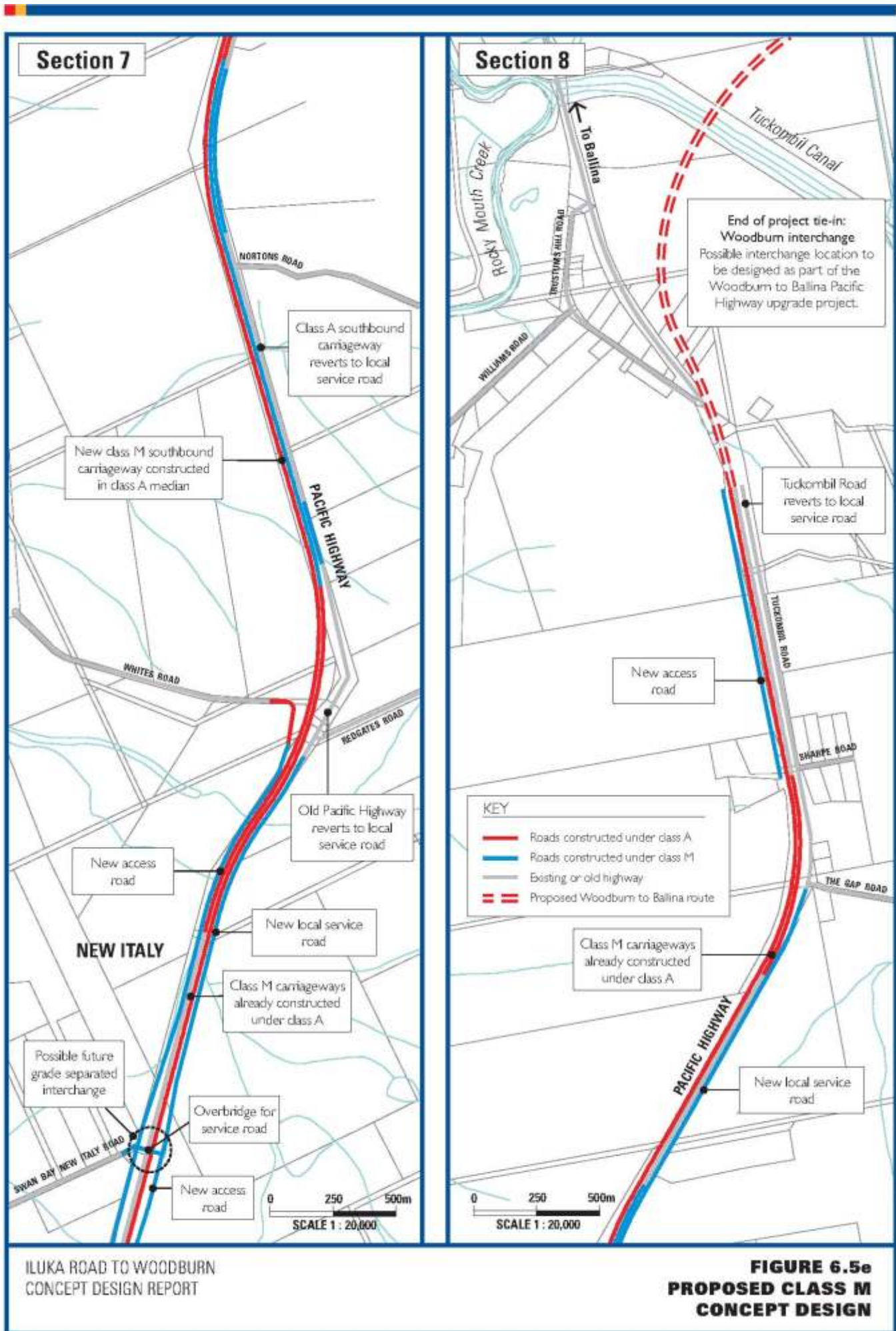
0 250 500m  
SCALE 1 : 20,000

**KEY**  
 — Roads constructed under class A  
 — Roads constructed under class M  
 — Existing or old highway

**FIGURE 6.5b**  
**PROPOSED CLASS M**  
**CONCEPT DESIGN**







Blank