

7. Assessment of the preferred route

7.1 Overview

This section provides a description of the potential impacts of the preferred route. A detailed Environmental Assessment, along with development of the concept design, will be part of the next stage of the project. The assessment will be undertaken in accordance with the requirements of the NSW *Environmental Planning and Assessment Act, 1979*. This section identifies the main social, economic, environmental and traffic and transport impacts of the preferred route as a precursor to the detailed Environmental Assessment.

The impacts of the preferred route have been assessed on the basis of the preliminary design as described in **Section 6.3**. The preferred route corridor is approximately 150 metres wide and within this corridor a road reserve approximately 100 metres wide has been identified. The road reserve is wider at interchange locations because these require a greater area of land for ramps and connections to local roads. In some locations, such as between Maclean and Townsend and through Harwood, a narrower road reserve has been adopted because of constraints in the surrounding area.

The impacts of the project will be subject to more detailed analysis as the concept design and environmental assessment of the preferred route are progressed. The road is generally expected to be located within the road corridor identified in **Section 6.3** and shown on **Figure 6-5** to **Figure 6-8**, unless investigations identify significant issues that necessitate more substantial realignment of the road or change in corridor width.

7.2 Traffic and transportation considerations

7.2.1 Traffic volumes, travel time and costs

The preferred route would provide benefits to through traffic in terms of travel time savings and a shorter distance. The travel time saving for through-traffic would be approximately 11 minutes, assuming a constant travel speed of 110 km/h, compared with travel on the existing highway. The preferred route is approximately 71 kilometres long, seven kilometres shorter than the existing Pacific Highway.

The preferred route would also provide benefits to some local and regional traffic, particularly for trips between the interchanges at Tyndale and Yamba Road, or Iluka Road. Local or regional traffic travelling between Grafton and destinations north of Tyndale such as Maclean, Yamba, Iluka and beyond would be likely to use the preferred route from Tyndale north, rather than the existing highway, because it is a higher standard road that would be safer and quicker.

Between Glenugie and Tyndale, traffic making local and regional trips to and from Grafton would not be likely to use the preferred route, as the existing highway would be more direct. It is therefore expected that mainly through traffic would utilise the preferred route between Glenugie and Tyndale. This would mean that, between Glenugie and Tyndale, approximately 65-70 per cent of total traffic in the corridor, and 50 per cent of heavy vehicles, would continue to use the Pacific Highway rather than the preferred route. Between Tyndale and Iluka Road interchanges, it is anticipated that approximately 95 per cent of all traffic would travel on the preferred route.

The location of the preferred route in relatively close proximity to Grafton and Maclean, with interchanges at Glenugie, Tyndale and Yamba Road, would provide good access for emergency vehicles.

7.2.2 Safety

Road safety would be improved in the corridor as a result of the preferred route and the improvements to the existing highway. Traffic using the preferred route would benefit from the high standard of road design. Between Glenugie and Tyndale approximately 65-70 per cent of traffic would continue to use the existing highway. This traffic would benefit from improved safety, including a reduction in the number and severity of accidents, as a result of a number of factors:

- Implementation of a package of improvement works on the existing highway which would be part of the development of the preferred route.
- Reduced overall traffic volumes on the existing highway.
- A significant reduction in heavy vehicle volumes, and in particular reduction in the number of very large heavy vehicles such as semi-trailers and B-Doubles.

The preferred route would save an average of two to three lives and about 25 serious injuries each year in the corridor from the year of commencement of operation.

7.2.3 Relationship to the local road network

Approximately 35 kilometres of the preferred route would be located adjacent to the existing highway, including sections from Wells Crossing to Glenugie and from Tyndale to Iluka Road. The remainder of the preferred route, between Glenugie and Tyndale, would be an entirely new road. The implications for the local road network are different for sections that follow the existing highway and sections that are a new route.

Between Wells Crossing and Glenugie, the existing highway would remain in the current location and would be used as a local road. The preferred route would be constructed adjacent

and to the east of the existing highway. Local roads such as Franklins Road and Eight Mile Lane would continue to intersect with the existing highway and would cross the preferred route via underpasses or overpasses.

Between Glenugie and Tyndale, the preferred route is a new corridor separate from the existing highway. The need for service roads would be minimal, as the alignment does not generally follow existing roads and therefore would have limited impacts on existing access. Where necessary, service roads would be provided in order to maintain access to properties and local roads. It is expected that local roads that cross the preferred route (such as Old Six Mile Lane, Wants Lane, Wooli Road, Bostock Road and Somervale Road) would do so via underpasses or overpasses. Some local road crossing points may be rationalised based on road use and availability of practical alternative routes. Where properties are severed by the preferred route, access would be provided across the new alignment to ensure land owners can access all parts of their property.

Between Tyndale and Harwood Bridge, the northbound carriageway of the preferred route would be constructed mostly on the alignment of the existing highway. The southbound carriageway and a new two lane local road would be constructed to the east of this. Properties on the western side of the existing highway are few, being limited to locations such as north of Tyndale and near Shark Creek, where the preferred route deviates to the east of the existing highway. In these locations the existing highway would be retained as part of the local road network to provide access to properties.

From Ferry Park to the Harwood Bridge, the new highway would involve reconstruction of the existing highway. Requirements for property access from the existing highway in this section are few. However, a road would be provided parallel to the upgraded highway to provide an alternative route for local traffic, so as to avoid the need to travel through Maclean. Property access would be via this road.

Interchanges would be included in the preferred route at Glenugie, Tyndale, Yamba Road and Iluka Road. There is limited potential for additional interchanges between these points, because the preferred route would not cross roads that provide access to major population or employment centres. Consideration would be given to intermediate interchanges based on travel demand analysis. However, based on current and projected traffic volumes, intermediate interchanges are unlikely to be required in the next 10 to 20 years.

7.3 Construction staging considerations

Economic analysis of the route options for the Wells Crossing to Harwood section of the Pacific Highway Upgrade indicates that because of the relatively high cost of all the options and the preferred route, and the relatively low volumes of traffic that use this section of the Pacific Highway, it is less cost effective to construct the entire preferred route as a single project. A staged approach to route development provides opportunities to improve the economic performance of the project while achieving safety and transport efficiency objectives.

Two possible approaches for the development of the preferred route have been considered to enable comparison of the economic benefits of staged implementation:

- A possible unstaged approach where the package of improvements to the existing highway described as part of the preferred route could be implemented as soon as possible to improve the safety of the highway between Glenugie and Tyndale, and the preferred route could be constructed over a period of five years.
- A possible staged approach where the package of improvements to the existing highway would be implemented as a first stage with the preferred route to be constructed in two subsequent stages – the first stage from Tyndale to Harwood following the improvements to the existing highway and then the remaining sections after 15 years.

A staged approach to development would likely have a better economic outcome than the unstaged approach, with the net present value improving significantly (by about 40 per cent) over a 30 year assessment period. This is because the expenditure on improvements to the existing highway and construction of the preferred route would be outlaid in line with growth in traffic volumes.

One possible implementation strategy could be to first improve the safety of the existing highway and to follow later with the construction of the preferred route. That would improve the safety of the existing highway as an interim measure, until such time as travel demand and funding availability determine that the preferred route should be constructed. The existing highway has sufficient capacity to cope with projected growth in traffic volumes for up to the next 30 years. Therefore, undertaking improvements to the existing highway as a first step in the upgrading of this section of the Pacific Highway could provide a cost effective means of addressing safety issues for road users, which are a key issue for the project.

The timing of construction of the preferred route and improvements to the existing highway has not been set. However, the staged development of the project described above is a potential scenario, subject to funding availability and priorities for the Pacific Highway Upgrade Program as a whole.

7.4 Statutory position

The statutory position of the preferred route has been considered with reference to the NSW EP&A Act, relevant environmental planning instruments and other NSW and Commonwealth legislation. An overview of approval requirements is provided below.

7.4.1 Planning controls

The preferred route is subject to local planning controls under Ulmarra LEP 1992 and Maclean LEP 2001. A summary of permissibility within each zone through which the preferred route passes is provided in **Table 7-1**. The preferred route is permissible either with consent or without consent in all zones through which it passes. In zones where it is permissible with consent, State Environmental Planning Policy (SEPP) 4 would operate to remove the need for development consent, making the entire project permissible without consent.

■ **Table 7-1: Permissibility of the preferred route under Ulmarra and Maclean LEPs**

Zone	Permissibility of preferred route
Ulmarra LEP 1992	
Zone 1 (a) (General Rural Zone)	Permissible with consent
Zone 1(f) (Rural Forests Zone)	Permissible with consent
Maclean LEP 2001	
Zone 1(a) (Agricultural Protection)	Permissible without consent
Zone 1(b) (General Rural)	Permissible without consent
Zone 1(f) (Rural Forests)	Permissible without consent
Zone 1(i) (Rural Investigation)	Permissible without consent
Zone 1(s) (Rural Small Holdings)	Permissible without consent
Zone 1(t) (Rural Tourist)	Permissible without consent
Zone 1(w) (Rural Waterway)	Permissible without consent
Zone 2(a) (Residential Low Density)	Permissible without consent
Zone 7(a) (Environmental Protection Ecological Significance)	Permissible with consent
Zone 7(e) Environmental Protection Escarpment/Scenic)	Permissible with consent

The 150 metre wide preferred route corridor includes a very small area of the SEPP 14 wetland at Yaegl Nature Reserve. SEPP 14 requires an Environmental Impact Statement under Part 4 of the NSW EP&A Act for filling within a SEPP 14 wetland. The preferred route would be designed to avoid filling within the SEPP 14 wetland. Therefore, approval processes under SEPP 14 would not apply to the project.

7.4.2 Part 3A of the EP&A Act

The NSW Parliament passed the *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005* No 43 on 16 June 2005. This amendment, which commenced in early August 2005, adds Part 3A to the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and in doing so establishes a new process for assessment of major infrastructure and other significant development (“Part 3A Projects”). Part 3A projects may be declared by:

- A State Environmental Planning Policy, such as the recently gazetted SEPP (Major Projects) 2005, or
- An order of the Minister published in the Gazette.

To be eligible for declaration as a Part 3A Project, a proposal must be either:

- major infrastructure or other development that is in the opinion of the Minister is of economic, social or environmental significance to the State, or
- major infrastructure or other development for which the proponent is also the determining authority under Part 5 of the EP&A Act, and where an EIS is required under that Part.

The RTA will make an assessment regarding the application of Part 3A during the course of the route development and assessment process.

7.4.3 Other approvals

The following approvals may be necessary for the preferred route, and the need to obtain these would be confirmed as part of the environmental assessment of the preferred route:

- Permits under the *Fisheries Management Act, 1994*.
- Approval under the *Heritage Act 1977*.
- Excavation permits or consents to destroy Aboriginal sites under the *National Parks and Wildlife Act, 1974*.
- Authorisation to clear vegetation under the *Native Vegetation Act, 2003*.
- Water Management Work approval under the *Water Management Act, 2000*.

The development of route options and the preferred route has considered the requirements of all the above Acts and has sought to minimise impacts to the greatest practicable extent. Consultation with the Government agencies responsible for administration of the above Acts has occurred as part of this project and would continue as part of the assessment of the preferred route, and the requirements of these agencies would be addressed in the Environmental Assessment process under Part 3A, should the project be subject to that assessment process.

There are a number of NSW Acts that would continue to apply to the preferred route as they are not affected by Part 3A.

The project would require a licence under the *Protection of the Environment Operations Act, 1997*. Construction of dual carriageway road projects are scheduled under this Act and a licence would be required for construction works only (that is, not for the operation of the road).

The preferred route is likely to have a small impact on the Yaegl Nature Reserve, which is reserved under the *National Parks and Wildlife Act, 1974*. The road footprint would be minimised in this area to reduce the extent of impacts, however, it is unlikely that impacts can be avoided altogether. Direct impacts on the Nature Reserve would require an Act of Parliament to amend the boundary of the reserve. The RTA would consult with the Department of Environment and Conservation to determine specific requirements and to ensure that impacts on the Yaegl Nature Reserve are minimal.

The preferred route impacts on approximately two hectares within Newfoundland State Forest, 120 hectares within the Glenugie State Forest and 12 hectares within the Pine Brush State Forest. Impacts of greater than 20 hectares require an Act of Parliament to amend the boundaries of the State Forest. Impacts on areas of less than 20 hectares require approval from the NSW Minister for Primary Industries. Part of Glenugie State Forest (including areas impacted by the preferred route) have been declared a National Forest under the *Forestry Act, 1916*. The same requirements for revocation apply to National Forests. An Act of Parliament would be required to remove areas of the preferred route through Glenugie State Forest.

There are several records of threatened flora and fauna listed under the *Environment Protection and Biodiversity Conservation Act, 1999* known from records in and around the study area. Further consideration of the potential for significant impacts on matters of National Environmental Significance under the Act would be undertaken for the preferred route. Consultation with the Department for Environment and Heritage would occur during the Environmental Assessment of the preferred route to confirm the status of the project under the *Environment Protection and Biodiversity Conservation Act, 1999*.

7.5 Land use and planning impacts

The preferred route passes through a mix of land uses and has a range of land use impacts. Importantly, the alignment of the preferred route includes adjustments that have been made in consideration of issues raised by property owners and land use and property data, to minimise impacts on properties. Further refinements may be made at the concept design stage subject to ongoing consultation with property owners. The footprint of the preferred route would be typically around 100 metres wide, but may vary between approximately 50 metres and 150 metres. Land use impacts, including property management issues, would be generated either

through direct land acquisition or severance of properties. The preferred route also has the potential to result in broader changes to land use, such as increased or decreased demand for development of different types. The land use impacts of the preferred route are summarised in **Table 7-2**, assuming a 100 metre wide nominal road reserve.

■ **Table 7-2: Land use impacts of the preferred route**

Criteria	Impact
Approximate number of houses within road reserve.	41 houses
Area of urban/ village zoned land within road reserve.	2.5 hectares
Area of rural residential or rural small holdings zoned land within road reserve.	13 hectares
State Forests within road reserve.	135 hectares
Direct impact on National Parks estate lands.	1.5 hectares
Direct impacts on SEPP 14 wetlands.	0 hectares
Impacts on productive agricultural land (land classification levels 1-3).	300 hectares

From Bald Knob Road north to Glenugie, the preferred route would be located within the Glenugie State Forest, generally to the east of the existing highway. Acquisition of additional land within the State Forest would be necessary to accommodate the preferred route. There would be a loss of some areas of productive State Forest land and areas within the forest that are currently identified as buffer zones for visual amenity purposes. Impacts on private property to the west of the existing highway in this area would be negligible.

Just south of Eight Mile Lane, the preferred route would deviate from the existing highway and pass in a northerly direction through Glenugie State Forest. Impacts in this area would include severance and direct acquisition of mainly harvesting areas of the forest. The total area of Glenugie State Forest is approximately 4800 hectares and the estimated impact on harvesting zones is approximately 85 hectares. This part of Glenugie State Forest is declared as a National Forest under the *Forestry Act, 1916*, because of its productive capacity. Impacts on the productive capacity of the State Forest are expected to be marginal due to the relatively small proportion of the forest that would be acquired. The dedication of land within the preferred route road reserve as a State Forest would need to be revoked and this process would require an Act of Parliament.

North of Glenugie State Forest the preferred route passes through rural land. This land is mostly identified as prime agricultural land and is generally used for grazing. It includes some areas of higher elevation that are outside the floodplain and therefore important to farmers as refuges in flood times. The preferred route has been aligned slightly further west than the alignment of the Purple/B option in this area, within land adjacent to Grafton Airport, to minimise private property severance.

Continuing east, the preferred route crosses the Coldstream River and past houses near Woolli Road. No direct acquisition of houses is required, but several houses are located close to the preferred route. Residents would experience impacts such as noise and visual intrusion to varying degrees, depending on distance from the road and potential views of it. The rural and rural residential character of this area would also be impacted by the preferred route. Further investigations are to be undertaken in this area to refine the alignment of the preferred route, and this will involve consultation with land owners to address property impacts.

North to Tyndale, the preferred route passes through land that is used for a range of rural activities including grazing, rural living and remnant bushland on private land. Impacts would include severance of properties and direct acquisition of privately owned land. The alignment of the preferred route has been modified in some locations to minimise property impacts by following property boundaries as closely as possible. The preferred route has been aligned to follow the boundary of Pine Brush State Forest, thereby minimising direct acquisition and severance of rural properties immediately to the west of Pine Brush State Forest. This re-alignment would also assist in the retention of access to flood free land for some farmers.

Around Tyndale the preferred route has been refined to minimise impacts on houses and businesses fronting the existing highway. The interchange and connections to local roads at Tyndale are proposed to be located to the east of the village in farmland, and would impact on prime agricultural land. The interchange and the preferred route to the north, have been re-aligned to maximise separation from Tyndale. The route would pass to the east of the caravan park and service station. Small sections at the rear of properties fronting the existing highway may need to be acquired, however, the preferred route is not expected to directly impact on the functioning of these properties. This refinement of the preferred route was undertaken to reduce the land use impacts of the preferred route by retaining these houses and businesses, and by moving the majority of traffic from the existing highway to the rear of the properties.

Further north of Tyndale, the existing highway follows a sharp bend in the river and does not meet the design standards for the upgraded highway. The preferred route would deviate to the east of the existing highway and would pass through cane fields, resulting in direct acquisition of farm land and severance of properties.

North of Tyndale to Maclean, the preferred route would mostly follow the existing highway. The existing road reserve is not sufficiently wide to accommodate the preferred route and associated service roads and widening of the existing road reserve would be necessary. Land use adjoining the highway in this section is predominantly cane farms and the majority of this land is prime agricultural land and is considered to be some of the highest yielding land in the study area. There are approximately 30 residences close to the highway that would need to be acquired. Impacts on cane farms and residences would generally result from strip acquisitions

required to widen the existing road reserve rather than severance of properties by a new road corridor. The exceptions to this are just north of Tyndale and around Shark Creek where the preferred route would deviate from the existing highway to meet design standards. This would result in some severance of cane farms in addition to direct acquisition required for the road corridor.

Between Ferry Park at Maclean and the Harwood Bridge, the preferred route continues along the route of the existing highway. The RTA owns some relatively large land holdings in this area and, where possible the road reserve would utilise RTA owned land rather than encroaching into private property. However, some private property would be impacted by the preferred route because of the narrow width of the road reserve, particularly north of Maclean Hill.

The preferred route is likely to require a wider road reserve than currently exists where the highway passes between portions of the Yaegl Nature Reserve. Some encroachment into the Nature Reserve would be necessary. However, this would be a minor edge effect only and is not expected to substantially impact on the functions or conservation values of the Nature Reserve. Consideration of connections under the preferred route would be part of the concept design process to maintain pedestrian access to all areas of the Nature Reserve.

Between Maclean Hill and Harwood Bridge the preferred route would impact on cane farms, including cane fields and areas of remnant wetland vegetation on private land, to the north of Yaegl Nature Reserve. The road reserve would be widened to the north and west, and this would require acquisition of farm land.

Immediately south of the Clarence River along Yamba Road, there is a row of houses and businesses west of the existing highway. There are few houses to the east of the existing highway along Yamba Road. The preferred route would be located to the east of the existing highway and no direct acquisition of houses would be required.

Through Harwood village the width of the required road reserve would be minimised to reduce the direct impacts on the village. The road reserve for a Class A standard road would need to be widened to the east from its current width of 40 metres to approximately 70 metres. Development to Class M standard would require widening of the road reserve to approximately 100 metres. Two houses to the east of the existing highway would be within the widened road reserve and require acquisition. However, direct impacts on the community hall and church are anticipated to be avoided.

Between Harwood and the Iluka Road intersection impacts on land use would be mainly edge effects on cane farms. The existing road reserve would need to be widened and this would

result in strip acquisition of cane farms adjacent to the road. The extent of additional acquisition would be minimised by keeping the road reserve as narrow as possible.

In all areas affected by the preferred route the RTA will consult with land owners to determine specific access requirements and to better understand potential impacts on their farms. The concept design process will include consideration of ways to minimise impacts by using the existing road reserve as much as possible, minimising service roads and by the inclusion of access across the road (underpasses or overpasses) at appropriate locations to assist with the movement of farm machinery and vehicles.

7.6 Social and local economic impacts

7.6.1 Property acquisition

The development of a road corridor will have significant direct and indirect impacts on properties. In order to construct the project, the RTA would be required to acquire land in accordance with the provisions of the *Land Acquisitions (Just Terms Compensation) Act 1991*. The RTA's Land Acquisition Policy reflects these provisions. Both partial and total property acquisitions would be undertaken as appropriate.

7.6.2 Community impacts

Community impacts relate to a range of factors associated with the changes that are brought about by the project. These relate more to impacts on the community as a whole, such as severance and changes to community structure, rather than impacts on individual residents.

The preferred route would result in improvements to the character and amenity of towns and villages such as South Grafton, Swan Creek and Ulmarra. While removal of through traffic may result in some short term downturn in business viability, experience from other highway bypass projects indicates that in the longer term, towns benefit from diversion of through traffic, in particular heavy vehicles. The preferred route would result in improved amenity and character in these small communities, and may provide opportunities for these towns, particularly Ulmarra, to capitalise on their historic character and river front locations. The preferred route avoids impacting on the character and amenity of communities including Gulmarrad, Taloumbi and James Creek.

From Wells Crossing to Tyndale, the preferred route passes through mostly rural areas and there are no towns or villages immediately adjacent to or bisected by the route. The Pillar Valley locality is close to the preferred route. Tucabia is approximately two kilometres to the west and the preferred route has been located to minimise visibility from the village.

Residences are scattered throughout the rural areas, and people have chosen to live in these areas either because they work on the land or because of the rural lifestyle the area offers.

While the population density of these areas is relatively low, and defined towns or other centres of activity are few, people have expressed in submissions the community cohesion that exists between neighbours in these areas. The preferred route would to some extent result in severance of these communities. The area around Wooli Road and along Wants Lane has the greatest potential for impacts of this kind. However, by providing access across the preferred route, the extent of severance would in practice be minimal. More noticeable impacts are likely to relate to changes to the amenity of these areas due to the presence of a road in an otherwise rural or bushland setting.

Community severance and disruption would be more evident around Tyndale. The preferred route would separate properties to the east of the village from the main village centre, and this could contribute to a feeling of isolation from the local community for some residents. Local access across the preferred route via the proposed interchange would assist in minimising this impact.

Along the existing highway from Tyndale to Maclean there is a scattered community of farmers and other residents. Many of these occupants have a sense of community that comes from living in this locale or from being associated with cane farming. Property acquisitions and loss of productive land have the potential to impact on this community because some residents would need to relocate and because the viability of some farms may be reduced. As with other sections of the preferred route, impacts would be minimised by the provision of access across the preferred route at appropriate locations to enable existing local movement patterns and social networks to be maintained.

Widening of the existing corridor between Townsend and Maclean minimises the potential for the preferred route to impact on new communities. However, the community in this area would be impacted by the preferred route as a result of acquisition and the need to relocate. The widening of the highway corridor through this area would change the physical character of parts of Townsend.

Community character and amenity within Harwood village would be affected by the preferred route. Widening of the existing highway corridor through the town would increase the perception of community severance, although road access across the highway would be retained along River Street. The preferred route would have a substantial visual impact on Harwood and this may contribute to diminishing of the historic and “small town” character of Harwood.

7.6.3 Visual amenity

The visual impacts of the preferred route have been assessed in relation to the following criteria:

- Potential impacts on landform in the form of cut and fill, embankments or conspicuous structures.
- Ability to conceal the road by integration with landform or vegetation.
- Impacts on areas of high or unique scenic or visual quality.
- Visibility from urban settlements or concentrations of houses.
- The degree of modification of the existing environment by other land use or activities such as agriculture or industry.

Table 7-3 summarises the impacts of the preferred route in relation to the criteria above.

■ **Table 7-3: Visual impacts of the preferred route**

Criteria	Wells Crossing to Woolli Road	Woolli Road to Tyndale	Tyndale to Harwood Bridge	Harwood Bridge to Iluka Road
Impacts on landform	<ul style="list-style-type: none"> ■ Follows gently undulating topography. ■ Maximum cut depth six metres. ■ Maximum fill height four metres. 	<ul style="list-style-type: none"> ■ Follows gently undulating topography. ■ Large cut required (20 metres deep) south of Tyndale interchange. ■ Maximum fill height six metres, south of Tyndale Interchange. 	<ul style="list-style-type: none"> ■ Generally flat land within floodplain. ■ Route generally on fill. ■ Maximum fill height four metres within the floodplain. ■ Large cut and fill required north of Tyndale. 	<ul style="list-style-type: none"> ■ Generally flat land within floodplain. ■ Route generally on fill. ■ Maximum fill height four metres across floodplain.
Potential concealment	<ul style="list-style-type: none"> ■ Well concealed by vegetation within Glenugie State Forest. ■ Undulating topography and vegetation assists in concealing route through private land. 	<ul style="list-style-type: none"> ■ Route is slightly elevated above the floodplain on the side of foothills and potentially visible. ■ Remnant vegetation provides good concealment. 	<ul style="list-style-type: none"> ■ Route is highly visible due to filling on the relatively open floodplain. ■ Vegetation and topography assist in concealing route past Maclean Hill. 	<ul style="list-style-type: none"> ■ New bridges across Clarence River likely to be highly visible. ■ Route is highly visible due to filling on the relatively open floodplain.

Criteria	Wells Crossing to Woolli Road	Woolli Road to Tyndale	Tyndale to Harwood Bridge	Harwood Bridge to Iluka Road
Impact on areas of high visual quality	<ul style="list-style-type: none"> ■ Glenugie interchange would be located in state forest with high visual values. 	<ul style="list-style-type: none"> ■ Impact on visual quality of coastal foothills adjacent to Tyndale Road. ■ Vegetation would assist to conceal this section of the route. 	<ul style="list-style-type: none"> ■ Visible from Bondi Hill. ■ Impact on high quality rural and floodplain environment around Tyndale and Shark Creek. ■ Impact on remnant vegetation around Maclean Hill and Yaegl Nature Reserve. 	<ul style="list-style-type: none"> ■ Likely impact on contribution of the existing Harwood Bridge to the landscape. ■ Impact on character of Harwood village. ■ New bridges would impact on visual quality of the Clarence River.
Visibility from settlements and houses	<ul style="list-style-type: none"> ■ Population density is low and route does not pass close to towns or villages. ■ Views from some rural residences. 	<ul style="list-style-type: none"> ■ Potentially visible from some parts of Tucabia, but generally screened by vegetation and topography. ■ Interchange and road highly visible from Tyndale. 	<ul style="list-style-type: none"> ■ Visible from parts of Townsend and Maclean. ■ Yamba Road interchange close to houses along Yamba Road. 	<ul style="list-style-type: none"> ■ Highly visible within Harwood village and surrounding rural areas. ■ Iluka Road interchange visible from parts of Woombah.
Extent to which existing environment is modified	<ul style="list-style-type: none"> ■ Relatively low modification through Glenugie State Forest. ■ Existing environment north of Glenugie State Forest modified by clearing and agriculture. 	<ul style="list-style-type: none"> ■ Large areas of remnant bushland with only minimal modification. ■ Clearing generally restricted to floodplain areas to the west. ■ Tyndale area has been modified with buildings and other infrastructure. 	<ul style="list-style-type: none"> ■ Highly modified floodplain environments, in particular cane fields. ■ Townsend and Maclean highly modified town environments. 	<ul style="list-style-type: none"> ■ Cleared floodplain and cane fields create highly modified environment. ■ Clarence River somewhat modified by vegetation clearing along banks and existing Harwood Bridge.

7.6.4 Noise and vibration

The overall effect of the preferred route is a reduction in the number of residences within the study area that would be subject to noise in excess of the NSW DEC criteria. The preferred route would reduce noise impacts for residents who live close to the existing Pacific Highway between Glenugie and Tyndale and currently experience high levels of road noise, particularly at night. South of Glenugie and north of Tyndale, where the preferred route would be adjacent to the existing highway, many of the residences that currently experience high levels of road noise would be either acquired, would receive some form of mitigation to reduce noise levels to

meet the NSW DEC criteria, or would experience reduced noise impacts as traffic would be moved further away.

The noise impacts of the preferred route have been modelled and assessed against the NSW DEC criteria to provide a preliminary estimate of potential noise affectation. The results of preliminary modelling are summarised in **Table 7-4**. The criteria for a new road have been used to present a worst case scenario. However, between Tyndale and Iluka Road, the criteria for a redeveloped road may apply. This would mean that fewer residences than reported in **Table 7-4** would be considered to be above the NSW DEC criteria. Results have also been considered along with likely acquisitions of houses that are located within the route corridor. Noise impacts would be further assessed following the display of the preferred route and development of the concept design.

■ **Table 7-4: Preliminary noise modelling results for the preferred route**

Noise Level Range L_{Aeq} dB(A)	No. of affected residences	
	Day	Night
>45 and ≤ 50	260	115
>50 and ≤ 55	120	130
>55 and ≤ 60	80	45
>60 and ≤ 65	30	25
≥ 65	25	10
Total above criteria	135	210
Total above criteria minus acquisitions	95	170

Notes:

Numbers of affected residences are approximate, based on a 100 metre wide road reserve and have been rounded up to the nearest 5.

■ Denotes residences where the criteria for a new road are potentially exceeded

Between Glenugie and Tyndale, residences would be subject to new noise exposure as in this section of the preferred route the existing environment is not subject to high levels of road traffic noise. Relatively low numbers of residences would be subject to noise above the criteria in this section of the project. However, residences predicted to experience noise levels below the criteria would still in many cases experience a substantial change in the noise environment. This is particularly the case for residences that are predicted to experience noise levels between 45-55 dB(A) during the day or 45-50 dB(A) at night.

The preferred route has the greatest potential to result in noise impacts in the area from Tyndale north to Harwood, where the population density close to the route is highest. However, in this section the majority of residences predicted to be affected by road noise from the preferred route are currently subject to high levels of road traffic noise. Of the approximately 210 residences

predicted to be exposed to noise above the night time criteria, approximately 175 of these are located in this section of the highway. Approximately 30 of these are likely to be subject to acquisition because they would be within the road reserve.

When cumulative noise impacts of traffic on the existing highway and the preferred route are considered, the preferred route would benefit a large number of residences along the existing highway as a result of reduced night time road noise. At night, the majority of traffic is through traffic and would use the preferred route in preference to the existing highway. This means that residences along the highway between Glenugie and Tyndale would experience a substantial reduction in night time noise exposure. While residences along the preferred route between Glenugie and Tyndale would be subject to new noise exposure at night, this is a small number of residences and these would be subject to consideration of mitigation to bring levels to the relevant NSW DEC criteria. Further discussion of this issue is contained in the *Noise and Vibration Working Paper* (RTA, 2006f).

7.6.5 Heritage

The preferred route has been developed with consideration of the heritage and cultural significance of items and localities in the study area. Extensive consultation with Council and the relevant Aboriginal groups in the study area has been undertaken during the development of the preferred route, and every effort has been made to avoid areas of known cultural or heritage significance.

As discussed in **Section 3.5**, the study area is rich in both Aboriginal and European heritage, but further study is required, particularly in relation to Aboriginal sites to identify specific heritage sites. Impacts on known items of Aboriginal and European heritage along the preferred route are minimal. Areas of known cultural sensitivity to the Aboriginal community have been avoided in the selection of the preferred route.

Of the known Aboriginal sites and areas of high cultural sensitivity in the study area (based on previous studies, heritage list and field work undertaken for this project) the following conclusions have been made in relation to the preferred route:

- Glenugie Peak (a site of cultural significance to the Aboriginal community) would be avoided.
- A culturally significant site in the Clarence River at Tyndale would be avoided.
- Two sites associated with Pheasant Creek, in Glenugie State Forest, would be avoided. These sites are located approximately 600-700 metres from the preferred route and indirect impacts are unlikely.

- A site associated with the Coldstream River is within 400 metres of the preferred route but would not be directly impacted and is unlikely to be subject to indirect impacts.
- Significant men's and women's sites at Pillar Valley have been avoided.
- A site south of Tyndale is located less than 400 metres from the preferred route but would not be directly impacted. The context of this site is potentially subject to impacts due to its proximity to the preferred route.

There are some areas of predicted high potential for Aboriginal archaeology that may be impacted by the preferred route. More detailed field survey is to be undertaken during the Environmental Assessment of the preferred route to identify sites. In particular, the crossing of the Coldstream River, Clarence River margins, Maclean Hill and Yaegl Nature Reserve would be subject to more detailed investigations and consultation with the Aboriginal community. The development of the concept design would aim to avoid or minimise impacts on identified sites.

Potential impacts on European heritage sites in proximity to the preferred route have been assessed as follows:

- Heritage items (houses) within Tyndale (site reference WIH12) would not be directly impacted but are located within 200 metres of the preferred route, and have the potential to be subject to indirect impacts.
- Site WIH10 (Shark Creek Bridge), is within 200 metres of the preferred route and would not be directly impacted, but may be subject to indirect impacts.
- Site WIH7 (Maclean Trig Point) and site WIH8 (house – Townsend) are unlikely to be directly or indirectly impacted by the preferred route.
- Sites within Harwood village, and the overall heritage character of the village, are likely to be indirectly affected by the preferred route passing through the town. Currently listed heritage items and those identified during field survey are unlikely to be directly affected.
- Site WIH1 (remains of boat ramp) is located to the west of the existing highway near the North Arm and is unlikely to be directly affected by the preferred route but may be subject to indirect impacts.

The potential impacts of the preferred route on items of European heritage significance within Harwood village would be subject to further assessment as part of the development of the concept design for the preferred route. Impacts have been minimised in the development of the preferred route alignment by minimising the width of the road reserve through Harwood. However, impacts on the overall heritage fabric and character of Harwood village are still expected to result from the preferred route.

7.6.6 The local economy

Access to and from the new road is an important consideration in determining the impacts of the preferred route on the local economy. The locations of interchanges, and of the road itself, in relation to centres of economic activity, are key determinants of accessibility. These considerations were emphasised by many of the community representatives at the Value Management Workshop, and in submissions. In addition, the direct impacts of the preferred route, arising from land acquisition for the road corridor, have potential economic consequences. Clarence Valley Council has released the *Clarence Valley Economic Development Strategic Plan (2006)*, which specifically refers to opportunities and potential impacts of the Pacific Highway upgrade.

Potential impacts of the preferred route on the local economy include:

- Impacts on agricultural production through loss of land and severance.
- Loss of passing trade for businesses that rely on highway traffic.
- Diversion of traffic away from major centres such as Grafton and Maclean.
- Potential changes in economic activity arising from changes to regional accessibility.

The preferred route would impact on approximately 300 hectares of prime agriculture land mainly as a result of widening the existing road reserve between Tyndale and Iluka Road. Much of this land is used for cane farming. Direct loss of productive land would be the primary impact, rather than severance, except in some locations where the preferred route deviates from the existing highway road reserve.

Impacts on prime agricultural land would also occur between Glenugie and Wooli Road. This land is used for grazing and cropping. Impacts would include direct acquisition and severance. Modifications to the alignment of the preferred route to follow property boundaries have in some locations reduced impacts, however, the potential for severance and direct land take remains for many properties.

Businesses that rely (either partly or wholly) on passing trade from highway traffic are likely to be impacted by the preferred route. This includes service stations, motels and food outlets along the existing highway. In particular, businesses along the highway in South Grafton including motels and truck stops are likely to lose a high proportion of trade as a result of the preferred route. Other businesses such as cafes, restaurants and service stations in other locations would be likely to experience a reduction in trade.

The interchange at Eight Mile Lane is located close to Grafton Airport and reasonably close to industrial land at South Grafton. Vacant land at both these locations means there is potential for

the development of transport related industries that could capitalise on the direct access to the new road via this interchange.

The inclusion of an interchange in the preferred route at Tyndale would provide access to towns and businesses along the existing highway. Appropriate signage, such as inclusion of the existing highway in a tourist route, may reduce the severity of potential business impacts. This is particularly the case at Tyndale, which has a motel and several shops. The location of the proposed interchange is likely to enable businesses to capture some passing trade, as drivers would be able to conveniently access the town with minimal deviation.

The *Clarence Valley Economic Development Strategic Plan* (Clarence Valley Council, 2006) identifies the development of a “Clarence River Way” route that capitalises on the character of river side towns. Removal of through traffic from these towns would enhance the attraction of the existing highway as a tourist route, and this may assist the development of the Clarence River Way concept. The Tyndale interchange would also provide access via the existing highway to Ulmarra and other river villages, and this has the potential to encourage visitation as part of a tourist route that may also include Grafton and Maclean. Amenity benefits associated with removal of through traffic may in fact create conditions that are more suited to some local businesses, improving their viability in the long term.

Businesses along the highway that are likely to be directly impacted by acquisition include a service station south of Maclean on the east side of the existing highway and a service station on the east side of the existing highway north of Harwood. If these businesses are to be acquired, a compensation package would be negotiated. Businesses that are affected by loss of income but are not subject to acquisition would not be eligible for compensation under NSW legislation.

The preferred route would result in diversion of through traffic away from Grafton and Maclean. However, the economic base of these towns, while centred on the local area or sub-region, is relatively diverse and is supported largely by the local population rather than business generated by traffic on the Pacific Highway. Interchanges would be located close to Maclean (south of Harwood Bridge) and at Eight Mile Lane and Tyndale. These interchanges would provide access to these towns for purposes such as deliveries to local shops and supermarkets and for tourists. Grafton is already off the existing Pacific Highway (although close to it) and the reduction in through traffic accessing Grafton is expected to be minimal. The small proportion of traffic that uses the Gwydir Highway and Summerland Way would continue to do so (and to pass through Grafton) regardless of the preferred route.

The design of the new bridge or bridges at the crossing of the Clarence River at Harwood is subject to further investigation at the concept design stage. However, consultation with boating groups and agencies has been undertaken in the development of the preferred route. The design

options for the bridges would accommodate the majority of boating traffic on the river by either an opening span or a fixed height bridge with clearance of 30 metres. This will facilitate ongoing recreational, commercial and tourism related boating activity on the Clarence River, including movements upstream to Maclean and Grafton.

7.7 Environmental impacts

7.7.1 Ecology

Significant ecological constraints have been identified during the investigations leading to selection of the preferred route. A distinctive feature of the local ecology is the high diversity of habitats, including those in a relatively natural state and those that have been impacted by human activity but which still provide important resources for flora and fauna. Areas of extremely high habitat value are found in the east of the study area, and large numbers of threatened species are known from the area. Ecological constraints including large contiguous areas of high value habitat, Endangered Ecological Communities on the floodplain, and fauna corridors linking areas of high habitat value have been important considerations in the selection and refinement of the preferred route. A key factor in the decision on the preferred route was the importance of avoiding or minimising impacts on the large areas of relatively intact habitat in the east of the study area, and minimising risks to the long term viability of the endangered coastal Emu population.

Table 7-5 summarises the ecological impacts of the preferred route option based on a nominal 100 metre wide road reserve.

■ **Table 7-5: Ecological impacts of the preferred route**

Native vegetation	National parks	SEPP 14 wetlands	State Forests zones 1, 2, 3A	EECs	High value habitat
650 hectares	1.5 hectares	0	28 hectares	68.5 hectares	120 hectares

The section of the preferred route between Glenugie and Tyndale traverses areas of remnant vegetation and some areas of Endangered Ecological Communities. The alignment of the preferred route has been selected to, where possible, follow the edge of remnant vegetation rather than causing severance and fragmentation from cutting through the large area of intact native vegetation in the east of the study area. The ecological impacts of clearing have been minimised to the greatest extent possible, taking into account other constraints such as the floodplain, which prevented route options further west. North of Tyndale, vegetation clearing requirements are minimal and clearing would be necessary only to widen the existing road corridor. No fragmentation of vegetation, habitat and fauna corridors would occur between Tyndale and Iluka Road.

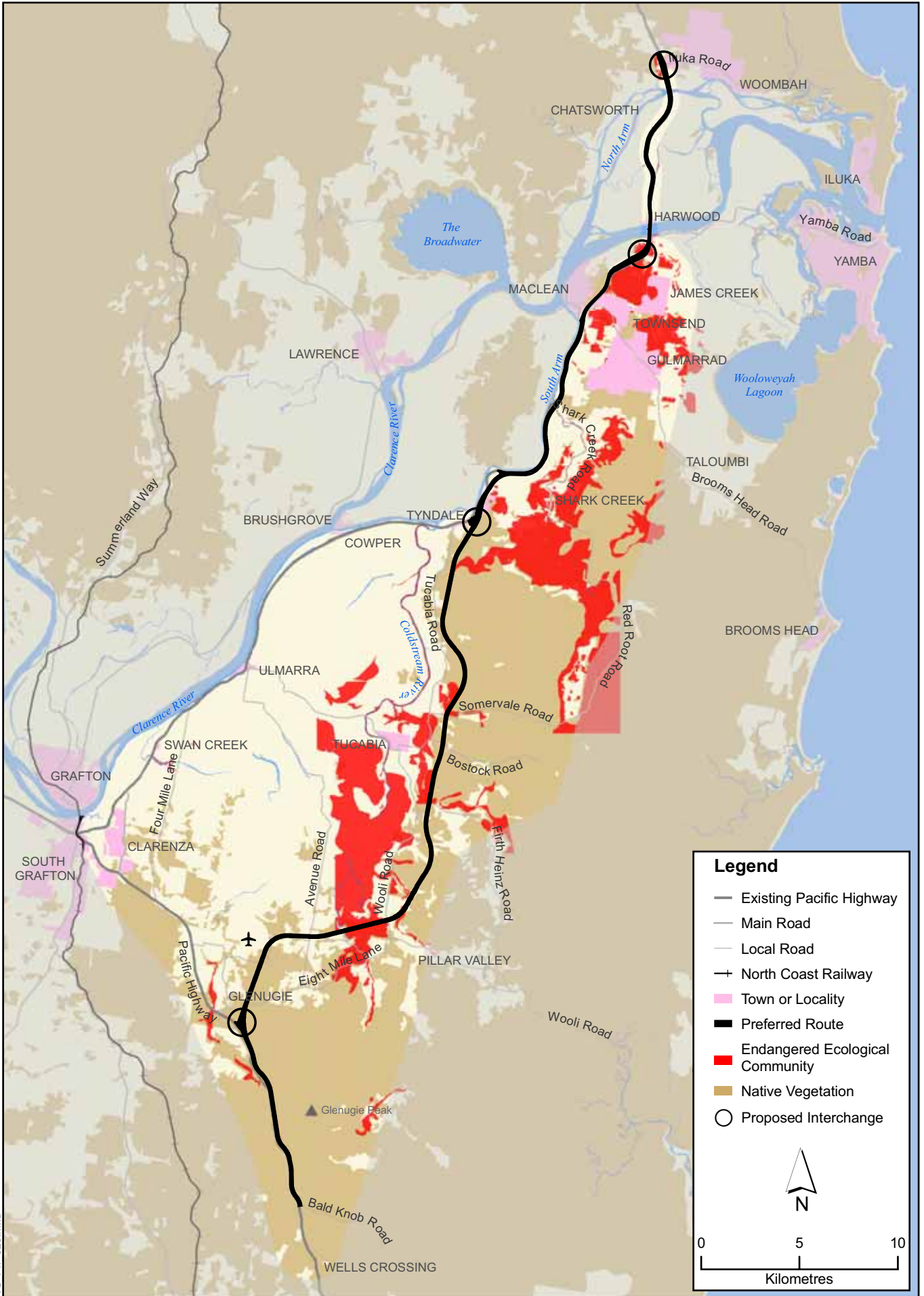
The condition of Endangered Ecological Communities has been assessed for areas impacted by the preferred route. Generally, areas of high quality have been avoided by the preferred route, except for small areas at the crossings of the Coldstream River and Chaffin Creek. At the crossing of the Coldstream River, consideration was given to relocating the preferred route to reduce the severance of the Endangered Ecological Community in this location. However, condition assessment indicated that areas to the south and north are of better condition, and that while severance of the remnant is an issue, impacts of a re-aligned route would be potentially greater. In some locations, such as north of Chaffin Creek and around Yaegl Nature Reserve, the preferred route has been slightly re-aligned to minimise impacts on Endangered Ecological Communities.

The potential impacts of the preferred route on vegetation and Endangered Ecological Communities are illustrated on **Figure 7-1**.

The preferred route avoids direct impacts on SEPP 14 wetlands. However, indirect impacts on SEPP 14 wetlands in the Coldstream Basin, Shark Creek and Yaegl Nature Reserve may result from changes in hydrological regimes arising from the preferred route.

By utilising the existing Pacific Highway corridor from Tyndale north, the preferred route avoids direct impacts on large areas of remnant vegetation containing important habitats and wetland areas. These areas are a significant feature of the study area and are contiguous with native vegetation in the Yuraygir National Park and State Forests along the Coast Range. Maintenance of fauna corridors linking the floodplain habitats with those of the forests and heath to the east is important to the overall ecological values of the area. The preferred route would have minimal impacts on this important ecological system, particularly north of Tyndale.

Between Wells Crossing and Tyndale, some fragmentation of habitat areas may potentially occur because the preferred route is located east of the wetlands associated with the Coldstream River. However, large bridge structures are required in these areas to enable flood waters to pass, and these would also provide fauna crossings for a wide range of species. Additional fauna crossings are to be provided as part of smaller waterway crossing structures, and purpose built fauna underpasses or overpasses may be considered at suitable locations to provide additional opportunities for fauna movement.



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Wells Crossing to Iluka Road
Upgrading the Pacific Highway

Figure 7-1: Vegetation and Endangered Ecological Communities along the preferred route

Figure 7-2 shows the locations of high value habitat areas and fauna corridors in relation to the preferred route.

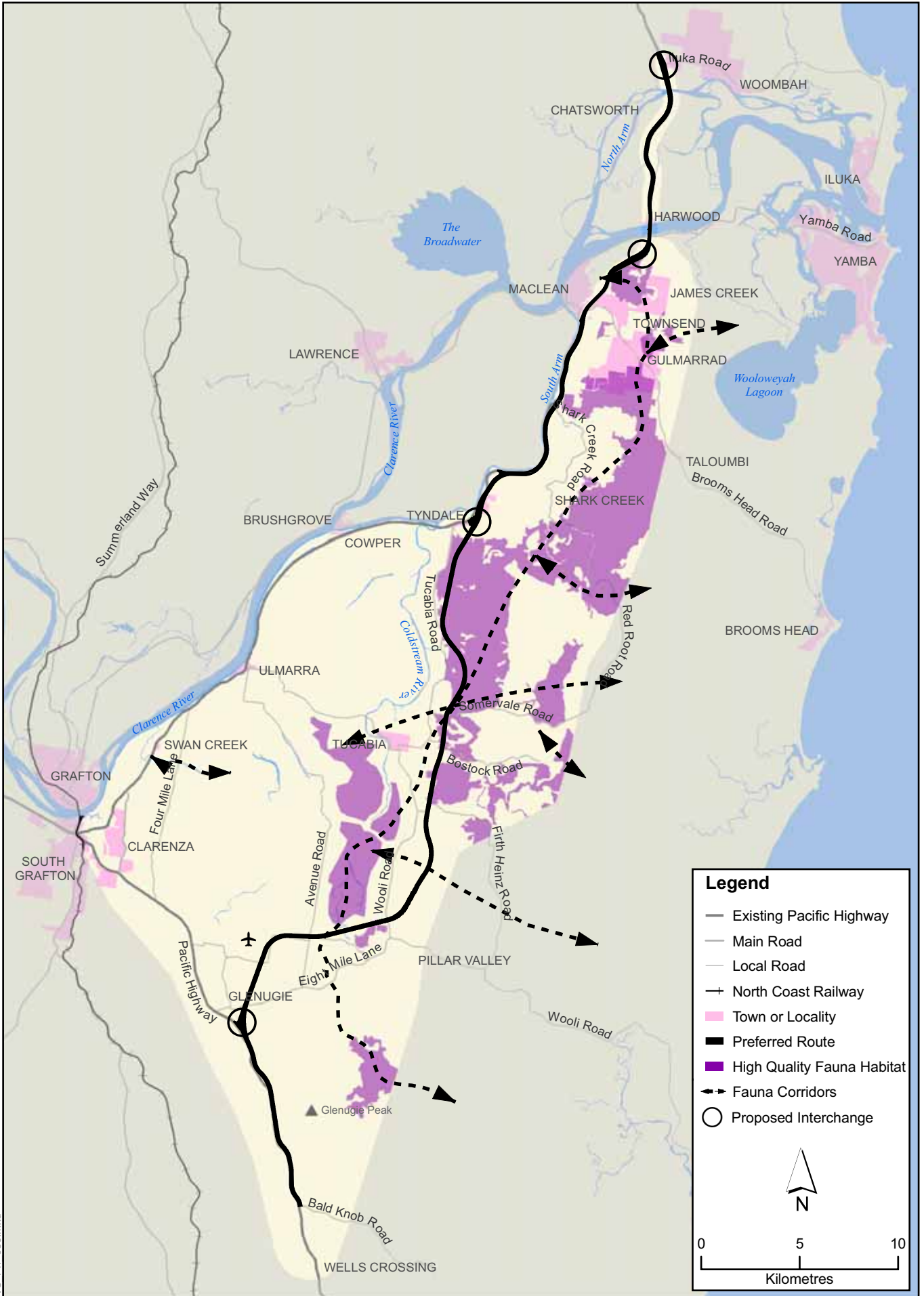
The sub-population of the coastal Emu population that is known to inhabit parts of the study area was an important issue in the decision on the preferred route. The preferred route minimises the potential for fragmentation of the known range of the sub-population, by avoiding impacts on important movement corridors to wetland areas in the north of the study area. Access to the vast majority of the known range of the sub-population would be unaffected by the preferred route, as illustrated on **Figure 7-3**. It should be noted that records of Emu sightings are not based on comprehensive surveys for the species, but are mostly compiled by the NSW DEC from opportunistic sightings. The high incidence of records from near public roads and towards the western extent of the known range of the Emu is explained by this.

Access to the Coldstream wetlands and other floodplain habitats within the Coldstream Basin is potentially restricted by the preferred route. Bridges up to 650 metres long are proposed for drainage purposes as part of the design of the preferred route crossing of the Coldstream River. These bridges have the potential to provide for crossing of the preferred route by the Emu and other fauna species. However, there is no evidence to demonstrate the effectiveness of bridge structures in allowing for passage of the Emu and assuming access to the Emu's habitat west of the preferred route would be restricted, a small proportion of the total known range of the Emu would be fragmented. Further research is required to address this issue, however, it is not expected that this would substantially impact on the population.

It is important to recognise that the coastal Emu population is subject to a wide range of threats from human activities within its habitat, as well as natural processes such as fire and predation. A comprehensive approach to addressing threats to the population is required, that incorporates measures to address the potential impacts of the preferred route and other threats.

As part of the further development of the preferred route, the RTA would identify a package of measures to provide a better understanding of the behaviour, local movement patterns and habitat requirements of the coastal Emu population. The package of measures would be developed in consultation with Clarence Valley Council, NSW DEC and the local community, and may include some or all of the following:

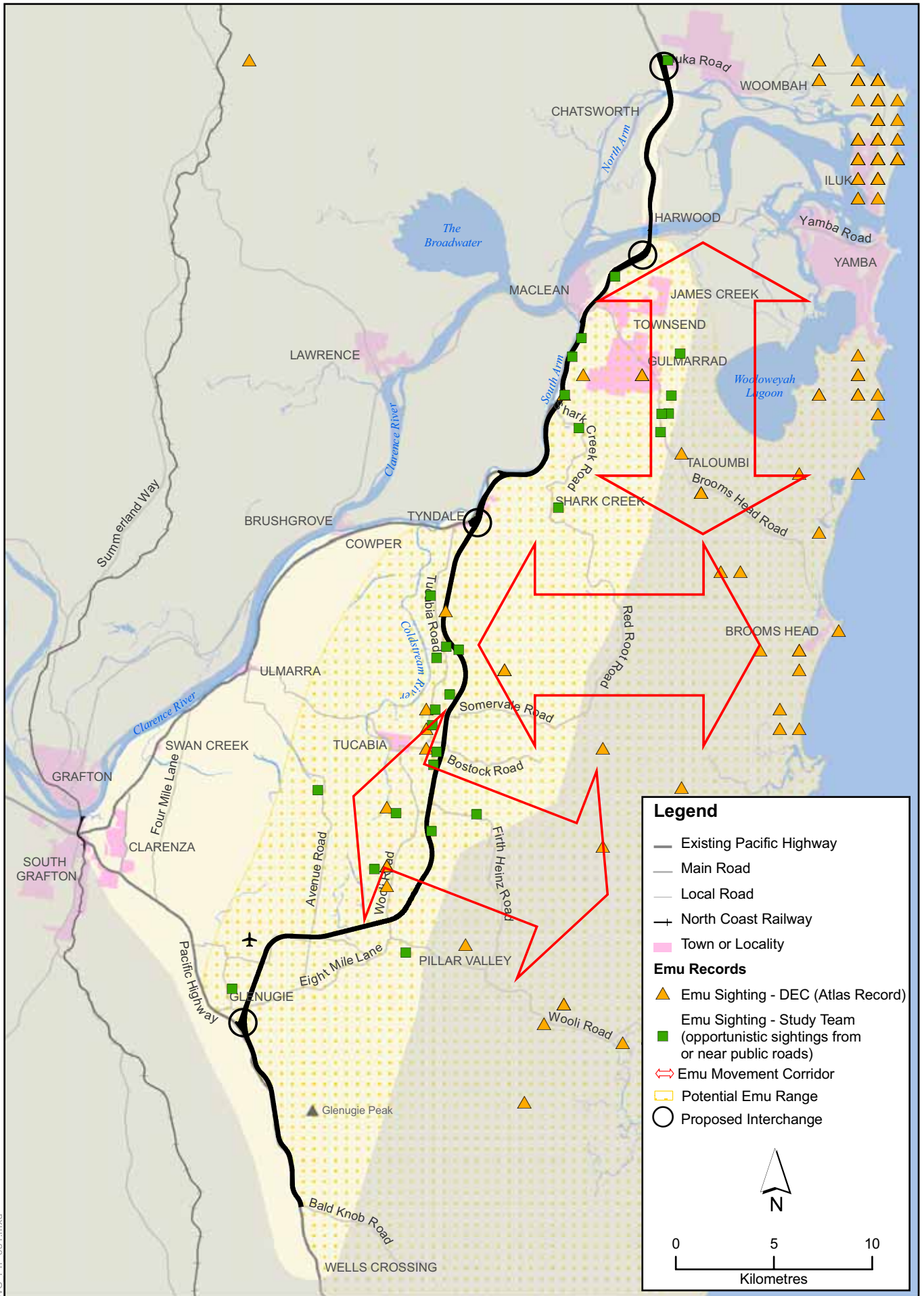
- Further research into the behaviour and movement of the coastal Emu population.
- Mapping of important movement corridors within and around the study area to provide a basis for locating fauna crossing structures and to better understand threats to Emu movement from other activities in the area.
- Research and trials into potential designs of exclusion fencing to minimise the risk of injury to Emus.



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Wells Crossing to Iluka Road
Upgrading the Pacific Highway

Figure 7-2: The preferred route in relation to high value habitat and fauna corridors



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Wells Crossing to Iluka Road
Upgrading the Pacific Highway

Figure 7-3: Potential impacts of the preferred route on the known range of the coastal Emu sub-population

- Research in relation to the potential effectiveness of bridges and other fauna crossing structures.

The preferred route would include at least six major waterway crossings and numerous smaller crossings of minor tributaries. Waterways traversed include Dundoo Creek, Coldstream River, Pillar Valley Creek, Chaffin Creek, Champions Creek, Shark Creek, the Clarence River, Serpentine Channel and the Clarence River North Arm. The waterways in the vicinity of the preferred route were assessed to exhibit mixed environmental conditions, though none could be considered in pristine condition. Good to poor riparian zones (narrow width and loss of continuity) and the predominantly agricultural adjacent land use reduce the habitat values of some of these streams. Waterway crossings would be designed to accommodate fish passage, in accordance with guidelines of the Department of Primary Industries (NSW Fisheries).

7.7.2 Topography, geology and soils

The preferred route passes through a mix of topographies and would be located on a range of different soil and geological conditions. A key advantage of the preferred route is the ability to balance cut and fill requirements south of the Harwood Bridge, which would minimise or avoid the need to acquire additional fill material from sources external to the project. Avoidance of the Coldstream Basin floodplain area substantially reduces construction risks associated with soft soils. Risks associated with floodplain soils from Tyndale north to Harwood Bridge are manageable and less substantial than within the Coldstream Basin.

Between Wells Crossing and Pillar Valley, the preferred route is located in low undulating hills consisting of interbedded siltstone, mudstone and sandstone. These materials are well suited to road construction. Materials from cuttings would be of reasonable quality, although they are not expected to be suitable for pavement materials. This section includes a crossing of the Coldstream River, which consists of soft floodplain soils that also potentially contain acid sulphate materials. The preferred route across the floodplain soils would be elevated above the natural ground level on fill or other structures, so acid sulphate soils are not expected to be an issue in this part of the project.

Between Pillar Valley and Tyndale, the preferred route follows the western slopes of the sandstone ranges. The Central Sandstone Ridge materials present reasonable construction conditions. Some seams may be difficult to rip and require blasting. Materials from cuttings would be of good quality with some materials from the stronger sandstones suitable for select fill. The likelihood of acid sulphate soils through the Central Sandstone Ridge soils is low.

North of Tyndale, the alignment of the preferred route is dominated by the Clarence River Floodplain. The floodplain is low lying and significant amounts of fill would need to be imported in order to achieve the design levels required. Soft soils within the floodplain are

likely to present difficulties with soft foundations and potentially high rates of settlement that would require either a long period of pre-loading or alternative treatments such as installation of wick drains to accelerate the settlement process, or piling of foundations. The location of the preferred route adjacent to the existing highway utilises better ground conditions than exist further east in the floodplain as there are better quality levee soils near the river margins. The potential for acid sulphate soils through the Clarence River floodplain is high, however, this would not greatly affect construction as the road would be predominantly on fill, with the exception of bridge foundations, which would require special design measures.

North of Shark Creek and east of Maclean, the preferred route passes through some smaller hills. These materials present reasonable construction conditions although some seams may be difficult to rip. Materials from cuttings would be of reasonable quality, although they are not expected to be suitable for select fill. The likelihood of acid sulphate soils through the Eastern Hills and Valley soils is low.

Across Harwood Island and Chatsworth Island, floodplain soils are deep, soft and highly compressible. The road would be required to be constructed on fill and construction techniques to manage settlement would need to be implemented.

7.7.3 Flooding and drainage

The Clarence River is the largest coastal river in NSW and flooding presents substantial risks to the local community and businesses as well as to the upgrade of the highway. The Coldstream Basin is particularly important as the largest flood storage area within the Clarence River catchment. Construction of a new road within the Coldstream Basin has inherent risks not only for the road itself, but for potential upstream and downstream property and business impacts. For this reason, the Coldstream Basin is identified as a major flooding risk to the project and the preferred route has been designed to mostly avoid it by skirting the southern and eastern boundary of the Basin.

Overall, as shown on **Figure 7-4**, approximately 24 kilometres of the preferred route is within the floodplain. The majority of this is north of Tyndale, where the preferred route is located along the existing highway corridor. The risks associated with flooding in the Shark Creek catchment and lower Clarence around Harwood are substantially less than within the Coldstream Basin, and flooding impacts are considered to be manageable for this section of the preferred route. The preferred route also avoids major flood impacts on Grafton.

The existing highway between Tyndale and Maclean is generally located on a levee, but this is not sufficiently elevated to provide the required flood immunity for the road. For most of the length in the floodplain, the preferred route would need to be raised on embankments typically between 1.5 to 2.5 metres high. In some locations between Tyndale and Shark Creek up to five

metres of fill would be required. Between Tyndale and Harwood, approximately 20 bridges have been included to allow for creeks and drainage channels as well as floodway openings.

Between Harwood and Iluka Road, approximately six to eight bridges would be provided for flooding.

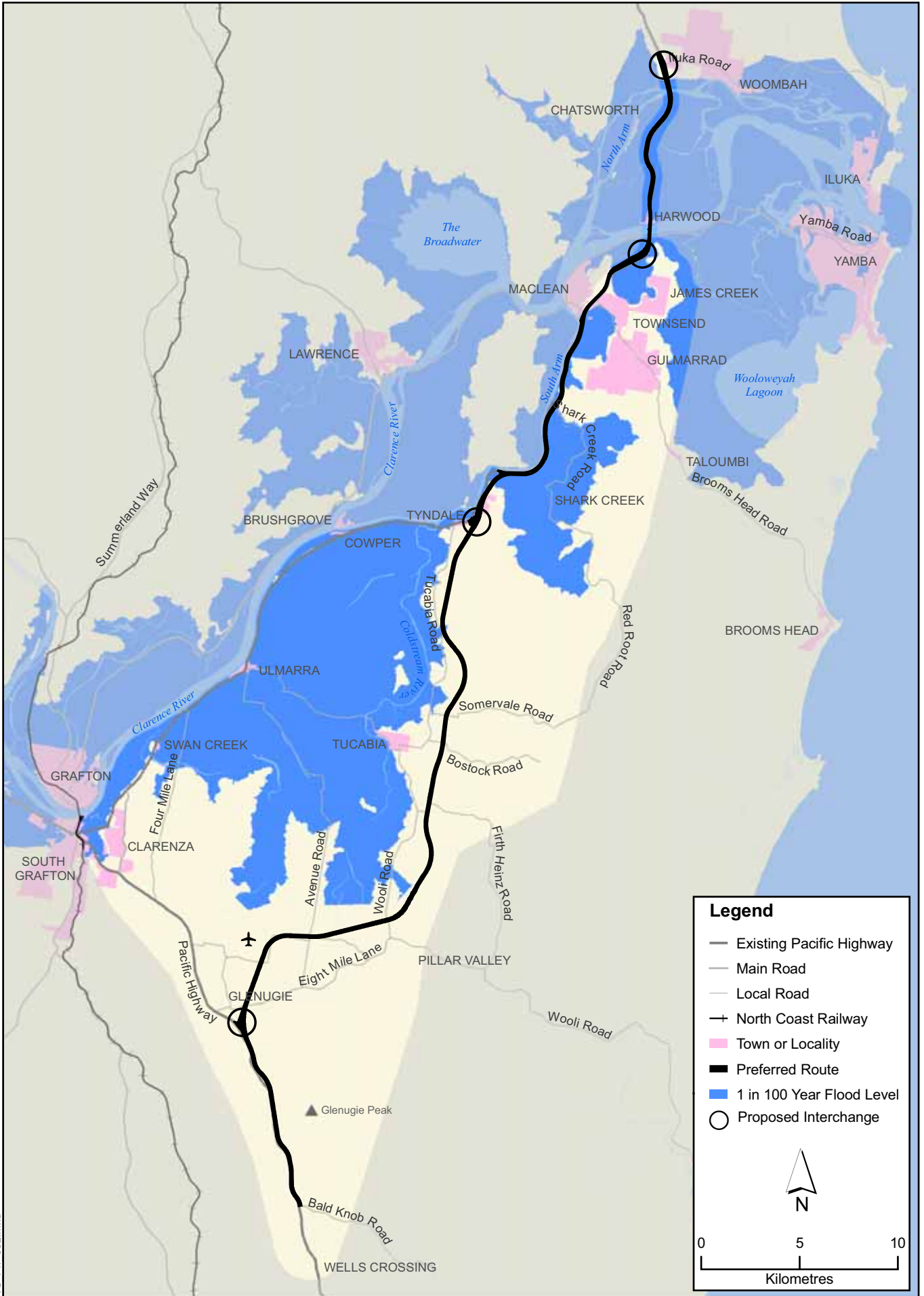
The height of the bridge over the Clarence River is primarily determined by the needs of boating traffic on the Clarence River. The proposed bridge structures would provide more than sufficient capacity to pass flood flows, and would be designed to minimise impacts on hydraulics.

Outside the floodplain, there are still significant waterways that must be crossed, including Glenugie Creek, Coldstream River, Pillar Valley Creek and Chaffin Creek. While these waterway crossings are not subjected to the long term flooding of the Coldstream Basin, the design must allow for rapid flows and rapid changes in water height during high rainfall events. The existing bridges for the local road system across these watercourses are generally of a lower standard than those proposed as part of the preferred route. The preferred route would include bridges with capacity to accommodate at least the 20 year ARI peak flows. Bridge overtopping would be relatively rare and bridge sizes would be considerably larger than those on the local road system.

7.7.4 Water quality

Typically, the water quality of creeks and rivers crossed by the preferred route varies depending on the location within the river system of the crossing point. Generally, water quality is expected to be better in the more vegetated upper catchment areas of streams; although many of these streams are small and intermittent, and it is difficult to accurately assess water quality through sampling.

Available data and sampling for the project indicate that streams such as Dundoo Creek had reasonably good water quality. These upper reaches of streams are generally well buffered from water quality impacts as a result of relatively natural catchments and intact riparian zones. While the condition of these streams is expected to be relatively good, the preferred route has the potential for impacts because these are smaller systems that are less able to resist impacts from constant pollution sources, particularly in the absence of rainfall events to flush these systems. However, these streams do have the advantage of more intact riparian zones and less influence from other polluting land uses within the catchment, and these features make them potentially more resilient to impacts from the preferred route.



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Wells Crossing to Iluka Road
Upgrading the Pacific Highway

Figure 7-4: The preferred route and the Clarence River floodplain

Middle reaches of creeks and rivers typically exhibit poorer water quality. Examples include the Coldstream River and Chaffin Creek in the vicinity of the preferred route. Both these waterways failed to comply with relevant water quality guidelines for dissolved oxygen and pH, with turbidity also an issue in numerous locations. This is likely to be because of the impacts of land uses within the catchments, and highly degraded riparian zones that provide little protection from activities in the catchment. These sections are susceptible to water quality impacts from the preferred route because they already exceed or are close to established limits for many pollutants, and because they have limited buffering from riparian vegetation. The cumulative impacts of the road and other activities in the catchment are likely to contribute to overall poor water quality in these locations.

Lower sections of rivers such as the Coldstream River and the Clarence River generally exhibit relatively good water quality. This is likely to be due to the influence of high flows and tidal flushing which assist the removal or dilution of pollutants. The lower Clarence River is subject to water quality pressures from a wide range of activities within the catchment, and the contribution of the preferred route to overall water quality is expected to be minimal.

Overall the greatest risk of water quality impacts from the preferred route is in the section from Tyndale to Maclean, where the preferred route runs close to the Clarence River. The potential for stormwater runoff and pollutants from accidental spills to enter the river system is greatest in this section of the preferred route.

The preferred route would incorporate measures to reduce the potential for water quality impacts both during construction and operation. These would include sediment basins, and erosion and sediment protection measures. During operation, stormwater control measures such as grassed swales would be incorporated in the design to capture pollutants. Detention basins would be incorporated in the design to capture spills from accidents and prevent entry of pollutants into natural watercourses.

7.7.5 Climate and air quality

Climate

The climate along the preferred route is temperate, characterised by warm summers and mild to cool winters. The local climate fluctuates on a daily and seasonal basis. Key issues for the project are high rainfall, which can lead to large floods of high flows in streams, and fog, which can occur at any time of year and at most locations across the study area.

Both rainfall and fog present risks to the operation of the preferred route. However, these issues are not avoidable within the study area. Design standards for the road aim to achieve a reasonable level of road safety but can not take into account all climatic conditions. Driver awareness and behaviour are important factors in reducing risk.

Air quality

Primary sources of particulate emissions (dust and particulate matter from engine exhausts) associated with the construction of the preferred route would include:

- Clearing of vegetation and topsoil by bulldozers and scrapers.
- Excavation and levelling of soil by bulldozers, backhoes and excavators.
- Movement of soil and fill by dump trucks and scrapers.
- Wind erosion from unsealed surfaces and stockpiles.
- Emissions from facilities such as concrete batching plants.
- Wheel generated dust by construction vehicles travelling along unsealed roads/access tracks.
- Vehicle exhaust from construction machinery.

These impacts would be generally managed through a suite of construction environmental management measures including vehicle maintenance, dust suppression, and modifying work practices during windy conditions.

Generally, because this section has one of the lowest traffic volumes of the whole Pacific Highway and air quality in the study area is good, the potential for air quality impacts in excess of NSW DEC criteria is limited. Once operational, emissions from the upgraded highway would comprise mainly of hydrocarbons, Carbon Monoxide, Oxides of Nitrogen and particulate matter. Modelling for the route options indicates that for all options (including the preferred route) concentrations of these pollutants would be well below NSW DEC criteria at a distance of 10 metres from the road edge. The concentrations would decrease as distance from the road increases, meaning that at the distance of most sensitive receivers from the road (typically at least 50 metres) concentrations would be substantially below NSW DEC criteria.

Numerous submissions from residents within the study area raised issues with the potential health and amenity impacts of air emissions from the route options. While these concerns may be relevant to the perception of health and quality of life, results from the assessment undertaken for the project indicate that the potential for health impacts arising from air emissions is negligible.