3. Study Area Characteristics

3.1 Local Community

3.1.1 Overview

The study area is located within the Port Macquarie – Hastings and Kempsey Local Government Areas (LGAs). The boundary between the two LGAs is located south of Kundabung, in the north of the study area.

The Port Macquarie – Hastings LGA covers an area of 3,693 square kilometres and is located approximately 420 km north of Sydney and 510 km south of Brisbane. The topography of the LGA is very diverse, with features including coastal plains and wetlands, flood plains, river systems and mountain ranges, national parks and state forests.

The Port Macquarie – Hastings LGA has an overall population of 64,485 (2001 Census). The main towns in the LGA are Port Macquarie and Wauchope. Port Macquarie, located on the coast approximately 10 km to the east of the southern boundary of the study area, is the largest town with a population of 38,289 people (2001 Census). It serves as a major tourist destination and regional centre for the area. Wauchope, located approximately seven kilometres to the west of the southern boundary of the study area, serves as the regional centre for the inland area, particularly for the rural communities along the Oxley Highway and the associated agricultural industries. The LGA has many small localities and villages in addition to the main towns. Of these, the village of Telegraph Point is located in the study area, on the Wilson River.

Kempsey LGA covers an area of 3,377 square kilometres. The town of Kempsey, located on the Macleay River, is approximately 10 km north of the northern boundary of the study area. Kempsey, with a population of approximately 11,000 people (Kempsey Shire Council) is an important rural town. The total population of the Kempsey LGA is 26,934 (2001 Census). Features of the Kempsey LGA include fertile agricultural lands, coastal plains, beaches, popular coastal towns, in addition to national parks and state forests. The village of Kundabung, in the north of the study area, is located in the Kempsey LGA.

A section of the North Coast Railway is located in the study area in the vicinity of Telegraph Point. The railway passes beneath the highway, at Telegraph Point, after which it tends to run parallel, and to the east of the study area boundary.

Key features of the study area are shown in Figure 1.2.

3.1.2 Socio-Economic Characteristics

A review of potential social effects was undertaken, to provide input to the selection of the route options and the preferred route. The review involved examining the existing community profile, identifying key issues and community concerns, and identifying the types of social impacts that may occur as a result of the project. Key socio-economic features of the study area are summarised below.

Demographic Characteristics

- In 2001, the study area collector districts had a population of approximately 3,800 people. Population densities are higher towards the southern part of the study area in the Port Macquarie - Hastings LGA;
- There is a higher proportion of the population in their young and teenage years (5-19 years) and in their middle age years (30-54 years) compared to the Mid North Coast Statistical Division as a whole. However, there is a substantially lower proportion of people aged 60 years and over compared to the Mid North Coast Statistical Division;
- In 2001, unemployment ranged between 5.9% and 22.6%, compared to 13.2% for the Mid North Coast Statistical Division overall; and
- In 2001, 13% of households earned less than $300.00 per week, compared with 17.4% for the Mid North Coast Statistical Division overall.

Social Aspects

- The existing highway passes through the villages of Telegraph Point and Kundabung;
- The Ballengarra State Forest, Maria River State Forest, Cairncross State Forest and Kalateenee State Forest supply timber to local timber mills;
- The various reserves located in the study area provide recreational opportunities for locals and visitors as well as contributing to the general amenity of the area; and
- There is the potential for an increase in population in the southern portion of the study area as a result of the development of “Area 13”, near the intersection with the Oxley Highway.

Employment and Industry

- The study area has a relatively high proportion of its workforce in agriculture, forestry, fishing and construction compared with the mid north coast;
- Cattle grazing and orchard and aquaculture enterprises are important rural economic activities in the study area;
- Two service stations and possibly local businesses in Telegraph Point and Kundabung receive a proportion of passing trade from the highway. Other industries such as sawmills, quarries, Birdon Marine, Expressway Spares, Cairncross Waste Management Facility and Cassegrain Wines also rely on the highway for access and transportation purposes (the location of the major businesses within the study area are shown on Figure 3.6); and
- Stoney Park Watersports and Recreation is anticipated to become a popular tourist destination (location is shown in Figure 3.6).

3.1.3 Community Issues

A summary of key issues raised by the community prior to the route options display is provided below.

Safety

The community raised many issues associated with road safety. These included:

- Improving the facilities provided at rest areas and the location of rest areas (it was reported that some truck drivers use the car park opposite the Telegraph Point School of Arts as a rest area);
- The current arrangement of merging and exit lanes at Kundabung was considered unsatisfactory;
- Blind spots on overtaking lanes;
- Increasing the width of the shoulder and distance to roadside barriers to allow sufficient space to pull over (for break downs);
- Improving signage, including road identification signs (turn offs) and improved sight distance to signage;
- Maintaining safe access to amenities, including the boat ramp at Log Wharf Reserve, Telegraph Point Public School, recreation areas and service stations;
- Ensuring that lanes are wide enough to accommodate caravans and B-double trucks (especially for overtaking);
- Establishing more bus stops / bus bays at appropriate locations;
- Improving the condition of the road surface, configuration and maintenance, for both safety and noise management;
- Improving intersections (particular mention was given to Telegraph Point and Sancrox Road);
- Improving the location of pedestrian crossings, especially those associated with bus stops and rest areas; and
- Managing the needs of cyclists (introducing bike trails to run parallel with the highway).

Access To / From Highway for the Local Community

Although the safety benefits of limiting the number of direct accesses to the highway were recognised, the community expressed concern about the implications of limiting direct access.

Other key access issues included:

- Improving the safety of access to and from the highway, especially when making right hand turns across the path of through traffic;
- Access in and out of Telegraph Point – how many access points would there be and how their location would be selected. Particular concerns were voiced about access to the Telegraph Point School;
- Access to various roads, including Smiths Creek Road, Cooperabung Drive, Moonee Street, Sancrox Road, Hastings River Drive and Fernbank Creek Road;
- Whether the upgrade would involve improving and / or maintaining access to important industrial areas; and
- Maintaining access for bushfire control, and other emergency vehicles.

Other Issues

Other issues raised by the community included:

- Land acquisition – a number of queries were raised about the acquisition process, including if there was a set price for purchasing properties, when would the land acquisition process take place and how would it be managed;
- Heritage value – concerns were expressed about maintaining the existing heritage items in the area;
- Environmental considerations – requests were made to conserve existing nature reserves and existing watercourses;
- Project timeframe – concerns were expressed about the length of time until a decision on the preferred route is made and construction commences. The need to address immediate needs (particularly those relating to safety) was raised as a concern;
- Addressing maintenance needs – the need to address immediate highway maintenance needs was raised as a concern;
- Future developments – information was sought on how proposed developments would be considered as part of the decision making process;
- Construction impacts – the community identified concerns about potential construction impacts, and requested information about how these would be minimised, including potential noise impacts, air quality impacts and any inconvenience that would be experienced during the construction period; and
- Impacts on Telegraph Point – members of the community raised concerns about the possible impact on Telegraph Point from the upgrade of the highway.

3.2 Existing Highway Corridor and Alignment

An assessment of the existing highway geometry was undertaken to determine upgrading opportunities. Opportunities to achieve a 110 km/h alignment, in accordance with new highway design standards, were considered. The objective of the assessment was to compare the current alignment with the proposed 110 km/h design speed, but not to compare with current design speeds. The results of this assessment are summarised below.

3.2.1 Road Reserve

The existing road reserve width varies considerably along the length of the highway, however it has a nominal width of 100 metres. Some sections of the road reserve have sufficient width to accommodate the upgrade with provisions for local access roads where required. However much of the road reserve is not of sufficient width for a 110 km/h design speed and property acquisition would be required. Property acquisition is required for the highway to be upgraded by duplication of the existing carriageway or by realignment.

3.2.2 Carriageway Configuration

All lanes and overtaking lanes along the existing highway are 3.5 metres wide.

There are six overtaking lanes within the study area along the northbound carriageway, which represent 14% of the length. There are seven overtaking lanes along the southbound carriageway, which represent 20% of the length.

Shoulder widths vary, particularly if an overtaking lane exists. Adjacent to single lanes, shoulders are generally two metres wide. Adjacent to overtaking lanes, shoulders are generally one metre wide.

Over the project length, pavement crossfall varies. Along the straights, crossfall is approximately 3%.

3.2.3 Horizontal and Vertical Alignment

The horizontal and vertical geometry of the carriageway contains lengths that do not comply with the 110 km/h design criteria for the Pacific Highway upgrade. Approximately 26% of the existing alignment contains horizontal and vertical curves that have radii or length that do not meet the design standard. A large proportion of these are crest curves, which do not meet the vertical design standard for 110 km/h.

There are two sections where the existing geometry generally complies with the highway design standards:

- Oxley Highway to south of Hastings River; and
- Moorside Drive to north of Ravenswood Road.

However, at several locations within the above sections the design standards are not met:

- Start / end of dual divided carriageways north of Oxley Highway interchange;
- South of Sancrox Road;
- North of Sancrox Road; and
- North of Cooperabung Drive.

All of these locations have vertical curves deficient in ‘k’ value, however they could meet the highway design standards with minimal changes to the existing alignment.

There are two sections of the highway where the geometry does not meet the design standard and the design speeds are less than 110 km/h:

- Hastings River Bridge to Moorside Drive; and
- North of Ravenswood Road to Maria River.

3.2.4 Clear Zones

Batter slopes vary from 1 in 1.5 in fills, to 1 in 2 in cuts. In general, fills steeper than 1 in 2 are protected by safety barriers. Flat areas and 1 in 4 fills have a clear zone of generally five metres to the tree line. Sections in cut have clearances from the base of the cutting to the lane line of the through carriageway of generally three metres minimum. The minimum clear zone required for 110 km/h in the Pacific Highway design standards for 1 in 4 cuts is 11 metres.

Considerable work would need to be done to flatten batters and clear roadside obstacles on the existing alignment to achieve clear zone requirements. The provision of safety barriers instead of minimum clear zones may increase crash likelihood but conversely may reduce their severity.

The provision of clear zones would substantially reduce crashes. The current crash data indicates that "off, path on straight" is the main type of crash that occur on the existing highway in the study area.

3.2.5 Intersections

Of the 45 intersections within the project, 14 do not comply with the 100 km/h visibility standards for a Class A upgrade scenario. The majority of the affected intersections are located adjacent to horizontal curves or crest curves that restrict visibility.

Private accesses have not been considered in this analysis.

3.2.6 Structures

The width and load capacity of the bridges on the existing highway are summarised in Table 3.1. The RTA's *Upgrading the Pacific Highway, Upgrading Program Beyond 2006: Design Standards* suggests a minimum width of 10.5 metres for a two-lane facility with an SM1600 load standard, as specified in AS5100. The existing bridges were also assessed against the T44 load standard, the predecessor to the new SM1600 load standard. SM1600 was introduced to reflect the heavier loads being transported on NSW roads. While Table 3.1 shows that none of the existing bridges meet the new criteria, further detailed assessments will be completed during the detailed design to confirm structural capacity.

Table 3.1 Existing Bridge Width and Load Conditions

Bridge	Width Between Kerbs (metres)	Existing Load Condition	Existing Barrier Rating to AS5100
Fernbank Creek Bridge	8.5	T44 Likely	No
Hastings River Bridge (Dennis Bridge)	8.53	May be able to be rated close to T44.	No (appears low)
Telegraph Point Bridge over Wilson River	8.53	May be able to be rated close to T44.	No
Telegraph Point Bridge over Access Road	8.5	T44 Likely	No
Cooperabung Creek Bridge	8.4	T44	No
Smiths Creek Bridge	8.4	<T44 (strengthening required)	No
Piper's Creek Bridge	8.4	<T44 (strengthening required)	No
Maria River Bridge - southbound	9.2	T44 (possible SM1600 with deck replacement)	Low / regular OK
Maria River Bridge - northbound	7.1	Not compliant	No

3.2.7 Drainage Infrastructure

Of the eight highway bridges within the study area, five have Q100 flood (1% AEP) immunity based on preliminary analysis. The Maria River bridge (northbound) is five metres lower than the southbound bridge and is lower than the Q100 flood level. The Q100 flood level for Smith's Creek bridge is 0.65 metres higher than the deck level and based on preliminary analysis it appears that Pipers Creek Bridge has 5% AEP (annual exceedance probability) flood immunity which represents a 1 in 20 year flood event.

Stormwater drainage along the highway consists of lined or unlined table or batter drains. Transverse drainage uses bridges, culverts or pipes. Longitudinal drainage is provided within Telegraph Point.

3.2.8 Asset Condition

The condition of road pavement varies within the study area, however a detailed assessment of pavement condition was not conducted as part of this project. It is assumed the highway will be in reasonable condition at the time of project construction and will have a residual asset value. The existing pavement would be rehabilitated as part of the RTA's ongoing maintenance program.

The bridges on the existing highway are generally in good condition and have residual life.

3.2.9 Highway Accesses

There are a number of accesses along the highway, as shown in Table 3.2. The project needs to consider treatment of accesses to the highway in the form of local access roads, access control, intersection form and / or interchanges.

Table 3.2 Accesses Along Pacific Highway

	Public Roads		Private Roads		Driveways		Total Accesses
Section	**East**	**West**	**East**	**West**	**East**	**West**	
Oxley Highway to Hastings River Drive	2	1	0	0	0	1	4
Hastings River Drive to Telegraph Point (Moorside Drive)	5	7	0	0	1	2	15
Telegraph Point to Cooperabung Drive	3	5	2	1	4	3	18
Cooperabung Drive to Mingaletta Road	4	2	0	0	2	0	8
Mingaletta Road to Smiths Creek Road	2	3	1	0	2	0	8
Smiths Creek Road to Maria River	5	6	0	0	10	2	23
Total Accesses	21	24	3	1	19	8	76

3.3 Traffic and Transport Characteristics

3.3.1 Existing Road Network and Performance

Existing Traffic Characteristics

Traffic characteristics have been determined from recent tube count surveys and are summarised below:

- The Annual Average Daily Traffic (AADT) is greater between Hastings River Drive and Telegraph Point;
- The AADT range for the highway is 8,280 to 12,030 vehicles per day. Heavy vehicles comprise approximately 20% of the highway traffic with approximately 13% during the day (7am to 7pm) and 43% during the night (7pm to 7am);
- The AADT traffic flow profile is similar along the route with the exception of the area south of Blackmans Point Road, which has higher traffic volumes. This indicates that there is more locally generated traffic north of Hastings River Drive;
- Traffic from 11pm to 5am is low, averaging around 180 vehicles per hour, of which over 60% are heavy vehicles;
- The average 85th percentile speed over a period of seven days is 101 km/h. This data is skewed slightly as one of the counters was located within an 80 km/h speed zone in the vicinity of the Dennis Bridge;
- The average speed is 93 km/h based on speed surveys completed at four locations along the highway over seven days;
- The highest speeds occur during the early morning hours (midnight – 6am); and
- The proportion of heavy vehicles as part of the traffic stream at night is more than double that during the day for most sections of the highway. The number of heavy vehicles is highest between 4pm and 1am.

The traffic conditions of major roads can be quantified in terms of their operating level of service. Level of service is defined by Austroads (1988) as a qualitative measure of features that include speed, travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort, convenience and operating costs. Level of service (LoS) ranges from A to F as described below:

- LoS A – Generally free flow conditions. Vehicles are unimpeded in manoeuvring in the traffic stream;
- LoS B – Stable flow. Manoeuvring in traffic stream only slightly restricted with the possibility of slight delays;
- LoS C – Stable flow. Manoeuvring becoming more restricted however any delays are acceptable;
- LoS D – Approaching unstable flow. Delays are common but tolerable;
- LoS E – Unstable flow. Traffic stream is congested with intolerable delays; and
- LoS F – Forced flow. Any movement of traffic stream is at very slow speed.

Table 3.3 shows that the highway is currently operating at LoS D and may already be experiencing unstable traffic flow conditions (where travel speeds are affected by congestion).

Table 3.3 Highway Traffic Volumes and Level of Service (2004)

Section	AADT (1)	LoS (2)	v/c (3)
South of Hastings River Drive	8,280	D	0.43
Blackmans Point (at Hastings River Bridge)	10,952	D	0.58
Telegraph Point	12,028	D	0.63
Kempsey LGA boundary (near Mingaletta Road)	9,846	D	0.52

Notes: (1) Annual Average Daily Traffic (AADT) – The number of vehicles crossing at a specific site per year and dividing this number by the number of days in the year (366 days in 2004);
(2) LoS determined from Austroads *Guide to Traffic Engineering Practices – Part 2: Roadway Capacity*.
(3) v/c is volume / capacity ratio.

Traffic Hierarchy

The traffic data indicates that a mix of local, regional and interstate traffic use the highway. The mix of local and through traffic reduces the capacity of the highway for other users. A solution is to separate the interstate and possibly regional traffic from the local traffic and construct local access roads for local traffic. This suggested road hierarchy is consistent with the Class A / Class M scenarios proposed for the upgrading of the highway.

Origin Destination Investigation

Number plate surveys were carried out in November 2004 to determine the proportion of through and local traffic. A summary is provided in Table 3.4.

The base data from the matches of the number plates for light and heavy vehicles is shown in Table 3.4. This data indicates that only 18% of northbound traffic at the Oxley Highway continues through to the end of the study area south of Kempsey (30% of heavy vehicles) and similarly 26% of the southbound vehicles south of Kempsey continue past the southern end of the study area at the Oxley Highway intersection (59% of heavy vehicles).

For the northbound vehicles south of Kempsey only 16% originated beyond the Oxley Highway intersection (24% of heavy vehicles), yet 38% of the southbound traffic at the Oxley Highway originated further north than the project limit south of Kempsey.

This data is for 12 hours during the day (7am to 7pm) and the percentage that is classified as through traffic may increase substantially at night (7pm to 7am). A review of the traffic counter data for night and day travel indicates that the through heavy vehicle component appears to increase substantially to 92% in the evening hours. However there appears to be no substantial change in the light vehicle travel patterns. This indicates that the travel patterns only change at night for the heavy vehicles where the proportion of through vehicles nearly doubles.

Table 3.4 Matched Number Plates – Total Traffic

	Out			
In	**South of Kempsey – Northbound**	**Oxley Highway – Southbound**	**Total**	**% Through Traffic**
South of Kempsey - Southbound	68 (2)	1082 (395)	4502 (678)	26% (59%)
Oxley Highway - Northbound	581 (160)	10 (10)	3217 (570)	18% (30%)
Total	4107 (667)	2861 (586)		
% Through Traffic	16% (24%)	38% (69%)		

Note: Numbers in parenthesis are heavy vehicles.

Heavy Vehicles

A small number of 19 metre B-doubles have been using the highway for some time now, while the 25 metre B-doubles were only granted access to the full length of the highway in August 2002. This was following reviews undertaken after the opening of the Yelgun to Chinderah Freeway, which bypassed a length of low standard alignment through the Burringbar Range.

Traffic data from a number of traffic counter sites indicates that within months of B-double access being granted to the full Pacific Highway route, the daily number of large heavy vehicle movements increased by approximately 250 on average over those recorded before B-Doubles were given access. However this rapid increase has not been sustained.

Between late 2002 and late 2004, vehicle monitoring at Port Macquarie has indicated that there has been a shift in the mix of the heavy vehicle fleet from semi-trailers to B-doubles (i.e. the number of semi-trailers on the highway has fallen since late 2002 from around 1,050 per day to around 900 per day and now appears to have stabilised at the lower number, while the number of B-Doubles has shown a gradual increase from around 180 to 300 in the same period) and there has been no substantial growth in overall heavy vehicle numbers since late 2002.

Key generators of heavy vehicle movements (existing and potential) within the study area include:

- Hard rock quarry at Sancrox Road – this operation generates heavy vehicle movements providing aggregate for concrete operations in Port Macquarie;
- State Forests – access for logging in the state forests at various locations along the highway. Timber is transported to local mills;
- The quarry north of Cooperabung Hill (Yarrabee Road) – recently developed and will generate heavy vehicle movements;
- The urban development area known as “Area 13” – development of this land, located to the east of the highway north of the Oxley Highway intersection, will generate heavy vehicle movements associated with construction activities and ongoing commercial operations;
- Land to the west of the highway in the vicinity of Sancrox Road that has the potential to be rezoned ‘industrial’ may generate heavy vehicle movements;
- Regional waste management facility at Cairncross – heavy vehicle movements will be generated from areas to the north and south;

- Cassegrain Vineyard – deliveries to and from this facility generate heavy vehicle movements; and
- Expressway Spares and proposed industrial land to the north of Sancrox Road – the number of heavy vehicle movements generated will depend on the nature of development of the industrial land.

Intersections

The project objectives include provision of intersections designed to achieve at least a level of service (LoS) C at 20 years after opening for the 100th highest hourly volume (15% of AADT).

The operation of the intersections (as at-grade facilities) at the time of opening (2016) under the "do nothing" scenario is:

- Sancrox Road / Pacific Highway – operates satisfactorily;
- Glen Ewan Road / Hastings River Drive / Pacific Highway – does not operate satisfactorily (right turn from Hastings River Drive is LoS F);
- Blackmans Point Road / Pacific Highway – overall performance is satisfactory;
- Telegraph Point South / Pacific Highway – overall performance is satisfactory; and
- Telegraph Point Access / Pacific Highway – operates satisfactorily (however LoS F on side road).

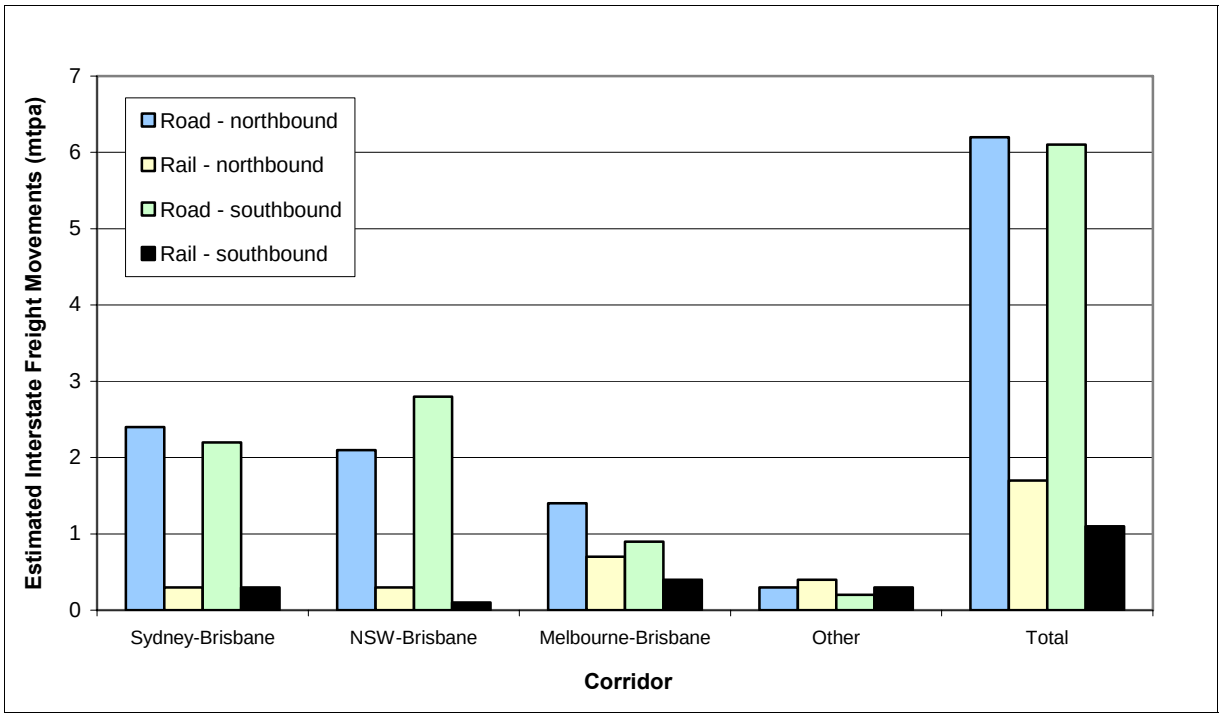
3.3.2 Other Transport Infrastructure

The North Coast Railway (NCR) runs between Sydney and Brisbane. Rail currently caters for approximately 11% of the freight transported between Sydney and Brisbane as shown in Figure 3.1.

Under proposed upgrades to the NCR between Sydney and Brisbane as outlined in AusLink and by the Australian Rail Track Corporation (ARTC), the modal split between road and rail is expected to change to between 14% and 35% by 2026 as shown on Figures 3.2 and 3.3. However the growth in heavy vehicle traffic is still predicted to approximately double the current road freight task between Brisbane and Sydney.

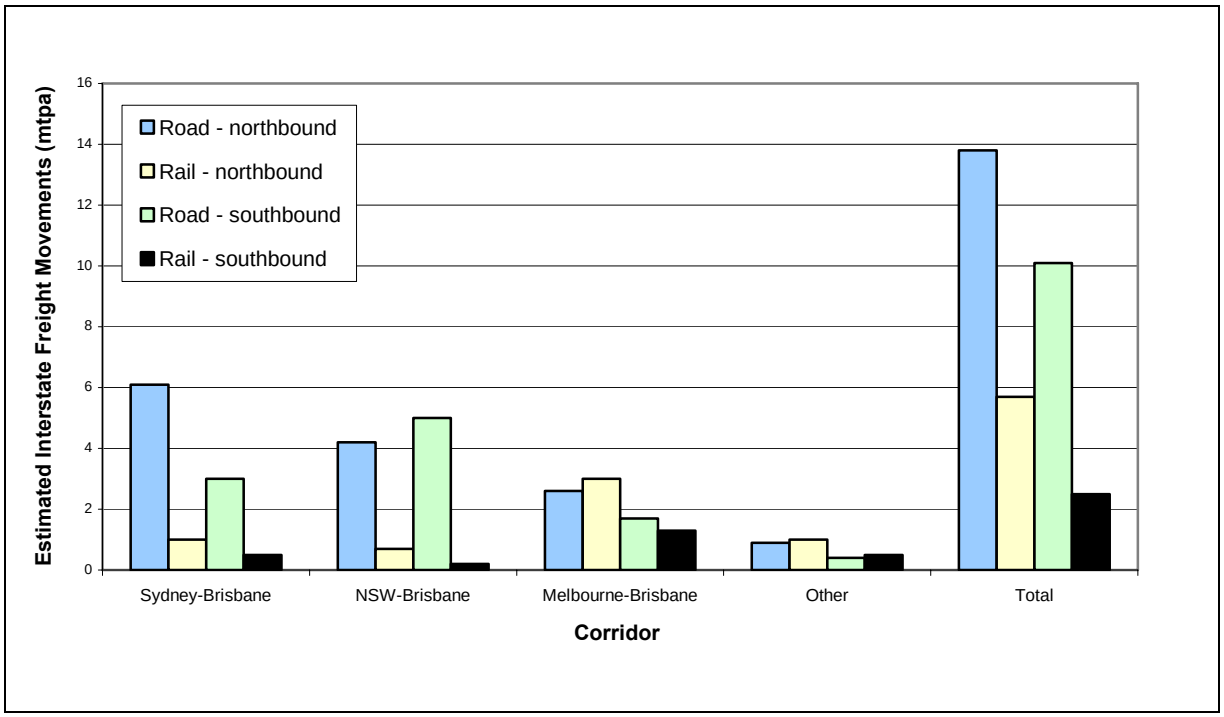
As a result, whilst the NCR can provide some relief for the highway, the modal shift will not be of sufficient magnitude to preclude the requirement to upgrade the highway.

Figure 3.1 Estimated Interstate Freight Movements (2002 – Million Tonnes Per Annum)



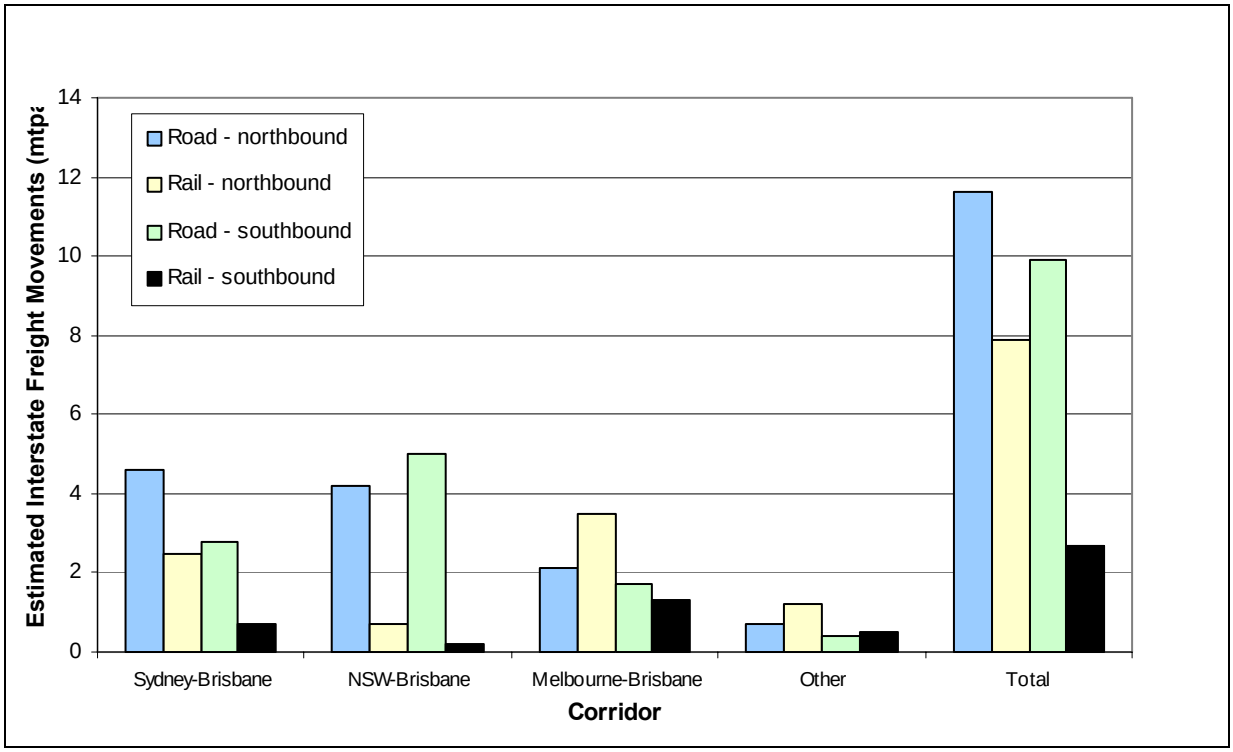
Source: **GHD and Booz Allen Hamilton, 2005, 'South East Queensland Inter-Model Freight Terminal Study, Stage 2'**

Figure 3.2 Estimated Interstate Freight Movements 2026 (Low Rail Share – Million Tonnes Per Annum)



Source : **GHD and Booz Allen Hamilton, 2005, 'South East Queensland Inter-Model Freight Terminal Study, Stage 2'**

Figure 3.3 Estimated Interstate Freight Movements 2026 (High Rail Share – Million Tonnes Per Annum)



Source: **GHD and Booz Allen Hamilton, 2005, 'South East Queensland Inter-Model Freight Terminal Study, Stage 2'**

3.3.3 Crash History

A total of 146 crashes have occurred in the study area between 2000 and 2005 including:

- Nine fatalities;
- 66 serious crashes; and
- 74 other crashes.

Figure 3.4 illustrates the locations of all crashes over the period 2000-2005 along the Pacific Highway within the study area. This data indicates that the majority of crashes occur within the vicinity of Telegraph Point and in the vicinity of Kundabung. The section of highway in the vicinity of the Dennis Bridge that crosses the Hastings River is another high crash zone.

The categories of crashes are described below:

- Fatality – a crash where there has been a fatality;
- Serious casualty crash – a crash where an injury has resulted that required hospitalisation; and
- Minor crash – a crash where only minor injuries have been received and / or the vehicles involved were required to be removed.

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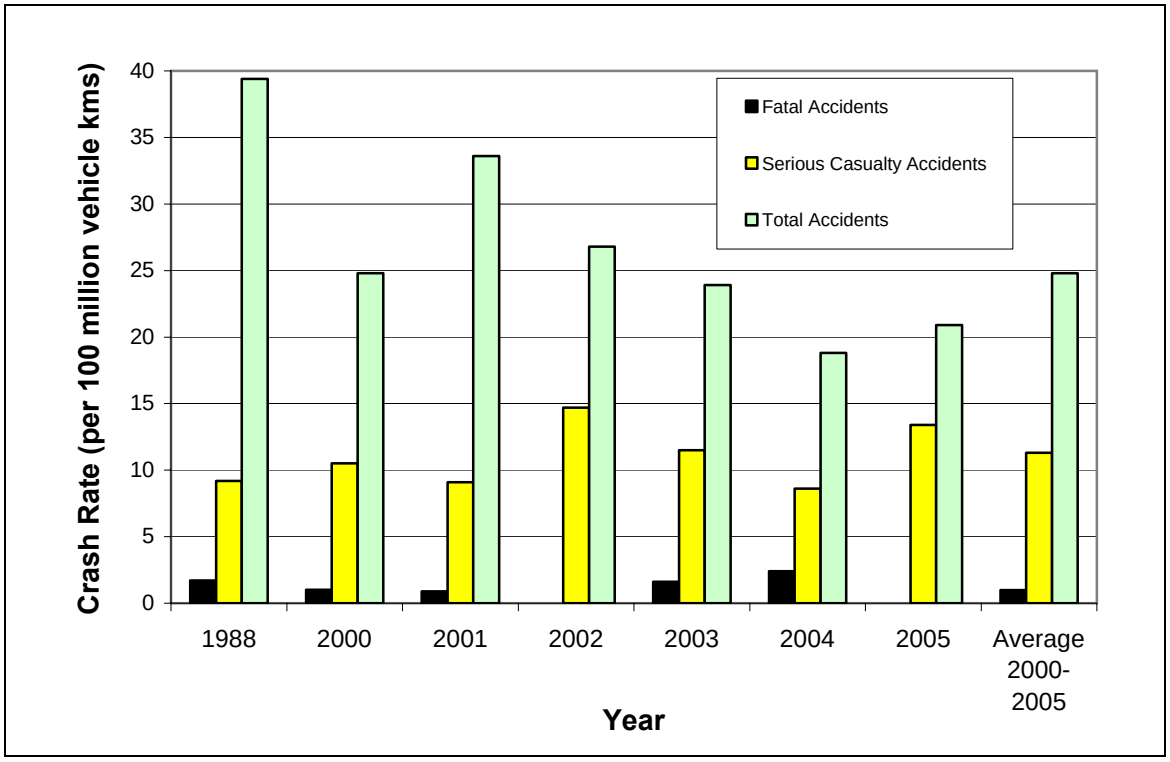
Crash Rates

Comparing the current crash rates against those in the RTA Road Design Guide indicate that the crash rates are less than what was encountered during 1988. Average crash rates from 1999 to 2004 are approximately 63% of those encountered during the late 1980's as shown on Figure 3.5. A comparison of this data with the crash rates per 100 million vehicle kilometres as documented in the RTA Road Design Guide indicates that fatal crashes over this section of the highway are higher than average, however the rate of serious casualty crashes are only slightly lower.

Figure 3.5 Crash Rate per 100 Million Vehicle Kilometres



Note: The 1988 rates have been modified from the RTA Road Design Guide based on the overall reduction in crashes between 1988 and 2004 (approximately 71%).

Crash Type Summary

The main crash types in the study area for the period 1 October 2000 to 30 September 2003 are as follows:

- Off path, on straight – 44%;
- Vehicles from opposing direction – 12%;
- Vehicles from same direction – 12%;
- Off path, on curve – 11%;
- Intersection – 11%; and
- On path – 7.5%.

The majority of crashes involved vehicles travelling in the same direction or vehicles losing control. Further analysis reveals the following:

- Off path, on straight crashes:
  - 63% occur when the vehicle leaves the roadway and crashes into an object; and
  - 37% occur when the vehicle leaves the roadway without hitting any other object.
- Vehicles from opposing directions:
  - 67% involve head on crashes not involving overtaking manoeuvres; and
  - 27% involve right-through accidents where a vehicle turns across the path of another to an access.
- Vehicles from same direction:
  - 61% are rear end crashes due to fast moving vehicles colliding with slower accelerating or decelerating vehicles from behind;
  - 11% are right rear accidents where vehicles are hit from behind as they attempt to turn right into private roads or accesses along the highway; and
  - 11% are accidents where vehicles are hit by other vehicles changing lanes to the left.
- Off path, on curve crashes:
  - 37% of the crashes involve leaving the roadway on a left hand curve; and
  - 63% of the crashes involve leaving the roadway on a right hand curve.
- Intersection crashes:
  - 69% of the crashes involve vehicles turning right onto roadway and through traffic from the right.
- On path crashes:
  - 45% involve animals on the roadway; and
  - 55% involve objects on the roadway.

3.4 Land Use

The study area is dominated by rural land uses, state forests and conservation areas. Residential areas are largely restricted to the villages of Telegraph Point and Kundabung. Other key features within the study area include the Pacific Highway, North Coast Railway and the Hastings, Wilson and Maria Rivers and their associated floodplains. Existing land uses within the study area generally consist of the following broad categories:

- Residential – predominantly within the villages of Telegraph Point and Kundabung, and surrounding rural catchments, with scattered development in other sections of the study area, particularly south of Hastings River;
- Rural – while much of the available rural lands within the study area remain heavily vegetated, rural uses include grazing lands, aquaculture, orchards, tea tree plantations, vineyards, poultry farms, small farms and other agricultural activities;
- State forests and reserves – these areas include state forests (Cairncross, Ballengarra, Maria River and Kalateenee State Forests), nature reserves (Rawdon Creek and Cooperabung Creek) and Kumbatine National Park; and

- Commercial enterprises – there are a number of businesses scattered along the highway, particularly south of Telegraph Point. Major operations include Cassegrain Wines, Expressway Spares, Hanson Construction Materials, Birdon Marine, Cairncross Waste Management Facility and Stoney Park Watersports and Recreation.

Large areas of land generally between the Oxley Highway and Fernbank Creek Road to the east of the existing highway have been identified for future urban and industrial development known as Area 13. This area is currently subject to environmental and planning investigations and if approved would change the character of the southern part of the study area. Land to the west of the existing highway surrounding Bushlands Drive and the area known as Le Clos farms is identified within the Hastings Rural Residential Strategy for potential rural residential development, while a larger area of land encompassing this, and partially bordering the existing highway, has also been identified as a rural residential investigation area.

Port Macquarie – Hastings Council has also recently identified land in the vicinity of Sancrox Road to the west of the existing highway for possible future industrial development although these plans are still subject to consultation and investigations and have not been endorsed.

Existing land use is depicted in Figure 3.6.

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3.5 Heritage

3.5.1 Indigenous Heritage

Searches of Commonwealth, State Government and local government heritage registers and a review of previous indigenous heritage investigations and studies have been undertaken. Consultation with the local Aboriginal community has also been undertaken.

Historical Characteristics

The Macleay River valley (including Kempsey and the northern portion of the study area) is considered by researchers and local indigenous people to have been occupied by Dhan-gadi speakers. The Birpay (Birpai) language was reportedly spoken over a broad area south of Kempsey around Port Macquarie.

The coastal and riverine zones contained abundant food resources. A wide variety of flora and fauna were available for exploitation, from a number of different resource zones. There is some debate about the extent of movement of people in the region. Some researchers claim that the occupational pattern of the region was characterised by high seasonal mobility, with people utilising coastal resources during the summer and the resources of the hinterland during the winter. Other researchers argue that occupation along the coastal zone was largely sedentary, with people limiting their movements to small territories in which they could adequately meet their subsistence needs.

Estimates of population density vary between 1.5 and three persons per square kilometre of land in the coastal zone.

By the mid to late 1800s the Aboriginal population had comprised small remnant groups along the coast or subsisting around the fringes of the now permanent non-indigenous settlements.

A large and active Aboriginal population remains on the north coast today, with the community taking an active interest in the management of their heritage.

Key Findings

Eighteen Aboriginal heritage sites listed on the NSW Department of Environment and Conservation Aboriginal Heritage Information Management System Register are located within the study area. The sites, and their identification numbers, are listed below:

- Twelve artefact scatters: (30-3-0194, 30-3-0195, 30-3-0207, 30-3-0210, 30-3-0211, 30-3-0212, 30-3-0293, 30-3-0294, 30-3-0300, 30-3-0316, 30-3-0317, 30-3-0318);
- Five isolated artefacts: (30-3-0156, 30-3-0157, 30-3-0208, 30-3-0209, 30-3-0311); and
- A scarred tree: (30-3-0162).

Sites of indigenous heritage significance are depicted on Figure 3.7.

The study area does not contain any heritage items registered for indigenous values under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* or the *Environment Protection and Biodiversity Conservation Act 1999*. However, the location of several items listed for indigenous values on the Register of the National Estate (Place ID #3470 and 18249) could not be confirmed, as the Australian Heritage Commission keeps these details confidential. The Australian Heritage Commission will be contacted during the next stage of the study to clarify the location of these sites, although on the basis of the information gathered to date, they are not anticipated to be within the study area.

The predictive model of site location indicates that additional indigenous heritage resources are likely to occur throughout the study area. Further investigations (in the form of detailed field survey and consultation with the Aboriginal community) are required to adequately establish the nature and distribution of indigenous heritage evidence across the study area.

Prior to these more detailed investigations it is not possible to assess the significance of any identified or potential indigenous heritage sites within the study area. However, it is noted that the scarred tree (30-3-0162) represents a regionally uncommon type, and may be of significance on the basis of representativeness.

Searches were undertaken of the National Native Title Register, Register of Native Title Claims and Register of Indigenous Land Use Agreements and for unregistered Claimant applications with the National Title Tribunal on 8 March 2005 for the local government areas of Port Macquarie – Hastings and Kempsey. No claims, agreements or applications within the study area are listed. Subsequent consultation with the local Aboriginal community indicates this has not changed.

Aboriginal Community Consultation

The study area lies within the boundaries of the Birpai Local Aboriginal Land Council (LALC) and Kempsey LALC, and within an area of interest to the Dunghutti Elders Aboriginal Corporation. The LALC boundary is shown on Figure 3.7.

A number of areas of cultural sensitivity to the local Aboriginal community, inclusive of both registered and unregistered sites, are also reported to occur within or in close proximity to the study area. This has been confirmed by consultations with the Aboriginal community. These areas include:

- A ceremonial place in the vicinity of the quarry in Sancrox Road, to the west of the existing highway. This site generally encompasses a broad area around the hill crest and possibly inclusive of NPWS registered sites 30-3-0194 and 30-3-0195;
- The general area surrounding the Hastings River is an area of sensitivity where battles between the Dunghutti and Birpai were fought in this locality;
- A possible unregistered artefact scatter on the northern side of Hastings River;
- A possible ceremonial site in the vicinity of Cooperabung Hill; and
- An area of unspecified sensitivity in the vicinity of the Maria River.

While some of these unregistered sites currently may have no legal protection, they could qualify for protection under the *Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984* or the *NSW National Parks and Wildlife Act 1974*, and therefore require due consideration.

These areas are shown on Figure 3.7.

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3.5.2 Non-Indigenous Heritage

A desktop assessment of non-indigenous heritage characteristics of the study area and surrounding locality was undertaken. The assessment included searches of Commonwealth, State Government and local government heritage registers and planning instruments, and research of local historical records.

Historical Characteristics

Port Macquarie was established as a penal colony in 1823 when convicts were transported by ship from Newcastle. The town ceased to be a penal station in 1833 although the prison continued until 1846.

Historically, like many areas on the north coast, timber (particularly red cedar) was an important industry for the region. The first cedar was cut near the Hastings River by convicts and was shipped out of Port Macquarie in 1824.

A number of timber mills operated in Telegraph Point (so named because the telegraph line between Port Macquarie and Kempsey crossed the river) in the early 20th century. Logs were brought to the mills by bullock drays and milled timber was shipped down the Wilson River.

Shortly after 1839 settlers started taking up large “runs” along the Macleay River. While large areas of land were settled, populations remained low. Although the first pastoralists brought sheep into the area, cattle became the dominant stock by 1848. Agriculturalists moved into the area in the 1850’s and began clearing the lands along the banks of many of the rivers.

The first crops of wheat were planted to the south of the Hastings River in 1824 and 1825. These failed and from that time farmers experimented with a range of “tropical” crops. Many crops were tried but either failed or demand was insufficient to make them a profitable enterprise. Dairying became popular from the 1890’s onward.

The first towns were located on rivers, particularly in areas with access to the sea, and inland towns were established.

The original “coastal” highway took an inland route, initially via Rolland’s Plains and then towards the end of the 19th century, via Telegraph Point. A bridge across the Wilson River at Telegraph Point opened in 1902. The railway to Kempsey opened in 1917, following its arrival in Telegraph Point in 1915. Railway construction brought an increase in population to the town, and the focus of town settlement shifted from the south bank of the Wilson River to the north. Construction of the railway at Telegraph Point was accompanied by the construction of a new church, post office, hall and housing.

Key Findings

No Commonwealth listed items are located within the study area. Two non-indigenous heritage items listed on the Register of the National Estate, Kundabung Lime Kiln Ruins (Place ID# 3490) and Piper’s Creek Lime Kilns (Place ID# 3489), are located outside the study area approximately two kilometres east and seven kilometres west of the Pacific Highway respectively.

No items currently listed by the National Trust of Australia (NSW), the NSW State Heritage Register, or the RTA’s Section 170 Heritage and Conservation Register are located within or in the immediate vicinity of the study area.

A recent study of the heritage significance of RTA controlled bridges in NSW has identified the Maria River bridge (northbound) over the Pacific Highway at the northern end of the study area as a heritage item of state significance.

A number of non-indigenous heritage items, located within or near the study area, are listed in Part 3 of Schedule 4 (Other Heritage Items) of the *Hastings Local Environmental Plan 2001* and Section 2 of the NSW State Heritage Inventory (items listed by local government and State Government agencies). These items include:

- School building and teacher's dwelling house, 479 Rawdon Island Road (Lot 30 FP 905648);
- Post Office building, 489 Rawdon Island Road (Lots 28, 29, 33, 37 and 38 DP 754446 and part Portion 9, Parish of Redbank);
- Hibbard slipway, Boundary Street (Lot 1 DP 774887, Lot 694 DP 729765 and Lot 699 DP 822635);
- Road bridge over railway line, off old Pacific Highway, Cooperabung Drive, Telegraph Point;
- Butter factory, Old Butter Factory Road, Telegraph Point (Lot 2 DP 206773);
- Timber mill, 320 Cooperabung Drive, Telegraph Point (Lot 1 DP 512380);
- Cemetery, Farrawells Road, Telegraph Point;
- Shop, 50 Rollands Plains Road, Telegraph Point (Lot 8 or 9 DP 243959, River Street);
- Shop, 54 Rollands Plains Road, Telegraph Point (Lot 8 or 9 DP 243959, River Street);
- Railway station water tower, River Street, Telegraph Point; and
- Railway bridge (over Wilson River), Telegraph Point.

One non-indigenous heritage item, located within or near the study area, is listed in Schedule 1 of the *Kempsey Local Environmental Plan 1987* (Schedule 1) and NSW State Heritage Inventory (Section 2). The North Coast Regional Environmental Plan lists the Piper's Creek lime kilns, which as noted above is located outside the study area.

Sites of non-indigenous heritage significance are depicted on Figure 3.8.

Historical records indicate that a range of industries and activities were carried out in the study area. There is potential for evidence of these activities, in the form of historical relics, to occur within the study area. Such evidence may be protected under the *NSW Heritage Act 1977* where it is 50 years or older.

To provide more detailed information on the nature, extent and significance of any non-indigenous heritage items within the study area, the potential impacts of the project, and to recommend appropriate management strategies, further investigations will be undertaken of the preferred route. These investigations will involve a detailed historical review and assessment and detailed field inspection for, and recording of, any sites or relics.

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3.6 Visual Amenity

The study area is characterised by a variety of landscape settings, within a predominantly rural environment. The southern part of the study area is flat to gently undulating, reflecting its location in the Hastings River valley. Expressway Spares, Cassegrain Wines and associated buildings are dominant visual features in this area.

The existing highway then passes through a flat and forested landscape, followed by open pastureland on the Hastings River floodplain. The southern bank of the Hastings River is characterised by industrial land uses (Birdon Marine and Birdon Dredging).

The Hastings River is crossed by a steel truss bridge with a concrete deck. The bridge offers views upstream (towards the Great Dividing Range) and downstream (views of coastal plains). The Hastings River is listed in the RTA's *Pacific Highway Urban and Regional Design Framework* as one of 16 key landmarks along the highway.

The highway continues through pastureland for a short distance north of the Hastings River, before rising out of the Hastings River valley and entering tall Eucalypt forest (within Cairncross State Forest and Rawdon Creek Nature Reserve). North of this forested landscape, the highway again passes through flat pastureland located in the floodplain of the Wilson River. In this location, the highway is elevated on an earth embankment. Views from this area include pastureland, patches of lowland forest, and forested foothills.

The highway then reaches the village of Telegraph Point. A section of Telegraph Point is located south of the Wilson River and adjacent to the western side of the highway. The main village of Telegraph Point is on the northern side of the Wilson River. The Wilson River bridge is of simple concrete box girder form. The most expansive views from the bridge are lateral views of the Wilson River, both upstream and downstream.

Immediately north of Telegraph Point the highway is cut into the hill that rises above the village. It then passes through a mosaic of forest patches and pastureland in the vicinity of Cooperabung Creek, before entering the steeper forested landscape of the Cooperabung Creek Nature Reserve, Ballengarra State Forest and Cooperabung Range.

Flatter topography occurs to the north of Ballengarra State Forest, where the highway descends towards Smiths Creek. A mix of forested land, pastureland and rural settlement is located in this area. The village of Kundabung is located north of Smiths Creek, mainly east of the highway along Kundabung Road.

From Kundabung to the northern boundary of the study area, the highway passes through gently undulating land with a mixture of pastureland and remnant forest patches. It then climbs into the steeper forested country associated with the Maria River State Forest.

3.7 Noise

Noise from the existing highway alignment was calculated at each potential receiver identified within the study area. Potential receivers generally within one kilometre of the existing highway were identified based on aerial photographic interpretation and limited ground truthing work.

The noise level from the existing highway was calculated using procedures based on the *CoRTN* prediction algorithms. This model was implemented using ROADent software. Modelling was undertaken for a typical weekday based on the surveyed traffic volume, traffic speed and composition for the existing highway.

The modelled results were compared with the NSW Department of Environment and Conservation's (DEC) criteria for a "Redeveloped Highway". These criteria would apply where it is proposed to upgrade the existing highway without major deviation from the existing alignment, and as such potentially represents the possible minimum upgrade for this project in some sections.

The preferred route may include sections that significantly deviate from the existing alignment of the highway. These locations would be subject to the DEC's "New Highway" criteria of 55 dB(A) during the day (7am – 10 pm) and 50 dB(A) at night (10pm – 7am).

The modelling results indicate that approximately 87 receivers (14% of total receivers) experience daytime noise levels that exceed the DEC's "Redeveloped Highway" criteria of 60 dBA. The results also indicate that approximately 170 receivers (28% of total receivers) experience night time noise levels that exceed the DEC's "Redeveloped Highway" criteria of 55 dBA.

The majority of these receivers are located in Telegraph Point. Additional isolated receivers are distributed along the remainder of the highway.

3.8 Ecology

This project has been divided into terrestrial and aquatic ecology based on the following study boundaries:

- Terrestrial ecology covers all non-aquatic habitats, as well as vertebrate non-fish fauna species that may occupy swamps and marshes; and
- Aquatic ecology covers all wetland habitats such as creeks and rivers, including their immediate riparian habitats, and swamps and marshes.
- The investigations have considered, as relevant, the following matters:
- Threatened species populations and endangered ecological communities listed under the NSW Threatened Species Conservation Act 1995 (TSC Act), NSW Fisheries Management Act 1994 (FM Act) or Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);
- Rare flora species being those identified by Briggs and Leigh (1996), Rare or Threatened Australian Plants (RoTAP). Rare flora species may also be listed as threatened;
- Migratory species as listed under the EPBC Act. Migratory species may also be listed as threatened;

- Protected species are defined as those listed under the FM Act or National Parks and Wildlife Act 1974 (NPW Act); and
- Wetlands listed as being of State significance under State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14), of national importance as listed under the Directory of Important Wetlands in Australia, or international importance (wetlands recognised as a result of the Ramsar Convention) as protected under the EPBC Act.

3.8.1 Terrestrial Ecology

Features of the Study Area

The natural environment within the study area is relatively uniform from south to north. Variations occur mainly in the vicinity of river and creek crossings and their floodplains, and in deep gullies. Most of the land within the study area is flat or gently undulating, with steeper land and deeper gullies in the vicinity of Barrys Creek. The most notable landform is Cooperabung Hill.

The dominant vegetation type throughout the study area is blackbutt / stringybark dry sclerophyll forest. Particular areas of this broad forest type are characterised by co-dominant tree layer species such as tallowwood, red bloodwood, forest red gum and spotted gum. The forest is mainly regrowth from past logging or clearing. Very little mature forest and few mature trees occur within the study area. The forested areas are interspersed with large expanses of cleared farmland. Cleared areas are interspersed with remnant areas of natural vegetation or isolated remnant paddock trees.

Areas of wet sclerophyll forest with rainforest elements occur in the Barrys Creek gully area, and on the adjacent hillsides with sheltered aspects. This forest type has also been heavily logged, but some mature trees occur.

Elsewhere, minor areas of riparian vegetation occur near creeks and rivers and their associated floodplains. The vegetation in these areas typically consists either of paperbarks, she-oaks and red gums by creek banks and floodplains, or salt marsh with or without mangroves by the major rivers with estuarine influences.

Scope of Investigations

The ecological investigations undertaken to date have been based on an initial preliminary field survey, supplemented by further more detailed field work in the vicinity of the developed route options in key parts of the study area.

For route options assessment these investigations are preliminary only. The environmental assessment of the preferred route will include detailed ecological assessments in accordance with relevant DEC guidelines including the currently draft Threatened Biodiversity Guidelines.

The preliminary survey generally involved:

- Review of the NSW Threatened Species Conservation Act 1995 and Commonwealth Environment Protection and Biodiversity Conservation Act 1999, including any recent determinations and any recently released relevant reports or mapping studies;
- Review of key threatened species databases including the NSW Department of Environment and Conservation and Bird Atlas of NSW lists of known or potential threatened species, endangered ecological communities and endangered populations for the study locality and study area;

- Preparation of maps indicating the likely location of any threatened species, endangered ecological communities and endangered populations within the study area;
- Describing the existing biological environment of the study area in relation to flora and fauna, based on preliminary field examination of habitats along the existing highway and interpretation of air photographs and maps for areas that have not been ground-truthed; and
- Discussion of the potential constraints and impacts of each route option with regards to threatened species, populations or ecological communities and other limiting factors, such as wildlife corridors, that are known or may potentially occur based on a review of flora and fauna databases.

Supplementary investigations were undertaken in key parts of the study area where the developed route options deviated significantly (i.e. Sections A, B and C) and generally included the following:

- A flora and fauna habitat assessment within vegetated areas of all route option investigation areas;
- Preparation of maps of the broad vegetation associations within the investigation areas for all route options within the relevant areas of Sections A, B and C based on a combination of the field data and aerial photograph interpretation;
- Describing the nature and characteristics of each broad vegetation association; including habitat, structure and dominant or characteristic species;
- Determining which of the vegetation associations are likely to constitute endangered ecological communities;
- Identifying areas of potentially key habitat for fauna species on maps, particularly threatened fauna;
- Mapping the locations of any fauna habitat features of particular importance, for example mature habitat trees; and
- Describing the particular fauna habitat features for each route option, and identify the threatened fauna species that could potentially utilise these habitat features.

Key Findings

Key areas of terrestrial ecological characteristics are depicted in Figures 3.9 to 3.11 (terrestrial flora) and in Figure 3.12 (terrestrial fauna).

Terrestrial Flora

Threatened Species

A desktop review of threatened species records from a variety of sources indicated the following:

- Within 10 km of the existing highway, nine threatened flora species have been recorded;
- Within two kilometres of the existing highway, three threatened flora species have been recorded;
- One threatened species, the orchid (Phaius australis) is known to occur in the vicinity of and north of Port Macquarie; and
- The Commonwealth Department of Environment and Heritage (DEH) Protected Matters Search Tool identified five threatened flora species that have the potential to occur.

Those threatened flora species recorded or identified as potentially being present within the study area are listed in Table 3.5.

Rare Flora Species

A review of RoTAP listings indicates that an additional 12 rare flora species have been recorded or have the potential to be present. Of these, one flora species, Green bottlebrush (*Callistemon flavovirens*) has been recorded within two kilometres of the existing highway. Those rare species recorded or identified as potentially being present within the study area are listed in Table 3.5.

Vegetation Communities

As previously discussed, maps of the broad vegetation communities within the investigation areas for all route options within the relevant areas of Sections A, B and C were prepared, based on a combination of the field data and aerial photograph interpretation.

The results of the vegetation community mapping is shown on Figure 3.10.

Flora Habitat Values

Based on interpretation of the vegetation community mapping, flora habitat features for each route option were assessed, the threatened fauna species that could potentially utilise these habitat features were identified.

In addition to the threatened and rare flora species listed in Table 3.5, habitat for an additional ten species was identified:

- Marsdenia longiloba (TSC Act, EPBC Act and ROTAP);
- Asplenium aethipicum (ROTAP);
- Ghania insignis (ROTAP);
- Acomis acoma (ROTAP);
- Gonocarpus salsoloides (ROTAP);
- Cryptocarya nova-angelica (ROTAP);
- Eucalyptus fusiformis (ROTAP);
- Corybas undulatus (ROTAP);
- Asperula asthenes (TSC Act, EPBC Act and ROTAP); and
- Thesium australe (TSC Act, EPBC Act and ROTAP).

Endangered Ecological Communities

Field investigations have identified four endangered ecological communities listed under the TSC Act within the study area, these include:

- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Swamp Oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- Subtropical coastal floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.

Two further endangered ecological communities listed under the TSC Act are considered possible to occur within the study area:

- River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions.

The following endangered ecological communities listed under the TSC Act have been identified in the North Coast bioregion but are considered unlikely to occur within the study area:

- Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Hunter lowland redgum forest in the Sydney Basin and NSW North Coast Bioregions;
- Lowland rainforest on floodplain in the NSW North Coast Bioregion; and
- White box, yellow box, Blakely's redgum woodland.

The locations of the confirmed endangered ecological communities and areas identified as potential endangered ecological communities are shown on Figure 3.11. This mapping is based primarily on the supplementary investigations undertaken in the vicinity of the developed route options in Sections A, B and C. It is likely that other areas of endangered ecological communities exist within the study area, particularly on the Hastings River and Wilson River floodplains.

There is potential for endangered ecological communities to be present at other locations within the study area.

Forest Ecosystem Mapping

As part of the Regional Forest Agreement (RFA) process, a Comprehensive Regional Assessment (CRA) was undertaken to assess a number of values, including ecological, within the Lower North East CRA regions. The CRA provided scientific information for the development of a comprehensive, adequate and representative forest reserve system.

The CRA included development of a forest ecosystem classification system that was derived by splitting and amalgamation of existing Forest NSW forest types based on analysis of variation between field survey plots with regard to environmental variables. These were then mapped based on existing mapping (primarily from aerial photography) and predictive mapping. The mapping was undertaken using a 100 metre grid system.

The data collected on each of the forest ecosystems included predicted area of the ecosystem pre-1750 and present; and the area remaining within reserve systems. It should be noted that the CRA data has not been verified by detailed field survey for the whole study area, and given the level of mapping used to derive this data, it is expected that there will be some inaccuracies.

This data was previously used for the Oxley Highway to Kempsey project as it represented the only complete vegetation data set for the study area. However, following completion of the supplementary field investigations, which included vegetation community mapping, significant inaccuracies were identified in the CRA data. As a result this data has not been referenced in this report.

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Table 3.5 Rare or Threatened Flora Species With Potential to be Present Within the Study Area

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	RoTAP Status
Hairy-joint grass	*Arthraxon hispidus*	Vulnerable	Vulnerable	3VC-+
Maundia	*Maundia triglochinoides*	Vulnerable	N/A	N/A
Biconvex paperbark	*Melaleuca biconvexa*	Vulnerable	Vulnerable	N/A
Swamp orchid	*Phaius tankervilliae*	Endangered	Endangered	3VC+-
Scented acronychia	*Acronychia littoralis*	Endangered	Endangered	N/A
Green bottlebrush	*Callistemon flavovirens*	N/A	N/A	3RC-
N/A	*Allocasuarina defungens*	Endangered	N/A	2E
White-flowered wax plant	*Cynanchum elegans*	Endangered	Endangered	3ECi
N/A	*Hakea archaeoides*	Vulnerable	Vulnerable	N/A
N/A	*Melaleuca groveana*	Vulnerable	N/A	3RC-
Milky silkpod	*Parsonsia dorrigoensis*	Vulnerable	Endangered	2VCi
N/A	*Acacia blakei subsp. Diphylla-**	N/A	N/A	N/A
N/A	*Acacia tessellata*	N/A	N/A	2RC-
N/A	*Bertya brownii*	N/A	N/A	2RC-
N/A	*Boronia chartacea*	N/A	N/A	3R
N/A	*Callerya australis**	N/A	N/A	N/A
Brittlewood	*Claoxylon australe**	N/A	N/A	N/A

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	RoTAP Status
N/A	*Eucalyptus fergusonii subsp. fergusonii*	N/A	N/A	3KC-
N/A	*Gahnia insignis*	N/A	N/A	3RCa
N/A	*Goodenia fordiana*	N/A	N/A	2RC-
N/A	*Grevillea linsmithii*	N/A	N/A	3RCa
N/A	*Kunzea sp.* 'Middle Brother Mountain'*	N/A	N/A	N/A

Note:

RoTAP coding (Briggs and Leigh 1996);

2 Geographic range in Australia less than 100 km;

3 Geographic range in Australia greater than 100 km;

E Endangered Species: at risk of disappearing from the wild within 10-20 years if present land use and other threats continue to operate;

V Vulnerable Species: not presently endangered, but possibly at risk in future due to continuing depletion or land-use change;

R Rare Species: rare in Australia, but currently without any identifiable threat;

C Reserved: indicates taxon has at least one population within a national park, or other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora;

K Poorly known;

i Indicates that less than 1000 plants are known to occur within a conservation reserve(s);

- Reserved population size is not accurately known;

+ Overseas occurrence;

a Indicates that 1000 plants or more are known to occur within a conservation reserve(s); and

* Not listed, but of local conservation value due to restricted distribution

Terrestrial Fauna

Threatened and Migratory Species

A desktop review of threatened and migratory species records from a variety of sources indicated the following:

- Within 10 km of the existing highway, 49 threatened fauna species have been recorded;
- 27 of these species have been recorded within two kilometres of the existing highway; and
- The DEH Protected Matters Search Tool identified an additional five threatened fauna species and six migratory species that have the potential to occur.

The results of the desktop review are given in Table 3.6 and shown on Figure 3.12.

Terrestrial Fauna – Fauna Habitat Values

Based on interpretation of the vegetation community mapping, fauna habitat features for each route option were assessed and the threatened fauna species that could potentially utilise these habitat features were identified.

In addition to the threatened fauna species listed in Table 3.6, potential habitat for an additional twenty-six threatened fauna species was identified:

- White-crowned snake;
- Pacific baza;
- Brown goshawk;
- Magpie goose;
- Brush-stone curlew;
- Red-capped plover;
- Red knot;
- Brown treecreeper;
- Barred cuckoo-shrike;
- Brolga;
- Swift parrot;
- Hooded robin;
- Black-chinned honeyeater;
- Barking owl;
- Wompoo fruit-dove;
- Rose-crowned fruit-dove;
- Superb fruit-dove;
- Rufous bettong;
- Squirrel glider;
- Large-footed myotis;
- Eastern chestnut mouse;
- Eastern false pipistrelle;
- Yellow-bellied sheathtailed bat;
- Common blosson bat;
- Stephen's banded snake; and
- Pale-headed snake.

Koala Habitat Values

Port Macquarie – Hastings Council has prepared a Draft Coastal Area Koala Plan of Management (KPoM) (Connell Wagner, 2000) that includes the southern section of the study area. The KPoM identifies divides the Port Macquarie – Hastings LGA coastal area into a number of Koala Management Units based on density of koala records. Within the units, areas were allocated Koala Habitat Management Regime zones based on koala habitat values.

The study area is located within Koala Management Units A and B, indicating a high to moderate number of koala recordings. Within these areas were areas identified as Primary Koala Habitat Management Regime zones, largely concentrated between the Oxley Highway and the Hastings River, with smaller isolated areas north of the Hastings River. These primary management zones provide for the highest level of habitat protection.

The KPoM also identified regional and local habitat links that provide connection between areas of Koala Habitat Management Regime zones. One regional link and two local links intersect with the study area (Connell Wagner, 2000).

Additional information on koalas within the study area has been provided by Vanessa Standing of the Koala Preservation Society. This information includes records of koala deaths on the existing highway, which are shown on Figure 3.12. Further information regarding anecdotal evidence on location of koala populations and key movement corridors within the study area was also provided and is summarised below.

- Known koala populations are present, or have been recorded south of Sancrox Road, within Cairncross State Forest (both east and west of the existing highway), in the vicinity of Wilmaria Road on the northern bank of the Wilson River, within Ballengarra State Forest, in the vicinity of Wharf Road near Kundabung, east of the existing highway in Kemps Road at the northern end of the study area, and to the east of the study area in Maria National Park.
- Key movement corridors across the existing highway are located in the general vicinity of Partridge Creek, Cairncross State Forest, Ballengarra State Forest, a number of crossings are located along the Kundabung straight, and within Maria River State Forest.

Endangered Populations

One endangered fauna population could occur:

- Emu (Dromaius novaehollandiae).

While there are no records within two kilometres of the study area, the potential presence of emus requires consideration.

Key Habitats and Wildlife Corridors

Seven wildlife corridors, mapped by the National Parks and Wildlife Service (NPWS) as part of the Key Habitats and Corridors in North East NSW Mapping Project, pass through the study area. A number of patches of key habitats are also located within the study area.

Table 3.6 Threatened and Migratory Fauna Species With Potential to be Present Within The Study Area

Common Name	Scientific Name	TSC Act Status	EPBC Act Status
Birds			
Glossy black-cockatoo	*Calyptorhynchus lathami*	Vulnerable	N/A
Black-necked stork	*Ephippiorhynchus asiaticus*	Endangered	N/A
Painted honeyeater	*Grantiella picta*	Vulnerable	N/A
Comb-crested jacana	*Irediparra gallinacean*	Vulnerable	N/A
Black bittern	*Ixobrychus flavicollis*	Vulnerable	N/A
Square-tailed kite	*Lophoictinia isura*	Vulnerable	N/A
Powerful owl	*Ninox strenua*	Vulnerable	N/A
Osprey	*Pandion haliaetus*	Vulnerable	Migratory
Marbled frogmouth	*Podargus ocellatus*	Vulnerable	N/A
Grass owl	*Tyto capensis*	Vulnerable	N/A
Masked owl	*Tyto novaehollandiae*	Vulnerable	N/A
Sooty owl	*Tyto tenebricosa*	Vulnerable	N/A
Regent honeyeater	*Xanthomyza phyrygia*	Endangered	Endangered / Migratory
White-bellied sea-eagle	*Haliaeetus leucogaster*	-	Migratory
White-throated needletail	*Hirundapus caudacutus*	-	Migratory
Black-faced monarch	*Monarcha melanopsis*	-	Migratory
Satin flycatcher	*Myiagra cyanoleuca*	-	Migratory
Rufous fantail	*Rhipidura rufifrons*	-	Migratory
Spectacled monarch	*Monarcha trivirgatus*	-	Migratory

Common Name	Scientific Name	TSC Act Status	EPBC Act Status
Frogs			
Wallum froglet	*Crinia tinnula*	Vulnerable	N/A
Green and golden bell frog	*Litoria aurea*	Endangered	Vulnerable
Stuttering frog	*Mixophyes balbus*	Endangered	Vulnerable
Green-thighed frog	*Litoria brevipalmata*	Vulnerable	N/A
Giant barred frog	*Mixophyes iterates*	Endangered	Endangered
Non-Flying Terrestrial Mammals			
Spotted-tailed quoll	*Dasyurus maculatus*	Vulnerable	Endangered
Yellow-bellied glider	*Petaurus australis*	Vulnerable	N/A
Brush-tailed phascogale	*Phascogale tapoatafa*	Vulnerable	N/A
Koala	*Phascolarctos cinereus*	Vulnerable	N/A
Common planigale	*Planigale maculate*	Vulnerable	N/A
Long-nosed potoroo	*Potorous tridactylus tridactylus*	Vulnerable	N/A
Flying Terrestrial Mammals			
Greater broad-nosed bat	*Scoteanax rueppellii*	Vulnerable	N/A
East-coast freetail-bat	*Mormopterus norfolkensis*	Vulnerable	N/A
Eastern bent-wing bat	*Miniopterus schreibersii oceanensis*	Vulnerable	N/A
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable
Southern myotis	*Myotis macropus*	Vulnerable	N/A
Large-eared pied bat	*Chalinolobus dwyeri*	Vulnerable	N/A
Golden-tipped bat	*Kerivoula papuensis*	Vulnerable	N/A
Little bent-wing bat	*Miniopterus australis*	Vulnerable	N/A

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3.8.2 Aquatic Ecology

Features of the Study Area

The main aquatic habitat features within the study area are the Hastings and Wilson Rivers. Both are tidal within the study area and support interrupted riparian bands of mangroves, mainly grey mangrove (*Avicennia marina*) and swamp oak (*Casuarina glauca*), as well as patches of broader estuarine wetlands.

The other major feature is the Thrumster sandplain, which occurs mainly south of the Hastings River. This is part of a large sandplain that extends along the Maria River to the north (the Maria River is generally east of and outside of the study area), which was cut some time in the geological past by the Hastings River. These are often referred to as "wallum" swamps, and characteristic vegetation includes broad-leaf paperbark (*Melaleuca quinquenervia*) swamp forests, heathland and sedgelands.

There are also a number of creeks and streams within the study area. Most of the streams are intermittent and comprise a well defined channel with ponds and riffles. The ponds may retain water for weeks or months, and are therefore important aquatic habitats. While some wetland plants often grow in the ponds, characteristic wetland vegetation is typically sparse or absent on the stream banks, generally being replaced by rainforest species (Melaleuca species are also often present).

Key Findings

Threatened Species

Database searches revealed that there are no records of aquatic flora or fauna species within the study area listed as threatened under the FM Act or the EPBC Act.

The endangered fish species, oxleyan pygmy perch (*Nannoperca oxleyana*), is known to occur in streams in wallum swamps north of Forster and could potentially occur in the study area.

Rare Flora Species

In addition to the species listed in Table 3.5, one RoTAP listed aquatic flora species (*Hydrocharis dubia*) is known to occur on the north coast, including the Kempsey LGA (although mainly north of the Clarence River). This species occurs in small shallow freshwater bodies or swamps.

Protected Aquatic Species

The following aquatic species, while not threatened, are listed as protected under the FM Act or NPW Act:

- Red-fruited saw edge (Gahnia sieberiana);
- Tassel-rush (Restio tetraphyllus);
- Pink Swamp Heath (Sprengelia incarnata);
- Grass trees (Xanthorrhoea spp.);
- Christmas bells (Blandfordia grandiflora);
- Seaweeds;
- Seagrasses;
- Mangroves; and
- Syngnathiformes (Seahorses, seadragons, pipehorses, pipefish, ghostpipefish and seamoths).

Listed Wetlands

There are two SEPP 14 wetlands located within the study area. These are located on Dalhunty Island in the Wilson River, and on the northern bank of the Wilson River to the northeast of Dalhunty Island.

There are also two SEPP 14 wetlands located downstream of the study area. These are located near Partridge Creek, south of the Hastings River, and surrounding Hughes Inlet (Hughes Inlet adjoins Munns Channel, a tributary of the Hastings River).

Key areas of aquatic ecological significance are depicted on Figure 3.14

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3.9 Topography, Geology and Soils

3.9.1 Topography

The southern portion of the study area, between the Oxley Highway intersection and Telegraph Point, traverses undulating low hills and the alluvial floodplains of the Hastings and Wilson Rivers. Gradients are typically gentle to very gentle and elevation is generally less than 30 metres above Australian Height Datum (AHD).

The middle of the study area (between Telegraph Point and Smiths Creek, south of Kundabung) traverses coastal hills that tend to be of steeper gradient and higher elevation. These are associated with Allen Hill and Cooperabung Range and border the broad low-lying coastal plain situated to the east. Gradients are typically gentle to moderate and elevation ranges up to approximately 166 metres AHD.

The northern portion of the study area traverses a number of watercourses and their associated valley flats. Elsewhere the terrain comprises undulating low hills where gradients are typically gentle to very gentle and elevation is generally less than 70 metres AHD.

Figure 3.15 depicts the topography of the study area. The figure indicates that the existing highway alignment avoids the majority of the steep and high elevation terrain in and in close proximity to the study area.

3.9.2 Regional Geology

The underlying geology of the southern portion of the study area features Quaternary alluvial sand, silt, mud and gravel on the floodplains of the Wilson and Hastings Rivers; and lithic sandstone, siltstone, tuff, shale and limestone of the Carboniferous Byabbara Beds, mudstone, siltstone and limestone of the Lower Permian Macleay Group including the Beechwood Beds and slate, meta sandstone and conglomerate of the Permian Thrumster Slate on the low hills.

The underlying geology of the middle portion of the study area mainly comprises the Youdale, Kullatine, Majors Creek, Mingaletta and Cooperabung Formations around the Cooperabung Range, with lithic sandstone, mudstone, conglomerate, minor limestone and coal. Quaternary alluvial sand, silt, mud and gravel is located in the vicinity of the Cooperabung Creek.

In the northern portion of the study area, the underlying geology mainly comprises the Kempsey Beds with lithic sandstone, mudstone, pebbly sandstone and minor conglomerate. Quaternary alluvial sand, silt, mud and gravel is located in the vicinity of Smiths and Pipers Creeks and Maria River.

3.9.3 Rock Cutting Stability

In the southern portion of the study area (south from the Wilson River), and the northern portion of the study area (north from Mingaletta Road), the existing highway batters are typically shallow (less than five metres) and generally slope at 1H:1V (every one metre horizontally corresponds to an increase of one metre in vertical height). These areas are characterised by numerous small-scale slumps and wedge style failures. This is most likely a result of the combination of dispersive soils and soil plasticity in conjunction with typically weak rock. Future rock cuttings in these areas should consider flattening of cut batters to 2H:1V to permit establishment of vegetation and reduce the occurrence of these types of instability.

The existing highway cutting immediately north of the Wilson River includes high strength rock with prominent jointing. Where the preferred route requires widening of this cutting, detailed geological assessment will be required to confirm cutting stability, particularly during construction under highway traffic conditions, and develop appropriate design responses.

The steep topography of the Cooperabung Range is expected to result in deep rock cuttings that traverse this area. The stability of the existing cuttings appears to be satisfactory though in need of maintenance to remove and / or treat localised small scale instability. The maximum cutting depth on the existing highway is in excess of 15 metres, with future cuttings likely to be of greater depth.

The structural geology of the Cooperabung Range is dominated by the presence of a regional east-southeast trending anticline. This feature has generated locally highly deformed and weathered rock strata and varying structural jointing within the stronger rock units of Cooperabung Range. The design of future rock cuttings will need to consider the interaction of the structural geology and cutting orientation to optimise cut batter design, whilst also ensuring the design incorporates appropriate measures for future rock cutting maintenance.

3.9.4 Soil Issues

Soft Soils

The nature of the study area is such that embankments would traverse alluvial materials and / or residual soil gullies in certain locations.

The upgraded highway would need to traverse deep alluvial materials within the Hastings River and Wilson River floodplains, in addition to shallow alluvial materials at Partridge Creek, Fernbank Creek, Cooperabung Creek, Smiths Creek, Pipers Creek and Maria River. The depth of alluvium within the shallow creek crossings is expected to be less than five metres.

Subsurface geotechnical investigations have been undertaken at various locations across the Hastings River and Wilson River floodplains. These investigations indicate deep alluvial soils in excess of 15 metres depth and soft soils of up to 15 metres depth within the Hastings River floodplain and varying from two to eight metres depth within the Wilson River floodplain.

The future highway crossing of these floodplains is likely to require major embankments with specific foundation treatments required in areas of soft soil. Embankment heights may also be locally higher at the locations of possible interchanges (due to on and off ramps and overpasses), bridge approaches and where larger culverts are required. The design of higher embankments in areas of soft soil would require detailed geotechnical assessment.

Cooperabung Creek is expected to contain relatively shallow alluvium with a low potential for soft soil. Based on this assumption, conventional embankment construction would be likely within this area.

Embankments would also be required to traverse alluvium material at Partridge Creek, Fernbank Creek, Cooperabung Creek, Smiths Creek, Pipers Creek and Maria River. These areas are not expected to contain soft soils, and given the shallow depth of alluvium expected in these areas, conventional embankment construction should suffice.

Both the shallow creek and alluvial areas contain waterlogged ground as evidenced by the prominence of Melaleuca forests and / or grassed swamps. Bridging layers are likely to be required to cross the alluvial plains. Residual soil areas may also be seasonally waterlogged in the vicinity of drainage gullies and basins.

Figure 3.16 shows the likely location of soft soils.

Acid Sulphate Soils

The following areas were identified from acid sulphate risk maps as having a risk of encountering acid sulphate soils – Partridge Creek, Fernbank Creek to Hastings River, Blackmans Point Road to Bill Hill Road, Wilson River Floodplain, Cooperabung Creek, Smiths Creek and Pipers Creek. Excavated acid sulphate soils may require treatment to prevent water quality impacts. Drainage measures in these areas will also need to consider the presence of potential acid sulphate soils to prevent acid generation associated with the dewatering of submerged soils.

Figure 3.17 shows the likely location of acid sulphate producing soils.

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Contamination

The preliminary contamination assessment found that there are a number of potential contamination issues in the study area. The majority of these are considered to pose only a minor risk of contamination to soils and groundwater. Potential contamination issues may exist at sites currently or previously occupied by service stations, the substation at Thrumster (just to the east of the study area) and drum storage on private property.

A site of particular concern is the former waste management facility site at Farrawells Road, Telegraph Point. If works were to be conducted in this area, issues such as settlement, disposal / handling of excavated landfill material, and the potential impacts of migration of contaminants would need to be assessed in detail.

3.10 Geotechnical Issues

3.10.1 Rock Cuttings

As described earlier, the future rock cuttings south of the Wilson River and north of Mingeletta Road are expected to be shallow. These future rock cuttings should consider cut batter slopes to 2H:1V to permit establishment of vegetation and reduce future maintenance associated with localised instability.

Due to the steep topography through Cooperabung Range, future rock cuttings in this area are likely to be deep (in excess of 15 metres). Given the variability of structural geology in this area associated with the regional anticline structure, future cuttings should be subject to detailed geotechnical assessment to enable optimisation of cut batter design according to the cutting orientation whilst taking due consideration of future cutting maintenance requirements.

3.10.2 Embankment Design

Embankments would be required to traverse alluvial materials and / or residual soil gullies. Generally, construction of embankments less than five metres in height within residual soil gullies would most likely incorporate conventional embankment construction. Embankments over five metres in height on residual soils and embankments on soft soils (particularly within the Hastings and Wilson River floodplains) would require more detailed embankment design.

Where fill embankments are required on steeper slopes, such as within Cooperabung Range, some embankment foundation preparation may be required to remove shallow colluvium that could be subject to instability and soil creep.

Based on the fill materials that would be generated from the cuts within the study area, an embankment slope angle to no steeper than 2H:1V should be considered for route options development assessment.

3.10.3 Trafficability

Alluvial floodplains are expected to include waterlogged ground, as evidenced by the prominence of Melaleuca forests, grassed swamps and wet grazing land within the alluvial plains. Bridging layers are likely to be required in these areas. Areas underlain by residual soils may also be seasonally waterlogged in the vicinity of drainage gullies and basins located within tributaries to the creeks.

3.10.4 Earthworks Materials

The materials generated from rock cuttings within the study area are expected to be suitable for use as general fill only, with the exception of some of the fresher sandstone and siltstone units through Cooperabung Range, which may also be suitable for use as select material, subject to further assessment of durability.

3.11 Hydrology and Flooding

Watercourses in the south of the study area include Hastings River and Wilson River and their associated alluvial floodplains. Partridge Creek, Fernbank Creek and a number of lower order tributary streams are also traversed by the highway.

In the middle portion of the study area, Cooperabung Creek and Barrys Creek and their associated small valley flats are traversed by the highway, along with a number of lower order tributary streams.

In the north of the study area, the highway traverses Smiths Creek and Pipers Creek and their associated valley flats, along with a number of lower order tributary streams, and the Maria River.

The hydrologic modelling has shown that the two major bridge crossings at Wilson River and Hastings River are not flood affected for events up to the Probable Maximum Flood (PMF) magnitude. The size of the catchment at the existing major bridge crossings is large, hence the construction of bridges within two kilometres downstream of the existing crossings is not expected to cause any detrimental effects upstream. The location of bridges would be dependant on the selection of a preferred route.

The Pacific Highway crossing of the Maria River (southbound) is predicted to be flood-free up to the 100 year ARI magnitude. However, this assessment is subject to some variability as there has been an observed flood level at the northbound structure that has been approximately one metre above the predicted 100 year ARI flood level. The reason for that discrepancy has not been determined and requires further assessment during the detailed design.

The preliminary flood assessment for Piper's Creek and Cooperabung Creek has indicated the structures to have a deck level above the 100 year ARI flood level.

Hence an initial assessment for the above structures indicates that they meet the flood immunity design standards for the project.

Smith's Creek bridge has been found to have a deck level above the 20 year ARI flood level and therefore meets the design standards. However, should a separate parallel bridge be constructed at this location as part of the upgrade then consideration should be given to the provision of an enlarged waterway at this location.

Approximately 100 minor structures (culverts) were identified along this section of the Pacific Highway. Of these, the preliminary assessment has indicated that four were found to require consideration for upgrading as part of any upgrade to the Pacific Highway, as they did not meet the design standards for the project. Figure 3.18 shows the watercourses around the study area and the results of the preliminary assessments of the flooding at existing bridges.

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3.12 Water Quality

The major watercourses within the study area are the Hastings River, Wilson River and Maria River. Water quality data was sourced from Port Macquarie – Hastings Council, Kempsey Council, Waterinfo internet site and a Manly Hydraulics laboratory report.

Where water quality data was available it has tended to focus on water quality parameters that are indications of stream health rather than parameters that are likely to be impacted by an upgrade of the Pacific Highway.

Data for the Hastings River showed that total nitrogen and total phosphorus were below the freshwater trigger levels but some exceeded the estuarine trigger concentrations.

Data for the Wilson River indicated one total nitrogen and one total phosphorus observation was significantly higher than the remainder of the analytes assessed. These were for samples collected on different days. One result for turbidity was very high when compared to the other samples. The majority of the results were below the appropriate water quality trigger values.

Several of the total nitrogen observations and one set of samples for total phosphorus taken from the Maria River exceeded the relevant trigger values.

The water quality of the major watercourses within the study area is good when compared with other watercourses in New South Wales.

3.13 Public Utilities

A number of overhead and underground public utilities are located within the study area. Depending on the type of service, local, regional and / or interstate connections may be provided.

Utilities within the study area include:

Telecommunications

- Telstra – trunk optic fibre and distribution copper networks;
- Optus – trunk optic fibre network; and
- Visionstream Nextgen – trunk optic fibre network.

Electricity

- Country Energy high voltage network (66 kV, 32 kV and 11 kV) and low voltage distribution;
- Transgrid high voltage line (132 kV) between Port Macquarie and Kempsey; and
- Transgrid have undertaken strategic planning for a substation near the existing quarry on Sancrox Road. This would include new 330 kV lines up to the west of Kempsey, however Transgrid have indicated that it can be designed around the upgraded highway. Country Energy are planning to add a substantial distribution facility from the substation. This would involve in the order of 10-15 cables under the road to the east back to Port Macquarie and new aerial cables running north and south. The aerial cables running north and south would be preferably located within the road corridor.

Water

- Port Macquarie – Hastings Council has potable water reticulation within the study area from around Port Macquarie up to, and including, Telegraph Point; and
- Kempsey Shire Council has no water services located within the study area.

Sewerage

- There are no sewerage services in the study area. Port Macquarie – Hastings Council is currently considering options for providing sewerage connections between Port Macquarie and Wauchope, and Port Macquarie and Telegraph Point.

The public utilities within the study area are shown in Figure 3.19.

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