Roads and Traffic Authority of NSW

Oxley Highway to Kempsey
Upgrading the Pacific Highway

Environmental Assessment

MAIN VOLUME

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13. Water quality

This chapter describes the existing water quality in the area covered by the Proposal and assesses the potential impacts as a result of construction and operation and proposes management measures.

The Director-General's environmental assessment requirements identify surface and groundwater to be a key issue. **Table 13-1** indicates where the aspects of the Director-General's environmental assessment requirements that relate to surface and groundwater are addressed, either in this chapter or in other chapters (in *italics*).

Table 13-1 Water quality

Environmental assessment requirements	Where addressed
Surface and Ground Water – including but not limited to:	
• Water quality taking into account impacts from both accidents and runoff and considering relevant environmental water quality criteria specified in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.*	**Section 13.3**
• Groundwater including cumulative impacts on regional hydrology. The assessment must consider: extent of drawdown; impacts to groundwater quality; discharge requirements; and implications for groundwater-dependent surface flows (including springs and drinking water catchments), groundwater-dependent ecological communities and groundwater users.	*Chapter 14 Groundwater* *Chapter 15 Flora and fauna*
• Identifying changes to existing flood regimes, in accordance with the *Floodplain Development Manual* (former Department of Natural Resources, 2005), including impacts to existing receivers and infrastructure and the future development potential of affected land.	*Chapter 12 Hydrology*
• Demonstrating consideration of the effects of sea level rise, changes to rainfall frequency and/or intensity as a result of climate change on the project.	*Chapter 12 Hydrology* *Section 20.8*
• Waterways to be modified as a result of the project, including ecological, hydrological and geomorphic impacts (as relevant) and measures to rehabilitate the waterways to pre-construction conditions or better.	*Chapter 12 Hydrology*

13.1 Assessment approach

13.1.1 Policy context

A brief summary of the strategic policy and guidelines that are relevant to the assessment of potential water quality impacts is provided below.

National Water Quality Management Strategy

The National Water Quality Management Strategy is a joint initiative of the Federal and State governments. The main policy objective of the strategy is to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development.

NSW Water Quality and River Flow Objectives

As part of environmental reforms to watercourse management across the State, water quality and river flow objectives have been developed for a number of catchments through a consultative process to assist in guiding plans and actions to achieve healthy watercourses. These objectives are primarily aimed at maintaining and improving water quality so that it is suitable for aquatic ecosystems, visual amenity, recreation, water supply and production of aquatic foods suitable for human consumption and aquaculture activities. The process for the development of these objectives is consistent with the National Water Quality Management Strategy for implementation under the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council (ANZECC) 2000), with catchment specific criteria based on these guidelines.

Water quality objectives were developed for the Hastings River (including the lower reaches of the Wilson and Maria rivers) and are included as part of the Camden Haven and Hastings River Water Quality and River Flow Objectives. These objectives were developed to guide catchment management and planning for the Hastings River and have been approved by the NSW Department of Environment, Climate Change and Water.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality

ANZECC:
Is the Australian and New Zealand Environment Conservation Council.

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC 2000, referred to as the ANZECC water quality guidelines) form part of the National Water Quality Management Strategy and list a range of environmental values for water bodies. Different water quality criteria are set for the water bodies based on environmental values assigned to that water body. These values include consideration as to whether the water is to be used for drinking, recreation or according to ecological values. The ANZECC water quality guidelines provide water quality criteria (scientifically-based benchmark values) for a wide range of parameters for each of these values.

NSW Oyster Industry Sustainable Aquaculture Strategy

The *NSW Oyster Industry Sustainable Aquaculture Strategy* (Department of Primary Industries 2006) establishes a set of water quality guidelines, flow objectives and management measures for oyster aquaculture areas that, if met, would provide for the healthy growth of oysters that are safe for human consumption.

The strategy also identifies priority oyster aquaculture areas, being areas assessed as being favourable for oyster production based on a range of criteria. The strategy identifies 120.5 hectares of priority oyster aquaculture areas within the Hastings River and lower reaches of the Maria River near its confluence with the Hastings River. Priority oyster aquaculture areas are located on the Hastings River, approximately 1 kilometre upstream and approximately 2.5 kilometres downstream of the Proposal. The majority of priority oyster aquaculture areas are located generally downstream of the confluence of the Hastings and Maria rivers, approximately 3 kilometres downstream of the Proposal.

Healthy Rivers Commission Report

The Healthy Rivers Commission has undertaken an inquiry into and prepared a report on the health of the North Coast rivers (Healthy Rivers Commission 2003). The report identifies goals for river health, however it does not include specific assessments of the Hastings, Wilson and Maria rivers. However, the Healthy Rivers Commission has indicated that, in terms of overall condition, the North Coast rivers are generally better than average when compared to rivers throughout other coastal catchments in NSW and water quality was generally found to be good.

Other relevant guidelines

The following guidelines were also considered in the water quality assessment:

- *RTA Water Policy* (2000).
- *RTA Code of Practice for Water Management* (1999b).
- *Road Runoff and Drainage Environmental Impacts and Management Options* (Austroads 2000).
- *RTA QA Specification G38 Soil and Water Management (Soil and Water Management Plan)* (2004b).
- *Managing Urban Stormwater: Soils and Construction, Volume 1* (Landcom 2004).
- *Managing Urban Stormwater: Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008b).
- *Floodplain Development Manual* (former Department of Natural Resources 2005).

13.1.2 Methodology for assessing existing water quality

The existing water quality in the area of the Proposal was obtained from existing data sources and reviewed and assessed against ANZECC water quality guidelines to determine past and current river health. Source records from organisations and community groups that have previously recorded water quality data, include:

- Port Macquarie-Hastings Council (in association with Kempsey Council).
- Former Department of Water and Energy.
- Manly Hydraulics Laboratory.
- Healthy Rivers Commission.
- Local and anecdotal water quality records.

Port Macquarie-Hastings Council, in association with Kempsey Council, maintains an extensive water quality-monitoring program that encompasses the Hastings, Wilson and Maria rivers. The program is undertaken in accordance with standard water quality sampling methods and assessed against the ANZECC water quality guidelines with analysis at an appropriate laboratory accredited by the National Association of Testing Authorities.

The data collected by the Port Macquarie-Hastings Council was considered the most representative data set for the water courses to allow an effective assessment of the water quality across the area of the Proposal. The data obtained for the Hastings, Wilson and Maria rivers was reviewed from 2004, 2006, October 2007 to December 2007, January 2008 to June 2008 and March 2009, focussing on the tidal areas of the catchment. The data is obtained at regular periods across the catchment and differences between the time of the year, activities within the catchment and weather conditions directly influence the water quality values obtained.

Table 13-2 describes the monitoring locations where data relevant to the Proposal was obtained for this assessment, while **Figure 13-1** shows the location of water quality monitoring points used in this assessment from the Port Macquarie-Hastings Council water quality monitoring program. It should be noted that the monitoring program for the Hastings, Maria and Wilson rivers is much broader than the information provided here, however a large number of the monitoring locations were significantly upstream of the Proposal and not specifically relevant to this assessment.

Table 13-2 Port Macquarie-Hastings Council water monitoring locations

Water course	Monitoring point	Location description
Hastings River	HAE-09	Approximately 300 m upstream of the Dennis Bridge.
	HAE-04	Big Bay, approximately 9.5 km downstream of the Proposal.
Wilson River	WSS-01	Telegraph Point, approximately 7 km upstream of the Proposal.
	WSS-04	Bril Bril Creek and the Wilson River, approximately 16 km upstream of the Proposal.
	WSS-06	Upper Wilson River, approximately 19 km upstream of the Proposal.
	RVS-05	Wilson River, west of Dalhunty Island, approximately 1.5 km upstream of the Proposal.
	HAE-07	Wilson River, approximately 750 m downstream of the Proposal.
Maria River	HAE-05	Confluence of Maria River and Hastings River, approximately 4 km east of the proposed Hastings River crossing.
	HAE-06	Adjacent to the “Hatch”, approximately 10 km downstream of the proposed Wilson River crossing.
	HAE-08	Local government boundary, approximately 3 km upstream of the confluence with the Wilson River.

13.1.3 Water quality objectives

The NSW Water Quality and River Flow Objectives for the Hastings River catchment are provided for separate sections of the catchment. The Proposal would cross the catchment in two main locations on the Hastings and Wilson rivers. The crossings over the Hastings and Wilson rivers are located in the estuary reach of the catchment, while the crossing of the Maria River is located generally within mainly forested areas and is classified as a lowland river flowing to the coast. The balance of the Proposal is located within areas classified as uncontrolled streams and mainly forested areas within Cairncross and Ballengarra state forests. The water quality objective levels specified for these sections of the catchment are shown in **Table 13-3**.

Figure 13-1 Water quality monitoring locations

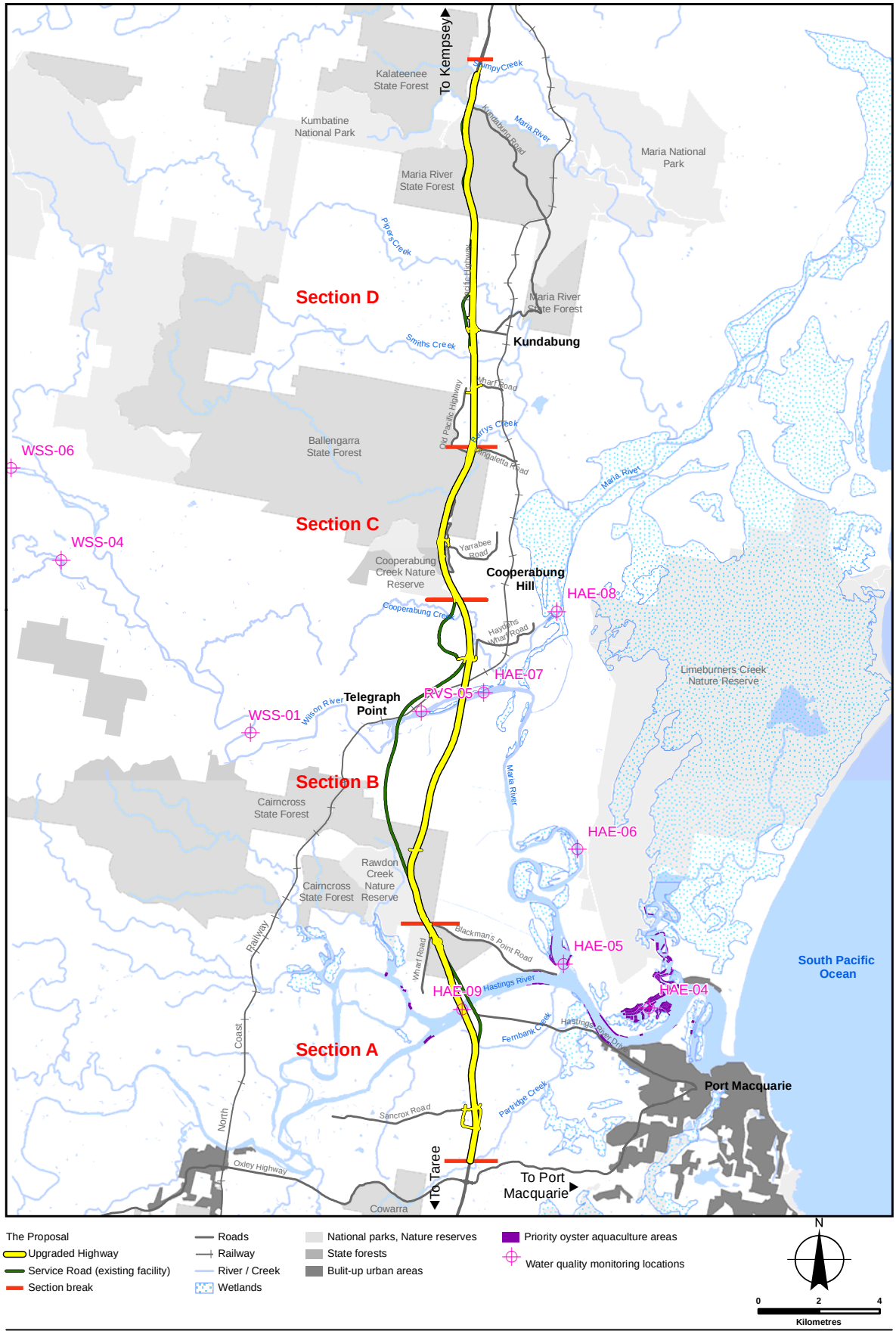

Table 13-3 Water quality objectives for the Hastings River catchment

Parameter	Estuaries	Lowland river
Phosphorus	30 µg/L (micrograms per litre)	25 µg/L
Nitrogen	300 µg/L	350 µg/L
Turbidity	0.5 to 10 ntu (nephelometric turbidity units)	6 to 50 ntu
Salinity	Not applicable	125 to 2200 microsiemens per centimetre
Dissolved oxygen	80% to 110%	85 to 110%
pH	7.0 to 8.5	6.5 to 8.5

Source: NSW Water Quality and River Flow Objectives for the Hastings River

These values reflect the default trigger values for estuaries in NSW as specified by the ANZECC water quality guidelines. A review of the available water quality data was undertaken to assess the Hastings River Catchment (incorporating the Maria and Wilson river sub-catchments) against the water quality objectives in place for this catchment. This assessment looked at the available data covering 2004, 2006, 2007, 2008 and 2009. The water quality for the area was found to be generally consistent with the water quality objectives for this catchment with the exception of some periodic fluctuations in water quality. It should be noted that the values in the NSW Water Quality and River Flow Objectives reflect the ANZECC water quality guideline default values and it is also important to note that the exceedances of these values are relatively minor and the water quality of these rivers is generally fairly good (Port Macquarie-Hastings Council 2008a).

The *NSW Oyster Industry Sustainable Aquaculture Strategy* (Department of Primary Industries 2006) sets out water quality guidelines specifically for the healthy growth of oysters that are safe for human consumption and these are listed in **Table 13-4**.

Table 13-4 Water quality objectives for oyster aquaculture

Parameter	Guideline
Faecal coliforms	43 MPN (most probable number) or 21 MF (membrane filtration) per 100 millilitres for 90th percentile
pH	6.75 to 8.75
Suspended solids	Less than 75 mg/L (milligrams per litre)
Aluminium	Less than 10 µg/L (micrograms per litre)
Iron	Less than 10 µg/L
Dissolved oxygen	Greater than 5 mg/L (approximately 63%)

Source: Department of Primary Industries 2008

13.2 Existing water quality

The Proposal lies within the catchment of the Hastings River. This catchment incorporates the tributaries of the Wilson and Maria rivers and drains an area of approximately 3700 square kilometres.

The Hastings River discharges into the Pacific Ocean at Port Macquarie. The tidal influence extends for approximately 32 kilometres upstream of the river mouth to Bains Bridge, 3 kilometres west of Wauchope.

The Proposal runs across the Hastings River floodplain for approximately 2 kilometres, and across the Wilson River floodplain for approximately 3 kilometres. Land uses in these areas are predominately rural with small farms, grazing and other agricultural activities. The villages at Telegraph Point and Kundabung are the main residential areas along the Proposal route, with other scattered development along its length.

There are a number of smaller creeks and drainage lines crossed by the Proposal. These include Cooperabung Creek, Fernbank Creek, Smiths Creek, Stumpy Creek, Barrys Creek and Pipers Creek. These creeks are tributaries of the Hastings, Wilson and Maria rivers.

The floodplains of the Hastings and Wilson rivers and tributaries of the Maria River typically have ground surface elevations of less than 3 metres above sea level. These areas were historically forested areas which were cleared for agricultural purposes. Current land use activities such as grazing continue to have an effect on water quality downstream, particularly during high flows.

The review of the available data indicates that the main watercourses within the study area have relatively good water quality, especially when compared to watercourses throughout NSW. A description of the general water quality for the catchment is provided below.

13.2.1 Hastings River

The Hastings River is a significant commercial and recreational river located to the west of Port Macquarie. The river is an important tourist attraction for recreational fishing and holiday makers with facilities including picnic areas, boat ramps, wharves and jetties along the riverfront. The estuary was closed to commercial fishing in 2000 (Port Macquarie-Hastings Council undated).

The Hastings River is used for commercial oyster production and contains 120.5 hectares of priority oyster aquaculture area as defined in the *NSW Oyster Industry Sustainable Aquaculture Strategy* (Department of Primary Industries 2006). In 2003-2004 the Hastings River accounted for approximately 4 per cent of the total NSW oyster production.

The Hastings River floodplain has been extensively developed for agricultural purposes including dairy and beef cattle. The Hastings River has training walls at the river entrance providing ocean access under most weather conditions. Maintenance dredging is undertaken in the lower reaches of the Hastings River below the Proposal at the Maria River confluence, Limeburners Creek and towards the river mouth.

The Proposal occurs within the tidally influenced estuary of the Hastings River. The water quality for the river was assessed against criteria for an estuary provided for under the NSW Water Quality and River Flow Objectives for the Hastings River and the ANZECC water quality guidelines. The results of Port Macquarie-Hastings Council's water quality sampling for the Hastings River indicated that:

- Water quality in the estuary generally complies with the NSW Water Quality and River Flow Objectives for the Hastings River and the associated default values for an estuary under the ANZECC water quality guidelines.

- Nitrogen levels were generally compliant with the NSW Water Quality and River Flow Objectives for the Hastings River although there were some notable elevated results across the catchment. The mean values for the Hastings River were between 280 micrograms per litre and 300 micrograms per litre at the two points (HAE-04 and HAE-09) located near the proposed bridge site and towards the river mouth in the estuary which is within the ANZECC water quality guideline values.
- Phosphorus levels are compliant with ANZECC water quality guidelines with a mean value at the two assessed monitoring sites (HAE-04 and HAE-09) of 22 micrograms per litre.
- No observations in the catchment were significantly elevated for turbidity with the bulk of the monitoring data meeting the NSW Water Quality and River Flow Objectives for the Hastings River. The mean values for the Hastings River were between 1.6 and 5.9 nephelometric turbidity units at the two points located near the proposed bridge site and towards the river mouth in the estuary (HAE-04 and HAE-09).
- The mean pH of the monitoring points assessed in the Hastings River indicate pH values in compliance with the ANZECC water quality guidelines with a mean value of 7.4 near the proposed bridge site and a mean of 7.62 in the lower reaches.
- Dissolved oxygen values in the Hastings River at HAE-09 and HAE-05 meet the ANZECC water quality values with mean values of 89 per cent and 94 per cent respectively. The dissolved oxygen values at HAE-04 are slightly elevated above the ANZECC water quality guidelines with a mean value of 116 per cent saturation.

Water quality in the Hastings River generally meets the guidelines under the *NSW Oyster Industry Sustainable Aquaculture Strategy* (Department of Primary Industries 2006) with the exception of faecal coliforms which are elevated above the objective levels within this guideline.

The Healthy Rivers Commission Report has indicated that bank erosion was visible along the lower reaches of the Hastings River. This report was primarily based on the relatively undeveloped freshwater upstream sections of the river catchment upstream of the Proposal.

Port Macquarie-Hastings Council extracts drinking water from the Hastings River at Koree Island, approximately 5 kilometres south west of Wauchope, for use at Port Macquarie. This is a significant distance upstream from the Proposal. An additional off-creek storage dam is provided within Port Macquarie with water sourced from the Koree Island pump station.

13.2.2 Wilson River

The Wilson River was historically subject to large-scale gravel extraction approximately 13 kilometres upstream from the Ballengarra Bridge near Rollands Plains (approximately 20 kilometres upstream of the Proposal). Although this has ceased, it has contributed to further erosion downstream of the extraction works and impacted on the riverbank and riparian vegetation. The Northern Rivers Catchment Management Authority and the Port Macquarie-Hastings Council currently have a rehabilitation project in place for the Wilson River to address these impacts. The water quality sites on the Wilson River are located within the lowland river area of the catchment with the sites WSS-01, WSS-04 and WSS-06 located above the tidal limit at Ballengarra with the exception of the monitoring site at Dalhunty Island HAE-07.

Water quality observations for the Wilson River indicated that:

- The majority of the total nitrogen observations were below the ANZECC water quality guidelines for a lowland river with a mean value 320 micrograms per litre recorded at WSS-04 and 200 micrograms per litre recorded at WSS-01, and 248 micrograms per litre recorded at WSS-06. The site in the estuarine reach at HAE-07 was also within the ANZECC Guidelines with an average value of 300 micrograms per litre.
- Phosphorus readings were generally compliant with the ANZECC water quality guidelines with mean levels between 10 and 28 micrograms per litre at WSS-06, WSS-04 and WSS-01. In the estuarine reach values were 30 micrograms per litre, within the ANZECC guidelines
- Turbidity readings complied with the ANZECC water quality guidelines with a mean of between 3.6 and 6.8 nephelometric turbidity units for the three sites at WSS-06, WSS-04 and WSS-01 within the lowland rivers reach and 6.9 nephelometric turbidity units in the estuarine reach at Dalhunty Island.
- At Dalhunty Island in the estuarine reach the pH values were observed below the ANZECC water quality guidelines trigger value having an average pH of 6.88. The mean pH values for the upper reaches of the Wilson River were 6.72 (WSS-01), 6.83 (WSS-04) and 6.95 (WSS-06) which complies with the ANZECC water quality guidelines for a lowland river.
- Dissolved oxygen values were below the ANZECC values for the Wilson River at WSS-01, WSS-04 and WSS-06. with mean values of 79 per cent, 63 per cent and 77 per cent saturation respectively in the lowland rivers section of the catchment and 79 per cent in the estuarine section of the catchment.

Drinking water for Telegraph Point is sourced directly from the Wilson River upstream of the Proposal at Telegraph Point. A micro-filtration water treatment plant enables Council to pump high quality drinking water to the village even when it is raining or the river water is turbid.

13.2.3 Maria River

The Maria River was previously used for oyster farming although the historic modifications to drainage along the catchment for agriculture have resulted in seasonal discharge of acidic groundwater following rainfall events (Port Macquarie-Hastings Council 2005). This has resulted in the abandonment of some oyster farms in the Maria River. The upper catchments of the Maria River are relatively unmodified, with some historic modification of the landscape on the floodplain for agricultural production.

Maintenance dredging has previously been undertaken at the confluence of the Maria River and the Hastings River and just upstream of the rivers mouth to maintain navigation and tidal flow. The lower reaches of the Maria River has been extensively modified with over 104 kilometres of constructed drains and 50 tidal attenuation structures with an extensive network of flood mitigation controls for improved pasture along the Maria River.

Water quality observations for the Maria River indicated that:

- Several total nitrogen sample results for the Maria River near the boundary with Kempsey local government area exceeded the ANZECC water quality guidelines with total nitrogen levels at HAE-08 having a mean value of 670 micrograms per litre in the estuarine reach of the river. Several of the total nitrogen samples downstream also exceeded the default trigger values with HAE-06 having a mean of 501 micrograms per litre. By the time this reached the confluence of the Maria and Hastings rivers the values were back within ANZECC water quality guideline values.

- Generally the total nitrogen observations were higher in the Maria River than for the Hastings and the Wilson Rivers.
- Several samples for total phosphorus in the lower catchment exceeded the ANZECC water quality guidelines with the mean value for HAE-06 of 34 micrograms per litre. The total phosphorus values upstream were generally within ANZECC water quality guideline values with a mean value at HAE-08 of 29 micrograms per litre.
- A number of pH values in the Maria River were slightly lower than the trigger values with the lowest individual value recorded at the Kempsey local government area boundary (HAE-08) with a pH of 4.8. The mean values for HAE-08, HAE-06 and HAE-05 were 6.20, 6.57 and 7.48 respectively as the river moves downstream. This indicates that the Maria River upstream of the confluence with the Wilson River is slightly more acidic than the ANZECC water quality guidelines trigger levels for lowland rivers.
- The turbidity values are slightly above the water quality objectives for the catchment with a mean of 12 nephelometric turbidity units above the confluence of the Maria and Wilson rivers, The values downstream meet the ANZECC water quality guideline values for an estuary.
- The dissolved oxygen levels at the Maria River are well below the values set in the ANZECC water quality guidelines with mean values upstream of the confluence of the Maria and Wilson rivers being 56 per cent saturation while those further downstream were recorded at 72 per cent and 94 per cent saturation, with the site just upstream of the Maria River (HAE-05) meeting the ANZECC water quality guidelines.

The elevated total nitrogen values in the catchment may be due to the agricultural activities along the Maria River catchment with the extensively modified catchment also contributing to the low pH and dissolved oxygen values recorded.

13.3 Water quality impacts of the Proposal

13.3.1 Potential surface water quality impacts during construction

The main risk associated with the construction of the Proposal would be the increased potential for erosion, and the associated release of sediment, which could result in impacts on sensitive environments including rivers, creeks and wetland areas. The soils across the alignment are generally non-dispersive with some unsuitable soil material located in proximity to freshwater wetlands, narrow gully areas and on the northern side of the Wilson River (Coffey 2007a).

A summary of the short-term impacts on water quality from the Proposal includes:

- Potential increase in sediment export loads to watercourses during the construction period.
- The exposure of acid sulfate soils resulting in acidic runoff or leachate.
- The potential exposure of unidentified contaminated material.
- Temporary altered drainage during construction.
- Dewatering operations from excavations resulting in the release of runoff. Refer to **Chapter 14 Groundwater** for further discussion.
- Loss of riparian vegetation.

- Release of groundwater generated from soft soil treatments (eg wick drains) into watercourses.
- The possibility of spilt chemicals and fuels during construction entering watercourses.
- General waste generation from construction activities.

Construction activities could also have the following potential long-term impacts:

- Bed and bank erosion associated with bridge and culvert construction that may cause changes to the geomorphology of a watercourse resulting in an increase in sediment load.
- Continuing pollution from erosion and sedimentation, as sediment moves downstream.
- Continuing pollution from acid sulfate soil exposed by construction activities.
- Ongoing impacts on surrounding vegetation.

The management of acid sulfate soil is a key consideration in developing the construction program for the Proposal. Management of the potential impacts from the disturbance of acid sulfate soil will be undertaken on a risk basis and would focus on the floodplain areas of the Wilson, Hastings and Maria rivers. Risk mapping for these areas identifies a high probability of occurrence on these floodplains.

The risk approach would focus on the areas of excavation adjacent to the watercourses and drainage lines on the floodplain. The potential for any release into the watercourses would be a point of management focus. The Maria River previously had oyster leases in operation in the lower estuaries however these have been abandoned due to acid generation from acid sulfate soils in the catchment. During the initial works onsite further testing of soils for acid sulfate soil or potential acid sulfate soil across the floodplains would be undertaken to quantify the risk of disturbing acid sulfate soils with a particular focus on any excavations.

Refer to **Section 20.3** for further consideration of acid sulfate soils.

The Proposal crosses a range of different environments along its length which has been considered in the design of the Proposal to minimise impacts on the environment. The aim of the Proposal is to adhere to the RTA's Water Policy and the road development and management process governed by the RTA's *Code of Practice for Water Management* (1999b) which state that the existing condition of water is to be conserved. Management measures to achieve these aims are presented in **Section 13.4**.

13.3.2 Potential surface water quality impacts during operation

It is anticipated that there would be an increase in the volume of traffic using the Pacific Highway regardless of the Proposal proceeding, and that this could lead to an increase in the load of heavy metals and oil being washed off the road. The Proposal however is expected to reduce the frequency of crashes along the road, despite the increase in traffic volume. This would be expected to produce a reduction in the potential for contaminated loads reaching the watercourses crossing the upgraded highway. During the operation, there is however potential for water quality impacts from road runoff associated with traffic movements.

Examples of the potential impacts on surface water quality include:

- Increase in heavy metals and oils on the pavement as a result of the growing usage of the upgraded highway. This would increase the potential of these contaminants entering adjoining watercourses. This would be a result of the increased traffic volume rather than the Proposal itself.
- Erosion downstream of culverts if flow velocities are not controlled.

- Erosion and sedimentation caused by changes in rainfall concentration and flow.
- Surface runoff of exhaust emissions, tyre wear and petroleum drips.
- Crashes resulting in chemical and fuel spills on the Pacific Highway entering receiving watercourses.

The Proposal is likely to reduce crashes. Access to the highway would be via the interchanges and traffic arrangements connected to the service and access road network. No direct property access would be available. This would decrease potential for spills or pollution from crashes entering watercourses or drainage lines during the operation of the Proposal.

13.3.3 Staging implications

In preparing this Environmental Assessment, the potential water quality impacts of the possible staging option described in **Section 7.3.2** in comparison to the construction of the entire Proposal to a full motorway standard have been considered as outlined below.

In this regard, the same water quality management controls would be implemented in both the possible staging option and motorway standard upgrade. There is however the potential for increased risk for water quality impacts associated with two separate construction periods, initially for this staging option and then later for the motorway standard upgrade.

Operationally, for this staging option, there would be slightly less impervious area than for the motorway upgrade, and therefore slightly less runoff and consequent potential for water quality impacts.

Should the Proposal be delivered in stages, the staging report described in **Section 7.3.3** would detail the water quality impacts of the selected staging option. If any additional or altered impacts are identified, the staging report would further assess these impacts and identify appropriate management measures.

13.4 Water quality management measures

The assessment of water quality has sought to identify potential impacts and provide appropriate management controls within the design.

The water quality treatment systems selected for the Proposal have been incorporated to protect sensitive areas, in particular watercourses, wetlands, endangered ecological communities and other areas of ecological importance. The design of watercourse crossings over rivers and drainage lines has considered the sensitivity of the receiving environments.

13.4.1 Construction management measures

Appropriate management measures would be implemented during construction to effectively reduce the generation of pollutants and minimise impacts on adjacent receiving environments including rivers and creeks. Measures to be implemented during the detailed design and construction phases of the Proposal include:

- Prior to construction, a water quality-monitoring program would be developed to assist in identifying any impacts that may be associated with the construction of the Proposal.

- Prior to commencement of earthworks there would be a range of measures put in place to minimise the volume of clean water crossing the Proposal. This would include:
  - Construction of cut-off drains to prevent clean water from upstream of the corridor flowing onto disturbed areas and hence becoming dirty water.
  - The diversion of those discharge points to the nearest watercourse so that clean water can be kept isolated from dirty water.
- When vegetation is being cleared, the vegetation would be stockpiled and then mulched and utilised in erosion and sediment control.
- Stabilisation of embankments would be undertaken as soon as practical following construction.
- Provision of drainage above cut butters would be implemented to minimise erosion across batter slopes.
- Progressive temporary erosion and sediment controls would be installed along the Proposal during clearing operations and ground disturbance to minimise the release of sediment to the surrounding watercourses.
- A water management plan would be developed in accordance with *RTA Specification G38 Soil and Water Management (Soil and Water Management Plan) (*RTA 2004b).
- Provision of temporary sedimentation basins for the construction phase, a number of which would be converted to provide an operational phase water quality function. The size, shape and location of these basins would be finalised during detailed design stage and would vary according to local conditions and sensitivity of water catchments. The design and installation of sedimentation basins would be undertaken in accordance with *Managing Urban Stormwater: Soils and Construction, Volume 1* (Landcom 2004) and *Managing Urban Stormwater: Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008b).

  Water within the sediment basins would be treated where required prior to release to meet the licensed water quality criteria for these basins.
- A number of controls outside the specific work area would be put in place and these would include but would not be restricted to:
  - Refuelling of plant and machinery within bunded areas or offsite in appropriate locations wherever possible.
  - Minimisation of disturbed areas so that the potential export of sediment is minimised.
  - The use of bunded areas at designated areas and compounds for the storage of chemicals and fuels utilised in the construction
  - The establishment and maintenance of an appropriate number of construction compounds to reduce the areas of overall disturbance.
- During the initial works onsite, further testing of soils for acid sulfate soil or potential acid sulfate soil across the floodplains would be undertaken to quantify the risk of disturbing acid sulfate soils with a particular focus on any excavations.
- Where disturbance of acid sulfate soils is unavoidable, a management plan would be developed in accordance with the NSW *Acid Sulfate Soils Manual* (Stone, Ahern and Blunden 1998) prior to construction to address excavation, disturbance and dewatering during construction works on the floodplains of the Wilson, Maria and Hastings rivers to prevent release of acidic water from construction activities entering these watercourses.

- Groundwater generated during the construction of the Proposal would be appropriately captured, reused and treated prior to release (if required).

13.4.2 Operational management measures

The general strategy for the treatment of road runoff during the operational phase is:

- In key sensitive areas, water would be captured and directed to permanent water quality basins. The permanent basins would serve to treat both day-to-day runoff from the road, and have adequate capacity to contain a major accidental spill from a traffic crash. These basins would be designed in accordance with *Managing Urban Stormwater: Soils and Construction, Volume 1* (Landcom 2004) and *Managing Urban Stormwater: Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008b). The size, shape and location of these permanent basins would be finalised during the detailed design stage and would vary according to local conditions and sensitivity of water catchments.
- Runoff from bridges over watercourses and floodplains would be captured and directed to the permanent water quality basins where practicable. During the detailed design phase further spill capture provision would be provided at the Hastings and Wilson river bridges. Swale drains on the Wilson River floodplain would provide further potential storage areas in the event of a spill from a vehicular crash.
- Benching and kerbs would be utilised at cuttings and some fill embankments to provide capture and reduce surface flow and erosion on the batter faces.
- In areas of lower sensitivity, water would be directed through open drains beside the road, which would be designed to allow spillage control prior to discharge to creeks. In most locations water would drain directly off the roads into these drains. The drains would be grass lined to provide filtration and water quality benefits. As a result, road runoff would be polished prior to discharge to local watercourses.

The development of the management measures across the Proposal would be refined during the detailed design to minimise impacts on the surrounding environment.