21. Other environmental issues

21.1 Water quality

21.1.1 Existing water quality

Assessments of surface and ground water quality in the Macleay Valley were undertaken by the RTA in 2002 and 2005. The results were analysed in *Kempsey to Eungai – Upgrading the Pacific Highway – Water Quality Report* (NSW Roads and Traffic Authority 2006e).

The results of surface water quality sampling indicated that water in the northern part of the proposed upgrade, within the Nambucca River catchment, is of good quality. Surface water in the Macleay River catchment tends to be of poorer quality. This is generally indicated by low pH, low dissolved oxygen and high nutrient concentrations at various surface water sites in the Macleay River catchment (NSW Roads and Traffic Authority 2006e).

Generally, water quality data taken from sites in active agricultural land use zones used for grazing and improved pastures showed elevated concentrations of nutrients such as ammonia, total kjeldahl nitrogen, nitrate and phosphorus, it is probable that these elevated concentrations are due to agricultural activities and run-off.

Water quality data from flood plain areas with a high risk of acid sulfate soils showed low pH and high electrical conductivity levels. It appears that the local surface water quality has been affected by the presence of acid sulfate soils and local agricultural land uses.

Groundwater conditions are highly variable across the Macleay Valley and reflect the underlying soils and geology. Shallow groundwater across the flood plain is generally of poor quality, which is a natural condition; although there appear to be some manmade impacts. Overall, the groundwater in sands and fractured rock is generally of better quality and is a higher value resource.

21.1.2 Construction

Potential impacts on surface and groundwater quality during the construction of the proposed upgrade include:

- Increased sedimentation and turbidity levels as a result of site disturbance (e.g. from vehicular movements).
- Waste and litter from building activities.
- Release of toxic materials/substances and hydrocarbons from accidental spills.
- Release of nutrients from fertilisers, herbicides and pesticides used, (e.g. in site landscaping).
- Paint and paint wastes.
- Acids from acid-based washes.
- Disturbance of contaminated soils and/or acid sulfate soils, which may adversely affect water chemistry including pH and dissolved solids.
- Dewatering of groundwater aquifers (draining or diverting waterways so that the excavation of soils/sediments may occur), this may induce saltwater or acid sulfate soil element intrusion into the groundwater system.
- Rainfall/run-off diverted away from important groundwater recharge areas.

- The quality of the groundwater recharge adversely affected by fuel spillages and other soluble contaminants, or possibly from the disturbance of contaminated soils and/or acid sulfate soils.
- Water quality during construction can be managed adequately through the application of standard management measures. These are outlined in the draft Statement of Commitments in Appendix D and Section 21.1.4. Measures would include:
  - Preparing and implementing a Soil and Water Management Sub-Plan as part of the Construction Environmental Management Plan.
  - Installing sediment control basins in various locations along the proposed upgrade. The location of sediment control basins would be determined during detailed design and would be based on soil conditions, and avoiding sensitive locations. Indicative locations for sediment basins are shown in Figures 7-1a to 7-1f.

21.1.3 Operation

Potential impacts on surface and groundwater quality during operation of the proposed upgrade include:

- Run-off delivering contaminants that have accumulated on the road surface to receiving waters. Contaminants may include gross contaminants and litter, sediment and suspended solids, nutrients, heavy metals, toxic organics, oils and surfactants. Contaminants in run-off could be particularly harmful to properties with organic certification.
- Soil stability affected by altered groundwater levels.
- The new road infrastructure intercepting or draining shallow groundwater flows that are vital to groundwater-dependent ecosystems or farm dams.
- Uncontrolled movements of contaminants off-site reducing the quality of recharge water, thus adversely affecting groundwater quality and groundwater-dependent ecosystems.

Containment of potential spills on the proposed upgrade is a water quality impact, and is discussed further in Chapter 13 - *Hazard and risk*.

Water quality during operation can be managed adequately through the application of standard management measures. These are outlined in the draft Statement of Commitments in Appendix D and in Section 21.1.4. Measures would include:

- Preparing and implementing a Soil and Water Management Sub-Plan as part of the Operational Environmental Management Plan.
- Some of the sediment control basins established during construction would be converted to permanent water quality basins for the operation of the proposed upgrade.

In addition, water running off the road surface would be treated prior to reaching any organic certified property.

21.1.4 Summary of management measures

Standard and project-specific mitigation and management techniques for water quality impacts arising from the construction and operation of the proposed upgrade are included in the draft Statement of Commitments for the proposed upgrade in Appendix D and are summarised below.

Water quality

- Prepare and implement a Soil and Water Management Sub Plan as part of the CEMP. The Sub Plan will:
  - Include standard hydrology and water quality management measures.
  - Identify the Construction activities that could cause soil erosion or discharge sediment or water pollutants from the site.
  - Describe management methods to minimise soil erosion or discharge of sediment or water pollutants from the site including a strategy to minimise the area of bare surfaces during construction.
  - Include contingency plans to be implemented for events such as fuel spills.
- Erosion and sedimentation controls will be installed, maintained and managed prior to and during construction in accordance with the Soil and Water Management Sub Plan and the principles in Managing Urban Stormwater – Soils and Construction, Volume 2 Book 4 – Main Road Construction (Landcom 2006).
- An appropriately qualified soil conservationist will be consulted according to a schedule identified in the Soil and Water Management Sub Plan to:
  - Undertake inspections of temporary and permanent erosion and sedimentation control devices.
  - Ensure that the most appropriate controls are being implemented.
  - Check that controls are being maintained in an efficient condition.
  - Check that controls meet the requirements of any relevant approval and/or licence condition.
- Scour protection and energy dissipaters will be installed in creek/river bank areas at risk of erosion as necessary.
- Culverts will be installed as early as possible in the construction program to ensure that transverse drainage is in place during early stages of construction. Permanent stream protection measures and other waterway structure requirements will also be established as early as possible.
- Investigate the potential for changes in the groundwater table before any major earthworks (defined as a cut or fill area with depth or height exceeding 5 metres). Where a potential for change is identified the RTA will:
  - Assess the significance of the change and any resultant effects within and outside the road reserve.
  - Where necessary, design and implement measures to manage the changes. Management measures will be determined in consultation with the regional office of Department of Water and Energy.
  - The requirement for spill containment basins for the operation of the proposed upgrade will be made on the basis of a site-specific assessment that considers the following:
  - The sensitivity of the receiving environment.
  - The likelihood of an accident occurring that would result in a spill.
  - The proximity of the discharge point to the receiving waters.
  - The condition of the receiving waters.
- Any construction materials and fuels stored or used on site will be managed to minimise the risk of water contamination.
- Prepare and implement an Acid Sulfate Soil Management Sub Plan in consultation with relevant government Departments as part of the CEMP. The Sub Plan will include a contingency plan to deal with the unexpected discovery of actual or potential acid sulfate soils and include a water quality monitoring program.
- Prepare and implement a Soil and Water Management Sub Plan as part of the OEMP. The Sub Plan will include:
  - Operational water management controls.
  - A maintenance and inspection program for operational controls.
- Ensure that all operation stage controls for stormwater drainage and water pollution will be located, designed, constructed, operated and maintained to meet the requirements of the RTA's Code of Practice for Water Management – Road Development and Management. These controls will be designed in consultation with relevant Government Departments and relevant Councils.

21.2 Cumulative impacts

Cumulative impact assessment requires an assessment of the combined effects of a proposal with the effects of other activities in the region or beyond. These combined effects may be associated with:

- The impact of multiple construction projects undertaken at the same time, including impacts on traffic and road users and construction fatigue for road users and residents of the region.
- Social and economic effects, including impacts on employment and businesses.
- Amenity impacts including noise and vibration, visual quality and air quality.
- Environmental changes including effects on water quality, hydrology, biodiversity, land use and landscape values.
- Transport, including mode of transport, accessibility and traffic.

The draft *Pacific Highway Upgrading Program Strategic Assessment* (Sinclair Knight Merz 2000) concluded that cumulative or strategic assessment was limited at a project level due to the wide scope and to the limited availability of regional baseline information.

Cumulative impacts of the proposed upgrade have been considered in terms of other components of the Pacific Highway Upgrade Program and in terms of other major projects identified from the Department of Planning's register of major projects on the mid north coast (http://www.planning.nsw.gov.au/asp/register2006.asp#mnc accessed 26 February 2007).

The cumulative impact of urban growth associated with improvements to infrastructure such as the Pacific Highway have various land use and economic implications for the Macleay Valley and the Mid North Coast. Chapter 15 – *Land use and property impacts* and Chapter 18 – *Socio-economic impacts* of the Environmental Assessment address the potential impacts associated with the significant growth in development in the region.

21.2.1 Pacific Highway Upgrade Program

The Pacific Highway Upgrade Program is a $2.2 billion, 10 year program to improve the standard of the highway between Hexham and the Queensland border. Past and proposed projects identified under the Pacific Highway Upgrade Program (NSW Roads and Traffic Authority 1997) are shown in Figure 1-1.

The components of the Pacific Highway Upgrade Program to be considered as contributors to potential cumulative construction impacts with the proposed upgrade comprise those that would be under construction at the same time as the proposed upgrade. However, as several of these are still in the development or approval phases it is difficult to determine timing with any certainty. As such, consideration has been given to those currently under construction, these include:

- Tugun bypass.
- Bonville upgrade.
- Karuah to Bulahdelah.

The components of the Pacific Highway Upgrade Program still under development that would be located the closest to the proposed upgrade comprise:

- Oxley Highway to Kempsey upgrade.
- Macksville to Urunga upgrade.

- Coopernook to Herons Creek upgrade, incorporating the Coopernook to Moorland and Moorland to Herons Creek projects.

The construction of these projects may coincide or overlap with the construction of the Kempsey to Eungai Pacific Highway upgrade. Cumulative construction impacts would relate to the concept of construction fatigue for residents of the region and for users of the Pacific Highway. Impacts would include traffic delays, including increased travel time, and amenity impacts such as noise, air quality and visual impacts.

The cumulative impacts of the proposed upgrade in the context of the entire Pacific Highway Upgrade include significant positive strategic benefits. These benefits would relate predominantly to:

- Increased infrastructure handling capacity and efficiency.
- Improved safety on the Pacific Highway, through the provision of motorway standard dual carriageway road, and in bypassed towns (such as Kempsey) through the removal of heavy vehicles and other through traffic from local roads.
- Reduced travel time: by May 2003, the Pacific Highway Upgrade Program had achieved a travel time saving of 55 minutes through the completion of 23 major and 19 minor bypass or road upgrading projects, the completion of additional sections of upgrading and bypasses would further improve travel times on the highway.
- Travel time savings would also benefit local and regional businesses.
- Improved accessibility to local and regional centres and between Sydney/Newcastle and Brisbane, resulting in improved freight efficiency and reliability on a nationally strategic freight corridor.
- Increased opportunity for tourism development based on improved accessibility to tourist attractors on the mid north coast.

Negative impacts, would include:

- Loss of highway related trade in bypassed towns including Kempsey and Frederickton.
- Loss of vegetated land, including reserved areas and areas of fauna habitat and endangered ecological communities.
- Disturbance of sites of cultural heritage significance.

These impacts would be substantially offset by the identified strategic benefits and the implementation of mitigation and management measures including provision of compensatory habitat. Completion of the proposed upgrade would improve the consistency of road standard on the Pacific Highway one of the key objectives of the Pacific Highway Upgrade Program.

21.2.2 Other major projects

A search of the Department of Planning's register of major projects on the mid north coast (http://www.planning.nsw.gov.au/asp/register2006.asp#mnc accessed 26 February 2007) yielded 24 major projects across five local government areas. The 24 major projects are shown in Table 21-1.

Table 21-1 **Major projects in the region**

Major project	Local government area					Total
	Greater Taree	Port Macquarie – Hastings	Kempsey	Coffs Harbour	Bellingen	
Residential subdivision	1	3	3	8		15
Resort development			2	1		3
Housing/unit construction				1		1
Shopping centre upgrade		1				1
Highway upgrade				1		1
Water treatment plant				1		1
Constructed corridor/ wetlands		1				1
Community facility (school, aged care)					1	1
Total	**1**	**5**	**5**	**12**	**1**	**24**

Cumulative construction impacts would be likely should any of these projects be constructed at the same time as the proposed upgrade. These impacts would be similar to those discussed for the Pacific Highway Upgrade Program in Section 21.2.1.

The operational cumulative impacts of the proposed upgrade and the identified major projects are expected to be minor and manageable through the environmental planning and approvals process.

21.3 Project sustainability

21.3.1 What is sustainable development?

Sustainable development is defined in the World Commission on Environment and Development's report *Our Common Future* as development that meets existing needs without compromising the ability of future generations to meet their own needs.

Sustainability is generally considered to consist of actions that support – now and for the future – social sustainability (individual and community well-being), economic sustainability (economic prosperity) and environmental sustainability (the protection of air, water, soils, energy, marine resources and other factors in the environment needed for biodiversity, including humanity, to live). The concept of sustainability has also been extended at different times to include sustainable development, sustainable consumption, cultural sustainability and sustainable businesses (Department of Premier and Cabinet 2007).

In order to achieve ecologically sustainable development it is important to:

- Give integrated consideration to the values of ecologically sustainable development. That is consider the wider economic, social and environmental implications of decisions made and actions taken at a local, regional, national and international scale and with regard to both communities and the environment.
- Make decisions and undertake actions with due consideration of long-term views rather than focusing solely on short-term outcomes.

The RTA is committed to ensuring that its projects are undertaken consistent with the principles of ecologically sustainable development. The principles of ecologically sustainable development have been an integral part of the development of the proposed upgrade (and of the Pacific Highway Upgrade Program as a whole) and in the assessment of its adverse and beneficial effects. The consistency of the proposed upgrade with the principles of ecologically sustainable development is discussed in Section 22.2.

21.3.2 Assessment approach

The RTA recognises that the environmental assessment for the Kempsey to Eungai Pacific Highway upgrade must demonstrate the project's capacity to address social, environmental and economic implications equally in order to meet the existing needs without compromising the needs of future generations.

Other environmental impact issues relating to the proposed upgrade that have been considered under project sustainability include emission of greenhouse gases, waste by-products from construction and operation of the proposed upgrade and strategies for the disposal of these wastes, energy use and demand on water resources and materials.

These issues are relevant to both the construction and operational stages of the proposed upgrade. The potential impacts relating to these issues during both construction and operation have been assessed, including source and estimated volume of greenhouse emissions, identification of waste streams and identification of energy and resource requirements.

Where appropriate, mitigation and management measures have been identified to address the potential impacts of the proposed upgrade, standard mitigation and management measures are discussed (and are included in the draft Statement of Commitments in Appendix D). In addition, a framework biodiversity offset strategy has been outlined to address the residual impacts of the proposed upgrade, particularly with regard to biodiversity.

21.3.3 Greenhouse gases

Australia is a signatory to the "International Framework Convention on Climate Change" (Rio Convention), which commits Australia to programs of monitoring and reporting on greenhouse gas emissions. One of the targets of the Rio Convention is for signatories to attempt to reduce greenhouse gas emissions to the levels that applied in 1990. At the Kyoto meeting, the convention agreed that the target for Australia was to reduce national greenhouse gas emissions to 8% above 1990 levels by 2008-2012.

At a federal government level, in December 2006, the Task Group on Emissions Trading was established by the Prime Minister to consider Australia's future response to climate change and to advise the Federal Government on future climate change policy options at an international and domestic level. The establishment of this task group and the release of an Issues Paper covering various climate change and greenhouse emissions issues for public comment are considered to potentially mark the beginning of a policy shift at a federal level. The task group has fully engaged major industry groups as well as the Federal Government. This may ultimately lead to progression on the establishment of a national emissions trading scheme.

At a state level, the NSW Government has developed a Greenhouse Plan; this document is currently under review and can be found at www.greenhouseinfo.nsw.gov.au. The main objectives of this Plan are to:

- Increase awareness among those expected to be most affected by the impacts of climate change.
- Begin to develop adaptation strategies to those climate change impacts we cannot avoid.

- Put NSW on track to meeting its targets of limiting 2025 emissions to 2000 levels and reducing emissions by 60% by 2050.

The RTA is currently developing a Greenhouse Plan to align with the NSW Greenhouse Plan.

The transport sector is accountable for approximately 12% of NSW's total greenhouse gas emissions (Department of Environment and Conservation 1998). The RTA has been involved in, and has implemented, several strategic initiatives to broadly address the issue of road transport related greenhouse gas emissions. These include:

- National Greenhouse Response Strategy: This strategy was adopted by the Council of Australian Governments in 1992, and aims to contribute to the national commitment to the National Strategy for Ecologically Sustainable Development. With respect to transport, the response strategy includes reducing motor vehicle fuel consumption, improving the technical and economic efficiency of operation of the road network and traffic management and encouraging the use of bicycles.
- RTA Greenhouse Reduction Plan: The RTA is currently developing a strategic level plan to address and provide policy on greenhouse gas emissions resulting from its activities.

The RTA also continues to engage in other strategies that promote more stringent vehicle emission standards. These include enhancing NSW's vehicle emissions enforcement resources, continuing its role on the Motor Vehicle Environment Committee to encourage early implementation of more stringent Australian Design Rules and playing a key role in the development of the *Diesel National Environment Protection Measure*.

The Motor Vehicle Environment Committee's revision of Australian Design Rules has included:

- Revision of 37/01 Emission Control for Light Vehicles.
- Revision of 70 Exhaust Emissions Control for Diesel Engineered Vehicles.

In addition, for the first time, the new Australian Design Rules 79/00 *Emissions Control for Light Vehicles* and 80/00 *Emissions Control for Heavy Vehicles* include vehicles that operate on liquefied petroleum gas or natural gas. Combined with the *Fuel Standard (Petrol) Determination 2001* and the *Fuel Standard (Diesel) Determination 2001* these new Australian Design Rules would facilitate the introduction of more advanced emission control technologies which will further reduce vehicular emissions in the future. For example, the *Fuel Standard (Diesel) Determination 2001* reduces the sulfur levels in road transport diesel fuel from the current level of 1,300 parts per million to 500 parts per million by January 2003, reducing air quality and greenhouse gas impacts.

The *Diesel National Environment Protection Measure* came into effect on 29 June 2001. The measure set a framework for the management of emissions, enabled the development of regulations on diesel emissions testing standards and facilitates the development and implementation of enforcement and alternative compliance strategies for vehicle emissions.

Greenhouse emissions

Management of Australian greenhouse gas issues is undertaken through the Australian Government Agency, the Australian Greenhouse Office. The method used to estimate greenhouse gas emissions during construction and operation of the proposed upgrade is detailed in Technical Report 4 – *Climate and Air Quality Assessment* in Volume 2. Greenhouse gas emissions estimates were based on emissions from the following sources:

- Emissions directly related to an activity, such as operation of construction plant and clearing of vegetation.

- Emissions associated with providing supplementary energy for an activity, such as generating the electricity used on-site.
- Indirect emissions, such as those associated with the production of materials used for construction, or from fuel used by vehicles driving on the road.
- Emissions associated with traffic on the proposed upgrade and on the Pacific Highway (base case) under 2011 and 2021 conditions.

Emissions during construction

The main contributors to greenhouse gas emissions during construction of the proposed upgrade would be production of material (e.g. bitumen, concrete and steel), the transport of material to the site, fuel consumption associated with construction machinery and the removal of vegetation. It has been estimated that up to 20 million litres of fuel would be used during construction, resulting in an approximate carbon dioxide-equivalent output of 53,000 tonnes.

It is expected that a total of 261 hectares of vegetation would be permanently cleared for the proposed upgrade (refer Table 11.4), this would equate to an estimated emission of 139,000 tonnes of carbon dioxide equivalent. The method used and assumptions for this estimate are detailed in Section 6.1.2 of Technical Report 4 – *Climate and Air Quality Assessment* in Volume 2. No greenhouse gas emissions were attributed to temporary clearing.

Indirect emissions associated with diesel use were predicted to contribute an additional 6,000 tonnes of carbon dioxide. Greenhouse gas emissions were also estimated based on likely construction material requirements. Greenhouse gas emissions associated with construction materials were estimated at 67,904 tonnes of carbon dioxide equivalent.

Overall emissions of greenhouse gas expected during construction of the proposed upgrade are:

- Fuel consumption: 53,000 tonnes.
- Vegetation clearing: 139,000 tonnes.
- Indirect emissions from diesel use: 6,000 tonnes.
- Indirect emissions from materials: 67,900 tonnes.

The total anticipated emissions are approximately 266,000 tonnes of carbon dioxide equivalent.

Part of the proposed upgrade would pass through Department of Primary Industry (Forests) plantation land. It is likely that any suitable timber cleared in this area would be harvested by the Department of Primary Industry. Any harvested timber would not represent a direct greenhouse emission as carbon would be captured and stored within the timber market and could be discounted from the emissions from vegetation clearing discussed above.

In accordance with the RTA's normal practice, landscaping and revegetation of batters and medians, along with any suitable areas in the road corridor would be included as part of the proposed upgrade, as detailed in Chapter 19 – *Landscape and visual impacts*. While this would help to reduce the impact of vegetation clearing during the construction phase, landscaping and revegetation of a proposed road corridor is not normally considered to be a mitigation measure for greenhouse gas emissions.

Emissions during operation

Ongoing greenhouse gas emissions from operation of the proposed upgrade are expected to largely relate to the use of the road. Although the road itself would not produce emissions, the use of the road by motor vehicles would. These are therefore considered indirect emissions.

What influences greenhouse gas emissions?

Road design and maintenance can make travel more fuel efficient, through smoother, straighter, and flatter roads, with fewer stops required.

Driver behaviour is also significant, by choosing fuel efficient vehicles, maintaining them well, and driving smoothly and efficiently. Alternative fuels, driving at less congested times, and car-pooling are also options available to reduce greenhouse gases.

Maintenance activities would be considered direct emissions; however they are not anticipated to be a major source for this project.

The greenhouse gas emissions during operation were estimated by comparing two scenarios. Firstly, estimated greenhouse gas emissions were calculated for continued use of the existing Pacific Highway, without the proposed upgrade. Secondly, estimated emissions were calculated for traffic predicted to use both the proposed upgrade and the existing highway after the proposed upgrade is opened to traffic.

The traffic model used to calculate greenhouse gas emissions **associated with** the operation of the proposed upgrade compares the total vehicle kilometres travelled on the existing highway (without the proposed upgrade) with the total vehicle kilometres travelled on both the existing highway and the proposed upgrade following project completion. Traffic using other parts of the local network has not been considered quantitatively. Other assumptions made for the calculation of greenhouse gas emissions during operation are outlined below.

Assumptions used in calculation of greenhouse gas emissions during operation

- For the operational fuel use assessment, the following methodology and assumptions were used to limit the complexities and uncertainties associated with the analysis:
- The assessment compared traffic on the proposed upgrade against a base case of traffic on the Pacific Highway, should the proposed upgrade not proceed. This comparison was made for 2011 and for 2021.
- The proposed upgrade and the Pacific Highway were assessed in segments, using the same traffic model as elsewhere in the Environmental Assessment.
- As with the traffic model, no network improvements have been assumed for the existing Pacific Highway between Kempsey and Frederickton. The conditions currently experienced on this section of the existing highway, particularly in Kempsey, are predicted to deteriorate over time due to the ongoing constraints on local traffic (refer Chapter 14 – Traffic, transportation and access), which is reflected in modelled future scenarios with and without the proposed upgrade. Although these local traffic conditions may be addressed by another party at some time in the future, the timing and implementation of any improvements are beyond the scope of this project. As such, the greenhouse gas assessment is based on the worst-case scenario for local traffic conditions without any improvements.
- Each segment was classified as having either free-flowing traffic (such as a rural road or freeway), or stop-start traffic (such as Kempsey town centre). No further allowance was made for intersections, grade or other factors.
- Based on the classification, fuel use in each situation was calculated (stop-start fuel efficiency from CSIRO 2004; free-flow fuel efficiency from Apelbaum Consulting Group 2001) and then converted to greenhouse gas emissions, in accordance with the Australian Greenhouse Office's (2006a) Factors and Methods Workbook.
- Potential changes to the vehicle fleet (such as fuel mix, alternative fuels, use of public transport or vehicle efficiency) and changes to the transport network (such as increased or decreased use of freight rail) were not considered.

Trends with significant implications for the greenhouse gas analysis for the project are evident within the traffic modelling results. Analysis of the total distances travelled on sections of the existing and proposed highway, as described above, clearly indicates that due to local traffic conditions some motorists would be expected to use the proposed upgrade during local trips rather than continue to use the local routes currently followed. These changes in route would result in additional distance travelled on the existing highway and the proposed upgrade when taken in combination and compared to the distance travelled on the existing highway without the upgrade in place.

The travel choices predicted for local motorists would partly result from improvements to road safety and travel efficiency on the proposed upgrade. However, this predicted behaviour

is considered to be mostly associated with the proposed upgrade providing opportunities for local traffic to avoid perceived constraints on local roads. For example, rather than exiting the proposed upgrade at the South Kempsey interchange to get to a destination in Kempsey, some motorists are expected to choose to exit at Frederickton and drive back down the existing highway to Kempsey, in order to avoid perceived travel constraints around the Kempsey town centre. These trips, while longer in distance, may reduce perceived or actual travel times for motorists. This scenario would most likely change if the prevailing local traffic conditions in Kempsey were addressed. However, consideration of the timing and nature of any such improvements are beyond the scope of this project.

While these trends are associated with driver choices over the entire local network around the proposed upgrade, they relate most clearly to traffic behaviour on the existing highway between Kempsey and Frederickton, in particular in Kempsey town centre.

The proposed upgrade would help to address local traffic conditions by providing a safer, more efficient means of travel for through traffic between Kempsey and Frederickton, thereby improving fuel efficiency and reducing the contribution of through traffic to greenhouse gas emissions.

The trip choice decisions discussed above have certain implications for this project. The significant greenhouse benefits that would arise from the rerouting of through traffic from stop-start conditions in Kempsey and Frederickton to free-flowing conditions on the proposed upgrade would be countered (when considering only the existing highway and the proposed upgrade), by the aggregated impacts of local traffic trips diverting onto the proposed upgrade.

These trends are discussed in *Technical Report 4 - Kempsey to Eungai Upgrading the Pacific Highway - Climate and Air Quality Assessment.*

Based on these assumptions and using traffic modelling results for 2011 and 2021, the total volume of greenhouse gas emissions were calculated. These are outlined in Table 21-2.

Table 21-2 Ongoing greenhouse gas emissions from vehicles using the existing highway and the proposed upgrade

Scenario	Annual greenhouse gas emissions 2011	Annual greenhouse gas emissions 2021
Without proposed upgrade	96,000 t CO_{2-e}	131,000 t CO_{2-e}
With proposed upgrade	109,000 t CO_{2-e}	159,000 t CO_{2-e}

Source *Technical Report 4 – Climate and Air Quality Assessment*
Note *CO_{2-e} = carbon dioxide equivalent t = tonnes*

The results shown in Table 21-2 indicate an increase in greenhouse gas emissions from traffic using the bypassed sections of the existing highway and the proposed upgrade. The estimated annual greenhouse gas emissions detailed in Table 21-2 for the scenario with the proposed upgrade clearly indicate the implications of the additional travel on the existing highway and the proposed upgrade discussed above. The apparent increase in greenhouse gas emissions following opening of the upgrade to traffic does not take into account or isolate the impacts of the related changes in behaviour on the local road network that have contributed to these estimates.

A more detailed study of the local network would be necessary to determine the particular features that are driving the increased distances travelled on the sections of existing and proposed upgrade that are addressed in this analysis. The offsets against the predicted greenhouse gas emissions detailed in Table 21-2 have not been quantified because a sufficiently detailed local network traffic model is not available at this time. Further to this, while it is recognised that travel efficiency would be a factor in the individual travel choices made, the model does not

allow for any potential reductions in greenhouse gas emissions due to associated fuel usage efficiencies.

The estimated combined emissions from traffic using the proposed upgrade and the existing highway, as discussed above and shown in Table 21-2 would be less than 0.1% of Australia's annual transport-related greenhouse gas emissions, without accounting for the reduced emissions expected from the remainder of the local network.

Mitigation of greenhouse gas emissions

The Australian Greenhouse Office's national greenhouse gas inventory for 2004 (AGO 2006b) reported that 76,200,000 tonnes of carbon dioxide equivalent was emitted by transport sources, throughout Australia out of a total of 564,700,000 tonnes. Greenhouse gas emissions attributable to construction of the proposed upgrade would represent a contribution of less than 0.05% to this total.

Management and mitigation measures to reduce construction related greenhouse gas emissions are limited. As previously discussed, a number of initiatives have been implemented by the RTA to minimise potential greenhouse gas generation from road transport. Minimum requirements for management / mitigation would include:

- Assess energy (fuel/electrical) efficiency when selecting equipment.
- Maintain equipment regularly to retain fuel efficiency.
- Purchase a minimum of 50% accredited renewable energy in order to reduce greenhouse gas emissions associated with electricity production.
- Where feasible, use of biofuels (biodiesel, ethanol, or blends such as E10 and B80), to reduce greenhouse gas emissions from construction plant and equipment.
- Minimise vegetation clearing and replant vegetation where feasible.
- If vegetation must be cleared, consider beneficial reuse of cleared material and avoid on-site burning; where land is to be purchased, pre-clearance for beneficial reuse should be encouraged, particularly State Forest land with harvestable materials.
- Use local material and local staff where possible to reduce transport-related emissions.
- Substitute recycled materials, such as replacement of cement with fly ash, recycled aggregate, and recycled content in steel, where feasible, to minimise the lifespan impact of greenhouse gas emissions in production.
- Substitute low greenhouse-intensity materials where appropriate.

The RTA have implemented or have been actively involved in the development of a number of initiatives to help minimise potential greenhouse gas generation from road transport. RTA and NSW Government strategies for addressing greenhouse gas emissions is outlined at the beginning of this section.

21.3.4 Waste, energy and demand on resources

Waste

Construction and operation of the proposed upgrade would generate various waste streams. The disposal of wastes is regulated by the *Waste Avoidance and Resource Recovery Act 2001*. This Act establishes a hierarchy of waste management (avoid, recover, dispose) that encourages the efficient use of resources, aims to minimise or avoid environmental harm and provides for continual reduction in the volumes of waste generated. The Department of Environment and Conservation's *Waste Avoidance and Resource Recovery Strategy 2006* provides guidance on waste management priorities (Department of Environment and Conservation 2006c).

Waste generating activities during construction would include earthworks, drainage works, clearing and grubbing, restoration works on existing pavement, equipment maintenance and site office activities. The key waste streams generated during these activities would include:

- Concrete.
- Reclaimed asphalt.
- Scrap metal.
- General construction waste.
- Green waste from clearing and grubbing of vegetation.
- Fuels, oils, liquids and chemicals.
- Wastewater.
- Sewage from site compounds.
- Contaminated/unsuitable spoil material.
- Excavated soil where cut/fill balance may not be achieved.
- Paper and cardboard.

As far as practicable, earthworks material would be reused on-site as fill embankments and sub-grade layers and other material would be reused on-site for batter extensions. Topsoil would be reused for landscaping.

The total volume of green waste generated from clearing and grubbing activities is difficult to estimate as the vegetation cover varies along the proposed upgrade. The area requiring major clearing is approximately 286.5 hectares (including clearing for ancillary areas). Areas containing timber resources would be identified for harvesting. Unsuitable material would be mulched, chipped or reused on-site for sediment filter fences and landscaping where appropriate. Suitable logs and limbs would be used to provide habitat and fauna refuge, and to prevent access to construction areas.

All other waste streams, including construction waste would be removed and disposed of in accordance with the relevant guidelines, including the Environmental Protection Authority's (now Department of Environment and Climate Change) *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (Environment Protection Authority 1999b).

Operational waste would be limited to waste generated from road maintenance and repair activities and road users. Maintenance wastes would include green wastes from wind blown limbs/trees, trimmed material from remnant vegetation and landscaped areas, and vehicle oils and greases from maintenance vehicles. Litter would be generated by road users along the highway and at rest areas.

Green waste from maintenance activities would be collected and where possible recycled for mulch within the road reserve or for other Kempsey Shire Council activities. Other maintenance wastes such as oils and greases would be disposed of to an appropriate facility. Waste generated by road users would be collected by the relevant maintenance organisation. Wastes would either be recycled or disposed of to an appropriate facility.

The management of waste is not considered a key issue given that standard measures are available to address waste generation, disposal and reuse in order to minimise potential impacts. Measures for the management of waste would be included in the Construction and Operational Environmental Management Plans and are included in the draft Statement of Commitments in Appendix D.

Energy

Energy consuming activities during construction of the proposed upgrade would be extensive and would take place over approximately 4 years. Plant and equipment used during this time would be diverse, including large, heavy machinery through to tools and small equipment. The energy used during construction of the proposed upgrade would be in the form of fuel (petrol and diesel) and electricity. Some opportunities for energy saving and reducing greenhouse gas emissions are outlined in Section 7.4.4.

The activities undertaken and plant and equipment used during construction would consume considerable quantities of fuel. Most of the fuel used would be diesel. Fuel use and efficiency are influenced by the condition of vehicles/equipment, speed of operation and site conditions. Fuel and energy use during construction would be minimised as far as possible through the use of efficient and well-maintained vehicles and effective planning.

Fuel consumption can also vary due to disruption of traffic on the existing highway. However, as the majority of construction would occur away from the operating highway, little change to fuel use is anticipated as a result of traffic disruption.

Energy consumption during operation of the proposed upgrade would be associated with vehicle use, provision of services and the use of maintenance vehicles and equipment. It is expected that the proposed upgrade would result in energy savings, particularly in relation to improved operating conditions and reduced travel time, and hence reduced fuel consumption.

Energy consuming services required for the operation of the proposed upgrade would include lighting, intelligent transport systems, and telephones (refer Section 6.1). Electricity would be supplied from the existing electricity network, and would be negotiated between the RTA and local government authorities during detailed design.

Maintenance of the proposed upgrade would include periodic landscaping activities, maintenance of water treatment facilities and pavement repairs. Maintenance activities are expected to require a small number of medium-sized vehicles and equipment. The amount of energy consumed during maintenance activities would be negligible.

Total operational energy use would gradually increase in proportion to overall growth in traffic volume on the highway.

Demand on resources

Water would be used during construction of the proposed upgrade for dust control, washing of plant and equipment, for drinking water, hand washing, toilets and watering landscaping. Water would also be required for the preparation of construction materials such as sub grade and concrete.

As discussed in Section 7.4.3, sources of water for construction, would, where possible, be sustainable. Sustainable supply options that would be considered as alternatives to traditional sources (such as dams and rivers), include re-use and recycling.

Construction activities that would require water include compaction and pavement stabilisation during earthworks and concrete and asphalt batching. Water would also be used for dust suppression and for watering vegetation. Reclaimed water could be used for dust suppression, watering of vegetation and during earthworks. However, concrete and asphalt batching activities would require water of a suitable quality due to the need to avoid some pollutants.

The quantities of water that would be used during construction are as follows:

- Earthworks – 18 litres per cubic metre for compaction and 70 litres per cubic metre for stabilisation.

- Dust suppression – water consumption for dust suppression would vary depending on site and meteorological condition, it is likely that the average water requirement for dust suppression would be around 70,000 litres per day in extreme weather.
- Vegetation watering – water consumption for vegetation watering would be variable depending on the amount of vegetation to be watered, the type of vegetation and prevailing meteorological conditions, in extreme weather it is likely that water consumption for watering would be similar to the volumes required for dust suppression.
- Concrete and asphalt batching – consumption of around 200,000 litres per day per batching plant during batching.

To ensure that the use of recycled water is maximised and waste minimised, a Water Use and Re-use Sub-Plan would be developed as part of the Soil and Water Management Plan for the project prior to construction.

The materials required for construction of the proposed upgrade are discussed in Section 7.4.2. There is estimated to be approximately 4.2 million cubic metres of bulk excavation generated during the proposed upgrade construction. Suitable material from cuts would be used in earthwork embankments. An additional 125,000 cubic metres of imported material is expected to be required for fill embankments. This material would be sourced during construction from local quarries. Additional materials required for construction would include concrete, steel and asphaltic concrete. These materials would be acquired from outside sources.

The entire Pacific Highway Upgrade Program has the potential to result in cumulative resource depletion. The impact of this has been minimised by considering the cut and fill requirements of the proposed upgrade and that of other nearby construction projects. In addition, consideration has been given to waste minimisation and efficiency of resource use in accordance with the NSW Government's *Waste Reduction and Purchasing Policy* (Environment Protection Authority 1999c).

21.3.5 Summary of management measures

Standard and project-specific mitigation and management techniques for greenhouse gas emissions and waste management during the construction and operation of the proposed upgrade are included in the draft Statement of Commitments for the proposed upgrade in Appendix D and are summarised below.

- Prepare and implement a Water Use and Re-use Sub-Plan as part of the CEMP.
- Plant and equipment will be maintained in a proper and efficient condition and operated in a proper and efficient manner.
- Promote the reduction of greenhouse gasses by adopting energy efficient work practices including:
  - Developing and implementing procedures to minimise energy use.
  - Conducting awareness programs for all site personnel regarding energy conservation methods.
  - Conducting energy audits during the activity to identify and address energy waste.

21.3.6 Compensatory habitat as an offset

As identified in Chapter 11 - *Biodiversity*, the proposed upgrade has the potential to result in a number of direct and indirect impacts on biodiversity. The majority of these would either be avoided, minimised through design decisions or can be adequately mitigated or managed. Although the mitigation and management measures are generally adequate, there are some impacts that cannot be sufficiently mitigated. There are likely to be the following residual impacts:

- A loss of native vegetation, including vegetation comprising the following threatened ecological communities - Freshwater wetlands, Swamp Sclerophyll Forest, Swamp Oak Floodplain Forest and River-flat Eucalypt Forest and the regionally significant Mahogany Dry Sclerophyll Forest.
- A loss of habitat for a variety of native fauna species including habitat for the following threatened species - Brush-tailed Phascogale, Koala, Glossy Black-cockatoo and Green-thighed Frog.

To address the residual impacts of the proposed upgrade, the RTA proposes to implement an habitat compensation strategy that would contribute to the long term conservation of biodiversity.

Based on the results of the biodiversity assessments undertaken for this Environmental Assessment and the discussion of impacts, a list of possible actions for a preliminary offset strategy is detailed in Table 21-3. This may involve one or a combination of actions.

It is anticipated that the preliminary strategy would be revised to form the adopted strategy following further investigation and consideration including consultation with relevant government agencies and stakeholders.

Table 21-2 Preliminary habitat compensation strategy

Action	Discussion
Provide compensatory habitat through revegetation and rehabilitation of surplus RTA property and/or through additional acquisition	• Consider surplus land following acquisition and boundary determination for use as compensatory habitat in consultation with Department of Environment and Climate Change (refer to Section 11.5 for details of key issues to be considered identification of compensatory habitat). • Surplus land to be subject to on-site investigation in accordance with the RTA's draft *Compensatory Habitat Policy and Guideline* (NSW Roads and Traffic Authority 2005b) in order to identify the extent of revegetation and rehabilitation to be undertaken. • Revegetation would be undertaken using plant species of local provenance, particularly species associated with the Freshwater wetlands, Swamp Sclerophyll Forest, Swamp Oak Floodplain Forest and River-flat Eucalypt Forest endangered ecological communities and the regionally significant Mahogany Dry Sclerophyll Forest. • Compensatory habitat areas would incorporate translocated Maundia triglochenoides specimens where appropriate. • Should compensatory habitat be required in addition to that already identified for the Green-thighed Tree Frog, investigations into acquiring land for this purpose and any subsequent long-term management arrangements would be undertaken in accordance with the RTA's draft *Compensatory Habitat Policy and Guideline* (NSW Roads and Traffic Authority 2005b).
Supplementary revegetation and enhancement of retained vegetation	• Revegetation would use plant species of local provenance, particularly species associated with the Freshwater wetlands, Swamp Sclerophyll Forest, Swamp Oak Floodplain Forest and River-flat Eucalypt Forest endangered ecological communities and the regionally significant Mahogany Dry Sclerophyll Forest. • Following detailed design, the RTA would determine if there are any sections of redundant road, and if so, whether they are appropriate for rehabilitation and revegetation, including for the above species. • Supplementary revegetation and enhancement of retained vegetation would focus on existing degraded habitats for threatened species including the Green-thighed Frog, Glossy Black-cockatoo and Brush-tailed Phascogale. • Supplementary revegetation would incorporate translocated Maundia triglochenoides specimens where appropriate.