



Warrell Creek to Urunga Upgrading the Pacific Highway

ENVIRONMENTAL ASSESSMENT

VOLUME 1 ENVIRONMENTAL ASSESSMENT

January 2010

ISBN 978-1-921692-63-5

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9. Environmental risk analysis

This chapter explains how environmental issues for the Proposal were identified and evaluated through an environmental risk analysis process. It also provides a summary of the environmental risk analysis results. The environmental risk analysis covered bio-physical, social and economic risks.

Director-General's requirements	Where addressed in the EA
Environmental Risk Analysis – notwithstanding the above key assessment requirements, the EA must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must be included in the EA.	Section 9.2. Results of the environmental risk analysis No additional key impacts identified.

9.1 Environmental assessment risk review

The consideration of environmental risks associated with the Proposal has been comprehensive through the route development and environmental assessment phases, spanning bio-physical aspects as well as social and economic matters. Input from the community as well as key government agencies, Councils and other stakeholders have been considered during the risk reviews.

For the environmental assessment, an analysis was undertaken which:

- Identified environmental issues, including but not limited key issues in the Director-General's Requirements.
- Examined potential impacts and proposed mitigation measures in relation to the identified issues.
- Examined impacts likely to remain after application of proposed mitigation measures.

Based on this analysis, an environmental risk category was assigned to each impact using a qualitative approach. This enabled the identification of any matters that might be considered as additional key issues and established the basis for an appropriately detailed assessment of those additional key issues to be included in this environmental assessment. The environmental risk categories assigned to each impact are described in Table 9-1.

Impacts that have been assigned a risk category of 'A' are considered in all cases to indicate key issues. The environmental risk analysis has automatically allocated a risk category of 'A' to all key issues identified in the Director-General's requirements.

Table 9-1 Environmental risk categories

Risk category	Description
A	May have high or moderate impacts. Detailed assessment necessary to determine the level of potential impact and to develop appropriate measures to mitigate and manage the impacts.
B	May have high or moderate impacts. These can be mitigated by the application of standard environmental management measures.
C	Has low impacts. These can be managed by standard environmental management measures.

9.2 Results of the environmental risk analysis

The environmental risk analysis is summarised in Table 9-2. The analysis confirmed that the Director-General's requirements included all key issues. No additional key issues were identified.

The analysis identified four 'other' environmental issues which have been included as part of the environmental assessment. The environmental risk of the other issues was not assessed as being as significant as that associated with the key environmental issues. These additional issues are discussed in further detail in Chapter 19 – *Other environmental issues*.

Table 9-2 Environmental risk analysis

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
Flora and fauna	Yes	Impacts on State (TSC Act) and Nationally (EPBC Act) listed threatened species.	Targeted field surveys have been conducted to identify locations of listed threatened species and subsequently refine the Proposal to retain individual flora and habitat, where possible. There would be no net loss of endangered ecological communities and habitat as a result of replanting and offset.	A	Chapter 10
		Impacts on threatened terrestrial fauna, including loss of habitat area and habitat connectivity.	Pre-clearance surveys would be carried out to identify the presence of native fauna within vegetation clearance zone and relocate fauna as required. Although fauna underpasses and glider crossing structures are provided, efficiency of fauna movement may be reduced. Identified habitat trees and mature vegetation in widened medians would be retained. There would be no net loss of habitat as a result of replanting and offset.	A	
		Severance of areas of key corridor, leading to erosion of genetic stock and habitat fragmentation.	Combined fauna underpasses and drainage structures and a dedicated fauna underpass included in design. Fauna exclusion fencing (e.g. floppy-top fencing) would be erected along the Proposal at appropriate locations to direct fauna movement towards fauna-crossing structures.	A	
		Clearing of native vegetation.	The clearing area would be kept to the minimum area necessary for construction. 'No-go areas' would be delineated with protective fencing. Existing native vegetation to be retained within road boundary and widened medians where possible to minimise overall vegetation loss. There would be no net loss of endangered ecological communities and habitat as a result of replanting and offset.	A	
		Proposal passes close to five State Environmental Planning Policy (SEPP) 14 wetlands and crosses four floodplains.	Avoidance of SEPP14 wetlands during route development.	A	
		Impacts on aquatic ecology, including aquatic and riparian habitat.	Major creeks and rivers to be bridged and design to be undertaken in accordance with government guidelines.	A	
		Impact on groundwater dependent species.	Cuttings and drainage designed to minimise potential impact on groundwater recharge and flow to avoid impacts to groundwater dependent ecosystems.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
		Potential regional scale impacts through loss of habitat, corridors and impact on threatened species.	The clearing area would be kept to the minimum area necessary for construction. Provision for fauna passage along the length of the Proposal. There would be no net loss of habitat as a result of landscape plantings comprising native species within the road reserve and offset.	A	
Land use and property	Yes	Changes to property access and access to the local and regional traffic network.	Access would be maintained to all properties. Property access to be re-arranged to link to the local access road network. Interchange locations to be sited to facilitate local access to major centres.	A	Chapter 11
		Severance of properties and sterilisation of land on individual properties.	The Proposal has been refined to minimise severance impacts and to ensure local access is maintained. Acquisition of the whole or part of properties affected by the Proposal in accordance with the RTA's <i>Land Acquisition Policy Statement</i> .	A	
		Severance and sterilisation of state forest resources.	The Proposal has been aligned to minimise impacts to forest harvesting zones and would not alter existing access arrangements to the Nambucca and Newry/Little Newry state forests. No sterilisation and fragmentation to resources would occur.	A	
		Impact on future urban development associated with investigation areas and proposed future urban areas. Impact on existing and future rural residential development.	Discussions have been held with relevant Councils to enable the concept design to facilitate access to potential future urban and industrial areas. Facilitates the implementation of the <i>Mid North Coast Regional Strategy</i> .	A	
		Impact on connectivity including for pedestrians and cycleway.	Pedestrians and cyclists would be able to use the existing highway under much lower traffic conditions than currently experienced, providing a safer walking or cycling environment. Opportunities for inclusion of pedestrian/cycle ways on bridges have been included in concept design.	A	
		Potential loss of contiguity of existing and planned settlements and activity clusters.	Connectivity across the Proposal and between existing and planned settlements and activity clusters, has influenced the concept design. This would be maintained during construction and operation.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
		Impact on the operation of Nambucca Valley Quarry.	Consultation with quarry established that quarry expansion was to be to the east and away from the existing highway. No anticipated impact on the future expansion of the Nambucca Valley Quarry.	A	
		Attainment of the objectives of the <i>Mid North Coast Regional Strategy</i> .	The aims of the <i>Mid North Coast Regional Strategy</i> would be facilitated by the Proposal, including growth in the region, while protecting high value environments and the coastal areas.	A	
Social and economic impacts	Yes	Potential for impacts on productivity, profitability and regional economic impacts to agricultural sector including regional and State significant farmland.	The <i>Mid North Coast Farmland Mapping Project</i> mapped regionally significant farmland representing the best farmland on the Mid North Coast and did not specifically distinguish between regional and State significant farmland. Proposal aligned to minimise severance of agricultural land and impacts on regionally significant farmland. 0.06 per cent of regionally significant farmland in the Mid North Coast Region would be affected by the Proposal.	A	Chapter 12
		Loss of businesses, or reduced exposure to passing traffic.	Appropriate signposting and visual prompts in design in accordance with RTA signposting standards. No existing businesses on industrial zoned land would need to be acquired as a result of the Proposal. Some impacts on businesses along the existing highway reliant on through-traffic. Access arrangements have been designed to facilitate access to communities bypassed by the Proposal.	A	
		Potential amenity impacts associated with increasing road infrastructure through the study area.	Visual and noise mitigation measures have been incorporated into design.	A	
		Impacts on land use viability, and natural resource values of business. Impacts on property infrastructure including farm water supplies, sheds etc.	Consultation has been undertaken with potentially affected landowners and issues associated with farming viability and property infrastructure incorporated into design. The potential for sterilisation and severance of land has been minimised as far as possible Further consultation with all directly affected land holders on how to best minimise the impact on the function and amenity of their land use arising from any land sterilisation or severance is proposed during detailed design.	A	
		Impacts on recreational and commercial fishing operations including oyster priority areas. Impact on sustainability, productivity and profitability.	No direct impacts on recreation, commercial fishing or oyster farms are anticipated. Indirect impacts would be prevented through the implementation of effective water quality management measures.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
		Impact on local residents from construction activities, construction sites, storage and batching plants.	Short term disruption to the local community during construction. Criteria for location of ancillary facilities include minimising biophysical and social impacts. Construction would be confined to approved construction hours. Local residents would be informed of any exceptions.	A	
Visual amenity and design	Yes	Urban design and landscape to be consistent with rest of Pacific Highway, considering the existing and desired characteristics of affected localities.	Urban design has been developed in accordance with the provisions of the RTA's Pacific Highway urban design guidelines, taking into consideration the affected localities	A	Chapter 13
		Impacts to local viewsheds arising from bridge embankments, interchanges and alterations to natural landscape features.	Guidelines for interchanges, bridges, viaducts and road furniture, noise attenuation, cuttings and embankments, landscaping and planting have been incorporated in the concept design. Permanent changes would occur to existing viewsheds, particularly for residences and receivers previously not exposed to road infrastructure. The Proposal is consistent with the RTA's Pacific Highway urban design guidelines.	A	
		Impacts of crossing the Nambucca and Kalang Rivers on local and district views across the floodplains.	Crossings have been designed to minimise impacts and a landscape plan has incorporated features to minimise impacts on district views. The Proposal is consistent with the RTA's Pacific Highway urban design guidelines.	A	
		Impacts on general visual amenity.	Location and alignment of Proposal has been designed to minimise visual impacts (both horizontal and vertical alignments). The Proposal is consistent with the RTA's Pacific Highway urban design guidelines.	A	
		Adverse visual impacts anticipated where the Proposal would be visible in the foreground.	Urban design and landscape management strategies include planting and mounding to minimise potential impacts.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
Noise and vibration	Yes	Impacts from construction noise and vibration including construction traffic noise and blasting.	Impacts from construction activities would occur during the construction period. Construction would be confined to approved construction hours. Local residents would be informed of any exceptions. Site-specific blast designs would be developed following trials to satisfy relevant performance criteria. Construction noise and vibration would be minimised as far as practical through the implementation of all feasible and reasonable measures, consistent with government guidelines.	A	Chapter 14
		New noise source along bypass sections with a number of sensitive noise receivers.	Noise impacts on sensitive noise receivers close to the Proposal which were not previously exposed to road infrastructure.	A	
		Operational road traffic noise impacts.	Long term positive noise impacts for receivers in areas which are to be bypassed by the Proposal. Design of Proposal incorporates measures to minimise noise impacts (both horizontal and vertical alignments, grading, and low-noise pavement). Topographical features have limited the effectiveness of noise barriers in some locations so property treatments are proposed. While this addresses noise experienced indoors, there would be some residual outdoor noise effects.	A	
		Potential secondary noise impacts from proposed noise mitigation measures.	Secondary noise from reflections from noise barriers are not expected to be significant for the Proposal due to the location of receivers with respect to the proposed barriers.	A	
		Impacts on specific noise receptors may vary depending on meteorological conditions.	Incorporation of meteorological data into the traffic noise model is not possible and no valid criteria exist for any such assessment (if possible). Appropriate site specific meteorological data were not available for the study area. In general, temperature inversions may increase noise levels by between 3-5 dB(A) during cooler months depending on conditions and are likely to affect residences greater than 100 m from the road. However, it is likely that windows and doors would be closed, providing attenuation of potentially increased noise impacts. Although an estimate of impacts may be made to account for potential increases in noise levels, as a result of temperature inversions, these estimates have no valid basis and may ultimately be an under or over estimate of noise impacts from these weather conditions.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
Aboriginal heritage	Yes	Potential impact on landscape cultural features including watercourses, spur lines, raised areas in floodplains.	Items uncovered during subsurface investigations of potential archaeological deposit sites would be managed through implementation of a CEMP, in consultation with the relevant LALC.	A	Chapter 15
		Direct impacts on nine archaeological sites and indirect impacts on one archaeological site and 34 areas of potential archaeological deposits.	Subsurface testing has been undertaken and detailed mitigation measures developed in consultation with the LALC for each of the impacted sites.	A	
		Potential impact on Cow Creek Aboriginal Reserve. Potential impact on undisclosed burial sites.	Subsurface testing has been undertaken in the Proposal corridor adjacent to the Cow Creek Aboriginal Reserve and further consultation undertaken with landowners and Aboriginal stakeholders to determine the site's history. If previously unidentified burial sites or other sites of potential Aboriginal heritage significance are uncovered during works, activities would cease in the locality and specific management procedures.	A	
		Potential impacts on 5 cultural places, the exact location of which is not known but identified in the area.	Mitigation measures for cultural sites have been developed in consultation with the LALCs, where appropriate.	A	
		Cumulative impacts on Aboriginal heritage in a regional context associated with the overall Pacific Highway Upgrade Program.	Cumulative impacts are not considered to be significant as much of the study area has been highly disturbed. Regionally, the loss of cultural heritage values and knowledge for the Gumbaynggirr people of the Nambucca Valley would be impacted by the loss of sites as a result of the Proposal.	A	
Water	Yes	Impact on waterway and wetland water quality due to runoff or accidental spillage during construction and operation.	Permanent sediment basins and spill containment devices have been incorporated into concept design to minimise the risk of impact as a result of accidental spillage during operation. Construction compounds and storage facilities to be located away from sensitive watercourses and waterbodies. Provided pollution management controls are implemented, maintained and managed through the life of the Proposal, no residual impacts on water quality are anticipated.	A	Chapter 16
		Potential acidic leachate from exposure of acid sulphate soils.	Management of works within areas of potential acid sulphate soils to minimise the risk of acidic leachate.	A	
		Changes to hydrology and impact on infrastructure, property and future development areas.	Future development taken into consideration during flood modelling and design.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
		Potential impacts on groundwater levels and quality and subsequent impacts on groundwater use and groundwater users particularly areas of steep cuttings in Sections 1, 2 and 4.	Groundwater users in proximity to the Proposal are unlikely to be significantly impacted as a result of cuttings or dewatering during construction. Environmental management measures have been included to minimise potential impacts to groundwater. Monitoring of selected bores would be undertaken prior to and during construction phase.	A	
		Potential impact on the existing flood regimes.	Design of Proposal incorporates measures to minimise impacts on flood levels and flooding regimes, with culverts, bridges and underpasses designed to ensure natural flow paths are not impeded.	A	
		Community concerns regarding potential impacts on flood regime in Nambucca River as a result of Council development in the region of Tilly Willy Creek.	Hydrological investigations have identified that the Proposal would have minimal impact on the flooding regime in Tilly Willy Creek and the surrounding area.	A	
Traffic and transport	Yes	Operational traffic and transport impacts to the local, regional and fire trail networks (existing and planned), including impacts from traffic rerouting and modified access to the upgraded highway.	Significant improvement in north-south travel times between Warrell Creek and Urunga. Regional, local and fire trail networks have been refined to accommodate traffic movement requirements.	A	Chapter 17
		Impacts on local traffic movements as a result of construction traffic (including spoil haulage).	Movement of construction vehicles and plant would be managed with a construction traffic management plan to minimise impacts on local traffic.	A	
		Disruption to local public transport networks including local bus services.	Public transport requirements to be discussed with the relevant parties to develop appropriate management measures during construction. Existing public transport routes have been maintained in the concept design.	A	
		Impacts on the interaction of rail infrastructure and the viability of shared road and rail corridor.	Shared rail/road alignments were discussed with ARTC. Significant upgrades of the North Coast Railway Line in the study area were not part of ARTC's forward works program for the foreseeable future.	A	
		Disruption to cyclist/pedestrian movements through the study area.	Pedestrians and cyclists would be able to use the existing highway under much lower traffic conditions than currently experienced, providing a safer walking or cycling environment. Opportunities for inclusion of pedestrian/cycle ways on bridges have been included in concept design.	A	
		Emergency vehicle access.	Provision for emergency vehicle access has been made in the design.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
Soils and Fill	Yes	Potential impacts on surface soils and geological characteristics.	Geotechnical investigations have been undertaken to identify surface and geological characteristics to inform the concept design. The Proposal concept design minimises earthwork quantities and balances over sections of the Proposal.	A	Chapter 18
		Soil contamination, including potential impacts on uncapped old municipal tip site in Nambucca State forest.	No significant contamination sources within the Proposal corridor have been identified. The route has been aligned to avoid impacting areas of potential large scale contamination such as the old municipal tip site in Nambucca State Forest. In the event that contamination was identified, it would be managed in accordance with relevant guidelines. Targeted groundwater monitoring may be conducted around the tip site to monitor potential impacts associated with leachate. If contamination is identified, a remediation action plan would be developed and implemented.	A	
		Soft soils - potential impacts on design including cost implications, long term settlement and timing.	Develop design and construction options to address short and long term settlement.	A	
		Acid sulphate soils – Areas of high risk of acid sulphate soils are present in low lying areas along the length of the Proposal.	Acid sulphate soils and potential acid sulphate soils would be managed in accordance with relevant guidelines.	A	
		Erosion of soil and sedimentation of waterways, particularly in sensitive wetland systems such as Gumma Flat tidal and wetland area.	Temporary erosion and sedimentation controls would be confirmed during detailed design. The boundary of the Proposal includes capacity for permanent sediment basins in sensitive areas, including SEPP14 wetlands and key watercourses such as the Nambucca River and Kalang River, to protect fisheries and oyster beds.	A	
		Instability of cutting slopes.	Generally slopes have been conservatively designed at 2:1 slope. Cutting slopes achieve slope stability requirements.	A	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
Hazardous substances	No	The hazards and corresponding risks to human health and the environment associated with incidents that could arise during operation (e.g. accidental release of toxic, flammable or explosive substances).	It should be noted that these risks exist now with few available mitigation measures. Spill containment has been considered in the drainage design of the Proposal. Measures such as permanent detention basins have been incorporated to protect waterways and surrounding areas from spills related to accidents on the upgrade. The risk of accidental collision of vehicles using the highway would be reduced due to improved safety as a result of the upgrade of the highway to dual carriageway.	C	Section 19.1
		Spillage of hazardous materials used in the construction process.	Construction phase handling and risk management procedures, including emergency response to be incorporated in the construction environmental management plan.	C	
Air quality and climate	No	Air pollution (including dust) from construction works or motor vehicle emissions.	There may be localised impacts arising from dust generation during construction. The risk of emissions from construction motor vehicles is negligible. An Air Quality management sub-plan would be prepared to effectively manage air quality during construction. It would focus on preventative actions using anemometers to trigger when increased site watering activities are required.	C	Section 19.2
		Operational air quality impacts from with increased vehicle traffic and associated vehicle emissions, including greenhouse gases and particulates.	The risk of impacts from air pollutant emissions during operation is minimal. Modelling indicates that likely increases in traffic are not significant enough to result in a noticeable difference in background pollution levels.	C	
		Impact of particulates on private properties, businesses and tank drinking water resources.	Particulates occur as a result of the incomplete combustion of fuel and are greater from diesel vehicles. Combustion is improved with free-flowing traffic that experiences consistent grades. The design of the Proposal attempts to minimise grade changes and enables a consistent speed of between 100-110 kilometres per hour. An exceedance of health criteria for drinking water in rainwater tanks is unlikely.	C	

Issue	DGRs key issue	Potential impacts	Analysis – proposed impact mitigation measures and impacts remaining after their application	Risk category following analysis	EA reference
Non-Aboriginal heritage	No	Impact on the following items of potential heritage significance. ■ Farm house, North Macksville(Nambucca Shire) ■ Tangye pump. (Nambucca Shire) ■ South Arm Road scenic road landscape. (Bellingen Shire) ■ Farm house, Kalang River. (Bellingen Shire) ■ Fire trail and right of carriageway.(Bellingen Shire) ■ Possible house site. (Bellingen Shire)	European heritage items have been avoided through design where possible. A Statement of Heritage Impact prepared for all six items potentially impacted by the Proposal, indicated no significant impact to heritage would occur. Mitigation measures for construction and operation have been developed. The following historical sites would be lost: ■ Farm house, North Macksville(Nambucca Shire) ■ Tangye pump. (Nambucca Shire) ■ Farm house, Kalang River. (Bellingen Shire) ■ Possible house site. (Bellingen Shire) South West Arm Road scenic road landscape would require protection during construction. The Heritage Office and Bellingen and Nambucca Shire Councils would be consulted during development of the detailed design of the Proposal and in preparation of the construction environmental management plan. Detailed archival records would be made prior to dismantling of the sites.	B	Section 19.3
Sustainability	No	Impacts of greenhouse gas emissions during the construction phase of the Proposal as well as the demand on resources in terms of utilities, energy and resources and wastes.	Sustainability principles have been considered throughout the route development/selection, concept design and environmental assessment. There would be further opportunities during detailed design and construction to innovate in terms of material use and recycling and reduced resource use.	B	Chapter 16, 19 and 20
		Impacts of climate change and sea level rise on the Proposal.	The potential implications of climate change and sea level rise have been considered for the Proposal. Structures have been designed with consideration given to scenarios involving higher sea levels and altered weather patterns.	C	
		Impact of Proposal on climate change.	Construction and operation of the Proposal would release greenhouse gases into the environment. Construction greenhouse gas emissions would be managed through the construction environmental management plan. Improving traffic flow as a result of the operation of the Proposal would reduce greenhouse gas emissions on a per vehicle basis. Government policy will dictate the efficiency of vehicles in the future.	C	

¹ - Issues falling within risk category 'A' are considered to be key issues. All DGRs key issues are designated category 'A'.