9 Environmental risk analysis

A detailed environmental risk analysis was conducted as part of this environmental assessment. This chapter outlines the environmental risk analysis process and identifies the key environmental issues. The Director-General's requirements (DGRs) in regards to an environmental risk analysis are detailed below.

Director-General's requirements	Where addressed
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.*	Chapter 9 Section 9.2

9.1 Environmental risk analysis process

An environmental risk analysis has been carried out to identify and confirm the key environmental issues for the project. Key issues are those that may have major or moderate impacts (actual or perceived) and require detailed assessment to determine the level or severity of potential effects and identify appropriate impact mitigation and management measures.

The environmental risk analysis process carried out for the project included:

- Preliminary environmental investigations to help identify the key environmental issues and inform the Part 3A Project Application.
- An assessment of the key issues identified in the DGRs for the project (refer to **Appendix A** for the DGRs).
- An environmental risk review to confirm the key environmental issues based on the results of the detailed investigations presented in this environmental assessment.

These steps are described in further detail in **Section 9.2** to **Section 9.4** below.

9.2 Preliminary environmental investigations

Preliminary environmental investigations were carried out prior to the preparation of this environmental assessment to inform the Part 3A Project Application. The outcomes of these investigations identified the following as key environmental issues for the project:

- Traffic and transport.
- Noise and vibration.
- Biodiversity.
- Landscape character and visual amenity.
- Aboriginal cultural heritage.
- Land use and property.
- Socioeconomic.

The outcomes of the preliminary environmental investigations were documented in the Part 3A Project Application, which was submitted to the Director-General of the NSW Department of Planning and Infrastructure in conjunction with the *Foxground and Berry Bypass Preliminary Environmental Assessment* (RTA, 2010). The purpose of the preliminary environmental assessment was to assist the Director-General in identifying the environmental impact assessment requirements for the project, including the key issues to be addressed in the environmental assessment.

9.3 Assessment of the key issues identified in the DGRs

The key environmental issues identified in the DGRs are consistent with, but add to the key issues identified in the preliminary environmental assessment. The DGRs identified the following as the key issues to be addressed in the environmental assessment for the project:

- Traffic and transport.
- Noise and vibration.
- Biodiversity.
- Surface water and groundwater.
- Flooding.
- Landscape character and visual amenity.
- Aboriginal cultural heritage.
- Non-aboriginal heritage.
- Land use and property.
- Socioeconomic.

The above-listed key issues have been assessed in detail as part of the preparation of this environmental assessment. These results of this assessment are presented in **Chapter 7**.

9.4 Environmental risk review

An environmental risk review was undertaken as part of this environmental assessment to help identify any additional key issues, other than those already identified in the DGRs. This risk review was based on a qualitative assessment of information obtained during the environmental impact assessment process, including the results of specialist investigations. It involved:

- Identifying all relevant environmental issues (actual and perceived), including but not limited to the key issues identified in the DGRs.
- Examining the relative potential environmental risks associated with each of the identified issues.
- Assigning a risk category to each of the identified issues based on the criteria outlined in **Table 9-1.**

The results of the risk review are presented in **Table 9-2**. No additional key issues, other those specified in the DGRs, were identified as an outcome of the risk review.

Table 9-1 Environmental risk category criteria for identified environmental issues

Risk Category	Description
Key issue	High or moderate impact (actual and perceived) requiring further investigation to identify specific management and mitigation measures.
Other issue	Moderate or low impact that can be managed effectively with standard and best practice management and mitigation measures

9.5 Confirmation of key environmental issues

The following issues have been confirmed as the key environmental issues for the project based on the information presented in this EA:

- Traffic and transport.
- Noise and vibration.
- Biodiversity.
- Surface water and groundwater.
- Flooding.
- Landscape character and visual amenity.
- Aboriginal cultural heritage.
- Non-aboriginal (historic) heritage.
- Land use and property.
- Socio-economic.

All key issues have been addressed in **Chapter 7**.

Table 9-2 Environmental risk analysis summary

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
Key issues					
Traffic and transport	Yes	**Construction risks**			
		Reduced safety to road users, cyclists and pedestrians during construction.	A traffic management plan (TMP) would be developed to identify, manage and respond to any changes in road safety as a result of the highway construction works. This includes signage and traffic control devices. Negligible impacts following management.	Key issue	Section 7.1
		Reduction in traffic efficiency for local and regional traffic due to construction activities.	A TMP would include both the general approach and the specific controls required at selected locations to minimise traffic disruptions. Offline works would be undertaken wherever possible to minimise delays to highway traffic. Construction methods and staging would be designed to minimise disruptions caused by road closures and online works (subject to other project constraints). Construction works that would significantly impact the performance of the road network would be scheduled, where possible, during periods that have typically lower traffic volumes. An 80 km/h construction speed zone would be maintained, where possible. Access to local roads and properties would be maintained. A local and regional communications strategy would be implemented to provide advanced notice of any major or prolonged impacts, and real-time information regarding current impacts. Despite the implementation of management measures, there would be a temporary residual impact on the network efficiency.	Key issue	Section 7.1
		Temporary transfer of traffic from the Princes Highway to the ‘Sandtrack’ and Toolijooa Road.	The TMP would be developed to identify traffic management requirements during construction, including any changes to road safety on the ‘Sandtrack’ as a result of the highway construction works.	Key issue	Section 7.1

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Temporary road closures, particularly during construction of the southern interchange for Berry.	Construction methods and staging would be designed to minimise road closures. Temporary detours would be designed to minimise delay and ensure that road safety is maintained. Measures to minimise network disruptions would be detailed in the TMP, and would include strategies to communicate changes for road users prior to and during construction. Negligible impacts remaining following implementation of these management measures.	Key issue	Section 7.1
		Operational risks			
		Reduction in traffic efficiency on the Princes Highway due to traffic growth, including the transfer of traffic from the 'Sandtrack'.	The four lane divided highway would provide sufficient capacity to accommodate additional traffic capacity to the design year of 2037 and beyond. The operational performance of the project would be monitored following completion of construction to ensure that the road network performs as efficiently as expected.	Key issue	Section 7.1
		Impact of increased highway traffic on the adjacent unimproved section of the highway between Schofields Lane and Cambewarra Road to the south of the project area.	A temporary tie-in would be provided to safely merge highway traffic between the project and the existing highway at Schofields Lane. RMS has commenced planning for the Berry to Bomaderry upgrade.	Key issue	Section 7.1
		Impacts to local road and property access due to the introduction of a central median and safety barrier, and left in left out only arrangements.	U-turn movements would be catered for at interchanges, the dedicated u-turn facilities at Mullers Lane and Austral Park Road, and the roundabout at Tannery Road. There would be a permanent increase in travel times for local residents affected by the left in left out arrangements. This is considered to be justified by the long-term safety gains to local and regional road users.	Key issue	Section 7.1

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Impacts to local roads and local traffic routes, including impacts to bus routes, garbage trucks and emergency services.	Rawlings Lane would be realigned to connect with the western portion of North Street, with a u-turn facility. North Street would be permanently severed and traffic would need to use Queen Street and the Berry bypass. This would minimise the additional travel required for road users who would be diverted. Victoria Street would be permanently closed at the western end and traffic accessing the highway southbound would be redistributed along the local road network. Additional travel times would be minimal and the affected local roads would continue to function within capacity and with minimal impact to the amenity. Turning facilities for garbage trucks and buses would be provided to maintain current services on Rawlings Lane and North Street. Residual impacts would include increased travel time for buses, garbage trucks and other services. Bus stops along the highway would be consolidated and provided at Toolijooa Road and Tindalls Lane interchanges. Changes to bus routes and/or stops would be made in consultation with bus service providers and communicated to patrons prior to and during the changes to services. Changes may result in an inconvenience for passengers but it would increase safety at bus stops and interchanges, and may reduce travel times.	Key issue	Section 7.1
		Operational impacts on pedestrians and cyclists.	Any design for Kangaroo Valley Road bridge at the southern interchange for Berry and other pedestrian/cyclists connections including those along North Street, would aim to support and complement the Pedestrian Access and Mobility Plan (SCC, 2006) developed by Shoalhaven City Council for Berry. Provisions for cyclists would comply with the NSW Bicycle Guidelines (RTA, 2005) and *NSW Bicycle Guidelines and Austroads Cycling Aspects of Austroads Guides*	Key issue	Section 7.1

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
Noise and vibration	Yes	**Construction risks**			
		Exceedance of construction noise management levels, including noise from ancillary construction sites.	A construction noise and vibration management plan (CNVMP) would be prepared prior to construction commencing. Construction noise impacts would be minimised through the use of best practice construction methods and reasonable and feasible noise mitigation. The potential for residual noise impacts would remain. If required, the location and height of temporary noise barriers at ancillary construction sites would be determined by the contractor during detailed design. The CNVMP would contain a community involvement plan, which would detail communication strategies for sensitive receivers that would be exposed to levels above noise management levels. Noise complaints would be dealt with through a complaints management procedure identified in the community involvement plan. Temporary noise impacts would occur during construction.	Key issue	Section 7.2
		Work outside of standard construction hours, including extended work hours and out of hours work.	Extended construction hours and out of hours work would be required for certain activities. . Wherever practicable, noise intensive works would be planned in the following order of priority to minimise the potential impacts on sensitive receivers: standard working hours, extended working hours, evening working hours, and night time working hours. Specific details of all out of hours work required would be provided to the Office of Environment and Heritage (OEH)/Environment Protection Authority (EPA) as part of the CNVMP. Affected residents and the OEH/EPA would also be informed of the timing and duration of approved work at least 48 hours before that work starts or as provided for in a site Environment Protection License Temporary noise impacts would occur during construction, but would be minimised by implementing these management measures.	Key issue	Section 7.2

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Exceedance of vibration limits causing human discomfort and structural damage in buildings.	Safe working distances would be adopted to minimise human discomfort and structural damage in buildings due to vibration. The CNVMP would require the use of certain equipment to achieve optimum safe working distances. Where safe working distances cannot be achieved, attended vibration monitoring, use of monitoring systems on equipment, negotiated agreements with affected receivers and dilapidation surveys of affected properties, would be undertaken (where appropriate).	Key issue	Section 7.2
		Increased blasting limits	A Blast Management Plan would be prepared for the project. This would include a program for smaller 'test' blasts to determine the correct setback distances for the project. Consultation would be undertaken when activities are predicted to not comply with the blasting criteria, or where simultaneous blasts are proposed. Residual impacts would be negligible.	Key issue	Section 7.2
		Increased traffic noise due to increased heavy construction related vehicle volumes	Implementation of traffic management practices to minimise road traffic noise from construction vehicles. Temporary noise impacts would occur during construction, but would be minimised by implementing the traffic management measures.		Section 7.2
		Operational risks			
		Exceedance of operational noise criteria at affected receivers.	Noise mitigation measures include the use of low noise road pavement materials, at source mitigation measures (noise barrier along North Street and along the southbound and northbound off-ramps at the southern interchange for Berry) and at receiver mitigation (architectural treatments). The final design and/or types of treatment for residences would be determined during detailed design, and the consideration of other factors, such as community views and urban design. Following the opening of the project, noise monitoring would be undertaken to confirm noise predictions and if additional noise treatments are required.	Key issue	Section 7.2

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
Biodiversity	Yes	**Construction and operational risks**			
		Loss of or disturbance to endangered ecological communities (EECs), including the river flat eucalypt forest.	The permanent and temporary loss of the EEC would be minimised through detailed design and through the revegetation and rehabilitation of riparian vegetation (river flat eucalypt forest EEC or similar) in strategic places. Temporary water crossings would be located to minimise the need for additional clearing of riparian vegetation. To offset the permanent loss of EEC vegetation, offsets would be provided as detailed in the Biodiversity Offset Strategy.	Key issue	Section 7.3
		Disturbance to terrestrial habitats, including increased fragmentation, edge effects, reduced connectivity and disturbance to wildlife corridors.	The Vegetation Management Plan (VMP) would detail measures to manage potential impacts on habitat for threatened flora and fauna. Clearing would be kept to the minimum area required for the project, and would be managed in accordance with the RTA Biodiversity Guidelines (RTA, 2011). This includes staged clearing, fauna rescue and relocation. Areas to be cleared would be fenced to identify 'no go' areas. Habitat features (such as hollow bearing trees) would be retained where possible. Measures to minimise the potential for edge effects for retained habitats and native vegetation would include weed management and erosion and sediment control. Fauna fencing, underpasses and rope bridges would be provided to minimise impacts on wildlife corridors and retain connectivity where vegetation (especially riparian vegetation) requires removal. Residual fragmentation impacts may occur depending on the final locations of revegetation and rehabilitation work.	Key issue	Section 7.3
		Impacts to or removal of threatened or migratory species (aquatic and terrestrial).	Impacts to and loss of threatened or migratory species would be unlikely, provided that mitigation measures to minimise the loss of habitat or connectivity are implemented. An unexpected finds procedure would be incorporated into the Construction Environmental Management Plan (CEMP) to ensure the appropriate management of any threatened species found on site during construction.	Key issue	Section 7.3

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Disturbance to aquatic habitats, including impacts to State Environmental Planning Policy (SEPP) 14 wetlands and reductions in water quality.	Aquatic ecosystems in the vicinity of the project are impacted by the surrounding agricultural land uses and existing water quality is low. Disturbance to aquatic habitats would be minimised by avoiding the removal of large woody debris and maintaining water quality. Where large wood debris is encountered, a priority management response would be implemented (ranging from lopping, relocating, removal). If removal is required, the offsets strategy would provide compensatory response. Water quality would be managed in accordance with the soil and water management plan (SWMP) as detailed in surface and groundwater. It is unlikely that any SEPP 14 wetlands would be impacted by the project. Residual impacts would be negligible.	Key issue	Section 7.3
		Invasion of environmental weed species.	The VMP would include weed management strategies to be implemented during the construction and operation of the project. Residual impacts would be negligible.	Key issue	Section 7.3
		Increased mortality or injuring of fauna during construction and operation.	Fauna fencing, underpasses and rope bridges would be provided at strategic locations to provide crossing locations for fauna. Management of fauna during construction and operation would be in accordance with the Biodiversity Guidelines (RTA, 2011). Residual impacts would be negligible.	Key issue	Section 7.3

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Alterations to flow regimes and interruptions to fish passage.	Transverse drainage structures would be used to allow the unrestricted passage of natural flows and changes in the natural flow regime. Impacts to fish passage would be minimal given that there would be no permanent in stream structures and construction methods would be developed during detailed design, to minimise any construction impacts including the construction of bridge piers and temporary creek crossing and construction pads. Bridge structures would be preferable for temporary crossings, however if culverts are required, fish passage may be maintained by minimising changes to the natural flow, channel width and water depth through the culvert cells. Changes to hydrology at Town Creek, Bundewallah Creek and Broughton Creek (near the bridge 2 embankment) would have a minor impact on aquatic ecology. This impact is not considered to be significant.	Key issue	Section 7.3
Surface water and ground-water	Yes	**Construction risks**			
		Spills from construction vehicles, equipment and plant.	Construction mitigation measures to minimise impact on water quality would include traffic control measures, appropriate maintenance of vehicles and the implementation of occupational health and safety practices in the storage and handling of dangerous and hazardous goods. There would be negligible residual impact following implementation of recommended controls.	Key issue	Section 7.4

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Runoff, erosion and sedimentation during construction activities.	A SWMP would be developed and would include mitigation measures such as erosion control, construction sequencing, at source controls, bunding and contamination prevention. Sediment basins would be constructed in accordance with the 'Blue Book'. Operational water quality control basins would be used to supplement (where appropriate) construction sedimentation basins. A soil conservationist would be engaged to provide advice throughout the construction period on erosion control strategies. There would be negligible residual impact following implementation of recommended controls.	Key issue	Section 7.4
		Impacts on groundwater quality and quantity.	During detailed design, additional geotechnical investigations would be completed to inform design opportunities to minimise impacts on groundwater quality and drawdown. Groundwater mitigation and management measures would be incorporated into the SWMP. This would include a groundwater monitoring plan that would monitor the performance of mitigation measures during and after construction. If dewatering is required at deep cuts that intersect groundwater, it would be discharged to creeks (under licence) or stored temporarily in sedimentation basins to reduce turbidity prior to discharge. Bunding would be provided around fuel depots and stockpile areas, with response plans to address fuel leaks and spills at machinery compounds or during refuelling. If present, the depth of excavation in alluvium soils would be minimised to reduce the risk of acid sulphate soil (ASS) infiltration to groundwater. There would be negligible residual impact following implementation of recommended controls.	Key issue	Section 7.4

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Use of recycled water from Berry and Gerringong-Gerroa sewage treatment plants during construction.	The SWMP would contain mitigation, monitoring and management measures to manage potential human health and environmental risks that may arise from the use of recycled effluent. Water quality would be tested prior to use. There would be negligible residual impact following implementation of recommended controls.	Key issue	Section 7.4
		Impacts on dams and water catchment areas (stock and domestic).	No domestic drinking water catchments are located within the study area. During construction, water quality in stock drinking water catchments would be protected with standard mitigation measures for erosion control and contamination prevention.	Key issue	Section 7.4
		Acid runoff from ASS	Further testing would be completed during detailed design and prior to the commencement of construction to determine the risk of disturbing potential acid sulphate soil (PASS). If the presence of PASS is confirmed, priority would be given to avoidance and minimising the extent of disturbance. If required, measures would be incorporated into the SWMP.	Key issue	Section 7.4
		Operational risks			
		Modifications to waterways resulting in water quality impacts. This includes impacts associated with flow changes in Town Creek.	Works in and around waterways would be managed to protect bank stability, prevent sedimentation and minimise impacts to waterways. The diversion of Town Creek flows would be designed to minimise scour impacts on Bundewallah Creek and within the diversion channel. The revegetation of the diversion channel would also minimise impacts on water quality within the diversion channel and within Bundewallah Creek. The reduction in flows in Town Creek south of the project (in Berry) would reduce the flushing efficiency of the creek and would lead to increased sedimentation. Given the existing degraded condition of Town Creek through Berry, sediment accumulation should not have any significant adverse impacts on water quality.	Key issue	Section 7.4

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Road impacts on dams and water catchment areas (stock and domestic).	The drainage catchments for a number of farm dams would be reduced as a result of the project. For the majority of these dams, this would be less than 20 per cent of original dam catchments. Undertake consultation with affected landowners prior to the commencement of construction where there would be permanent losses in dam catchments. No domestic drinking water catchments are located within the study area.	Key issue	Section 7.4
		Impact to surface water quality and receiving environments from spillages due to vehicle and truck accidents.	The alignment of the new highway is safer and therefore the likelihood of accidents would be decreased. If spills occur, these would be directed to and captured by the permanent water quality basins upstream of sensitive receivers or elsewhere by swales.	Key issue	Section 7.4
		Impact to surface water quality and receiving environments due to runoff from road surfaces.	Water quality treatment measures for runoff from road catchments would be implemented, including swales and water quality basins. Biofiltration systems would be provided, where appropriate, to mitigate impacts on downstream sensitive receiving environments.	Key issue	Section 7.4
		Impacts on groundwater dependent ecosystems (GDEs)	The risk to downstream GDEs is low. Local GDEs are within elevated areas and would continue to be sustained. Impacts to downstream GDEs would also be low, as flows in Broughton Creek would remain virtually unchanged and surface water discharged under licence to the creek from operational water quality basins would be treated in accordance with best practice.	Key issue	Section 7.4
		Road impacts on groundwater quality and quantity, including draw down and flow to springs.	Groundwater recharge decreases would be minor given the small road surface compared to the size of the catchment. Draw down in the vicinity of Toolijooa Ridge cut is not expected to impact other users. This would be confirmed during detailed design. A groundwater monitoring program would be compiled in consultation with the OEH/EPA and NSW Office of Water (NOW) to assess the performance of groundwater mitigation measures. RMS' Incident Response Plan would address risks to groundwater quality due to accidental spillages.	Key issue	Section 7.4

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
Flooding	Yes	**Construction risks**			
		Inundation of construction ancillary sites during flood events, leading to environmental impacts.	Flood prone sites would be avoided, where possible. If flood prone land is to be used, a risk management approach would be taken for ancillary sites, with restrictions or additional mitigation measures to be provided.	Key issue	Section 7.5
		Operational risks			
		Modifications to waterways impacting on flood regimes. Flows in Town Creek to be diverted to Bundewallah Creek.	Drainage structures would be designed to allow for the natural flow of floodwaters and existing overland paths to be maintained post-construction where possible. Piers would be located outside main creek channels, and the intrusion of bridge abutments into the 100 year ARI flood extents would be limited. Bridges would be designed to maintain existing flow paths and to as far as possible, minimise increases in flood levels and velocities. The diversion of Town Creek flows to Bundewallah Creek would alleviate flooding impacts in Berry. The diversion channel and outlet would be designed to minimise scour protection. Increases in flood levels in Bundewellah Creek as a result of the diversion would have localised impacts around the outlet of the diversion swale, but would be minimised to a large degree by the larger Bundewallah Creek flows. Any increases in flood levels downstream associated with the Town Creek diversion and additional flows in Bundewallah Creek and Broughton Mill Creek would be addressed during detailed design and alleviated by appropriate flood mitigation developed in consultation with any affected property owners. Increases in flood levels upstream of bridges would occur, but would not impact on habitable structures and would mostly impact agricultural land.	Key issue	Section 7.5

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Changes to flood behaviour, including duration, time of inundation and afflux, taking into account the impact of climate change on the project.	Culverts would be designed to minimise impacts on flow and the project has been designed to achieve flood immunity during the 1 in 100 year flood event. Where high velocities are predicted, scour protection would be specified for the applicable drainage structures. Embankment protection measures would be identified during detailed design in response to the change in flood flow paths as a result of the embankment between Broughton Creek bridges 2 and 3. The design of bridges and drainage structures have accounted for a six per cent increase in rainfall intensity to cater for potential impacts of climate change. An adaptive management approach would respond to any climate change impacts over and above the six per cent increase.	Key issue	Section 7.5
		Changes to regional hydrology	The project has been designed for the 1 in 100 year flood event, and would have adverse flood impacts during a probable maximum flood (PMF) event. However, critical infrastructure and evacuation routes should not be affected.	Key issue	Section 7.5

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
Landscape character and visual amenity	Yes	**Construction and operational risks**			
		Loss of visual connectivity to and from Berry due to the roadway, bridges and noise barriers. Loss of connectivity and visual amenity along North Street and the severance between Berry and west Berry (including Huntingdale Park Estate).	During detailed design, opportunities to further reduce the overall footprint of the project would be considered, where possible. The scale and final design of noise attenuation would be determined in consultation with the affected community, including the use of mounds, barrier height, barrier materials and use of landscaping. RMS will engage with the local community during design development and outcomes will feed into the detailed design. The existing landscape would be blended up to the edge of the highway and the noise barrier around North Street by reducing the steepness of the embankments. RMS will engage with the local community to gather feedback as the design develops, foster broader community support and ownership for the design outcome and facilitate integration of the project with the existing pedestrian access mobility plans (PAMP) for the township of Berry. Existing vegetation would be reinforced to integrate the bridge at Berry within the landscape. The bridge would be designed to achieve a simple structure with design elements that complements the surrounding landscape setting. The Kangaroo Valley Road bridge would be designed level with the surrounding land to provide continuity and to minimise the perceived severance between east and west Berry. This includes providing a wide bridge, with a landscaped verge between the shared path and carriageway on both sides of the bridge. While residual impacts can be minimised through design in consultation with the local community, connectivity and visual impacts to and from Berry, particularly around North Street, would remain.	Key issue	Section 7.6

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Poor integration with existing landform resulting from large embankments, cuttings and bridges. New structures within landscape would occur at Toolijooa Ridge, Kangaroo Valley Road, Broughton Creek and Berry bypass.	Reinforcing existing landscape patterns by integrating the highway with the existing landscape through design (such as by flattening the batters), would minimise the impact of the project on the visual landscape. Existing vegetation would be avoided, where possible. New vegetation would be integrated with the existing landscape character and vegetation communities. The urban and landscape design strategy would include measures to blend and extend the pastoral landscape to the edges of the carriageway. There would be residual impacts given that the project would add new structures into the landscape.	Key issue	Section 7.6
		The integration of local roads.	The transition points between the highway and local street networks would be clearly defined. Any modifications to local roads would be designed to ensure that they remain as local roads and operate independently and with minimal impact from the highway. There would be negligible residual impacts.	Key issue	Section 7.6
		Loss of and reduced access to recreational facilities.	There would be a permanent loss of recreational space at Mark Radium Park. The impact would be minimised by ensuring that the project is well integrated with the remaining recreational space. RMS would engage with the local community to gather feedback as the design develops, foster broader community support and ownership for the design outcome and facilitate integration of the project with the existing PAMP for Berry. Recreational and pedestrian and cyclist access along North Street and across the Kangaroo Valley Road overbridge would be maintained through the inclusion of shared pedestrian and cyclist facilities at these locations. There would be a residual impact due to the permanent loss of recreational park space.	Key issue	Section 7.6

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
Aboriginal cultural heritage	Yes	**Construction and operational risks**			
		Impact to recorded archaeological sites and potential archaeologically sensitive areas (PASAs).	Where possible, impact to recorded archaeological sites and PASAs would be avoided. If impact is likely, archaeological salvage actions would be conducted prior to impact. Subject to stakeholder agreement, salvaged material would be curated in culturally appropriate manner (this may include re-positioning into landscape following construction). Salvaged material would be listed on the RMS' section 170 register. Protocols for unanticipated archaeological finds and human remains would be adopted. Potential for residual impacts to non-salvaged artefacts remaining within the road easement.	Key issue	Section 7.7
		Impact on the ethno-historically recorded locations of Brookside historic encampment and 'Dicky Wood's meadow' battle ground (though the exact site location is not known).	Brookside encampment would be managed within the locality, in accordance with the management of archaeological recordings. Direct impact to natural soil profile in area of the battle ground would be minimised by adopting a construction methodology which minimises the disturbance to the natural soil profile. Where practicable, the removal of top soil would be avoided or minimised prior to the placement of fill. There remains some potential for encountering human remains within the general area of Dicky Woods Meadow battle ground. To effectively manage this potential, prior to the start of construction works, further and targeted archaeological salvage excavation would be conducted in areas of anticipated direct impact such as from pier, abutment and swale construction.	Key issue	Section 7.7
		Impact to cultural landscape values of Toolijooa Ridge (TRCL).	Impacts to cultural values would be minimised through mitigation measures such as minimising adverse visual impacts, re-establishing natural vegetation and minimising impact to wildlife corridor values. There would be residual impacts given that the upgraded highway would be a significant introduction to the cultural landscape.	Key issue	Section 7.7

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Impact to generalised cultural values associated with large and old growth fig trees.	Large and old-growth fig trees would be avoided (where possible), with fig species to be re-planted as part of a rehabilitation program where avoidance is not feasible.	Key issue	Section 7.7
Non-Aboriginal heritage	Yes	**Construction and operational risks**			
		Impact to specific heritage deposits.	Salvage actions and archival recordings would be conducted where disturbance to sites of heritage significance cannot be avoided. Potential for the permanent loss or damage of heritage items exists.	Key issue	Section 7.8
		Contextual impacts to existing structures.	Retain local heritage values by avoiding impact to local heritage structures and maintaining the visual amenity and landscape within which the items are set. The potential for a permanent loss of heritage value and visual amenity exists, should heritage items not be appropriately managed.	Key issue	Section 7.8
		Impacts to cultural landscapes.	Impacts to cultural landscapes, including the Southern Illawarra Coastal Plain and Hinterland, would be minimised by reducing visual amenity impacts. This would be in accordance with the urban and landscape design strategy. Residual impacts would include the upgraded highway being viewed as a structural intrusion into the local viewshed. This would permanently impact on the visual and cultural amenity of the project area and its surrounds.	Key issue	Section 7.8

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Direct impact to Federation cottage (G2B H11, 77 North Street, Berry) which is of moderate local significance.	Archival recording of the item would be completed prior to the commencement of construction. Residual impacts may include the permanent loss of a significant heritage item or the loss of heritage value to that particular item. These residual impacts could be minimised through archival recording of the item prior to the commencement of construction, monitoring of ground disturbance with the aim to record and recover any significant relics, recovering (in the event of demolition) suitable materials for reuse in local infrastructure (with commemorative identification) and making the property available to a third party for conservation or relocation within or near Berry.	Key issue	Section 7.8
Land use and property	Yes	**Construction and operational risks**			
		Construction related impacts on land use (ancillary facilities)	Land used for ancillary construction facilities to be rehabilitated at completion of construction. Negligible impacts remaining.	Key issue	Section 7.9
		The acquisition of 63.7 hectares of private and Council owned land.	Acquisition of land to be negotiated with the land owner in accordance with the provisions of the *Land Acquisition (Just Terms Compensation) Act 1991* and the Land Acquisition Information Guide (RTA, 2011). Agricultural land in excess of project needs to be repackaged and sold following the completion of the project. Residual land in Berry to be considered for community uses along North Street and the southern interchange for Berry. Negligible impacts remaining.	Key issue	Section 7.9

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Changes to property accesses and internal farm accesses	Changes to internal and external accesses to be negotiated with land owners during detailed design. Access to be maintained during construction. Consultation with and notification of property owners and the community regarding the construction schedule, changes to property accesses and changes to local roads. Negligible impacts remaining.	Key issue	Section 7.9
Socio-economic	Yes	**Construction risks**			
		Amenity impacts from construction activities, such as noise, dust and visual impacts.	Construction amenity impacts would be managed as per the traffic and transport, noise and vibration, and landscape character and visual amenity sections above, and the air quality section below. Mitigation measures would be incorporated into the CEMP. Given that impacts would be temporary in nature, residual impacts would be negligible.	Key issue	Section 7.10
		Alienation of sections of the community due to construction activities and locations, particularly within Berry.	Construction of the project would not involve any works within the centre of Berry. The most significant cohesion impacts would occur around Kangaroo Valley Road where temporary road closures would be required. Alternative routes would be required for any necessary road closures and the community would be regularly informed of construction activities. Road closures during construction would be temporary and residual impacts would be negligible.	Key issue	Section 7.10
		Construction traffic impacts, including, temporary disruptions and delays to local and highway traffic and temporary changes to access arrangements to local properties.	Alterations to traffic flow and access would be managed through the TMP. Where feasible and appropriate, a variable message sign would be used to communicate road changes to road users. The community consultation strategy would ensure that residents and road users are advised of any changes in a timely manner. Residual construction traffic impacts would be minimal given that they would be temporary in nature.	Key issue	Section 7.10

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Creation of construction jobs and the flow on effects to other businesses in the vicinity of the project.	Construction of the project would be a positive social and economic impact and therefore no mitigation measures have been proposed.	Key issue	Section 7.10
		Temporary loss of productive agricultural land for ancillary sites.	Land utilised for construction ancillary sites would be rehabilitated, consolidated and sold on completion of the project. Where possible, the sites would be returned to their original uses. There would be minor residual impacts where land cannot be reused for agricultural purposes following construction.	Key issue	Section 7.10
		Temporary impacts to recreational activities, including amenity impacts at parks and sports ground, temporary loss of recreational land and restricted fishing access.	Amenity impacts to users of recreational facilities would be managed as per the traffic and transport, noise and vibration, and landscape character and visual amenity sections above, and the air quality section below. Mitigation measures would be incorporated into the CEMP. Access to recreation areas such as Mark Radium Park and Berry sportsground would be maintained during construction. Ongoing discussions with Shoalhaven City Council and the Berry Riding Club would aim to identify a temporary site for the Berry Riding Club during the construction period. Construction impacts to recreational fishing would be managed in accordance with the mitigation measures presented in the aquatic ecology assessment. This would include managing sedimentation and pollution in order to minimise impacts to fish stocks and maintaining access to the existing Broughton Creek bridge throughout the construction period.	Key issue	Section 7.10
		Operational risks			
		Amenity improvements in Berry due to the removal of highway traffic from Queen Street.	Positive air quality and traffic impacts, therefore no mitigation measures have been proposed.	Key issue	Section 7.10

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Reductions in amenity, particularly around North Street and west Berry.	New permanent structures such as noise barriers, bridges, embankments and cuttings would have a permanent visual amenity impact. The visual prominence of these features would be reduced through design as discussed in Section 7.6 Landscape character and visual impact. While the prominence of these features would be reduced, a residual visual amenity impact would remain for these new structures. Noise attenuation strategies would be developed during detailed design. Residual noise impacts would be managed through architectural property treatments. Community consultation would continue throughout the detailed design and construction phases of the project to inform the community about mitigation measures to be implemented.	Key issue	Section 7.10
		Severance of communities, including property acquisition, severance of properties and reduced access to community and recreational facilities.	Community consultation and information sessions would aim to minimise any cohesion impacts experienced. Continued community consultation would develop a plan to maintain pedestrian access and cycle links over the proposed highway (along Kangaroo Valley Road), between Berry and west Berry. The risk of major incidents closing the sole access between Berry and west Berry via the Kangaroo Valley Road bridge would be managed with an incident response plan. There would be a residual impact of permanent property acquisition as well as the permanent severance of North Street, reducing pedestrian access between Berry and west Berry.	Key issue	Section 7.10
		Loss of productive agricultural land and impacts to the economic productivity and viability of agricultural properties.	Impacts to agricultural businesses would be managed through continued consultation with business owners. In accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, where a property would be divided into two parts, a suitable, safe and economically justifiable means of connecting the portions of land would be considered and discussed with the property owner. There would be a residual impact of the loss of agricultural land where rural properties are fully acquired.	Key issue	Section 7.10

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference[1]
		Changes to local access arrangements and traffic movements, including increased travel times for local residents.	The RMS has discussed functional and safe access with individual property owners and consultation with affected property owners would continue during the detailed design process. There would be a residual impact of increased travel times for some residents, however this would be offset by improved road safety for all road users.	Key issue	Section 7.10
		Positive and negative impacts on local and regional businesses, including improved accessibility to markets and decreased turnover for highway-reliant businesses.	Negative impacts to local businesses would be managed through sign posting and traffic management to encourage highway traffic to visit Berry for a rest stop. There may be residual impacts for some highway-reliant businesses, however these would be mitigated through continued discussions with Shoalhaven City Council to assist in developing strategies to encourage the ongoing viability of businesses in the town and to encourage new businesses, for example, programs to enhance community areas and streetscapes.	Key issue	Section 7.10
		Impacts to recreational land and activities, including Mark Radium Park, Berry Sportsground, Camp Quality Memorial Park, the pony club and recreational fishing.	RMS would continue discussions with the Berry Riding Club and Shoalhaven City Council to establish a new location or facilities arrangement for the club. In consultation with the community, the buffer zone between North Street and the edge of the project would likely be set aside for use as a public open space following the construction of the project. Access to local creeks would be maintained where practicable. This would include the use of the existing Broughton Creek bridge, the use of parking bays for bridge maintenance workers and consultation with the Department of Primary Industries (DPI) - Fisheries on appropriate angler access signage and access infrastructure such as fence stiles.	Key issue	Section 7.10

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference
Other issues					
Geology and soils	No	**Construction and operational risks**			
		Erosion and sedimentation during and following earthworks including the construction of cuttings and embankments.	Erosion and sedimentation would be managed in accordance with the Blue Book 2 (Department of Environment and Climate Change (DECC), 2008) and follow the RMS Erosion and sediment management procedure (RTA 2008). Measures would be monitored and maintained. Operational sediment basins would be utilised during construction and operation. Where capacity is not sufficient during construction, construction only sediment basins, scour erosion controls and sediment capture devices would be implemented. The detailed design would ensure that cut and fill batters would satisfy the short and long-term stability requirements. Management measures that would be considered during detailed design would also include retaining structures and soil nailing where appropriate. There would be minimal residual erosion and sedimentation impacts following the implementation of appropriate management measures.	Other issue	Section 8.1
		Unearthing, disturbing or spreading contaminated soil.	It is expected that there would be a low to moderate likelihood of impacting contaminated land during construction. Impacts to potentially contaminated land would be minimised by reducing the disturbance to ground during construction. Residual impacts associated with the disturbance of contaminated areas of land would be managed through a remedial action plan, if the contamination is found to pose unacceptable risks to the environment or human health.	Other issue	Section 8.1

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference
		Exposing, disturbing or spreading acid sulfate soil.	Testing would be completed during detailed design and prior to construction to quantify the risk of disturbing PASS, particularly in areas of excavation. If PASS cannot be avoided, the disturbance of PASS would be managed through an acid sulfate soil management plan (ASSMP) which would provide procedures for storage, bunding, treatment, use and monitoring. The ASSMP would be developed in accordance with the Guidelines for the Management of Acid Sulfate materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulphidic Black Ooze (RTA 2005).	Other issue	Section 8.1
Air quality	No	**Construction risks**			
		The impact of dust (PM_{10} and total suspended particles) construction work on sensitive receivers. Sensitive receivers may also experience increased levels of carbon monoxide and nitrogen oxides from construction vehicles and equipment.	Standard air quality mitigation measures would be implemented through an air quality management plan. Mitigation measures would include road watering and sealing, wind breaks, vehicle and equipment maintenance, installation of truck wheel washes or other dust removal procedures and watering or revegetating stockpiles and exposed areas. On sites where there is a clear and unambiguous dust impact resulting from the construction of the project, management measures would include: • Disconnecting water tanks from roofing and maintaining water supply to properties using tanks. • Wash-down of the roof at the completion of dust generating works to ensure a clean roof for water supply and reconnection of the water tanks. Residual impacts would be negligible.	Other issue	Section 8.2

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference
		Operational risks			
		The impact of carbon monoxide, nitrogen oxides and particulate matter (PM_{10}) from increased vehicular traffic on sensitive receivers during operation of the upgraded highway.	Air quality impacts during the operation of the project would be minimal and therefore no mitigation measures have been proposed. Residual impacts would be negligible.	Other issue	Section 8.2
Hazard and risk	No	**Construction risks**			
		Impacts to human health and the environment resulting from the handling, storage and transport of hazardous substances.	The transport, storage, handling and use of hazardous construction materials would be undertaken in accordance with Occupational Health and Safety (OH&S) legislation and codes. Secure, bunded areas would be provided where materials are stored at the site. Protocols and equipment for incident response would be implemented. . Measures would be incorporated into the CEMP to address the specific risks associated with the transport of hazardous substances to and from work sites. There would be an inherent residual risk of impact, however with the implementation of management measures this would remain low. The potential impacts associated with higher quantities of hazardous materials (that exceed relevant thresholds) being present on site would be managed through the completion of a preliminary hazard analysis (PHA).	Other issue	Section 8.3
		Occupational health and safety hazards, such as dangers to construction workers and road users.	Site specific hazard and risk management plans would be prepared and implemented as part of the CEMP. These would include environmental risk management measures, contingency plans, site-specific OH&S plans and safe work method statements. There would be an inherent residual risk of impact, however with the implementation of management measures this would remain low.	Other issue	Section 8.3

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference
		Potential rupture or interference with underground services, in particular the Eastern Gas Pipeline.	Mitigation measures would include the completion of utility checks, consultation with the relevant service infrastructure providers and relocation and/or protection of utilities within the corridor prior to the commencement of construction. A safety management study would be prepared for construction work that crosses the Eastern Gas pipeline (in consultation with Jemena) to ensure there would be no impact to the pipeline. There would be an inherent residual risk of impact to human health and the environment.	Other issue	Section 8.3
		Operational risks			
		Accidental spills of dangerous goods as a result of vehicle collisions that would represent risks to human health or the environment.	Both permanent sedimentation basins and swales would provide capacity to treat first flush from the pavement surface and reduce the risk of spills discharging onto adjacent land or watercourses. There would be an inherent residual risk of impact, however with the implementation of management measures this would remain low.	Other issue	Section 8.3
Waste management	No	**Construction risks**			
		Inappropriate management of waste generated during construction of the project. This has the potential to adversely impact visual amenity and aesthetics, water quality and may proliferate and spread noxious weeds.	All wastes would be managed and disposed of in accordance with relevant State legislation and government policies. Standard work practices and internal RMS waste policies and specifications would be implemented during construction. A management strategy would be developed to limit the amount of excess spoil and to develop appropriate disposal methods. The project is likely to generate excess spoil which would require disposal.	Other issue	Section 8.4

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference
		Operational risks			
		Inappropriate management of waste generated during the operation and maintenance of the project.	Standard work practices and internal RMS waste policies and specifications would be implemented during routine maintenance and repair activities. Rubbish bins would be installed in the heavy vehicle rest area and litter collection activities would be implemented.	Other issue	Section 8.4
Greenhouse gas and climate change	No	**Construction and operational risks**			
		Release of greenhouse gases emissions during construction.	Standard procedures would be implemented to reduce greenhouse gas emissions associated with the use of carbon based fuels and energy sources, the removal of vegetation, and emissions resulting from the use of materials to construct the project. This would include, where feasible and reasonable, the use of fuel efficient plant and vehicles, the use of renewable energy sources, strategies to minimise resource consumption and strategies to recycle or use recycled materials.	Other issue	Section 8.5
		Release of greenhouse gases during operation (including maintenance).	Greenhouse gas emissions resulting from the use of the project by vehicles are predicted to reduce when compared to the road network in the absence of the project owing to improved vehicle fuel efficiencies from the enhanced road network design and travel time efficiencies. During detailed design, measures to reduce greenhouse gas emissions over the life of the project would be implemented, where reasonable and feasible. This includes the use of energy efficient street lighting, use of renewable energy sources for the variable message sign and heavy vehicle rest area. Strategies to minimise greenhouse gas emissions associated with future maintenance of the highway would be implemented at that point in time. These would be similar to strategies implemented during the construction of the project (eg use of recycled materials).	Other issue	Section 8.5

Issue	DGRs key issue?	Potential impacts	Analysis – Proposed mitigation measures and impacts remaining after their application.	Risk category prior to mitigation	EA reference
		Climate change impacts on the project.	A six per cent increase in rainfall intensity has been factored into peak flow estimates to account for likely climatic changes (increased rainfall). An adaptive approach would provide the most appropriate methodology for the management of future climate change. This would involve including climate change considerations in maintenance procedures, such as monitoring, review and maintenance of road surfaces and drainage structures.	Other issue	Section 8.5

[1] *Refers to relevant section of this environmental impact statement (EIS) where the issues are described in detail.*