

NSW Roads and Maritime Services

WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE ENVIRONMENTAL IMPACT STATEMENT

MAIN VOLUME 1B

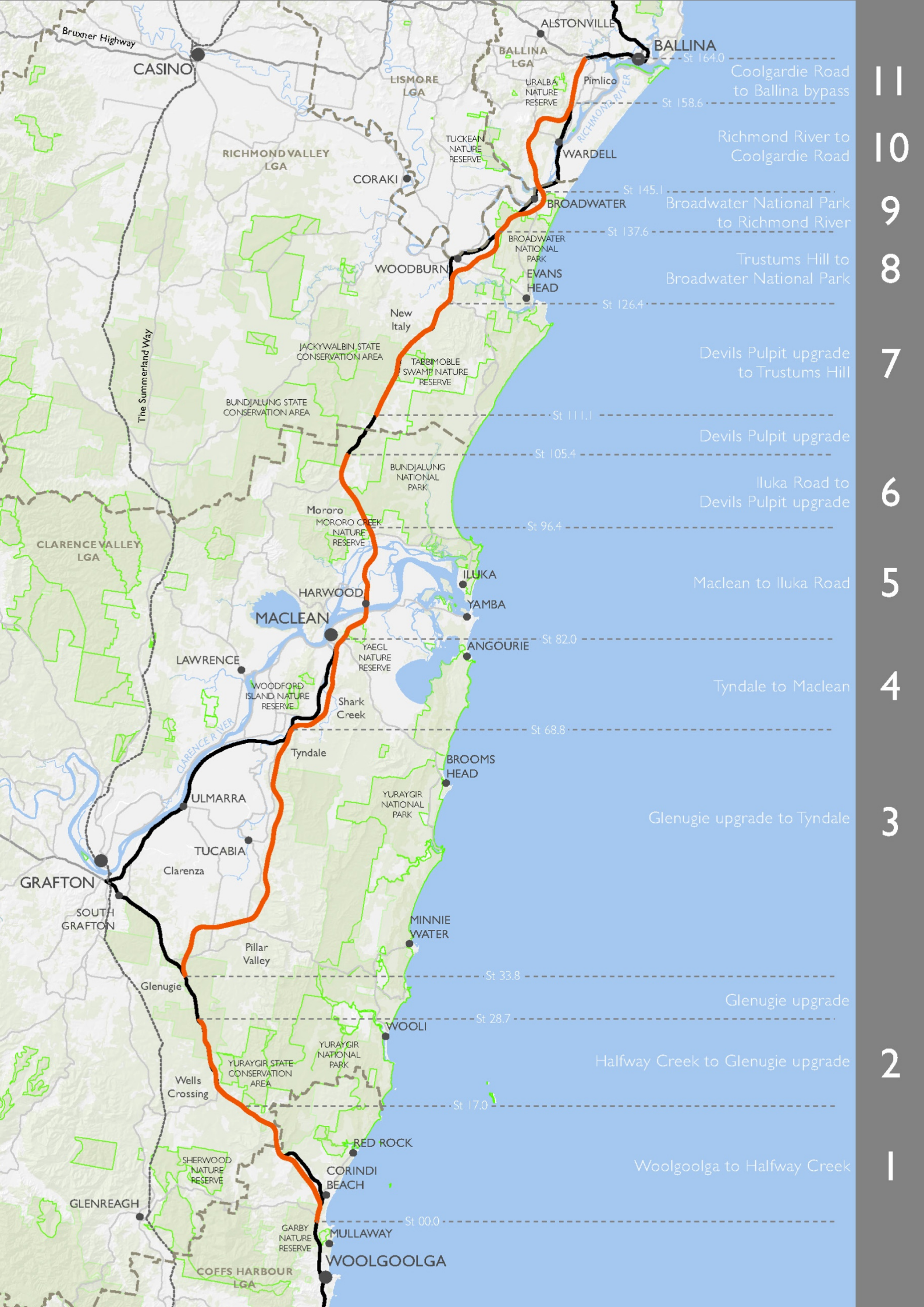
Chapter 19 – Mitigation and management measures

Chapter summary

This chapter summarises the proposed mitigation strategies and environmental management measures identified throughout this Environmental Impact Statement.

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Coolgardie Road to Ballina bypass
Richmond River to Coolgardie Road
Broadwater National Park to Richmond River
Trustums Hill to Broadwater National Park
Devils Pulpit upgrade to Trustums Hill
Devils Pulpit upgrade
Iluka Road to Devils Pulpit upgrade
Maclean to Iluka Road
Tyndale to Maclean
Glenugie upgrade to Tyndale
Glenugie upgrade
Halfway Creek to Glenugie upgrade
Woolgoolga to Halfway Creek

St 164.0
St 158.6
St 145.1
St 137.6
St 126.4
St 111.1
St 105.4
St 96.4
St 82.0
St 68.8
St 33.8
St 28.7
St 17.0
St 00.0

CASINO
LISMORE LGA
RICHMOND VALLEY LGA
CORAKI
WOODBURN
NEW ITALY
JACKYWALBIN STATE CONSERVATION AREA
TABBIMOBLE SWAMP NATURE RESERVE
BUNDJALUNG STATE CONSERVATION AREA
BUNDJALUNG NATIONAL PARK
MORORO MORORO CREEK NATURE RESERVE
HARWOOD
MACLEAN
LAWRENCE
WOODFORD ISLAND NATURE RESERVE
TYNDALE
ULMARRA
TUCABIA
CLARENZA
SOUTH GRAFTON
GRAFTON
GLENREAGH
SHERWOOD NATURE RESERVE
GARBY NATURE RESERVE
COFFS HARBOUR LGA
WOLLGOLGA
MULLAWAY
CORINDI BEACH
RED ROCK
WOOLLI
MINNIE WATER
BROOMS HEAD
ANGOURIE
YAMBA
ILUKA
YAEGL NATURE RESERVE
SHARK CREEK
BROADWATER
WARDLELL
PIMLICO
URALBA NATURE RESERVE
TUCKEAN NATURE RESERVE
BALLINA LGA
ALSTONVILLE
BALLINA

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19 Mitigation and management measures

The Director-General's environmental assessment requirements have been addressed in the assessment and are provided below. This chapter summarises the environmental management measures identified throughout this Environmental Impact Statement.

Director General's requirements	Where addressed
The Environmental Impact Statement (EIS) must be prepared in accordance with and meet the minimum requirements of Part 3 of Schedule 2 of the <i>Environmental Planning and Assessment Regulation 2000</i> (the Regulation) and include the following:	Chapter 5 Chapter 6 Chapter 19
2. the content listed in clause 7(e) of Schedule 2 of the Regulation, as follows: "a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d)(iv)" which is "measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment".	

The environmental management measures for the project are summarised in Table 19-1 to Table 19-13. The tables identify:

- Environmental issues that the management measures are addressing
- Actions that the Roads and Maritime Services will undertake to achieve the environmental outcomes, with each action assigned a number for future cross reference
- Timing for implementation of the action
- Applicable project sections for each measure.

These environmental management measures may be revised in response to public submissions on this environmental impact statement and/or design changes, during the detailed design phase, to improve environmental outcomes. These measures would be considered by the Department of Planning and Infrastructure in assessing the project.

19.1 Environmental management

Each construction contractor will be required to have an environmental management system (EMS) in accordance with the requirements of the *Environmental Management Systems Guidelines* (NSW Government 1998) and the *RMS Quality Assurance Specification G36 Environment Protection (Management System)*.

A construction environmental management plan is to be prepared by each contractor and will identify measures to be implemented to minimise environmental impacts. The construction environmental management plan will be required to include any conditions of approval for the project and construction measures identified in this chapter. The construction environmental management plan will be required to include:

- Roles and responsibilities for planning, approval, implementation, assessment and monitoring of environmental controls
- Required licences, approvals and permits
- Environmental legislation that will be required to be complied with
- Potential environmental impacts resulting from construction of the proposed upgrade and the control and mitigation measures to be implemented
- Objectives and targets for environmental performance
- Environmental monitoring programs and a mechanism for evaluating environmental performance.
- Communication procedures
- Document control procedures

- Emergency response procedures to mitigate potential environmental damage
- Training, competence and awareness assessment procedures and programs
- An environmental auditing program and a mechanism for control and management of non-conformances.

The Construction Environmental Management Plan would provide specific information in particular areas of environmental management, either by way of direct reference or by environmental management sub-plans.

19.2 Hydrology and flooding (Chapter 8)

Table 19-1: Hydrology and flooding mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Flood models	HF1	<ul style="list-style-type: none"> Flood models for the Clarence, mid Richmond and lower Richmond rivers would be updated with survey data (as released by the NSW government in mid 2012). 	Pre-construction	4, 5, 6, 8, 9, 10
	HF2	<ul style="list-style-type: none"> The bathymetrical data on which the Clarence River flood model is based would be updated to reflect the current status of bathymetry at the relevant river crossing locations. 	Pre-construction	4, 5
Operational impacts on cane drains	HF3	<ul style="list-style-type: none"> Cane drain diversions would be designed and constructed in consultation with the relevant drainage unions and impacted landowners and in consideration of the potential diversions detailed in the Working Paper – Hydrology and flooding. 	Pre-construction	4,8, 10
Permanent road fencing	HF4	<ul style="list-style-type: none"> Any permanent fencing at culvert and bridge crossings would need to consider the potential for blockage and be designed and operated in a manner that doesn't result in impacts on flooding. 	Pre-construction	All
Scour protection	HF5	<ul style="list-style-type: none"> Scour protection and erosion protection measures at waterway crossings would be designed for upstream and downstream of the highway (particularly on sugarcane floodplains). 	Pre-construction.	All
Waterway diversions	HF6	<ul style="list-style-type: none"> Waterway diversions would be designed in a manner that the final diversion mimics to the greatest extent possible the characteristics of the waterway that is being diverted. Characteristics include flow regime, flow velocity, base material, vegetation and habitat for aquatic fauna. 	Construction	All
	HF7	<ul style="list-style-type: none"> Revegetation of the diversion and surrounding area would: <ul style="list-style-type: none"> Be completed prior to the diversion receiving flows, in conjunction with the establishment of other scour and erosion control measures Include planting and the establishment of appropriate vegetation communities along the channel bed and banks, using endemic native species that are able to tolerate a potentially fast-flowing environment. 	Construction	All
Management of flows for aquatic habitat and movement	HF8	<ul style="list-style-type: none"> Velocities of flood flows through watercourse and floodplain structures (ie bridges and culverts) would need to be assessed in areas identified as potential habitat for the Oxleyan Pygmy Perch and the Purple-spotted Gudgeon. The design of these structures would need to consider the predicted changes to watercourse and floodplain velocities from the existing case due to the project. Structure design would include reviewing flood velocities in threatened aquatic species habitat during detailed design in consultation with DPI Fishing and Aquaculture. 	Pre-construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Picaninny Creek diversion	HF9	<ul style="list-style-type: none"> Batter stability issues would be assessed due to the nearness of the water quality basin and highway batter slopes to the creek diversion. Sufficient room would be provided on both sides of the diversion route to allow access for maintenance and to satisfy stability requirements. 	Pre-construction	3
Impacts on farm dams	HF10	<ul style="list-style-type: none"> Farm dams located within or partially within the project boundary would be acquired as part of the acquisition process in accordance with the <i>Land Acquisition (Just Terms Compensation) Act 1991</i>. 	Pre-construction	All
	HF11	<ul style="list-style-type: none"> Farm dams located outside the project boundary that would have a reduction in their catchment area due to the project would have mitigation measures applied, if possible. Potential mitigation options would include (but not be limited to) the diversion of rainfall runoff back into the farm dam through drainage routes (subject to land acquisition agreements and environmental assessment). 	Pre-construction	All
Evacuation and access	HF12	<ul style="list-style-type: none"> An access track would be constructed under the eastern abutment of the Coldstream River bridge at station 43.1 to assist in the movement of stock during times of flood. This access track would need to be constructed above 2.1 metres AHD and tie into the ground adjacent to the project boundary at 2.1 metres AHD. 	Construction	3
	HF13	<ul style="list-style-type: none"> Specific instances of flood access impacts would be assessed in consultation with individual landowners. Mitigation measures would be developed for changes in stock access routes. 	Pre-construction	All
	HF14	<ul style="list-style-type: none"> The level of flood immunity of Eggins Drive into Corindi would be further reviewed in consultation with Coffs Harbour City Council 	Pre-construction	1
	HF15	<ul style="list-style-type: none"> Appropriate flood evacuation and stock refuges for a property at approximate station 52.0 near Chaffin Creek would be further considered. 	Pre-construction	3
Construction impacts on cane drains	HF16	<ul style="list-style-type: none"> The potential impacts of ancillary facilities and haul roads on cane drains would be further investigated and addressed when construction compounds are confirmed. The design would need to verify that the conveyance characteristics of the cane drains are maintained by providing waterway crossings under any construction compounds and haul roads. Temporary drainage would be oversized to prevent blockages. Consultation would be undertaken with the relevant cane cooperatives drainage unions and impacted landowners to inform the development of appropriate impact mitigation measures. 	Pre-construction	4, 5, 6
Goodwood Street underpass	HF17	<ul style="list-style-type: none"> A drainage structure with an equivalent capacity of the current Goodwood Street underpass needs to be maintained during all flood seasons. 	Construction	4

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Bridge pier construction	HF18	<ul style="list-style-type: none"> Any temporary infrastructure (which are not fixed) associated with the construction of bridges and bridge piers in following waterways (but not limited to) Clarence River, Clarence North Arm, Richmond River, Tuckombil Canal, would be removed from the river and floodplain during times of flood to avoid the creation of floating debris and potential blockages. 	Construction	5, 8, 10
	HF19	<ul style="list-style-type: none"> All works within waterways would be constructed and managed in accordance with relevant NSW Office of Water guidelines. 	Construction	All
Temporary fencing	HF20	<ul style="list-style-type: none"> The design of temporary fencing at culvert and bridge crossings would consider the potential for blockage and be designed and operated in a manner that does not result in impacts on flooding. This could include temporary fencing that is easily removed during flood events (where ample warning time is provided), or specifically designed fencing so the blockage of structures would not occur. 	Construction	All
Climate change impacts	HF21	<ul style="list-style-type: none"> The need for design modifications to address changes in flood behaviour as a result of climate change would be assessed periodically throughout the life of the project. 	Pre-construction and operation	All
Impacts of ancillary facilities on flooding	HF22	<ul style="list-style-type: none"> Recommendations made in Table 8-8 of Working paper – Hydrology and flooding to minimise the flood impacts of ancillary facilities would be considered in the final siting and layout of ancillary facilities. 	Pre-construction	3, 4, 5, 6, 8, 10, 11
Meeting flood management objectives	HF23	<ul style="list-style-type: none"> Continued application of the design objectives (road flood immunity and flood management objectives) would be required throughout the detailed design phase to provide ongoing identification and mitigation of flood impacts as a result of the project. 	Pre-construction	1, 4, 5, 11
Drainage structures	HF24	<ul style="list-style-type: none"> The design of drainage structures across Chatsworth Island would be further reviewed during detailed design to enable the most appropriate and cost-effective structures to be installed 	Pre-construction	5
	HF25	<ul style="list-style-type: none"> Regular clearing of drainage structures would be required to maintain the efficacy of structures by keeping culverts and bridges free of debris. 	Operation	All
On-going consultation on drainage matters	HF26	<ul style="list-style-type: none"> Continual consultation with the NSW Office of Water and relevant councils would be required during detailed design and construction regarding flooding impacts on residences and other properties. 	Construction and operation	All

19.3 Soils sediments and water (Chapter 9)

Table 19-2: Soils, sediment and water mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Design of cut-and-fill batters	SSW1	<ul style="list-style-type: none"> Batters to be designed using appropriate slope gradients to minimise erosion of selected covering topsoil where possible, to minimise the erosion potential. 	Pre-construction	All
	SSW2	<ul style="list-style-type: none"> Where cuttings are to be benched, benches would be diverted onto contours and surface flow drainage paths designed to spread flow at the source in preference to concentrating the flow and treating it further downstream, with consideration of site constraints. 	Pre-construction	All
Management of soils, sediment and water issues	SSW3	<ul style="list-style-type: none"> As part of the Construction Environmental Management Plan, a soils and water management plan would be prepared and include (but not limited to): <ul style="list-style-type: none"> Erosion and sediment control plans for all stages of construction Consideration of soil erodibility At-source erosion controls (eg check dams) Sedimentation basin construction and management Protection of waterways Acid sulfate soil issues Management of stockpiles Tannin leachate management control Batch plant/ chemical storage controls Water quality monitoring and checklists Detailed consideration of measures to prevent, where possible, or minimise any water quality impacts. 	Pre-construction	All
	SSW4	<ul style="list-style-type: none"> Erosion and sediment control plans would be developed in line with current RMS specifications and as detailed in the Working paper – Water quality. 	Pre-construction	All
	SSW5	<ul style="list-style-type: none"> A soil conservationist would be engaged during detailed design to develop an erosion and sedimentation management report to inform the soils and water management plan. 	Pre-construction	All
	SSW6	<ul style="list-style-type: none"> Sedimentation basins and water quality ponds would be sized and located in accordance with the principles identified in the Working paper – Water quality. 	Pre-construction and construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Stockpile management	SSW7	<ul style="list-style-type: none"> Exposed areas would be progressively rehabilitated. Methods would include permanent revegetation, or temporary protection with spray mulching or cover crops. 	Construction	All
	SSW8	<ul style="list-style-type: none"> Approval would be obtained from relevant agencies for permanent and temporary waterway crossing. Each contractor would be required to comply with any conditions the approval authority imposes. 	Construction	All
	SSW9	<ul style="list-style-type: none"> Topsoil, earthworks and other excess spoil material would be stockpiled in accordance with RMS Stockpile Management Guidelines (RMS, 2011a). 	Construction	All
	SSW10	<ul style="list-style-type: none"> The maintenance of established stockpile sites would be in accordance with RMS' Stockpile Management Guidelines (RMS, 2011a). 	Construction	All
	SSW11	<ul style="list-style-type: none"> Stockpiles would be positioned in low, flat elongated embankments with a height not exceeding 2.5 metres and batter slopes not steeper than 2H:1V. 	Construction	All
	SSW12	<ul style="list-style-type: none"> Stockpiles would be placed within a designated ancillary site and would: <ul style="list-style-type: none"> not require removal of areas of native vegetation (where reasonable and feasible) not be located under the 'dripline' of trees be located outside of known areas of weed infestation be located such that waterways and drainage lines are not directly impacted. 	Construction	All
	SSW13	<ul style="list-style-type: none"> Where practicable, stockpiles would be located away from areas subject to concentrated overland flow. Stockpiles located on a floodplain would be finished and contoured so as to minimise loss of material in flood or rainfall events. 	Construction	All
	SSW14	<ul style="list-style-type: none"> Materials which require stockpiling for longer than 28 days would be stabilised by compaction, covering with anchored fabrics, or seeded with sterile grass. 	Construction	All
	SSW15	<ul style="list-style-type: none"> Potential runoff from stockpiles would be controlled by a suitable sediment trap such as a sediment fence or compost berm. 	Construction	All
	SSW16	<ul style="list-style-type: none"> Topsoil would be stockpiled separately and inspected for noxious weed seedlings at six monthly intervals and controlled with herbicide as required. 	Construction	All
	SSW17	<ul style="list-style-type: none"> All construction stockpiles would comply with the requirements of the <i>Protection of the Environment Operations Act 1997</i> and NSW Waste Avoidance and Resource Recovery Strategy 2007 for any waste activities that involve the generation, storage and/or disposal of waste and also consider the NSW Resource Recovery Exemptions as applying the storage of stockpiled material. 	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	SSW18	<ul style="list-style-type: none"> Stockpiles containing potential acid sulfate soils would be lined, banded and covered in accordance with relevant guidelines. 	Construction	All
	SSW19	<ul style="list-style-type: none"> Management of tannin leaching from vegetation mulch stockpiles into waterways would be in accordance with RMS' Environmental Direction – Management of Tannins from Vegetation Mulch (RMS, 2012). Management measures would include: <ul style="list-style-type: none"> Locating vegetation stockpiles away from overland flowpaths Diverting runoff around vegetation stockpile sites Minimising the number and size of vegetation stockpiles Lining the base of vegetation stockpiles if they are located over a shallow water table Treating vegetation stockpiles by covering them with plastic sheets or collecting stockpile drainage in a stockpile-specific sedimentation basin or sump and monitoring the water quality of the basin to determine its suitability for discharge to the environment. 	Construction	All
Management of contamination	SSW20	<ul style="list-style-type: none"> Opportunities to refine the project alignment in vicinity of the Tucabia landfill and old Maclean Shire Council landfills would be investigated. 	Pre-construction	3
	SSW21	<ul style="list-style-type: none"> A Stage 1 Preliminary Site Investigation would be conducted to verify past and present potentially contaminating activities, potential contaminants of concern and the need for further investigation. This would include a review of past highway crashes and spills and the associated contamination risks. 	Pre-construction	All
	SSW22	<ul style="list-style-type: none"> If necessary (based on the results of the Stage 1 Preliminary Site Investigation), a Stage 2 Detailed Site Investigation would be undertaken to: <ul style="list-style-type: none"> Provide information on the type, nature, extent and concentrations of contamination present, and the corresponding risks to human health and the environment Examine pathways of contaminant dispersal and exposure, the potential for off-site impacts and the management requirements and options. 	Pre-construction	All
	SSW23	<ul style="list-style-type: none"> If the Stage 2 Detailed Site Investigation recommends further action, a Stage 3 Remedial Action Plan would be produced, detailing the remediation goals, environmental safeguards, and any necessary approval and licence requirements. 	Pre-construction	All
	SSW24	<ul style="list-style-type: none"> Where further assessment indicates that further action is not required, RMS' Contaminated Land Management Guideline (RTA, 2005a) would be applied to address any contamination issues and prevent any associated adverse impacts. 	Pre-construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	SSW25	<ul style="list-style-type: none"> Where required, a remedial action plan or appropriate environmental management plan would be prepared to remove and/or manage the contamination risks in accordance with NSW Office of Environment and Heritage guidelines. 	Pre-construction	All
	SSW26	<ul style="list-style-type: none"> A hazardous materials buildings assessment would be carried out before the demolition of any structures or buildings to identify the issues of concern and the management requirements. This is required under Clause 1.6 of Australian Standard AS 2601 – 2001 The Demolition of Structures. 	Construction	All
Emergency spill response	SSW27	<ul style="list-style-type: none"> An emergency spill response plan would be developed and incorporated into the soils and water management plan. This plan would detail measures for the prevention, containment and clean-up of accidental spills of fuels and chemicals. 	Construction	All
	SSW28	<ul style="list-style-type: none"> The storage, handling and use of the chemicals and fuels would be in accordance with the Work Health and Safety Act 2000 and Workcover's Storage and Handling of Dangerous Goods Code of Practice (WorkCover, 2005). 	Construction	All
Acid sulfate soils	SSW29	<ul style="list-style-type: none"> Where it is identified that a temporary sedimentation basin or permanent water quality pond is located in an area of acid sulfate soil, the basin sizing would be reviewed to reduce basin depth to avoid excavation into the acid sulfate soil layer. The minimum allowable depth would be in accordance with the Blue Book, with the volume of the basin maintained. Alternatively, where not feasible, clay capping/ lining of the basin would be undertaken. 	Pre-construction	All
	SSW30	<ul style="list-style-type: none"> Acid-resistant construction materials would be used where possible in areas known to contain acid sulfate soils. 	Construction	All
	SSW31	<ul style="list-style-type: none"> Where excavation is to be carried out in areas anticipated to contain acid sulfate soils, works would proceed according to the acid sulfate soils management plan. Specific controls to be implemented would include: <ul style="list-style-type: none"> Capping of exposed surfaces with clean fill to prevent oxidation. Placing excavated acid sulfate soils separately in a lined, bunded and covered area. Neutralising acid sulfate soils for reuse (where appropriate) by using additives such as lime. Disposing of acid sulfate soils where necessary in accordance with the relevant guidelines set out in DECC (2008b). 	Construction	All
	SSW32	<ul style="list-style-type: none"> If acid sulfate soils are disturbed, any acid produced would be neutralised and acid waste leaving the site would be prevented in accordance with the applicable guidelines. 	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Soil erosion and sedimentation control	SSW33	<ul style="list-style-type: none"> Appropriate erosion and sediment controls, following the guidelines of the 'Blue Books' (Landcom, 2004 and DECC, 2008a), would be established before the start of construction and maintained in effective working order for the duration of the construction period until site stabilisation. Specific controls would include: <ul style="list-style-type: none"> Sediment fences and filters to intercept and filter small volumes of non-concentrated construction runoff Rock check dams across swales and diversion channels to reduce the velocity of flow, thereby reducing erosion of the channel bed and trapping sediment Level spreaders to convert erosive, concentrated flow into sheet flow Diversion drains that collect construction runoff and direct it away from unstable and/or exposed soil to treatment facilities Diversion drains to collect clean runoff from upstream of the construction area and divert it around or through the site without it mixing with construction runoff Lining of channels and other concentrated flow paths Sedimentation basins to capture sediment and associated pollutants in construction runoff (see further details below) Specific measures and procedures for works within waterways, such as the use of silt barriers and temporary creek diversions, in accordance with RMS' Technical Guideline – Temporary Stormwater Drainage for Main Road Construction (RMS, 2011b). 	Construction	All
	SSW34	<ul style="list-style-type: none"> Sensitive receiving environments would be reconsidered during detailed design to include any threatened ecological communities and non- aquatic species and their habitats that may be affected by the project. Appropriate management measures would be implemented, if required. 	Pre-construction	All
	SSW35	<ul style="list-style-type: none"> When designing and implementing specific measures and procedures for works within waterways, consideration would be given to the need to maintain fish passage. 	Construction	All
	SSW36	<ul style="list-style-type: none"> The design and construction of works within riparian corridors and within the minimum required distance from waterways would be undertaken in accordance with NSW Office of Water guidelines for working within riparian corridors. 	Pre-construction and construction	All
	SSW37	<ul style="list-style-type: none"> Flow discharge points would be designed with erosion controls to slow the flow velocities. 	Pre-construction	All
	SSW38	<ul style="list-style-type: none"> In steep areas, the length between sediment fences and other physical controls would be decreased to reduce soil erosion. 	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	SSW39	<ul style="list-style-type: none"> Construction sequencing and temporary diversions of water would be developed and designed to consider the impact of change on flow regimes and to minimise these changes throughout construction. 	Pre-construction and construction	All
Design and maintenance of construction sedimentation basins	SSW40	<ul style="list-style-type: none"> Where appropriate and required, construction phase sedimentations basins would be designed so they could be retained and used as permanent operational water quality ponds. 	Construction	All
	SSW41	<ul style="list-style-type: none"> Sediment basins would be located within the permanent boundary where possible, or on leased land, subject to approval from landowner. 	Construction	All
	SSW42	<ul style="list-style-type: none"> The final locations and sizes of sedimentation basins would be confirmed during detailed design. 	Construction	All
	SSW43	<ul style="list-style-type: none"> Sizing of sedimentation basins that drain into the Solitary Islands Marine Park would be reviewed to consider the use of 100th percentile sedimentation basins. 	Construction	Section 1
	SSW44	<ul style="list-style-type: none"> In areas of highly erodible soils or in areas of large excavations or embankment construction, sedimentation basins would be designed to include sediment storage capacity sufficient for the increased sediment loading in these areas. 	Pre-construction and construction	All
	SSW45	<ul style="list-style-type: none"> Sedimentation basins would be inspected at regular intervals and following significant rainfall events to assess available water storage capacity, water quality, structural integrity and debris levels. 	Construction	All
	SSW46	<ul style="list-style-type: none"> Where appropriate, an approved flocculent would be applied to sedimentation basins as early as possible so that early mixing of flocculants occurs. Water quality would be tested prior to discharge in accordance with any licence requirements. 	Construction	All
	SSW47	<ul style="list-style-type: none"> Where sediment has built up in a basin to a point where the total sediment storage zone has reached capacity, sediment would be removed and appropriately disposed of. 	Construction	All
	SSW48	<ul style="list-style-type: none"> Water from sedimentation basins would be used for construction purposes, such as dust suppression, where feasible. 	Construction	All
	SSW49	<ul style="list-style-type: none"> When sedimentation basins require pumping out rather than discharge via a flow outlet, a float would be attached to the suction hose or the hose would be located inside a bucket to prevent sediment from the basin floor from being discharged. 	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	SSW50	<ul style="list-style-type: none"> Records would be kept of water quality monitoring and erosion and sediment control inspections, including details of rain events, use of flocculants, discharge, sediment removal and dewatering activities. 	Construction	All
Chemical use and storage	SSW51	<ul style="list-style-type: none"> Physical controls to address the potential risks associated with the use and storage of chemicals on site would include: <ul style="list-style-type: none"> Use of appropriately bunded storage facilities for chemicals and fuels Use of appropriately bunded areas for refuelling and washdown Availability of effective spill kits at all construction sites. 	Construction	All
Ancillary facility management	SSW52	<ul style="list-style-type: none"> Measures to be implemented to minimise impacts to surface and ground water quality include: <ul style="list-style-type: none"> Bunded storage facilities for chemicals and clay lined where located on land where groundwater is within two metres of the ground surface Bunded areas for refuelling and washdown Locating storage areas away from areas of known near-surface groundwater supplies, in areas where the water table is more than five metres below the surface, otherwise the areas are to be lined if they are located over a shallow groundwater source less than two metres deep. Providing bunded storage facilities for chemicals; these bunded areas would be lined with clay where located on land where groundwater is within two metres of the ground surface Providing bunded areas for refuelling and washdown Locating storage areas away from areas of known near-surface groundwater supplies, in areas where the water table is more than five metres below the surface; otherwise, the areas would be lined if located over a shallow groundwater source less than two metres deep. 	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	SSW53	<ul style="list-style-type: none"> At ancillary facilities, management of runoff and spills would include: <ul style="list-style-type: none"> Restricting vehicle movements to designated pathways where feasible Paving areas that would be exposed for extended periods, such as car parks and main access roads, where feasible Diverting off-site runoff around sites where required Locating chemical or other hazardous material storage areas away from areas of known near-surface groundwater supplies, in areas where the water table is more than five metres below the surface; otherwise, areas would be lined if they are to be located over a shallow groundwater source less than two metres deep If the above local controls are not implemented, and where required, treating onsite runoff with a construction or compound-specific sedimentation basin, which would be monitored for parameters such as dissolved oxygen levels and organics to determine suitable discharge to the environment (such basins would be considered during detailed design). 	Construction	All
	SSW54	<ul style="list-style-type: none"> Where possible, stockpiles, vehicle washdown, batch plants, refuelling and chemical storage sites would be located in areas where the groundwater table is located greater than five metres from the surface. 	Construction	All
	SSW55	<ul style="list-style-type: none"> Mitigation of borrow source sites (particularly Lang Hill) would be in line with Volume 2E of the Blue Book which covers water management of mines and quarries. 	Construction	8,10
	SSW56	<ul style="list-style-type: none"> Management of soil and erosion issues at borrow sources would include : <ul style="list-style-type: none"> Development of detailed site specific erosion sediment control plans for borrow sources covering construction and rehabilitation of the site (considering the needs for any adjacent aquatic habitats). Diverting upstream runoff around borrow sources. Treating runoff from borrow sources at the source as per the Blue Book (Landcom, 2004 and DECC, 2008) requirements, or otherwise treating with a site-specific sedimentation basin and monitoring the sedimentation basin for parameters such as dissolved oxygen levels, pH and organics to determine suitable discharge to the environment (such basins would be considered during detailed design). 	Construction	8,10

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	SSW57	<ul style="list-style-type: none"> Runoff from the Lang Hill borrow source would be treated by a sedimentation basin. The required water quality parameters for the basins discharging into this area would be determined during detailed design based on pre-construction water quality monitoring. These would be included in the EPL. Discharges from the sediment basins during construction that do not meet the water quality parameters for Oxleyan Pygmy Perch habitat should not be discharged into the waterway but rather sprayed into adjacent open grass areas or used for construction purposes such as dust suppression to avoid changing water depth and physico-chemical conditions in the potential Oxleyan Pygmy Perch Habitat. If it is not feasible to irrigate to land to completely re-use sediment basin water, then as a last resort discharge water from sedimentation basins to Oxleyan Pygmy Perch waterways will be treated to ensure it has the correct pH of less than 6.5 and total suspended solids of less than 50mg/L. 	Construction	8
Management of groundwater intersection	SSW58	<ul style="list-style-type: none"> Further assessment involving geotechnical boreholes, monitoring boreholes and water quality testing at cutting sites would be undertaken at deep cutting sites to confirm that impacts would be limited to minor impacts on local groundwater reserves. 	Pre-construction	All
	SSW59	<ul style="list-style-type: none"> Where groundwater is released, recharge of the water table is the preferred option of managing groundwater. This would be facilitated by collecting groundwater in grassed swales for infiltration back to the groundwater source. Where possible, these swales would divert the groundwater around the construction area so that the groundwater does not further mix with construction runoff. 	Construction	All
	SSW60	<ul style="list-style-type: none"> If recharging is not possible or suitable, then discharging groundwater would be collected via the sedimentation basins before discharge into natural waterways. If discharging to downstream groundwater, then the potential effects of mounding¹ would be mitigated. 	Pre-construction	All
	SSW61	<ul style="list-style-type: none"> Dewatering of excavations would be undertaken in line with RMS' Technical Guideline – Environmental Management of Construction Site Dewatering (RMS, 2011c), and in accordance with any licence conditions. 	Construction	All

¹ An outward and upward expansion of the free water table caused by surface recharge.

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Prevention of groundwater impacts at type A and type B cuttings and major embankments	SSW62	<ul style="list-style-type: none"> The proposed management strategy to address potential impacts at type A cuttings includes: <ul style="list-style-type: none"> Pre-works investigations — geotechnical investigations of cuts to determine groundwater condition (quality parameters: electrical conductivity, groundwater depth, geological information), presence of actual or potential acid sulfate soils, presence or potential of salinisation, establishing groundwater monitoring sites, and gathering of other pertinent information Assessment — involving this study, the pre-works investigations carried out, groundwater modelling of cuts (and the Rous Water Woodburn borefield site), and predictions made from those results Monitoring — to assess whether the investigation and its predictions are accurate and to instigate early intervention in the unlikely case/s that the actual outcomes deviate from predictions. Monitoring would start before construction, and continue during construction. Monitoring would also continue into the operation phase of the project until groundwater conditions have stabilised Mitigation — implement environmental and engineering management measures where predictions and/or modelling and monitoring suggest that these are required to minimise impacts on groundwater. 	Pre-construction and construction	All
	SSW63	<ul style="list-style-type: none"> The monitoring of type B cuttings and major embankments would commence before construction to identify the need to implement any mitigation measure. 	Pre-construction, construction and operation	All
	SSW64	<ul style="list-style-type: none"> If required to manage groundwater impacts at type A and type B cuttings and major embankments, the following engineering mitigation measures would be considered: <ul style="list-style-type: none"> Engineering measures that transfer the seepage water downstream. Standard practice would be to collect the seepage from the cut face in the drainage system for the highway, which would be diverted into water quality basins before being released back into the creek or natural drainage system at some point downstream. Engineering impact mitigation measures that transfer the seepage water (where present) into the groundwater ecosystem immediately downslope of the cutting or embankments. 	Pre-construction and construction	All
	SSW65	<ul style="list-style-type: none"> Major embankments will be designed to enable distributed flow of surface waters. 	Pre-construction and construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Prevention of potential impacts on groundwater quality	SSW66	<ul style="list-style-type: none"> Measures to manage high-risk groundwater impact areas would continue to be considered through the detailed design process. In identified areas, the design of water quality controls would be reviewed and the need for additional controls may be identified. 	Pre-construction	All
	SSW67	<ul style="list-style-type: none"> Where practical, sites used for stockpiles, washdown, batch plants, refuelling and chemical storage would be located in areas where the water table is more than five metres below the surface. If this is not possible, the sites would be lined to protect groundwater. The sites that require lining to protect groundwater would be identified during detailed design. 	Construction	All
Prevention of impacts on Rous Water bore fields	SSW68	<ul style="list-style-type: none"> All construction runoff in the catchment of the Rous Water bore fields would be diverted to sedimentation basins. No runoff would bypass the basins untreated, regardless of the size of the footprint of the work. In addition, all basins in the bore fields would be clay lined to prevent seepage. If required, the depth of the basins would be reduced from the standard depth of two metres to one metre in these areas to avoid penetration of the natural clay layer, with the volume of the basins maintained by increasing their footprint. 	Construction	Section 8
	SSW69	<ul style="list-style-type: none"> Sizing of sedimentation basins in the Rous Water bore fields would be reviewed to consider the use of 90th percentile basins. 	Construction	Section 8
	SSW70	<ul style="list-style-type: none"> The following construction activities would not be permitted within the Rous Water bore field catchment: <ul style="list-style-type: none"> Refuelling Washdown Storage of chemicals or other hazardous substances Installation of concrete batch plants. 	Construction	Section 8
	SSW71	<ul style="list-style-type: none"> Water quality ponds would be designed to be shallower between stations 131.1 and 134.0 (namely one metre compared to two metres) to avoid penetration of the natural clay layer, where possible. Alternatively, where not feasible, clay capping/ lining of the basin would be undertaken. 	Pre-construction	Section 8
	SSW72	<ul style="list-style-type: none"> Alternative operational water quality management measures such as the use of biofilters, sand filters or measures used in the Tintenbar to Ewingsdale Pacific Highway upgrade project would be considered during detailed design. 	Pre-construction	Section 8
	SSW73	<ul style="list-style-type: none"> Consultation will be undertaken with Rous Water to co-ordinate mitigation actions including the definition of appropriate buffer zones between the project and bores. 	Pre-construction	Section 8

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Protection of water quality	SSW74	<ul style="list-style-type: none"> Permanent water quality management and protection measures to protect adjacent waterways from pollutants from the highway upgrade would include: <ul style="list-style-type: none"> Permanent water quality basins Grassed swales Gross pollutant traps. 	Operation	All
	SSW75	<ul style="list-style-type: none"> All permanent water quality basins would incorporate measures to contain accidental fuel and chemical spills resulting from vehicle accidents on the highway. Basins would be designed to accommodate a spill volume of up to 40,000 litres. 	Operation	All
	SSW76	<ul style="list-style-type: none"> For water quality treatment in floodplains and other locations with minimal changes in gradient, grassed swales would provide sufficient treatment to meet the water quality treatment targets. 	Operation	All
	SSW77	<ul style="list-style-type: none"> In addition to water quality basins and grassed swales, rock check dams would be used to provide additional impact mitigation, including mitigation of flow concentration and scour erosion. The sizes and locations of rock check dams would be determined during detailed design. 	Operation	All
Monitoring programs	SSW78	<ul style="list-style-type: none"> Surface water quality monitoring would be undertaken in accordance with RMS' Guideline for Construction Water quality Monitoring (RTA, 2003), and as per the framework outlined in the Working paper – Water quality. 	Pre-construction	All
	SSW79	<ul style="list-style-type: none"> Groundwater monitoring would be undertaken in accordance with the framework outlined in the Working paper – Groundwater (Section 5.2). 	Construction	All
Impacts to former Evans Head aerial bombing ranges	SSW80	<ul style="list-style-type: none"> Consultation will be undertaken with Department of Defence regarding the potential for unexploded ordnance to be encountered within the area of the Evans Head aerial bombing ranges. 	Pre-construction	9 and 10

19.4 Biodiversity (Chapter 10)

Table 19-3: Biodiversity mitigation measures

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
Monitoring strategy	B1	<ul style="list-style-type: none"> A measurable and targeted monitoring program would be developed to assess the effectiveness and success of the proposed biodiversity mitigation and management measures. The monitoring program would be prepared based on the outline in Appendix B of the Working paper – Biodiversity and in consultation with relevant state and Commonwealth agencies. This program would be finalised following project approval to incorporate any specific conditions of consent. 	Pre-construction	All
Connectivity Strategy	B2	<ul style="list-style-type: none"> The Connectivity Strategy would be further developed during detailed design, in consultation with relevant state and Commonwealth agencies, building upon the Connectivity Strategy in Appendix A of the Working paper – Biodiversity. 	Pre-construction	All
	B3	<ul style="list-style-type: none"> All fauna connectivity structures would be developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, building upon the current concept design structures. 	Pre-construction	All
Fauna exclusion fencing	B4	<ul style="list-style-type: none"> Fauna exclusion fencing locations and design would be further developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, building upon the current concept design. 	Pre-construction and construction	All
	B5	<ul style="list-style-type: none"> Fauna exclusion fencing required in low-lying floodplains would be designed to exclude emus from the road corridor. It would be placed higher on fill embankments to reduce impacts of flooding on the fauna fence. 	Construction	3 and 4
Arboreal crossing structures	B6	<ul style="list-style-type: none"> Tree surveys would be conducted at proposed rope and glider crossing locations outlined in the Connectivity Strategy to determine the most appropriate location to place arboreal crossing structures. The design would aim to place arboreal crossing structures at grade level, where average tree heights exceed 20 metres, and/ or taller trees would be naturally positioned close to the road edge. 	Pre-construction	All
Widened median	B7	<ul style="list-style-type: none"> Widened medians with retained vegetation are located in the design to provide connectivity for gliders. The design of fauna exclusion fencing and drainage or fauna underpass structures in widened medians would minimise vegetation clearing. 	Pre-construction and construction	1, 2 and 7

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
Flora and fauna management plan	B8	<ul style="list-style-type: none"> An overall project Flora and Fauna Management Plan would be prepared to detail consistent guidance on the general management measures required for flora and fauna across all stages of the project. The management plan would cover: Pre-clearing process Exclusion zones Re-establishment of native vegetation Clearing of vegetation and removal of bushrock Re-use of woody debris and bushrock Weed management Pathogen management Nest boxes Fauna handling Aquatic habitats and riparian zones. 	Pre-construction	All
Threatened species management sub-plans	B9	<ul style="list-style-type: none"> A threatened flora management sub plan would be prepared to specifically address project sections where populations of threatened flora are known to have plants immediately adjacent to the project footprint, as identified in this assessment and include: Identification and physically surveying and mapping the specific location of individuals and patches along the edges of the project boundary to inform the management actions of the flora and fauna management plan A clearing protocol, translocation trial, seed collection, storage and propagation to use in revegetation of disturbed habitats Details for protection of retained plants, planting and maintenance and monitoring procedure during construction A revegetation monitoring program and performance criteria, reporting and adaptive management. 	Pre-construction	All
	B10	<ul style="list-style-type: none"> A rainforest invertebrates management sub plan focusing on the Pink Underwing Moth and Atlas Rainforest Ground Beetle would be prepared and include: Details on targeted surveys of both species within and around the project boundary to identify the extent of the population and map the distribution of suitable habitat adjacent to the project. In particular potential breeding habitat containing the caterpillars' food plant, <i>Carronia multisepalea</i> should be identified. This would inform the detailed design, flora and fauna management plan and translocation and habitat rehabilitation program. The surveys will aim to map the species distribution and correlate presence with the habitat characteristics at identified sites to accurately model the distribution of potential habitat in proximity to the project Consideration to minimise or avoid impacts, where possible. The identified potential habitat would be targeted for translocation of individuals and habitat rehabilitation as compensation for the loss of habitat from the project 	Pre-construction	10, 11

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
		<ul style="list-style-type: none"> An outline of capture and relocation actions for Rainforest Ground Beetle and Pink Underwing Moth larvae focusing on identified suitable habitat Identify procedures for habitat rehabilitation and revegetation of suitable habitat near the project including the planting of the host plant for the Pink Underwing Moth. Details of a monitoring program for translocated individuals and retained habitat adjacent to the project. The monitoring program would include the collection of baseline data and would continue through construction and operation for a period of three years post-construction. The plan would include clear key milestones, performance indicators, corrective actions and timeframes for the completion of all actions outline. The plan would address the success of habitat rehabilitation as well as the translocation success by monitoring populations of the target species. 		
	B11	<ul style="list-style-type: none"> An emu management sub plan would be prepared and include: The location of emu exclusion fencing to be implemented during construction. The plan should also consider fence design around bridges to exclude domestic stock but allow emus to cross Detailed landscape plan including locations for dense plantings of Melaleuca and Casuarina species, and other suitable species to act as a natural barrier fence and to also direct emus to crossing areas where exclusion fencing is not possible. These plantings would form a natural dense barrier up to 4 to 5 metres wide. The natural brush barrier fence is to be established immediately following property acquisition through sections 3 and 4 and well in advance of clearing of vegetation to assist in educating emus to use crossing points. Gaps would be placed where the dedicated and combined structures are to finally be located. This is designed to allow time for the vegetated barrier to achieve suitable height and also to educate emus to use the designated crossing locations prior to construction Fencing locations, including how permanent and temporary fencing should be used Baseline monitoring of emu movements prior to clearing Roadside plantings in emu habitat (Section 3 and 4) should not be within the first 40 metres of the road unless there is fauna exclusion fencing in place or as part of the exclusion barrier. In particular, common landscape species such as Dianella, Gahnia, Lomandra and Ficus in addition to Bangalow Palm (Archontophoenix cunninghamiana) and soy, oats or rye grass cover crops should not be used as they represent food plants for emus and may attract them to the road edge Plantings under dedicated and combined bridges in emu crossing zones (Section 3 and 4) including the approaches to the crossing are to use grasses or low ground covers and avoid dense plantings of trees including low trees such as Acacia or Casuarina. This is to leave the opening clear. Ground cover crops such as soybean and oats or rye grass could be used on disturbed ground around the approaches to the bridge to attract emus to the crossing zone as these represent known food plants Identification of a trial to test the use of tethered twirling spirals, silver on one side and red or blue on the other. These can be trialled on different bridge underpasses targeted at attracting emus. These would have to be constructed in some way that could endure and would not harm other investigating wildlife 	Pre-construction	3-4

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
		<ul style="list-style-type: none"> The method and approach to monitoring the effectiveness of crossing structures for emus and consider the results of the pilot program for satellite / GPS tracking and other techniques such as camera monitoring. Thresholds for action regarding the need for additional structures will also be identified. 		
	B12	<ul style="list-style-type: none"> A management sub plan for threatened fish species Oxleyan Pygmy Perch would be prepared. This would include: <ul style="list-style-type: none"> Measures to avoid and mitigate impacts to threatened fish species in particular the Purple-spotted Gudgeon and Oxleyan Pygmy Perch and their habitat A methodology and program for survey of potential habitat for this species at least 6 months prior to construction in the appropriate season to inform the flora and fauna management plan and monitoring program Recommendations on the location of batch plants outside and away from Oxleyan Pygmy Perch habitat where sediment erosion will not runoff into waterway Procedures to avoid in-stream works on known and potential habitat for Oxleyan Pygmy Perch or Purple-spotted Gudgeon. The in-stream construction works should avoid the critical spring-summer period (October – December) where feasible and reasonable Where feasible and reasonable, existing pools should be retained upstream and downstream of crossings within known occurrences of the Oxleyan Pygmy Perch to provide resting and refuge habitat near crossing structures. A proposed program for monitoring the species at identified known locations, to include a before-after-control-impact design and continue during construction and operation for a period of five consecutive monitoring periods. A proposed adaptive management actions to be implemented for this species in the event that any changes to the identified populations or habitat conditions are demonstrated and can be attributed to the project construction or operation. Clear key milestones, performance indicators, corrective actions and timeframes for the completion of all actions outlined 	Pre-construction	1-4, 6-10
	B13	<ul style="list-style-type: none"> A threatened frog management sub plan (with a focus on the Giant Barred Frog, Green-thighed Frog, and Olongburra Frog) would be prepared and include: <ul style="list-style-type: none"> A program for survey or potential habitat for these species at least 6 months prior to construction to identify potential waterways and swamp habitat locations to inform the flora and fauna management plan A record of riparian / habitat condition baseline data at identified sites near the project to inform construction and post-construction monitoring program Identification of known sites, protection measures to be implemented during construction, monitoring methods and timing for species and habitat condition and monitoring mitigation measures and reporting in line with the flora and fauna management plan 	Pre-construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
		<ul style="list-style-type: none"> An outline of methods for monitoring species and habitat condition during post-construction. 		
	B14	<ul style="list-style-type: none"> A Koala management sub plan would be prepared and include details on targeted surveys to identify the presence and status of koala populations near the project alignment. The surveys will focus near the project alignment and the data used to inform further development of connectivity structures. 	Pre-construction	6-10
	B15	<ul style="list-style-type: none"> A glider management sub plan would be prepared and include: Targeted surveys for Squirrel Glider and Yellow-bellied Glider to inform the flora and fauna management plan, nest box management plan and the detailed design. The targeted surveys would inform the appropriate placement of the arboreal crossing structures and widened medians. 	Pre-construction	1-3, 6-8
	B16	<ul style="list-style-type: none"> A Lowland Rainforest management sub plan would be prepared and include targeted surveys for Lowland Rainforest to more accurately identify the distribution, condition and area of this community in proximity to the alignment. The survey would concentrate on classifying the community according the criteria used under the EPBC Act to identify the patches which meet the Commonwealth listed separately to the State listed community. The data from the survey would provide input into the flora and fauna management plan and the compensatory habitat measures for this community and for dependent threatened fauna species such as the Pink Underwing Moth. 	Pre-construction	8-11
Re-establishment of native vegetation	B17	<ul style="list-style-type: none"> A landscape management plan would be developed to provide specific details for the re-establishment of native vegetation on batters, cut faces, surrounding sediment basins and other areas disturbed during construction. This would include details for the appropriate removal and restoration of temporary creek crossings. The landscape management plan would be developed in line with RMS Biodiversity Guidelines (RTA, 2011a), the design principles identified in the Connectivity Strategy and the design principles in Working paper – Urban design, landscape character and visual impact. The approach to landscape planting for the purposes of fauna management would be consistent with principles set out in the urban design and landscape strategy for this project (refer to Working paper- Urban design, landscape character and visual impact). 	Pre-construction	All
Minimising loss of vegetation and habitat	B18	<ul style="list-style-type: none"> Disturbance and clearing of vegetation would be minimised, particularly : Avoiding and minimising vegetation removal wherever possible through the detailed design process Sensitive selection of ancillary facilities. The ancillary facilities identified present a selection of available sites; however during detailed design an evaluation should be conducted to select the minimum number of sites required with a priority to avoid native vegetation clearing if possible. A prior site inspection is required to survey and map hollow-bearing trees and check for large nests for species such as raptors, including Osprey and also Black-necked Stork at these sites Construction compounds and stockpile sites are to be sited in cleared or sparsely treed portions of the ancillary facility sites where feasible and reasonable, to avoid unnecessary clearing of vegetation and threatened flora species 	Pre-construction and construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
		<ul style="list-style-type: none"> Water quality basins would be placed in the optimal location for treating surface runoff. During detailed design, the location of water quality treatment measures would consider the competing environmental requirement of minimising vegetation removal, particularly where there is the potential for threatened plant species, threatened fauna habitat or in identified regional wildlife corridors. 		
Bridge and culvert design	B19	<ul style="list-style-type: none"> Instream structures such as bridges and culverts are to be designed and managed to minimise any potential impact to flow regimes and fish passage, in accordance with Fairfull and Witheridge (2003). Use of bridges or bebo arch is the preferred structure for Class 1 (major fish habitat) waterways. 	Pre-construction	All
	B20	<ul style="list-style-type: none"> Two Class 1 waterway crossing structures have not been designed as bridges, but rather as culverts (Redbank Creek region and an Unnamed Watercourse at Station 134.7). During detailed design, the design would be reviewed to consider bridge structures at these locations. 	Pre-construction	1, 8
	B21	<ul style="list-style-type: none"> All drainage structures between station 134.5 to 143.0 would be reviewed in consultation with Department of Primary Industries (Fisheries) to ensure suitable connectivity for threatened fish species is maintained. 	Pre-construction	8, 9
	B22	<ul style="list-style-type: none"> Each waterway crossing is to be designed to ensure no physical, hydraulic and behavioural barriers to aquatic fauna movements. Impacts would be minimised by ensuring that: The natural stream flow and velocity are maintained as closely as possible Surface level of any causeway is the same or lower than the natural stream bed to reduce interference with flow Habitat within a culvert is as natural as possible (eg allow rock and bed materials to infill the culvert base) There is the maximum light penetration Fauna and fish passage standards are maintained, as detailed in the Connectivity Strategy, including minimum design widths, including for natural banks, while also providing for scour protection and cut and fill batters Creek crossing structures would be designed to maximise habitat features within the passage. To achieve this, the design of bridge and culverts would encourage the deposition of sediment creating similar bed substrate to adjacent creek and the planning of specific plant species Pools would be constructed or retained upstream and downstream of the waterway crossings to provide resting and refuge habitat near the crossing structures Design culverts (specifically where Oxleyan Pygmy Perch has been confirmed) so that hydraulic habitat conditions would be suitable for fish passage Bridges would be designed and sized to limit peak flood velocities to less than 1m per second in commonly occurring flood events, similarly to the bridge design over Macdonalds Creek where Oxleyan Pygmy Perch have been confirmed. 	Pre-construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
	B23	<ul style="list-style-type: none"> Bridge structures would be designed in light of the following principles: Bridges are to be single span bridges with piers located outside the main channel Bridge structures to be designed to prevent an increase of backup of water during times of flood, that would enable Plague Minnow to access waterbodies where they are currently not found (eg Broadwater National Park) Construction would not alter or reduce flow where there are existing or potential Oxleyan Pygmy Perch populations (primarily within Sections 7, 8 and 9) which would negatively impact on this threatened species by draining the waterbodies. 	Pre-construction	All
Temporary and permanent waterway diversions/ crossings	B24	<ul style="list-style-type: none"> Where temporary access tracks are required over drainage lines with no flow, fords may be installed. 	Construction	All
	B25	<ul style="list-style-type: none"> Where possible, existing crossings would be used. Where this is not feasible or reasonable, the temporary crossings would be designed to minimise impacts on the existing aquatic ecology and water quality. 	Construction	All
	B26	<ul style="list-style-type: none"> Temporary crossings would be further investigated during detailed design including, location, type of structure, duration of need and rehabilitation process. 	Pre-construction	All
	B27	<ul style="list-style-type: none"> General temporary waterway access track mitigation measures have been provided below: Installation and subsequent decommissioning of temporary crossings would be undertaken outside of Oxleyan Pygmy Perch spawning seasons (October to March). Temporary crossings would be constructed from clean fill using pipe or box culvert cells to carry flows. All temporary works (eg crossings, flow diversion barriers) would be removed as soon as practicable and in a way that does not promote future channel erosion. The preferred temporary structure for crossing waterways would be consistent with Witheridge (2002) where the use of bridges is the preferred structure for Class 1 (major fish habitat waterways). Scour protection works would be established at temporary crossings as required At the completion of construction, the temporary crossings would be removed and rehabilitated. 	Construction	All
Fish translocation	B28	<ul style="list-style-type: none"> Fish that become stranded due to temporary access crossings or construction of temporary or permanent creek diversions must be captured and translocated following the DPI Fisheries Guidelines – A Guide to Acceptable Procedures and Practices for Aquaculture and Fisheries Research. General mitigation measures include: Fish to be captured from the creek using appropriate gear for the watercourse and species present. These methods may include electrofishing, seine nets, bait and fyke traps Threatened fish species are unlikely to occur within Picaninny Creek, however, translocation would be done in the cooler months to minimise stress to the fish (as fish are less active in the cooler months) Captured fish to be handled, transported and released in a manner that minimises any damage and 	Construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
		<ul style="list-style-type: none"> stress to the fish (such as handling the fish with wet hands) Fish would be released into an equivalent watercourse with similar water quality and habitat conditions. The capture of fish for translocation would require a Fisheries Permit and Animal Ethics Approval. 		
Pre-clearing surveys	B29	<ul style="list-style-type: none"> The pre-clearing process would be consistent with RMS Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA projects (RTA, 2011a) and include: Pre-clearing surveys by an experienced ecologist to identify the location and extent of important habitats in the construction footprint to be salvaged for reuse/relocation, such as bushrock, hollow trees and woody debris. Pre-clearing surveys by an experienced ecologist for large bird nests, particularly for listed species such as the Black-necked Stork, Eastern Osprey, Square-tailed Kite and Little Eagle during the nesting and breeding season (July to December). If the species is present in or directly adjacent to the project footprint, measures including buffer and exclusion zones, translocation of nests or establishment of adjacent nesting platforms would be considered, if required Habitat features to be protected during construction, would be identified and marked on-site by a qualified ecologist. Checking for threatened flora and fauna species immediately before clearing begins. This includes a targeted survey for threatened flora during the appropriate season and a survey of any bridges or culverts to be removed to search for roosting bats Identifying and marking on-site any exclusion zones Identifying nearby habitats on both sides of the existing highway along the length of the proposal suitable for the release of fauna that may be encountered during the pre-clearing process or habitat removal Mapping the location of any threatened flora and/or fauna species, Threatened Ecological Communities and habitat Developing an unexpected threatened species finds procedure to be included in the CEMP as outlined in the RMS Biodiversity Guidelines (RTA, 2011a) No parking of vehicles and/or machinery and storage of equipment and resources under the dripline of any trees. Construction traffic would be restricted to defined access tracks, fenced prior to the start of construction and maintained until construction is complete. 	Pre-construction and construction	All
Exclusion zones	B30	<ul style="list-style-type: none"> The location of exclusion zones would be identified, with temporary fencing or flagging tape to indicate the limits of clearing (in accordance with the RMS Biodiversity Guidelines (RTA, 2011a)). Permanent fauna exclusion fencing for the project (as described in the Connectivity Strategy), where reasonable and feasible, would be installed prior to clearing and can function as exclusion fencing. 	Construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
Staged removal process	B31	<ul style="list-style-type: none"> A staged habitat removal process would be implemented consistent with the RMS Biodiversity Guidelines (RTA, 2011a) and involve the following steps: Contact vet and/or wildlife carers to ensure they are willing to assist in treating injured animals if necessary An experienced and licensed wildlife carer and/or ecologist would be present during all habitat removal activities to capture and relocate any encountered fauna Remove non-habitat vegetation first Identified habitat (eg hollow-bearing trees) would be left for at least 24 hours after removing non-habitat vegetation to allow fauna to escape. Remove habitat trees as carefully as possible to avoid injury to any fauna still remaining in trees. An experienced and licensed wildlife carer and/or ecologist would inspect habitat once it is removed. All hollows would be placed in adjacent habitat until the following day for further inspection by a licensed wildlife carer and/or ecologist to verify no fauna is present. If possible, the hollows would be permanently relocated in adjacent areas in accordance with the RMS Biodiversity Guidelines (RTA, 2011a). Outcomes of the clearing process would be recorded to relevant personnel (eg environment manager or RMS regional environment staff). 	Construction	All
Re-use of woody debris and bushrock	B32	<ul style="list-style-type: none"> Woody debris and bushrock would be re-used on site for habitat improvement where possible and would be detailed in the landscape management plan in accordance with the RMS Biodiversity Guidelines (RTA, 2011a) and include: Implementing the removal, stockpiling, transportation and relocation of woody debris and/or bushrock in a manner that minimises disturbance to native vegetation or bushrock Engaging an ecologist in the pre-clearing phase of the proposal to provide advice on the re-use of woody debris and bushrock including potential negative impacts and positioning of woody debris and bushrock at the relocation areas When relocating woody debris, placing it evenly across the site whilst keeping topsoil disturbance to a minimum Avoiding the spread of any weeds or pathogens that may be in the soil when relocating woody debris and bushrock from stockpiles Mulching would include only native vegetation and separate stockpiles need to be established for weedy vegetation and the native vegetation to be mulched. Manage stockpiles in accordance with RTA's Stockpile Site Management Guideline, RTA Environmental Protection (Management System) QA Specification G36 and RTA Vegetation QA Specification R178 Preparing a mulch tannin management plan for the project where tannins are likely to be generated. 	Construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
Weed management	B33	<ul style="list-style-type: none"> A weed management plan would be developed as part of the CEMP, in accordance with the RMS Biodiversity Guidelines (RTA, 2011a) and the Introductory Weed Management Manual (Richards, 2004) and would include: Taxa and potential sources of the weed species (including alligator weed, tropical soda apple and myrtle rust) Weed management priorities and objectives Sensitive environmental areas within or adjacent to the site Location of weed infested areas Mechanical weed control methods such as slashing or mowing, as well as a range of herbicides to avoid the development of herbicide resistance Measures to prevent the spread of weeds A monitoring program to measure the success of weed management Strategic management with adjacent landowners Appropriate disposal of weed infested materials and soils to be identified in the CEMP Communication strategies to improve contractor awareness of weeds and weed management 	Pre-construction and construction	All
	B34	<ul style="list-style-type: none"> A site assessment by an ecologist or person trained in weed identification would be undertaken to identify the presence and extent of Alligator weeds. If present, management measures in the Weed Management Plan would be in accordance with the DPI Alligator Weed control manual (van Oosterhout, 2007). 	Pre-construction	7-10
Pathogen management	B35	<ul style="list-style-type: none"> Measures to prevent the introduction and/or spread of pests and disease causing agents such as bacteria and fungi would be incorporated into the CEMP, in accordance with the RMS Biodiversity Guidelines (RTA, 2011a) and would include: A background search of government-maintained websites for the most up-to-date hygiene protocols for each pathogen Provide vehicle and boot wash down facilities and ensure vehicles and footwear is free of soil before entering or exiting the site The risk of spreading pathogens and the mitigation measures required on site should be regularly communicated to staff and contractors during inductions and toolbox talks Construction works would be programmed to move from uninfected areas to any known infected areas Restrict vehicles to designated tracks, trails and parking areas 	Pre-construction and construction	All
	B36	<ul style="list-style-type: none"> If pathogens are identified on site: Testing may be required to confirm the presence of pathogens advice from government departments would be sought on practical hygiene management measures Fenced exclusion zones would be identified to restrict access into contaminated areas. 	Construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
Nest boxes	B37	<ul style="list-style-type: none"> Nest boxes would be installed as per RMS Biodiversity Guidelines (RTA, 2011a) and a nest box strategy developed as part of the CEMP, detailing: The number and type of nest boxes required based on the number, quality and size of the hollows that would be removed. Specifications for nest box dimensions, installation requirements, locations of nest boxes and ongoing monitoring and maintenance. Installation timeframes, including the installation of 70 % of nest boxes prior to the removal of any vegetation. 	Pre-construction and construction	All
Fauna handling	B38	<ul style="list-style-type: none"> To prevent injury and mortality of fauna during the clearing of vegetation and drainage of farm dams an experienced and licensed wildlife carer and/or ecologist would be present to supervise vegetation clearing and capture and relocate fauna where required. Further details regarding fauna handling and vegetation clearing procedures are provided in the RMS Biodiversity Guidelines (RTA, 2011a). The following would be implemented to avoid injury and fauna mortality: Allow fauna to leave an area without intervention as much as possible In circumstances where the handling of fauna is completely unavoidable, best practice methods need to be followed as outlined in the RMS Biodiversity Guidelines – Guide 9 Fauna Handling (RTA 2011) Include the procedures in project inductions for construction staff to implement if fauna is found or injured on site and also the importance of not feeding any wildlife that may be encountered on construction sites Never deliberately kill a snake as all snakes are protected under the NSW National Parks and Wildlife Act 1974 Keep records of fauna captured and relocated Report any injury to or death of a threatened species to the RMS environmental staff. 	Construction	All
Riparian and aquatic habitat management	B39	<ul style="list-style-type: none"> Prior to any disturbance of waterway banks, a thorough inspection by a qualified ecologist would be undertaken for aquatic fauna such as turtle nests. 	Construction	All
	B40	<ul style="list-style-type: none"> Streams to be crossed perpendicular to flow and where possible crossing sites selected to avoid unstable banks, bends in the channel, deep pools and confluences with other channels 	Pre-construction	All
	B41	<ul style="list-style-type: none"> Scour protection would be provided on any constructed works and temporary and permanent crossing structures within 50 m of Class 1 waterways or within the range of the Oxleyan Pygmy Perch as identified in section 3.9.6 of the Working paper – Biodiversity. 	Construction	All
	B42	<ul style="list-style-type: none"> The bed and banks are to be reinstated to a condition similar to or better than the original condition ensuring that there are no adverse impacts on the aquatic values (different measures may be required for each crossing). Banks are to be graded to a slope that is no steeper than existing site conditions 	Construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
	B43	<ul style="list-style-type: none"> The reinstatement process would need to ensure that there is no detrimental impact on geomorphic processes which in turn impacts aquatic values 	Construction	All
	B44	<ul style="list-style-type: none"> All water way crossing construction materials (rocks and gravel) are to be washed prior to being used for construction to minimise turbidity. 	Construction	All
	B45	<ul style="list-style-type: none"> Instream and riparian disturbance would be minimised and sediment, woody snags or debris removed from a stream or stream channel would be minimised. Trimming or 'lopping' of branches and logs would be considered as a first option before moving. 	Construction	All
	B46	<ul style="list-style-type: none"> Any instream woody debris removed during construction would be replaced at the completion of the works within the same waterways from which it was removed. 	Construction	All
	B47	<ul style="list-style-type: none"> A vegetation clearing strategy and a revegetation management strategy would be developed and implemented to minimise instream and riparian weed invasion. 	Construction	All
	B48	<ul style="list-style-type: none"> Avoid in-stream works on known and potential habitat (as identified in section 3.9.6 of the Working paper – Biodiversity) for Oxleyan Pygmy Perch or Purple-spotted Gudgeon to minimise sedimentation impacts. In stream works should be timed in a manner that minimises impacts to aquatic fauna. The in-stream construction works should avoid the critical spring-summer period (October – December) where feasible and reasonable as this represents the typical water temperatures between 19-34°C and high rainfall period when aquatic habitats are flowing and the spawning season for many fish species including the Oxleyan Pygmy Perch and Purple-spotted Gudgeon 	Construction	All
	B49	<ul style="list-style-type: none"> Where feasible and reasonable, existing pools would be retained upstream and downstream of crossings within known occurrences of the Oxleyan Pygmy Perch to provide resting and refuge habitat near crossing structures. 	Construction	1 to 4 and 6 to 10.
	B50	<ul style="list-style-type: none"> Appropriate plant species would be incorporated into the rehabilitation of disturbed aquatic habitats and drains as a result of construction, in regions of suitable Oxleyan Pygmy Perch habitat. 	Construction	All
	B51	<ul style="list-style-type: none"> All sediment and erosion control measures would be put in place during the construction process and may include sediment and erosion control curtains in the waterways to control turbidity generated during the construction and restoration process 	Construction	All
	B52	<ul style="list-style-type: none"> No turbid water generated from the construction corridor or construction area is to be discharged to any waterway 	Construction	All

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
	B53	<ul style="list-style-type: none"> The proposed road surface would drain away from known Oxleyan Pygmy Perch habitat to reduce potential for pollution. 	Pre-construction, construction and operation	1 to 4 and 6 to 10.
	B54	<ul style="list-style-type: none"> Operational spill basins are to be installed at key locations ie near Broadwater National Park and other key drainage lines that lead directly into threatened fish habitat. 	Operation	All
	B55	<ul style="list-style-type: none"> Chemicals and fuels would be appropriately stored and bunded, away from waterways and drainage lines. 	Construction	All
Water quality	B56	<ul style="list-style-type: none"> Discharges from sediment basins and/or treatment wetlands that do not meet the water quality parameters for Oxleyan Pygmy Perch habitat (to be determined through pre-construction water quality monitoring) would not be discharged into waterways but rather sprayed into adjacent open grass areas or used for construction purposes such as dust suppression to avoid changing water depth and physio-chemical conditions in potential threatened fish habitat. 	Construction	1 to 4 and 6 to 10.
	B57	<ul style="list-style-type: none"> If not reasonable and feasible, to irrigate land to completely re-use water from sedimentation basins during construction in Oxleyan Pygmy Perch habitat, as a last resort, water could be discharged to waterways after treatment (to ensure the pH less than 6.5 and total suspended solids of less than 50mg/L) depending on environmental protection licensing requirements. 	Construction	1 to 4 and 6 to 10.
	B58	<ul style="list-style-type: none"> Water quality monitoring would be undertaken to assess the effectiveness of (and where necessary amend) water, sediment and erosion management strategies that aim to protect the Oxleyan Pygmy Perch and Purple-spotted Gudgeon, their habitat and other aquatic flora and fauna species. Water quality monitoring program would be undertaken in line with details in Appendix B of the Working paper – Biodiversity. 	Construction	1 to 4 and 6 to 10.
Stockpile and ancillary facilities management	B59	<ul style="list-style-type: none"> Stockpiles would be located above the 1:100 year flood level with appropriate management control measures in place such as bunding. 	Construction	All
	B60	<ul style="list-style-type: none"> Stockpiling of material for bridgeworks at known areas of Oxleyan Pygmy Perch would be undertaken after April to avoid the breeding seasons of October to March. 	Construction	1 to 4 and 6 to 10.
	B61	<ul style="list-style-type: none"> Batch plants would be located outside well away from Oxleyan Pygmy Perch habitat where sediment erosion would not runoff into waterways (due to the risk of high alkaline runoff) 	Construction	1 to 4 and 6 to 10.

Issue	Mitigation ID no	Mitigation measure	Timing	Relevant section
	B62	<ul style="list-style-type: none"> Ancillary facilities would be sensitively location to avoid removal of any Threatened Ecological Community. 	Pre-construction and construction	All
	B63	<ul style="list-style-type: none"> Stockpiles would be managed in accordance with RTA's Stockpile Site Management Guideline. 	Construction	All
Slender Screw Fern	B64	<ul style="list-style-type: none"> The project boundary in section 1 to be reviewed to identify any opportunities to avoid significant impacts to the existing population 	Pre-construction	1
	B65	<ul style="list-style-type: none"> The project boundary and placement of sedimentation basins would be evaluated to minimise impacts to Slender Screw Fern. 	Pre-construction	6
Biodiversity Offset Strategy	B66	<ul style="list-style-type: none"> The Biodiversity Offset Strategy (detailed in Appendix C of the Working paper – Biodiversity) would be further developed, in consultation with relevant state and Commonwealth agencies, and implemented during detailed design. 	Pre-construction	All

19.5 Urban design, landscape character and visual impact (Chapter 11)

Table 19-4: Urban design, landscape character and visual impact mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Noise wall visual impacts	UD1	If further noise modelling undertaken during detailed design identifies that noise walls would be required, further visual assessment will be required to address the visual implications of the change. Their location and design would be in accordance with the Noise Wall Design Guideline (RTA, 2007) and the principles identified in Working Paper – Urban design, Landscape Character and Visual Impact (Section 4.6.3).	Pre-construction	All
Clarence River and Richmond River bridge impacts	UD2	If the design of the Clarence and Richmond rivers bridges changes from the structures identified and assessed in this EIS, further visual assessment would be required, including assessment of any shadowing impacts. Any changes would consider the principles identified in Working Paper – Urban design, Landscape Character and Visual Impact (Section 4.6.2).	Pre-construction	5, 9
Landscaping and planting strategy	UD3	The project would be carried out in accordance with the urban design and landscaping strategy, as identified in Section 11.4.1 of this EIS. It would be further developed into detailed landscape design for all project batters, and median planting areas would be developed in accordance with the Landscape Guidelines (RTA, 2008), the requirements of the Working Paper – Biodiversity (Section 5.2.2) and the landscape strategy to provide a robust, successful and effective planting design.	Pre-construction	All
	UD4	Mitigation measures identified to mitigate visual impacts to viewpoints would be implemented as per the Working Paper – Urban Design, Landscape Character and Visual Impact (Section 4) and the urban design and landscape strategy.	Pre-construction and construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Design of urban design features and road furniture	UD5	<p>The built form of the project, including consideration of the height, bulk, scale, materials and finishes for:</p> <ul style="list-style-type: none"> • Bridges • Retaining walls • Cuttings and embankments • Road barriers • Signage • Fences • Clear zones • Topsoil management • Water quality control ponds • Fauna crossing • Place marking and cultural plantings <p>would be designed in accordance with the design principles identified in Working Paper – Urban Design, Landscape Character and Visual Impact, and relevant RMS guidelines including Beyond the Pavement (RTA, 2009a), Pacific Highway Urban Design Framework (RTA, 2005) and Bridge Aesthetic Guidelines (RMS, 2012).</p>	Pre-construction	All
Shadowing	UD6	Further assessment would be undertaken of the impact of overshadowing on areas surrounding the project, particularly around Harwood Bridge, interchanges and overpasses near residential properties.	Pre-construction	All
Visual impacts from viewpoints	UD7	Measures to mitigate visual impacts on particular residences would be implemented, as identified in Table 11-42 and Working Paper – Urban Design, Landscape Character and Visual Impact. If any further viewpoints were identified during detailed design that would have a moderate-high or high impact, screen planting would also be considered.	Construction	All
Construction visual impacts	UD8	Disturbed areas would be progressively revegetated throughout the construction period.	Construction	All
Visual impacts of ancillary facilities	UD9	<p>Typical landscape treatments for ancillary facilities in forest areas would include:</p> <ul style="list-style-type: none"> • Providing screen planting at ancillary facility locations to minimise visual impact and disturbance • Considering reinstatement of disturbed forest in heavily forested areas to ensure existing ecological corridors are maintained • Considering the importance of the visual landscape at each ancillary facility location and allowing restoration of important forest vegetation to prominent ridge lines or other landscape elements as appropriate • Negotiating with private landowners, as applicable, to determine future treatments for other non-forested ancillary facility locations. • Regrading disturbed areas to achieve a sustainable and functional landform • Stabilising all surfaces in accordance with good engineering and environmental practice 	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Visual impacts of ancillary facilities	UD10	<p>Typical landscape treatments for ancillary facilities in agricultural areas would include:</p> <ul style="list-style-type: none"> Considering returning remnant agricultural land to agricultural uses Providing screen planting to ancillary facility locations to minimise visual impact and disturbance Reinstating 'fingers' of riparian vegetation through ancillary facilities, where practicable, in the open landscape Considering the visual landscape at each ancillary facility and considering restoration of important forest vegetation to prominent ridge lines or other landscape elements as appropriate Regrading disturbed areas to achieve a sustainable and functional landform. Stabilising all surfaces in accordance with good engineering and environmental practise. 	Construction	All
Visual impact of Lang Hill and Lumleys hill material source	UD11	The extent of excavation and landscaping strategy at Lang Hill and Lumleys Hill would be reviewed considering material requirements on the project and the visual impact on the resultant cutting.	Pre-construction	Section 8 and 10
Monitoring of landscaping and rehabilitation	UD12	Landscape and rehabilitation works would be monitored and remedial measures implemented where required until vegetation has stabilised.	Operation	All
Earth mounds	UD13	Any earth mound design is to ensure the mounding profile blends suitably into the existing landscape setting. Any mounding to be landscaped should be compacted in 1.5m layers with 1:3 maximum batter slopes. Permanent mounds should be treated with ameliorants and overlaid with topsoil to minimum 150mm to ensure suitable planting conditions are achieved.	Construction	All
	UD14	Where mounding batters is to be steeper than 1:3, treatments such as the use of gabions or retaining walls should be considered.	Construction	All

19.6 Aboriginal Heritage (Chapter 12)

Table 19-5: Aboriginal heritage mitigation measures

Issue	Mitigation ID no	Management measure	Timing	Relevant section
General impacts to Aboriginal archaeological sites	AH1	Where artefact concentrations per square metre (over all depths) encountered are 50 per cent greater than previously encountered, additional salvage excavation using hand tools would be undertaken. If these artefact concentrations are encountered during machine excavation, then machine excavation would stop within 20 metres of the artefact concentrations. Up to, but no more than, an additional six square metres would be excavated in this situation at that site, unless rare features are encountered, in which case discussions with the registered Aboriginal stakeholders and NSW Office of Environment and Heritage would be undertaken to agree on a suitable approach.	Pre-construction and construction	All
	AH2	For areas avoided by construction, exclusion zones would be put in place to ensure archaeological deposits are not incidentally damaged. These would be fenced with parawebbing or some other similar fencing that would exclude entry by people or plant to avoid incidental impacts on the site.	Construction	All
	AH3	Salvage excavation and systematic collection of previously recorded artefacts that would be impacted by the project, along with any other impacted sites that are identified prior to or during construction, to be undertaken by qualified archaeologists in conjunction with the registered Aboriginal stakeholders <ul style="list-style-type: none"> The location of excavations would be within the area of the site to be impacted, and would be decided upon in the field by a qualified archaeologist and registered Aboriginal stakeholders If any datable material is located, a minimum of two samples (per archaeological site) would be subject to either radiocarbon, standard or accelerated mass spectrometry dating For all salvaged material, suitable storage would be agreed upon with the registered Aboriginal stakeholders prior to commencing salvage in those areas. 	Construction	All
	AH4	Curation of any collected heritage evidence in an appropriate manner, as determined in consultation with the registered Aboriginal stakeholders and the NSW Office of Environment and Heritage and in accordance with the National Parks and Wildlife Act 1974, details of the material's nature and context would also be provided.	Construction and post-construction	All
	AH5	Preparation of a detailed technical report documenting the results of the salvage excavations and the archaeological material analysis. Development of a summary report (to be made public) to accompany the technical report.	Construction and post-construction	All
	AH6	Lodgement of site records with NSW Office of Environment and Heritage for any previously unrecorded Aboriginal heritage evidence that is identified and for any evidence that is salvaged.	Construction and post-construction	All

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Human skeletal remains	AH7	<p>In the event that the project reveals possible human skeletal remains, the following procedure would be followed (in accordance with RMS' Standard Management Procedures: Unexpected Archaeological Finds 2011:</p> <ul style="list-style-type: none"> • As soon as remains are exposed, all construction would halt at that location immediately and the on-site supervisor would be immediately notified to allow assessment and management • The on-site supervisor would notify the Environmental Representative, RMS Project Manager and RMS Senior Environmental Officer. Police, EPA (Environment Line on 131 555) and the Heritage Branch ((02) 9873 8500) would also be contacted • A physical or forensic anthropologist would inspect the remains in situ (organised by the police unless otherwise directed by the police) and make a determination of ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or forensic) • Should the remains be identified as a forensic matter (ie crime scene), liaison with the police would be undertaken • Should the remains be identified as Aboriginal, liaison with RMS, the EPA, the Department of Planning and Infrastructure (DP&I) and registered Aboriginal stakeholders would be undertaken • Should the remains be identified as non-Aboriginal (historical), liaison with RMS, the Heritage Branch and the DP&I would be undertaken • No construction is to recommence in the area until appropriate clearances have been given. 	Construction	All
Aboriginal stakeholder consultation	AH8	Aboriginal focus group consultation (through letters or meetings), would occur at least once every six months, prior to and during construction (unless management actions have been completed).	Pre-construction and construction	All
	AH9	Further consultation with the registered Aboriginal stakeholders in relation to the project to provide them with the opportunity to be involved in the ongoing management of the Aboriginal heritage resource within the project boundary.	Construction and post-construction	All
Awareness of Aboriginal heritage	AH10	Aboriginal culture awareness training for all relevant staff and contractors prior to commencing work on-site. This could include information about the Aboriginal culture and history of the locality, nature of the identified and potential Aboriginal heritage evidence and cultural values within the project boundary, heritage management measures and protocols, and legal obligations. This service would be provided by suitably trained personnel from local Aboriginal organisations represented by the relevant registered stakeholders for that area.	Pre-construction and construction	All
	AH11	Appropriate precautionary measures to avoid identified heritage evidence. This would include informing relevant staff and contractors of the nature and location of the items and the need to avoid impacts, and temporary protective fencing and signage.	Pre-construction and construction	All

Issue	Mitigation ID no	Management measure	Timing	Relevant section
	AH12	Prepare an Aboriginal heritage interpretation strategy as part of the Aboriginal heritage management plan. This will identify how archaeological and cultural information can be sustainably communicated to different audiences, including the local Aboriginal community, the local general public and the broader group of people interested in Aboriginal heritage as part of the North Coast's history. Measures would include opportunities for promoting salvage and investigation, the recovery of information, permanent installations and ways of marking the presence of Aboriginal people in the landscape, including, signage, interpretation products such as written materials, and through place naming.	Pre-construction and construction	All
	AH13	Regular review of the Aboriginal heritage management plan to establish that it is functioning to the standard required.	Pre-construction and construction	All
	AH14	Compliance auditing of the cultural heritage management measures would be undertaken every three months during construction.	Construction	All
Ancillary facilities	AH15	At all locations proposed for ancillary facilities that are situated outside the current boundary of the project: <ul style="list-style-type: none"> Before the commencement of the use of the ancillary facilities area for the project, field survey would be undertaken by a suitably qualified and experienced heritage consultant. Any Aboriginal heritage items identified would be assessed for their level of significance, and appropriate recommendations presented to RMS for avoidance, harm minimisation and / or impact mitigation. Any investigation should be in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (OEH 2010b), and have regard to the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (DECCW 2010b). 	Pre-construction	All
Impacts on WWC39	AH16	Salvage excavation would be undertaken within the portion of the site to be impacted. Each excavation would be undertaken in 50 mm spits to sterile base deposits. <ul style="list-style-type: none"> The WWC39 (22-1-0343) site, 80 m² would be excavated by machine (a mechanical sieve and an excavator (about 900 mm bucket)). <p>Around 40% of the site would be avoided by construction, exclusion zones would be put in place to ensure the remaining archaeological deposits are not incidentally damaged. These would be fenced with parawebbing or some other similar fencing that would exclude entry by people or plant to avoid incidental impacts on the site.</p>	Construction	1
Impacts on WWC46	AH17	Salvage excavation would be undertaken within the portion of the site to be impacted. Each excavation would be undertaken in 50 mm spits to sterile base deposits. <ul style="list-style-type: none"> The WWC46 (22-1-0342) site, 40 m² would be excavated by machine (a mechanical sieve and an excavator (about 900 mm bucket)). 	Construction	1

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on WWC Dirty Creek 1	AH18	<p>Due to restricted property access the WWC Dirty Creek 1 (22-1-0403) site has only been subject to field survey. Therefore the following approach would be followed:</p> <ul style="list-style-type: none"> Subsurface testing: The methodology outlined in the archaeological assessment in the Woolgoolga to Ballina Aboriginal Cultural Heritage Assessment Report: Woolgoolga to Wells Crossing Section Volume 2 would be applied if identified as being required Salvage would be undertaken if the requirement is identified during subsurface testing. The triggers for subsurface testing would be: <ul style="list-style-type: none"> More than 10 but less than 50 artefacts – a minimum of 10 m² to be excavated by machine More than 50 but less than 100 artefacts – a minimum of 30 m² to be excavated by machine More than 100 but less than 300 artefacts – a minimum of 60 m² to be excavated by machine and hand excavation. If multiple site components are identified or a higher number of artefacts (300+) are identified within the area, these salvage measures may require revision All salvage quotas and revisions to salvage quotas would be approved by RMS' Senior Environmental Officer (Heritage), or the Office of Environment and Heritage All machine excavation would be undertaken with a mechanical sieve and an excavator (900 mm bucket) Each excavation would be undertaken in 50 mm spits to sterile base deposits. 	Construction	1
Impacts on Tyndale 2	AH19	<p>Salvage excavation would be undertaken within the portion of the site to be impacted. Each excavation would be undertaken in 50 mm spits to sterile base deposits.</p> <ul style="list-style-type: none"> The Tyndale 2 (13-1-0115) site, 20 m² would be excavated by machine (a mechanical sieve and an excavator (900 mm or 1100 mm bucket)). 	Construction	4
Impacts on IR2W4	AH20	<p>Salvage excavation would be undertaken within the portion of the site to be impacted. Each excavation would be undertaken in 50 mm spits to sterile base deposits.</p> <ul style="list-style-type: none"> The IR2W4 (13-1-0115) site, 60 m² would be excavated by machine (a mechanical sieve and an excavator (900 mm bucket)). 	Construction	8

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on Gittoes Jali	AH21	<p>For the Gittoes Jali (09-1-0204, 09-1-0205, 09-1-0203) site:</p> <ul style="list-style-type: none"> Where possible, impacts on the Gittoes Jali site would be reduced or avoided. To avoid impact, avoided areas would be fenced to ensure they are protected. If avoidance is not an option, then extensive salvage is recommended Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment from the site to 0.6 m depth that is proposed to be used outside the boundary of the site would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas 250 m² would be excavated by machine, which would be undertaken with a mechanical sieve and excavator (900 mm bucket). Hand excavation of around 130 m² would be undertaken in a controlled manner using trowels and / or shovels and 5 mm hand or mechanical sieves. This would be undertaken using an open excavation methodology to explore the features (such as knapping events, caches, etc) initially detected during subsurface testing (and any new features detected). Intra-site variability should be explored to attempt to detect activity zones within the site. <p>Paint wells and grinding rock:</p> <ul style="list-style-type: none"> Residue analysis would be undertaken to determine if any pigment is found within the wells. This would be undertaken by a suitably qualified consultant The location of these paint wells would be accurately plotted and drawn If the paint wells cannot be avoided, they would be relocated; this would require consultation with the registered Aboriginal stakeholders. <p>Geomorphology assessment:</p> <ul style="list-style-type: none"> A geomorphology assessment would be undertaken that encompasses the Gittoes Jali, E2/2, Site 11, and Melino sites. The assessment would be non-invasive, but could use observations of the machine salvage excavation. <p>Material source:</p> <ul style="list-style-type: none"> The extent of excavation at Lang Hill (encompassing the Gittoes Jali sites) would be reviewed in consultation with relevant Aboriginal stakeholders and consideration of urban design guidelines. 	Pre-construction and construction	8

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on E2/2	AH22	<p>For the E2/2 (13-1-01-09) site:</p> <ul style="list-style-type: none"> Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment from the site to 1.5 m depth that is proposed to be used outside the boundary of the sites would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas <p>Shell Midden</p> <ul style="list-style-type: none"> Hand excavation of 10 m² (near the fence line) of the midden that would be impacted to a total depth of 500 mm. This would be excavated in a controlled manner using trowels and 3 mm and 5 mm nested sieves It is recommended that a sequence of dates (radiocarbon or AMS) be collected from the hand excavation All shell recovered would be subject to analysis including minimum number of individuals (MNI) and weight (g). An analysis of the number of individual specimens (NISP) may also be undertaken if deemed appropriate. <p>Area surrounding the shell midden</p> <ul style="list-style-type: none"> 80 m² would be excavated by machine (a mechanical sieve and an excavator (900 mm bucket)) <p>Overburden</p> <ul style="list-style-type: none"> All overburden would be removed and sieved for cultural materials, to ensure any cultural material located within the overburden is collected. <p>Geomorphology assessment</p> <ul style="list-style-type: none"> A geomorphology assessment would be undertaken that encompasses the Gittoes Jali, E2/2, Site 11, and Melino sites. The assessment would be non-invasive, but could use observations of the machine salvage excavation. 	Pre-construction and construction	9

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on Site 11	AH23	<p>For Site 11 (13-1-0189):</p> <ul style="list-style-type: none"> Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment from the sites to 1.5 m depth that are proposed to be used outside the boundary of the sites would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas A minimum of 100 m² would be excavated by machine, which would be undertaken with a mechanical sieve and excavator (900 mm bucket). A minimum of 20 m² would be excavated by hand within the vicinity of the mechanical transect where a knapping floor was identified (543354E/6790489N). This would be excavated in a controlled manner using trowels and 3 mm and 5 mm nested sieves <p>Geomorphology assessment</p> <p>A geomorphology assessment would be undertaken that encompasses the Gittoes Jali, E2/2, Site 11, and Melino sites. The assessment would be non-invasive, but could use observations of the machine salvage excavation.</p>	Pre-construction and construction	9

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on Melino	AH24	<p>For the Melino (04-4-0173) site:</p> <ul style="list-style-type: none"> Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment from the sites to 1.5 m depth that are proposed to be used outside the boundary of the sites would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas An artefact scatter including a discrete knapping floor was located on the top of the rise. 30 m² would be excavated by machine. This would be undertaken with a mechanical sieve and excavator (900 mm bucket). Unless it can be avoided, directly adjacent to the original 1 m x 1 m Test Pit (542652E/6702777N), two 2 m x 1 m areas would require hand excavation. These would be excavated in a controlled manner using trowels and 5 mm sieve <p>Shell Midden</p> <ul style="list-style-type: none"> Hand excavation of 20 m² of the midden that would be impacted to a total depth of 1 m (this would be excavated in a controlled manner using trowels and 3 mm and 5 mm nested sieves) It is recommended that a sequence of dates (radiocarbon or AMS) be collected from the hand excavation All shell recovered would be subject to analysis including minimum number of individuals (MNI) and weight (g). An analysis of the number of individual specimens (NISP) may also be undertaken if deemed appropriate. <p>Area surrounding the shell midden</p> <ul style="list-style-type: none"> 100 m² would be excavated by machine (a mechanical sieve and an excavator (900 mm bucket)) <p>Geomorphology assessment</p> <ul style="list-style-type: none"> A geomorphology assessment would be undertaken that encompasses the Gittoes Jali, E2/2, Site 11, and Melino sites. The assessment would be non-invasive, but could use observations of the machine salvage excavation. 	Pre-construction and construction	10

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on Site 1	AH25	<p>For Site 1 (04-4-0179):</p> <ul style="list-style-type: none"> Further mechanical excavation would be undertaken in order to reach and record the depth of the archaeological deposit 10 m² to be excavated by machine. This would be undertaken with a mechanical sieve and an excavator (900 mm bucket). If constraints such as the water table are encountered, measures would be taken to safely stabilise and then proceed with deeper excavation Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment to 1 m depth from the site that is proposed to be used outside the boundary of the site would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas. 	Pre-construction and construction	10
Impacts on Site 2	AH26	<p>For Site 2 (04-4-0178):</p> <ul style="list-style-type: none"> Further mechanical excavation would be undertaken in order to reach and record the depth of the archaeological deposit 30 m² to be excavated by machine. This would be undertaken with a mechanical sieve and an excavator (900 mm bucket). If constraints such as the water table are encountered, measures would be taken to safely stabilise and then proceed with deeper excavation Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment to 1.5 m depth from the site that is proposed to be used outside the boundary of the site would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas. <p>Excavation at Site 2 would be undertaken at a time of the year when the water table is at its lowest, to ensure maximum depth can be reached with a machine.</p>	Pre-construction and construction	10
Impacts on Site 3	AH27	<p>For Site 3 (04-4-0175):</p> <ul style="list-style-type: none"> Further mechanical excavation would be undertaken in order to reach and record the depth of the archaeological deposit 40 m² to be excavated by machine. This would be undertaken with a mechanical sieve and an excavator (900 mm bucket). If constraints such as the water table are encountered, measures would be taken to safely stabilise and then proceed with deeper excavation Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment to 1.5 m depth from the site that is proposed to be used outside the boundary of the site would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas. <p>Excavation at Site 3 would be undertaken at a time of the year when the water table is at its lowest, to ensure maximum depth can be reached with a machine.</p>	Pre-construction and construction	10

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on Site 4	AH28	<p>For Site 4 (04-04-0132):</p> <ul style="list-style-type: none"> Further mechanical excavation would be undertaken in order to reach and record the depth of the archaeological deposit 20 m² to be excavated by machine. This would be undertaken with a mechanical sieve and an excavator (900 mm bucket). If constraints such as the water table are encountered, measures would be taken to safely stabilise and then proceed with deeper excavation Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment to 0.5 m depth from the site that is proposed to be used outside the boundary of the site would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas. 	Pre-construction and construction	10
Impacts on Site 12	AH29	<p>For Site 12 (04-4-0176):</p> <ul style="list-style-type: none"> Further mechanical excavation would be undertaken in order to reach and record the depth of the archaeological deposit 10 m² to be excavated by machine. This would be undertaken with a mechanical sieve and an excavator (900 mm bucket). If constraints such as the water table are encountered, measures would be taken to safely stabilise and then proceed with deeper excavation Salvage excavation would be undertaken in 50 mm spits to sterile base deposits Any sediment to 1.2 m depth from the site that is proposed to be used outside the boundary of the site would be sieved to remove any cultural material to ensure new sites are not recorded in relocation areas. 	Pre-construction and construction	10, 11
Impacts on the Gumi Scarred Tree	AH30	<p>For the Gumi site (04-4-0180):</p> <ul style="list-style-type: none"> The Gumi scarred tree would be removed and the trunk would be relocated to an area agreed to with the registered stakeholder groups and Roads and Maritime Services – an arborist would be consulted to guide in the removal of the tree The location would be visually protected during the construction and operation of the road with culturally sensitive plantings or by existing vegetation Access to the tree would be provided for local Aboriginal people to enable them to be able to use the tree as a teaching site. 	Pre-construction and construction	10

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on the Melino Scarred Tree	AH31	<p>For the Melino Scarred Tree 4 (04-4-0166) site:</p> <ul style="list-style-type: none"> Prior to construction a 15 m exclusion zone would be established around the scarred tree and maintained until construction activities have ceased. The exclusion zone would be fenced using chain wire or plastic mesh and star pickets. 'Do Not Enter' signage would be attached to the fencing. A representative of the Local Aboriginal Land Council would be present during establishment of the fencing <p>An arborist would be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree.</p>	Pre-construction and construction	10
Impacts on the MST3 Scarred Tree	AH32	<p>For the MST3 (04-4-0131) site:</p> <ul style="list-style-type: none"> Prior to construction a 15 m exclusion zone would be established around the scarred trees and maintained until construction activities have ceased. The exclusion zone would be fenced using chain wire or plastic mesh and star pickets. 'Do Not Enter' signage would be attached to the fencing. A representative of the Local Aboriginal Land Council would be present during establishment of the fencing <p>An arborist would be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree.</p>	Pre-construction and construction	10
Impacts on the C21 Scarred Tree	AH33	<p>For the C21 (04-4-0107) site:</p> <ul style="list-style-type: none"> Prior to construction a 15 m exclusion zone would be established around the scarred trees and maintained until construction activities have ceased. The exclusion zone would be fenced using chain wire or plastic mesh and star pickets. 'Do Not Enter' signage would be attached to the fencing. A representative of the Local Aboriginal Land Council would be present during establishment of the fencing <p>An arborist would be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree.</p>	Pre-construction and construction	10
Impacts on the MSRT2 Scarred Tree	AH34	<p>For the MSRT2 (04-4-0130) site:</p> <ul style="list-style-type: none"> Prior to construction a 15 m exclusion zone would be established around the scarred trees and maintained until construction activities have ceased. The exclusion zone would be fenced using chain wire or plastic mesh and star pickets. 'Do Not Enter' signage would be attached to the fencing. A representative of the Local Aboriginal Land Council would be present during establishment of the fencing <p>An arborist would be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree.</p>	Pre-construction and construction	10

Issue	Mitigation ID no	Management measure	Timing	Relevant section
Impacts on the Rudgley Scarred Tree	AH35	<p>For the Rudgley Scarred Tree (04-4-0170) site:</p> <ul style="list-style-type: none"> Prior to construction a 15 m exclusion zone would be established around the scarred trees and maintained until construction activities have ceased. The exclusion zone would be fenced using chain wire or plastic mesh and star pickets. 'Do Not Enter' signage would be attached to the fencing. A representative of the Local Aboriginal Land Council would be present during establishment of the fencing An arborist would be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree. 	Pre-construction and construction	10
Impacts to Corridors of Movement	AH36	<ul style="list-style-type: none"> Aboriginal culture and heritage awareness induction workshops would be undertaken by all construction staff Educational and cultural signage would be placed at viable locations along the highway in this locality, potentially describing the history of Aboriginal occupation of the area. At a minimum, signage would include acknowledging the area as the traditional lands of the Gumbaynggir peoples. Any signage would be subject to approval by the registered Aboriginal stakeholders. 	Pre-construction, during, and post-construction	1
	AH37	<p>Tyndale and Woodford Island Corridors of Movement:</p> <ul style="list-style-type: none"> Pedestrian access across the project would be provided if reasonable and feasible within the existing local road network, to maintain the connectivity of this corridor of movement. 	Pre-construction, during, and post-construction	3
	AH38	<p>Pillar Valley Corridors of Movement:</p> <ul style="list-style-type: none"> Pedestrian access across the project would be provided if reasonable and feasible within the existing local road network, to maintain the connectivity of this corridor of movement. 	Pre-construction, during, and post-construction	3
Direct impact on culturally significant places	AH39	<p>Place B</p> <ul style="list-style-type: none"> To maintain connectivity, access would be provided across the project area, from the end of Richmond Road, Pine Tree Road, or Fischer St to Broadwater National Park during construction and operation, in consultation with the traditional owners Pedestrian access within the project boundary would be provided where feasible and reasonable from the eastern side of the project to the western side of Broadwater National Park. A connection from the existing Pacific Highway to Broadwater National Park along Eversons Lane would be considered, in consultation with traditional owners and relevant land owners. 	Pre-construction, during, and post-construction	9, 10

Issue	Mitigation ID no	Management measure	Timing	Relevant section
	AH40	Place D <ul style="list-style-type: none"> Signage acknowledging the traditional owners of the area and providing information on culture would be installed within the highway corridor between Woodburn and Wardell as agreed with the registered stakeholder group. 	Pre-construction, during, and post-construction	9, 10
	AH41	Place K <ul style="list-style-type: none"> To gather further information on the broader landscape, it is recommended that a geomorphological assessment within the extent of Place K be undertaken, including the geomorphological setting of the archaeological sites within this landscape, and how the landscape has formed and changed over the last 40,000 years. This would take into account both the cultural and scientific significance of the place. A report would be produced by a geomorphologist in conjunction with an archaeologist / anthropologist. 	Pre-construction, during, and post-construction	11
Indirect impact on culturally significant places	AH42	Place E <ul style="list-style-type: none"> This place would be fenced prior to and during construction to avoid incidental impact on it. Surface water runoff from the construction site or from the highway pavement during operation of the project would be prevented from directly entering into Place E. 	Pre-construction, during, and post-construction	9
Indeterminate impact on culturally significant places	AH43	Place C <ul style="list-style-type: none"> An education package would be prepared to pass information associated with this area onto future generations. This would include at a minimum a printed document detailing the story of the occupation of this area and the ensuing massacre. Further research and interviews would be undertaken for this purpose. Where possible, oral recordings and/or video footage would also be compiled into the package Caution would be undertaken in and around the project in this area with regard to potential human remains. 	Pre-construction, during, and post-construction	9, 10

19.7 Historical (non-Aboriginal heritage) (Chapter 13)

Table 19-6: Historical (non-Aboriginal heritage) mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Unidentified historical heritage materials, features and/or deposits	HH1	<p>If at any time during construction associated with the project, unidentified historical heritage materials, features and/or deposits are found, the NSW Roads and Maritime Services' Standard Management Procedure: Unexpected Archaeological Finds (2011) would be followed, specifically:</p> <ul style="list-style-type: none"> All construction that could potentially harm the historical heritage materials, features or deposits would cease (including stopping all construction within at least 10 metres). Only construction that is required to comply with occupational and environmental health and safety standards and/or to protect the historical heritage would occur. Construction that does not have the potential to harm the historical heritage would continue only if it is outside the minimum 10-metre buffer A suitably qualified and experienced archaeologist (the archaeologist) would be contacted as soon as practicable in relation to the unexpected discovery of any historical heritage and would be responsible for recording, in detail, the location and context of any historical heritage. Any materials, features and/or deposits would be analysed and/or catalogued and any official site records would be created or updated (where appropriate). The archaeologist would also make recommendations for the management of the historical heritage in relation to the project If avoidance of the heritage item were not possible, the archaeologist would conduct a salvage excavation. The aims of the salvage excavation would be to obtain as much information as possible from the historical heritage materials, features and/or deposits The archaeologist would provide a report detailing the excavation, salvage and analysis results to the Heritage Branch of the Office of Environment and Heritage at the completion of the salvage RMS would be responsible for the costs associated with assessing, cataloguing, labelling and packaging (etc) any historical heritage materials, features and/or deposits Construction would only recommence within the area of exclusion when appropriate protective measures have been undertaken, relevant records updated and/or completed and when all parties agree there is no other prudent or feasible course of action. 	Construction	All
Human skeletal remains	HH2	Should human skeletal remains be identified during construction, the procedure outlined in AH7 would apply (refer to section 12.4 of this EIS).	Construction	All
Awareness of non-Aboriginal heritage items	HH3	Contractors would be given awareness training on non-Aboriginal historical heritage prior to commencement of construction works to ensure understanding of potential heritage items and the procedure in the event of discovery of historical heritage materials, features or deposits, or the discovery of human remains.	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Ancillary facilities	HH4	At the nine proposed locations for ancillary facilities that have been identified as having medium potential for the presence of previously unrecorded or unknown historical heritage sites: <ul style="list-style-type: none"> Before the commencement of the use of the ancillary facilities, field survey would be undertaken by a suitably qualified and experienced heritage consultant. Any historical heritage items identified would be assessed for their level of significance. For those heritage items identified as being of state or local heritage significance an impact assessment would be undertaken and provided to the Heritage Branch of the Office of Environment and Heritage. 	Pre-construction	All
	HH5	Where local or state significant heritage items are identified on an ancillary site and use of the site would impact on the heritage significance of the item, the site would not be used for ancillary facilities.	Pre-construction	All
	HH6	Where local or state significant heritage items are identified on an ancillary site and use of the site would not impact on the heritage significance of the item, appropriate management measures (such as barrier fencing) would be put in place to clearly identify the heritage item and exclude use of the ancillary site within the heritage item's curtilage. Use of these ancillary facilities may commence: <ul style="list-style-type: none"> When the appropriate protective measures have been implemented When the relevant records have been updated and/or completed. 	Pre-construction	All
	HH7	Should any new ancillary facility locations not identified as part of this EIS be considered for use, a non-Aboriginal heritage assessment would be undertaken, with a database search and site walkover to identify any potential heritage items. If items are found, HH4-HH6 would be followed	Pre-construction	All
Impacts on item 2: House, sheds and stockyards, Milleara	HH8	A temporary barrier fence would be erected between the stockyards and the works area prior to road construction works commencing. The fence would remain in place until the conclusion of the works in the vicinity of the items at which time it would be removed. The batter slope would not be constructed within five metres of the stockyards.	Pre-construction and construction	1 (initial upgrade)
	HH9	The house has been identified for architectural noise treatment to control noise levels from the project. The noise controls would be developed in consultation with a qualified heritage consultant to minimise impacts on the heritage significance of the item. A more detailed SOHI would be prepared for this item when the specific architectural noise treatments for the house are identified.	Pre-construction	1 (initial upgrade)
Impacts on item 7: Service station complex, Halfway Creek	HH10	Salvage excavation (to salvage any subsurface artefacts from the coach way station and early coach road) would be undertaken in an area extending from the project boundary running along the front of the complex buildings to the edge of the existing highway before construction starts in the vicinity of the heritage item. Excavations would be undertaken in accordance with Heritage Branch guidelines and under the supervision of an appropriately qualified and experienced historical archaeologist. An appropriate research design and methodology would be prepared to best realise the research potential of this area of the site.	Pre-construction and construction	2 (initial upgrade)

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	HH11	The batter slope for the motorway upgrade would not be constructed within eight metres of the bar/restaurant building.	Construction	2 (initial upgrade)
	HH12	A temporary fence would be erected between the bar/restaurant building and the motorway upgrade construction before work starts in the vicinity of the heritage item. The fence would remain in place until construction is completed, at which time it would be removed.	Pre-construction and construction	2 (initial upgrade)
	HH13	A photographic condition survey would be undertaken of the current condition of the heritage items with any damage to the item from construction to be repaired once construction is complete.	Pre-construction and construction	2 (initial upgrade)
	HH14	The old residence has been identified for architectural noise treatment to control noise levels from the project. The noise controls would be developed in consultation with a qualified heritage consultant to minimise impacts on the heritage significance of the item. A more detailed SOHI would be prepared when the specific architectural noise treatments for the residence are identified.	Pre-construction	2 (initial upgrade)
Impacts on item 36: North Coast Railway Branch Tramway	HH15	Archival photographic recording would be undertaken in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to its removal.	Pre-construction	2 (initial upgrade)
Impacts on item 11: Tyndale residence, Tyndale	HH16	Prior to the start of construction, the location and condition of the mature bunya trees would be recorded by an arborist. In consultation with an arborist, protective fencing would be erected adjacent to the property boundary to control impacts on the trees.	Pre-construction and construction	3 (initial upgrade)
	HH17	The residence has been identified for architectural noise treatment to control noise levels from the highway. The noise controls would be developed in consultation with a qualified heritage consultant to minimise impacts on the heritage significance of the item. A more detailed SOHI would be prepared when the specific architectural noise treatments for the residence are identified.	Pre-construction	3 (initial upgrade)
Impacts on item 12: Cane barge and former Ashby ferry, Maclean	HH18	A photographic condition survey would be undertaken of the current condition of the heritage items with any damage to the item from construction to be repaired once construction is complete.	Pre-construction	4 (initial upgrade)
	HH19	Where appropriate, and before construction commences, any loose or unstable components of the heritage item would be secured to minimise vibration impacts and remain secured until the conclusion of construction, at which time the securing mechanism/s would be removed. Any methods to secure the heritage item would be reversible and not cause damage to the item.	Pre-construction and construction	4 (initial upgrade)
	HH20	RMS would install appropriate directional signage on both the northbound and southbound highway approaches to help maintain a high level of awareness regarding the heritage item's existence.	Operation	4 (initial upgrade)

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Impacts on item 17: Harwood tram tracks, Harwood	HH21	The Petticoat Lane tram tracks section would have a protective covering placed over them, (eg a geo textile fabric and heavy duty metal sheeting or similar) to minimise impacts from construction in the area. The covering would be secured before construction and would remain in place until the end of construction.	Pre-construction and construction	5 (initial upgrade)
Impacts to item 20: Harwood Bridge, Harwood	HH22	The design of the new bridge would be undertaken in accordance with Bridge Aesthetics: Design Guidelines to Improve the Appearance of Bridges in NSW (RTA, 2003) with specific reference to section 6.1, New bridges next to existing bridges.	Pre-construction	5 (initial upgrade)
Impacts on item 21: Convent, Harwood	HH23	An archival photographic recording would be made of the convent building and its surrounds in accordance with the Heritage Branch guidelines How to Prepare Archival Records of Heritage Items (NSW Heritage Office, 1998) prior to its relocation.	Pre-construction	5 (initial upgrade)
	HH24	The feasibility of relocating the building to an appropriate site within the Harwood Heritage Conservation Area would be investigated. The investigation would be undertaken in consultation with an appropriately qualified house removal contractor and an appropriately qualified heritage consultant.	Pre-construction	5 (initial upgrade)
Impacts on item 34 Townsend Residence, Townsend	HH25	The residence has been identified for architectural noise treatment to control noise levels from the highway. The noise controls would be developed in consultation with a qualified heritage consultant to minimise impacts on the heritage significance of the item. A more detailed SOHI would be prepared when the specific architectural noise treatments for the residence are identified.	Pre-construction	5 (initial upgrade)
Impacts on New Italy Settlement (State Heritage Register 1648), New Italy Museum Complex (item 23: New Italy Settlement sites, New Italy)	HH26	A photographic condition survey would be undertaken of the current condition of the heritage items with any damage to the item from construction to be repaired once construction is complete.	Pre-construction and construction	7 (initial upgrade)
	HH27	Monitoring of dust would be undertaken at this location in accordance with the project dust management plan.	Pre-construction and construction	7 (initial upgrade)
	HH28	A temporary fence would be erected between the State Heritage Register boundary and the construction works before work starts in the vicinity of the heritage item. The fence would remain in place until construction is completed at which time it would be removed.	Operational	7 (initial and motorway upgrades)
	HH29	Appropriate directional signage to the New Italy Museum Complex would be installed at both the interchange at Woodburn and interchange at Illuka Road to divert visitors onto the service road in order to access the museum complex.	Operation	7 (motorway upgrade)

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Impacts on New Italy Memorial and Stone-lined well (item 23: New Italy Settlement sites, New Italy)	HH30	Before construction starts, the memorial and flagpole would be removed from their current location and reinstated within the boundaries of Lot 1 DP207390, outside the project boundary to the north of the stone-lined well. This work would be undertaken under the supervision of an appropriately qualified monumental stonemason and a qualified heritage professional.	Pre-construction	7 (initial upgrade)
	HH31	An archival photographic recording and dilapidation survey would occur prior to the movement of the memorial and flagpole in accordance with Office of Environment and Heritage guidelines.	Pre-construction	7 (initial and motorway upgrades)
	HH32	A photographic condition survey would be undertaken of the condition of the heritage items in their re-located positions with any damage to the items from construction to be repaired once construction is complete.	Pre-construction	7 (initial and motorway upgrades)
	HH33	Monitoring of dust would be undertaken at this location in accordance with the project dust management plan.	Pre-construction and construction	7 (initial and motorway upgrades)
	HH34	A temporary fence would be erected between the new location of the memorial and flagpole and the construction works (with a five metres from the heritage items) before work starts in the vicinity of the heritage item. The fence would remain in place until conclusion is completed at which time it would be removed.	Pre-construction and construction	7 (initial and motorway upgrades)
Impacts on Roder's stone-lined well and orchard (item 23: New Italy Settlement sites, New Italy)	HH35	Salvage excavation would be undertaken to salvage any subsurface artefacts related to the well and adjacent wall. Excavations would be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist and in accordance with the Heritage Branch guidelines, including an appropriate research design and methodology in order to best realise the research potential of this area of the site.	Pre-construction and construction	7 (initial upgrade)
	HH36	Before construction starts in the vicinity of the orchard, the location and condition of each of the mango trees would be recorded by an arborist.	Pre-construction and construction	7 (initial upgrade)
	HH37	Protective barrier fencing to protect the mango orchard would be erected between the construction area and the trees with a buffer of at least five metres. This would be erected before construction starts in the vicinity of the items and would remain in place until the end of construction at which time it would be removed.	Pre-construction and construction	7 (initial upgrade)
	HH38	An archival photographic recording would be made of the mango orchard and its surrounds in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to its demolition.	Pre-construction	7 (class M upgrade)

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Impacts on Historic New Italy Village Area	HH39	If any historical heritage remains are discovered at the New Italy Village Area during construction, management measure HH1 would be applied.	Pre-construction and construction	7 (class M upgrade)
Impacts on item 26: Maloney property, Broadwater	HH40	An archival photographic recording would be made of the buttery/creamery, the dairy and its surrounds in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to demolition.	Pre-construction	9 (initial upgrade)
	HH41	The homestead has been identified for architectural noise treatment to control noise levels from the highway. The noise controls would be developed in consultation with a qualified heritage consultant to minimise impacts on the heritage significance of the item. A more detailed SOHI would be prepared when the specific architectural noise treatments for the homestead are identified.	Pre-construction	9 (initial upgrade)
Impacts on item 27: Meerschaum Vale brickworks, Wardell	HH42	If brick material or any other historical heritage remains are discovered during works, management measure HH1 would be applied.	Construction	10 (initial upgrade)
Impacts on item 28: Byrne property, Broadwater	HH43	An archival photographic recording would be made of the stone quarry and small clay pit in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) is to be undertaken prior to construction.	Pre-construction	9 (initial upgrade)
	HH44	Salvage excavations to the south of the quarry (to salvage any artefacts relating to of the impact area of the site situated to the south of the quarry) would be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist. Salvage excavation would be undertaken in accordance with the Heritage Branch guidelines including an appropriate research design and methodology in order to best realise the research potential of this area of the site.	Pre-construction	9 (initial upgrade)
	HH45	The brick-lined well would be retained in situ and protected from all impacts.	Pre-construction and construction	9 (initial upgrade)
	HH46	A photographic condition survey and structural audit of the brick-lined well would be undertaken of the current condition of the heritage item with any damage to the item from construction to be repaired once construction is complete.	Pre-construction	9 (initial upgrade)

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	HH47	A detailed assessment of the level of vibration at the brick-lined well based on factors including distance from the blast site and the quantity of the explosive, and modelling of the predicted vibration levels at the brick-lined well. This assessment may result in additional mitigation measures for the structure including, but not limited to: <ul style="list-style-type: none"> • Construction of temporary or permanent supports or shoring within the brick-lined well • Stabilisation of the brick-lined well • Installation of vibration monitoring devices. 	Pre-construction and construction	9 (initial upgrade)
	HH48	Protective barrier fencing would be erected around the brick-lined well with a 15-metre buffer before the start of construction and would remain in place until the conclusion of the work, at which time it would be removed.	Pre-construction and construction	9 (initial upgrade)
	HH49	Due to the proximity of the well to the roadway, the well may be closed for safety reasons. Any measures to close the well would ensure that the well could be accessed in the future for heritage research or other purposes and that no detrimental physical impact on the well occurs.	Operation	9 (initial upgrade)
Impacts on item 29: 'Stonehenge' Property, Wardell	HH50	An archival photographic recording would be made of the main residence and the drainage system and its surrounds in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to its demolition. A detailed survey and recording of the location of the drainage system within the 'Stonehenge' property would also be undertaken.	Pre-construction	10 (initial upgrade)
	HH51	The 1940s residence has been identified for architectural noise treatment to control noise levels from the project. The noise controls would be developed in consultation with a qualified heritage consultant to minimise impacts on the heritage significance of the item. A more detailed SOHI would be prepared when the specific architectural noise treatments for the residence are identified.	Pre-construction	10 (initial upgrade)
Impacts on item 38: Cemetery reserve	HH52	To protect the heritage item from construction activities, the boundary of the reserve would be clearly identified on site/construction plans as an area of exclusion, and temporary barrier fencing would be constructed continuously along the project boundary: <ul style="list-style-type: none"> • Immediately south of the cemetery reserve • Where it crosses the south east corner of the cemetery reserve • Where it follows the east boundary of the cemetery reserve. 	Pre-construction and construction	9 (initial upgrade)
Impacts on Item 33: High Conservation Value Old Growth Forest	HH53	During detailed design, further consideration would be given to minimising the area of HCVOGF to be cleared.	Pre-construction	2, 6 and 7

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	HH54	The area to be cleared would be clearly identified on-site. High Conservation Value Old Growth Forest adjacent to areas to be cleared would be delineated to avoid accidental disturbance on further areas.	Construction	2, 6 and 7

19.8 Traffic and transport (Chapter 14)

Table 19-7: Traffic and transport mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Construction traffic management	T&T1	<p>Construction traffic management plans would be prepared and implemented for work sites. They would include:</p> <ul style="list-style-type: none"> • Identification of all public roads to be used by construction traffic • Management methods to direct construction traffic to use identified roads • Identification of all public roads that may be partially or completely closed during construction, and the expected timing and duration of closures • Details on likely impacts on existing traffic (including pedestrians, vehicles, cyclists and disabled persons) • Temporary traffic arrangement measures, including property access • Details on access to construction sites, including entry and exit locations, and measures to prevent construction vehicles queuing on public roads • A response plan for any incident involving construction traffic • Mechanisms for monitoring, reviewing and amending the success of the plans <p>The traffic management plans would be prepared in consultation with councils.</p>	Pre-construction and during construction	All
Bulk earthworks haulage	T&T2	A strategy would be prepared for bulk earthworks haulage between the crossing of the Richmond River and the interchange at Wardell. The strategy would seek to maximise the extent of haulage within the project boundary and limit the need to haul material through the town of Wardell.	Pre-construction and during construction	Section 10
Inspection of roadwork traffic schemes	T&T3	<p>Traffic control schemes would be inspected as follows:</p> <ul style="list-style-type: none"> • Pre-start and pre-closedown inspections of short-term traffic controls • Weekly inspections of long-term traffic controls • Night-time inspections of long-term traffic controls. 	During construction	All
Vehicle movement	T&T4	<p>Vehicle movement plans and haulage route plans would be prepared. Drivers would be briefed on these vehicle movement plans during project induction.</p> <p>Deliveries would be planned to occur outside peak traffic periods, where possible.</p> <p>To minimise queuing of construction vehicles on the highway, site personnel would use two-way radios to call up haulage trucks from layover areas on a 'just in time' basis.</p>	During construction	All
Road occupancy	T&T5	Applications for Road Occupancy licences would be submitted to Roads and Maritime Services and the relevant council at least 10 working days prior to proposed occupancy.	Pre-construction and during construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Road damage	T&T6	Pre-construction road dilapidation reports would be prepared for all roads likely to be used by construction traffic. Post-construction road dilapidation reports would be prepared following the completion of construction for all roads assessed prior to construction. Dilapidation resulting from construction activity would be repaired. Copies of road dilapidation reports would be sent to the relevant roads authority.	Pre-construction during construction and post-construction	All
Property and road access	T&T7	Access would be maintained to properties during construction including, where necessary and feasible, temporary alternative access unless otherwise agreed with property owners. Where any legal access is permanently affected, alternative access to an equivalent standard to and from a public road would be provided where a property has no other legal means of access and where such alternative access is feasible and practical. Where alternative access arrangements are not feasible or practical and a property is left with no access to a public road, negotiations would be undertaken with the relevant property owner for acquisition of the property in accordance with the provisions of the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	During construction	All
Bus services	T&T8	Where changes in access affect bus stop locations, temporary alternatives would be provided in conjunction with bus operators and affected schools to maintain access during construction.	During construction	All
Access to State forests	T&T9	Where access to State forest land is affected during construction, a new access route would be provided in consultation with the Department of Primary Industries (Forests NSW).	During construction	All
Maritime traffic	T&T10	Where maritime traffic access to the Clarence and Richmond rivers is affected during construction of bridge crossings, appropriate signage would be provided indicating alternative means of access and the timing of the works.	During construction	Section 5 and Section 10
Access and connectivity	T&T11	The interchange arrangement at Range Road would be reviewed to refine local access to and from the highway.	Pre-construction	Section 1
	T&T12	The location of access to the service station for northbound traffic at Lemon Tree Road, Halfway Creek would be reviewed at the detailed design stage.		Section 2
	T&T13	Access to Glenugie State Forest around the interchange at Eight Mile Lane and Lookout Road would be further reviewed in consultation with Forests NSW.		Section 3
	T&T14	Access arrangements between the interchange at Maclean and Townsend via Jubilee Street would be reviewed taking into consideration the current heavy vehicle movements to the industrial estate at Townsend.		Section 4
	T&T15	The layout of the intersection at Yamba Road would be reviewed to better meet the needs of truck movements from Harwood Mill.		Section 5

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	T&T16	Connectivity between the shared user path from Harwood Bridge to Yamba Road would be reviewed to refine pedestrian and cyclist access		Section 5
	T&T17	The need for a full interchange at Yamba Road would be investigated should traffic growth warrant it in the future.		Section 5
	T&T18	The need for a full interchange with south facing ramps at Watts Lane, Harwood would be investigated should traffic growth warrant it in the future.		Section 5
	T&T19	The need for the overbridge and the arrangement of local access at Chatsworth Road would be reviewed at the detailed design stage depending on specific staging and delivery of the highway.		Section 5
	T&T20	The need for the overbridge and arrangement of local access at Carrols Lane would be reviewed at the detailed design stage depending on specific staging and delivery of the highway		Section 5
	T&T21	The need and delivery strategy for the heavy vehicle checking station at the rest area in Section 10 north of Richmond River would be reviewed.		Section 10

19.9 Noise and vibration (Chapter 15)

Table 19-8: Noise and vibration mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant project section
Construction phase				
Noise	CNV1	Affected receivers would be consulted prior to the commencement of out of hours work.	Construction	All sections
Noise	CNV2	Construction would be timetabled to minimise noise impacts where feasible and reasonable. This may include time and duration restrictions and respite periods. These measures would be considered after consultation with affected receivers.	Construction	All sections
Noise	CNV3	Haulage routes would be located as far away as possible from residential receivers, where this is reasonable and feasible.	Construction	All sections
Noise	CNV4	The use of noisy plant simultaneously and/or close together would be avoided, where possible. This would include equipment operating at separate early work sites to avoid cumulative noise impacts.	Construction	All sections
Noise	CNV5	Equipment/plant within ancillary facilities would be located as far as possible from receivers.	Construction	All sections
Noise	CNV6	Equipment would be maintained in efficient working order.	Construction	All sections
Noise	CNV7	Quieter construction methods would be used, where there are sensitive receivers potentially affected and where this is considered reasonable and feasible. These may include grinding, rock splitting or terrain levelling instead of hydraulic rock breaking.	Construction	All sections
Noise	CNV8	Where acceptable from a work health and safety perspective, quieter alternatives to reversing alarms (such as spotters, closed circuit television monitors and 'smart' reversing alarms) would be used, particularly during night-time activities.	Construction	All sections
Noise	CNV9	All noise complaints received would be dealt with promptly. Construction methods may need to be altered to reduce noise impacts at the affected locations.	Construction	All sections
Noise	CNV10	Machinery would not be turned on prior to the work hours outlined in this EIS. This would include daily maintenance activities and/or 'warming up' of engines.	Construction	All sections
Noise	CNV11	Truck movements would be restricted to identified haulage routes and the routes outlined in the Construction Traffic Management Plan.	Construction	All sections
Noise	CNV12	Where it has been identified as necessary (eg in response to community complaints), noise monitoring would be undertaken to check that the noise mitigation measures are effective.	Construction	All sections
Noise	CNV13	After community consultation, the use of temporary noise shielding should be considered at locations where substantial exceedances of noise criteria are predicted.	Construction	All sections

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant project section
Noise	CNV14	Static noise sources, such as generators, pumps and lighting towers, would be located as far as possible from sensitive receivers.	Construction	All sections
Noise	CNV15	Regular noise monitoring would be undertaken during normal business hours at a representative receiver location.	Construction	All sections
Noise	CNV16	The selection of plant and equipment would be based on noise emission levels. This equipment would be operated and maintained so that noise emissions are minimised.	Construction	All sections
Vibration	CNV17	Where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of any structure or service, a building condition survey would be conducted and preliminary vibration monitoring undertaken by a qualified contractor.	Construction	All sections
Vibration	CNV18	Where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of any heritage structure or potentially structurally unsound service, a building condition survey would be conducted and preliminary vibration monitoring undertaken by a qualified contractor. A follow-up survey would be conducted in response to any vibration complaints.	Construction	All sections
Vibration	CNV19	Appropriately sized equipment would be selected in order to minimise vibration emissions, where required.	Construction	All sections
Blasting (controlled)	CNV20	A blast management plan would be prepared prior to the start of blasting activities.	Pre-construction	All sections
Blasting (controlled)	CNV21	Where sensitive receivers are located close to the blast site, a series of trials would be undertaken at a reduced scale to determine site-specific blast response characteristics, in order to define allowable blast sizes to occur within the criteria.	Construction	All sections
Blasting (controlled)	CNV22	Controlled blasting activities would only be undertaken between the hours of: <ul style="list-style-type: none"> 8am to 5pm, Monday to Friday 8am to 1pm, Saturday. These times may be increased with the written agreement of affected residents. Where the blast management plan has identified potential impacts on sensitive receivers, these hours would be subject to change.	Construction	All sections
Blasting (controlled)	CNV23	A minimum of 24 hours' notice would be provided to all residences located within 500 metres of any blast, including an indication of blasting times and a contact name and telephone number.	Construction	All sections
Construction Blasting (controlled)	CNV24	Monitoring of overpressure and vibration levels would be undertaken for each blast at the potentially most affected receivers.	Construction	All sections

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant project section
Blasting (controlled)	CNV25	A building condition survey would be undertaken for all buildings located within 200 metres of the proposed blasting area prior to the start of blasting. The proponent would be responsible for rectifying any damage occurring from the blasting, with the cost to be borne by the proponent.	Construction	All sections
Blasting (controlled)	CNV26	The maximum instantaneous charge (MIC) would be reduced to the lowest possible level by the use of delays, reduced diameter holes, and/or deck loading.	Construction	All sections
Blasting (controlled)	CNV27	Adequate stemming would be provided and exposed detonating cord would be eliminated (by covering with at least 300 millimetres of quarry dust or road base).	Construction	All sections
Blasting (controlled)	CNV28	Secondary blasting would be eliminated. (A rock breaker or drop hammer would be used instead of popping). Effort would be made to eliminate the need for toe shots (eg by better control of drill patterns).	Construction	All sections
Blasting (controlled)	CNV29	Weather conditions at the time of the blast would be assessed. Blasting would be avoided where possible during heavy cloud cover and/or if a strong wind is blowing towards residences. Days of severe temperature inversion would be avoided where possible or, (if not possible) blasting would occur between 11am and 1pm.	Construction	All sections
Blasting (controlled)	CNV30	Strict control would be exercised over the spacing and orientation of all blast drill holes. Holes would be spaced in such a manner that the explosive force is just sufficient to break the stone to the required size.	Construction	All sections
Blasting (controlled)	CNV31	Controlled blasting times would be determined in consideration of site-specific conditions and in consultation with affected residents and would take place, where possible, when impacts are likely to be the least intrusive (eg all blasts would be fired at a set time acceptable to residents and preferably when the background noise is highest).	Construction	All sections
Consultation	CNV32	<ul style="list-style-type: none"> Identified receivers would be notified by letter of the proposed hours and asked for comment and feedback. This would include justification for the proposed extended working hours along with the benefits the community can expect Where the community or individual residents wish to receive further clarification on the proposed hours, individual interviews or public meetings would be organised to address any further issues. Discussions would be sufficiently detailed to provide a general summary of the expected impacts but also how this relates to individual receivers. At this stage, more detail would be available regarding the proposed construction activities to be undertaken in the extended hours Property owners would be provided with the complaints management procedures to be in place for extended working hours Feedback would be collected to help determine the final adopted working hours for the project, with community consultation continuing throughout the project. 	Pre-construction	All sections

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant project section
Road traffic noise	ONV1	<ul style="list-style-type: none"> Architectural treatments would be considered for all identified noise-affected receivers, subject to confirmation at the detailed design stage. 	Pre-operation	Noise affected sections
Road traffic noise	ONV2	Low noise wearing surface would be considered for noise affected sections of the project where required, subject to confirmation at the detailed design stage.	Pre-operation	Noise affected sections
Road traffic noise	ONV3	<p>No later than one year after commencement of operation of the project, RMS would undertake operational noise monitoring to compare the actual noise performance of the project against predicted noise performance. The report would include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> Noise monitoring to assess compliance with the operational noise levels predicted A review of the operational noise levels in terms of criteria and noise goals Methodology, location and frequency of noise monitoring undertaken Details of any complaints and enquiries received in relation to operational noise Any required recalibrations of the noise model An assessment of the performance and effectiveness of applied noise mitigation measures Any additional feasible and reasonable measures required. 	Post-operation	All sections

19.10 Land use and property (Chapter 16)

Table 19-9: Land use and property mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Property acquisition and managing surplus land	LU1	<ul style="list-style-type: none"> Undertake ongoing communication and consultation with directly affected property owners about the property acquisition process. This includes the provision of information on the timing of acquisitions, and the process for property acquisitions under the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> and RMS' Land Acquisition Policy (RTA, 1999). 	Pre-construction	All
	LU2	<ul style="list-style-type: none"> Undertake ongoing consultation with directly affected property owners during the detailed design phase to identify measures to mitigate potential impacts on the use and viability of land. This would relate to matters such as adjustments to fencing, access, farm infrastructure and relocation of impacted ancillary structures, as required. 	Pre-construction	All
	LU3	<ul style="list-style-type: none"> Complete property adjustments for fencing, access tracks, cattle underpasses and other farm infrastructure in consultation with the impacted land owner. 	Pre-construction	All
	LU4	<ul style="list-style-type: none"> Minimise sterilisation and severance of land uses and lots by amalgamating severed parcels of land together, where possible, with provision of road access. 	Pre-construction	All
	LU5	<ul style="list-style-type: none"> Where required, undertake acquisition of State forests in accordance with the provisions of the <i>Forestry Act 1916</i>. Revocation of land dedicated or reserved as national parks or nature reserves would be in accordance with the <i>National Parks and Wildlife Act 1974</i>. Acquisition of land owned by Local Aboriginal Land Councils would be in accordance with the provisions of the <i>Aboriginal Land Rights Act 1983</i>. 	Pre-construction	All
	LU6	<ul style="list-style-type: none"> A remnant land strategy to minimise land use severance and sterilisation, and a mitigation strategy for final land uses would be developed in consultation with the Cane industry, Coffs Harbour City, Clarence Valley, Richmond Valley and Ballina Councils. 	Pre-construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Property access during construction	LU7	<ul style="list-style-type: none"> Maintain access to properties near construction works, including where required for the movement of farm equipment and livestock between properties. 	Construction	All
	LU8	<ul style="list-style-type: none"> Where temporary changes to property access are required during construction, determine alternative access in consultation with affected property owners and tenants. 	Construction	All
	LU9	<ul style="list-style-type: none"> Undertake ongoing communication with local communities about changes to the local road network, including likely delays and disruptions and alternative accesses if required. 	Construction	All
Local amenity during construction	LU10	<ul style="list-style-type: none"> Undertake early and ongoing consultation and communication with residents and local communities closest to construction works about construction activities, including timing, duration and likely impacts. This is particularly important where works are proposed outside standard daytime construction hours. 	Construction	All
Construction impacts to primary industry, including forestry, and agriculture uses	LU11	<ul style="list-style-type: none"> Develop a spoil management plan to manage surplus spoil from construction. Where possible, onsite reuse of any spoil is the preferred solution for managing the impacts, although alternative options for the reuse or disposal of spoil would be identified in the spoil management plan. 	Construction	All
	LU12	<ul style="list-style-type: none"> Forests NSW would harvest millable timber in affected State forests prior to works commencing. However, consideration should also be given to opportunities for the productive use of trees removed from non State forest areas of the project, including ancillary facilities where necessary. 	Construction	All
	LU13	<ul style="list-style-type: none"> Implement environmental management measures to minimise potential for impacts on adjoining agricultural uses, including from changes in water quality and spread of weeds and pests. 	Construction	All
	LU14	<ul style="list-style-type: none"> Where pesticides are required during construction, implement appropriate environmental management measures to avoid potential impacts on adjoining agricultural properties. 	Construction	All
	LU15	<ul style="list-style-type: none"> Undertake ongoing consultation and communication with managers of agricultural properties to identify any potential impacts on nearby construction workers from farm operations (ie use of pesticides on agricultural properties). 	Construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	LU16	<ul style="list-style-type: none"> Undertake ongoing consultation and communication with commercial fishing and relevant aquaculture operators about construction activities within and near the Clarence and Richmond rivers. Stakeholders would include the estuary prawn trawl fishery, and estuary general fishery within the Clarence River, the NSW Department of Primary Industries (Fisheries) and licensed fishing interests within the Richmond River regarding the timing and duration of construction, potential impacts (including changes to river access) and proposed mitigation measures. 	Construction	All
Utilities and infrastructure	LU17	<ul style="list-style-type: none"> Where relocation or adjustment of infrastructure is required, these should be planned to minimise disruptions and impacts on surrounding properties 	Construction	All
	LU18	<ul style="list-style-type: none"> Communicate with nearby communities about the timing and duration of potential disruptions to infrastructure. 	Construction	All
Property management	LU19	<ul style="list-style-type: none"> Ensure RMS' land that is required for the project is appropriately maintained. This would be undertaken by regional RMS officers or a designated local authority. RMS would manage the leasing and maintenance of property identified as suitable for tenants. 	Operation	All
	LU20	<ul style="list-style-type: none"> Ensure that excavation works near Lot7008 DP92609 are carefully managed in consultation with Richmond Valley Council to minimise potential impacts on any unknown heritage items including potential burials. 	Construction	9
Operational impacts to primary industries, including forestry, agriculture and aquaculture	LU21	<ul style="list-style-type: none"> Undertake ongoing consultation with owners of agricultural properties affected by the project – through acquisition, changes to local access or fragmentation of properties – about potential impacts on farming operations and potential measures to manage or mitigate identified impacts 	Operation	All
	LU22	<ul style="list-style-type: none"> Consult with Forests NSW regarding access to and within State forests where required, in accordance with the <i>Forestry Act 1916</i> 	Operation	All
	LU23	<ul style="list-style-type: none"> Consult with Forests NSW about the relocation of fire trails directly impacted by the project's construction or operation 	Operation	All
	LU24	<ul style="list-style-type: none"> Revegetate land as appropriate, particularly where there are ecological and/or landscape opportunities. 	Operation	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	LU25	<ul style="list-style-type: none"> Identify suitable locations for relocated cane pads and restore affected cane drains where possible in consultation with cane-growers and affected property owners. 	Operation	All
Property access	LU26	<ul style="list-style-type: none"> As far as possible, reinstate or provide new property accesses to replace those that are lost or modified, in consultation with impacted landowners 	Operation	All
	LU27	<ul style="list-style-type: none"> The tie in to the existing highway and land requirement for the property at station 145.0 would be reviewed at the detailed design stage. 	Pre-construction	9
Mining and petroleum production	LU28	<ul style="list-style-type: none"> Undertake on-going consultation with land owners operating quarries within the project boundary and adjacent to the project, including those near Tucabia, Broadwater and Bagotville, and relevant NSW State government agency. Consultation would aim to identify appropriate management measures required due to the realignment of the project near to operational quarries. In particular, management arrangements would be determined for each affected quarry, particularly regarding operational approvals in terms of site access, extraction limits, blasting limits, timing of works, noise and vibration 	Pre-construction	3, 9 and 10
	LU29	<ul style="list-style-type: none"> Undertake ongoing consultation with the coal seam gas proponents operating in the study area and the relevant State Government agency to ensure that impacts on the project and on future coal seam gas production are minimised. 	Pre-construction	All
Utilities and infrastructure	LU30	<ul style="list-style-type: none"> Undertake ongoing consultation with service providers to verify locations and specific impacts on infrastructure and utilities. 	Operation	All
	LU31	<ul style="list-style-type: none"> Undertake consultation with Richmond Valley Council during the detailed design phase, regarding the location and timing of the Broadwater Sewerage Scheme rising pump station, located off Broadwater-Evans Head road. 	Pre-construction	9

19.11 Social and economic (Chapter 17)

Table 19-10: Social and economic mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Consultation with local business, community facilities and residents	SE1	<ul style="list-style-type: none"> Ongoing communication and consultation with local business owners, industry and tourism operators directly affected by construction and located closest to construction works. The focus would be on the timing, duration and likely impact of construction activities, and to identify appropriate measures to manage potential impacts. 	Pre-construction and during construction	All
	SE2	<ul style="list-style-type: none"> Ongoing communication and consultation with managers of community services and facilities near the proposed construction works, to ensure that potential impacts are appropriately managed. 	Pre-construction and during construction	All
	SE3	<ul style="list-style-type: none"> Early and ongoing consultation and communication with residents and local communities closest to construction works about construction activities, including timing, duration and likely impacts. This would be particularly important where works are proposed outside of standard daytime construction hours. 	Pre-construction and during construction	All
Strategy for by-passed towns, local government areas and amenity	SE4	<ul style="list-style-type: none"> Implementation of effective signage for bypassed towns in accordance with RMS signage guidelines. Signage on the project would identify bypassed townships (Grafton, Ulmarra, Maclean, Woodburn, Broadwater and Wardell) as places for 'stopovers' for fuel, supplies and short term accommodation, to support demand for goods and services within these townships. 	During construction, and operation	All
	SE5	<ul style="list-style-type: none"> RMS would work with Councils affected by the upgrade, where relevant, to support strategies by local councils and/or chamber of commerce and industry to promote townships and villages as stopovers for tourist activities with the aim of bringing increased business to nearby townships and villages. 	During construction, and operation	All
Access and connectivity	SE6	<ul style="list-style-type: none"> Maintain access to properties near to the project during construction, including, where required, for the movement of farm equipment and livestock between properties, and for access to the Berry Exchange and other affected agribusinesses. 	During construction	All
	SE7	<ul style="list-style-type: none"> Where temporary changes to property access are required during construction, alternative access should be determined in consultation with 	During construction	All

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
		affected property owners and tenants.		
Access and Connectivity	SE8	<ul style="list-style-type: none"> Undertake consultation with the New Italy community about proposed access changes for the New Italy Museum, including potential impacts and recommended mitigation measures. In particular, access into Swan Bay-New Italy Road and the New Italy museum would be investigated at the detailed design stage. 	Pre-construction	All
	SE9	<ul style="list-style-type: none"> Undertake consultation with the Harwood Island Public School and other community facilities located adjacent to the project about proposed changes to local access. 	During operation	All
	SE10	<ul style="list-style-type: none"> Undertake early and ongoing communication and consultation with emergency services to allow planning for potential changes to response patterns and input into the design development. 	During operation	All
	SE11	<ul style="list-style-type: none"> Appropriate access arrangements to and from Gulmarrad, including the provision of a highway overbridge at McIntyres Lane would be considered at the detailed design stage in consultation with Clarence Valley Council. 	Pre-construction	Section 4
	SE12	<ul style="list-style-type: none"> Access arrangements between Bondi Hill and Byron Lane, and north towards Gallaghers Lane, would be reviewed at the detailed design stage in consultation with affected property owners and the cane industry. 	Pre-construction	Section 4
	SE13	<ul style="list-style-type: none"> Access arrangements east and north of Watts Lane would be reviewed at the detailed design stage to facilitate delivery as part of the initial upgrade to arterial standard. 	Pre-construction	Section 5
	SE14	<ul style="list-style-type: none"> Access to Broadwater mill land between MacDonalds Street and River Road would be reviewed at the detailed design stage. 	Pre-construction	Section 9
	SE15	<ul style="list-style-type: none"> The access arrangements for local traffic at Whytes Lane and the tie into the Ballina bypass upgrade would be reviewed together with any potential boundary refinements at the detailed design stage. 	Pre-construction	Section 11
River access	SE16	<ul style="list-style-type: none"> Maintain access to the Clarence and Richmond rivers near construction activities, including for industry, tourism, fishing (general and prawn trawl) and recreation users. 	During construction	Sections 5 and 10

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
	SE17	<ul style="list-style-type: none">Maintain recreational access to the Clarence and Richmond rivers near construction activities, including access to existing boat ramps upstream of the existing Clarence River bridge at Harwood. Where river access is disrupted, suitable alternative access should be provided.	During construction	Sections 5 and 10

19.12 Other issues (Chapter 18)

Table 19-11: Greenhouse gas emission mitigation measures

Issue	Mitigation no.	ID	Mitigation measure	Timing	Relevant section
Carbon stored in vegetation	GHG1		<ul style="list-style-type: none"> Vegetation clearance would be minimised where feasible. Areas to be revegetated would be revegetated with native species, where practicable, taking into account potential for offsetting lost CO₂ from clearance. 	Construction	All
Embodied carbon in concrete production	GHG2		<ul style="list-style-type: none"> Flyash content within concrete would be specified where feasible. Contractors would be required to propose recycled content construction materials where they are cost, quality and performance competitive. 	Pre-construction / construction	All
Re-use of excavated road materials	GHG3		<ul style="list-style-type: none"> Reuse of excavated road materials would be maximised as far as possible where they are cost, quality and performance competitive to reduce use of materials (with embedded energy). 	Pre-construction / construction	All
Embodied carbon in steel	GHG4		<ul style="list-style-type: none"> Steel with high recycled content would be specified where feasible where they are cost, quality and performance competitive. Contractors would be required to propose recycled content construction materials where they are cost, quality and performance competitive. 	Pre-construction / construction	All
Carbon in fuel	GHG5		<ul style="list-style-type: none"> The feasibility of using biofuels (biodiesel, ethanol, or blends such as E10 or B80) would be investigated by the contractor, taking into consideration the capacity of plant and equipment to use these fuels, ongoing maintenance issues and local sources. Works would be planned to minimise fuel use. 	Construction	All
Energy consumption: construction	GHG6		<ul style="list-style-type: none"> An energy management plan would be developed during the construction of the project. The plan would include a commitment to monitor on-site energy consumption and identify and address on-site energy waste. 	Pre-construction / construction	All
Energy consumption: operation	GHG7		<ul style="list-style-type: none"> RMS would investigate the use of LED lighting in place of incandescent lamps as part of the project's detailed design, and use them where practicable to reduce electrical energy consumption. Any energy-efficient alternatives would have to meet lighting standards for major roads. 	Operation	All
Education	GHG8		<ul style="list-style-type: none"> An education program would be developed and delivered to the construction personnel to promote energy-efficient work practices.. 	Construction	All

Table 19-12: Air quality mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Air quality management planning	AQ1	An air quality management plan would be developed for the construction stage of the project prior to the start of construction. The air quality management plan would address all aspects of construction including spoil handling, machinery operating procedures, soft soil treatments, stockpile management, traffic management, haulage, dust suppression and monitoring.	Pre-construction	All
Air quality management during construction	AQ2	<p>An air quality management plan would be prepared and implemented by the contractor during construction to mitigate dust. The following dust mitigation measures would be used on-site and included as part of the management plan:</p> <ul style="list-style-type: none"> • Covering materials transported to and from construction sites. • Covering or spraying water on stockpiles of soil or other potential dust generating materials, particularly during dry or windy conditions. • Temporarily seed and stabilise temporary stockpiles that are planned to be in place for long periods • Imposing speed limits for vehicles and equipment travelling on unsealed surfaces. • Minimising the extent of disturbed areas as far as practicable. This would be achieved by staging the works to minimise the number of disturbed areas at any one time. • Progressively rehabilitating disturbed areas as soon as practicable. • Suppressing dust on unsealed surfaces, temporary roadways, stockpiles and other exposed areas using water trucks, hand held hoses, temporary vegetation and other practices. • Modifying or stopping dust generating activities during very windy conditions. • Installing wheel wash facilities at appropriate locations to reduce tracking of mud and soil off-site. • Monitoring air quality, both visually, using instrumentation and/or depositional dust gauges, near representative sensitive receptors to verify the effectiveness of controls. • Amend controls where necessary to minimise any impacts identified through monitoring, Consider the use of mitigation measures (such as covers) where dust is impacting water tanks or other drinking water sources, and cannot be controlled at the dust source. 	Construction	All

Table 19-13: Waste management mitigation measures

Issue	Mitigation ID	Mitigation measure	Timing	Relevant section
Sustainable management of resources	WM1	<ul style="list-style-type: none"> The cut-and-fill balance of the project would be further refined to obtain as much material as possible for reuse on the project. 	Pre-construction	All
	WM2	<ul style="list-style-type: none"> A resource management strategy would be prepared for construction of the project to identify the hierarchy for sourcing and use of resources. It would include provisions: <ul style="list-style-type: none"> Available project cutting material (including Select Material Zone (SMZ) and verge material) would be used for the construction of embankments, SMZ and verge within that section to the extent that it is suitable Project sections with a deficit in material would import surplus material from other project sections in preference to external sources Where possible, the distances that earthworks materials are moved across the project as a whole would be minimised, notwithstanding the above two requirements Any unsuitable material would be used for landscaping or disposed of within each project section, either for batter flattening or noise mounds or placed in stockpile Contractors will reduce the amount of unsuitable waste generated during excavations, where feasible (eg treatment at source) Other locations of disposal of unsuitable material will be considered including borrow source areas created as part of the project The generation and management of unsuitable material during project earthworks will be monitored to ensure appropriate management of the issue The resource management strategy would also identify: <ul style="list-style-type: none"> Details on materials that would be sourced from the project (including location and type) Viable material suppliers (including water) near the project Proposed sustainable material sources practices (such as use of recycled materials or wastewater) Materials that could be recycled and re-used on-site or transferred to other project sections. 	Pre-construction / construction	All
Minimising construction waste	WM3	<ul style="list-style-type: none"> A waste register would be maintained by each contractor, detailing types of waste collected, amounts, date, time, and details of disposal. 	Construction	All
	WM4	<ul style="list-style-type: none"> Where possible, materials would be bought in bulk to minimise the amount of package required. Sources of material that have sustainable packaging design, recycled and recyclable packaging would be favoured over other material sources where cost effective. 	Construction	All

Issue	Mitigation ID	Mitigation measure	Timing	Relevant section
	WM5	<ul style="list-style-type: none"> Waste material generated on-site will be dealt with in accordance with the <i>Protection of the Environment Operations Act 1997</i> and Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009). 	Construction	All
	WM6	<ul style="list-style-type: none"> Waste minimisation and management measures would be developed based on the principles in the <i>Waste Avoidance and Resource Recovery Act 2001</i>, the NSW Government's Waste Reduction and Purchasing Policy, and waste exemptions including: <ul style="list-style-type: none"> Excavated Natural Material Exemption (EPA, 2008)). Excavated Public Road Material Exemption (EPA, 2012)) Raw Mulch Exemption (EPA, 2008) Reclaimed Asphalt Pavement Exemption (EPA, 2012) Recovered Aggregate Exemption (EPA, 2010) Stormwater Exemption (EPA, 2008) Treated Drilling Mud Exemption (EPA, 2011) Measures would seek to avoid, minimise, re-use, recycle, treat or dispose of waste streams during construction and address transport and disposal arrangements. 	Construction	All
	WM7	<ul style="list-style-type: none"> Chemical, fuel and lubricant containers, and solid and liquid wastes would be disposed of in accordance with the requirements of Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009). 	Construction	All
	WM8	<ul style="list-style-type: none"> Millable timber would be harvested for reuse off site. All other felled timber would be reused on-site in the form of habitat recreation or mulch in landscaping and erosion and sedimentation controls. Where mulch cannot be reused on-site, consideration would be given to making the mulch available to the public in accordance with the RMS Environmental Direction 25 (2012) and the Raw Mulch Exemption (EPA, 2008). 	Construction	All
	WM9	<ul style="list-style-type: none"> Sediment removed from sedimentation basins would, where appropriate, be used on-site in landscaping and/or flattening of batters. 	Construction	All
	WM10	<ul style="list-style-type: none"> The use of recycled products in construction works would be investigated. 	Construction	All
	WM11	<ul style="list-style-type: none"> Where feasible, the contractor would be required to re-use materials. This could include, but is not limited to, concrete formwork or surplus concrete pours. 	Construction	All
	WM12	<ul style="list-style-type: none"> Site inductions and on-site training will be required to include waste minimisation principles and measures. 	Construction	All

Issue	Mitigation ID	Mitigation measure	Timing	Relevant section
Management of waste water	WM13	<ul style="list-style-type: none"> At site compounds, on-site recycling facilities would be provided for recycling paper, plastic, glass and other re-useable materials. Liquid waste such as paints and solvents would be disposed of in accordance with the Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009) and the <i>Protection of the Environment Operations Act 1997</i>. 	Construction	All
	WM14	<ul style="list-style-type: none"> Regular visual inspections would be conducted to ensure that work sites are kept tidy and to identify opportunities for reuse and recycling. 	Construction	All
	WM15	<ul style="list-style-type: none"> Water captured in excavations will be required to be either: <ul style="list-style-type: none"> Managed in accordance with the construction Soil and Water Management Plan Transferred to a licensed sediment basin, treated and discharged in accordance with any licence conditions that apply to the discharge of water, or Re-used for construction water or dust suppression 	Construction	All
	WM16	<ul style="list-style-type: none"> Tannin rich leachate generated from mulch stockpiles would be managed in accordance with the RMS Environmental Direction – Management of Tannins from Vegetation Mulch (2012). Any tannin impacted water captured in bunded areas or traps would not be released into the environment. Tannin effected water would be removed from bunded areas or traps within five days of a rainfall event and used as construction water, dust suppression or landscape watering. These activities would be managed to prevent any pooling or runoff tannin impacted water. The reuse of this water would also be in accordance with the mitigation measures identified in Chapter 10 of this EIS. 	Construction	All
Management of operational wastes	WM17	<ul style="list-style-type: none"> Appropriate waste and recycling facilities would be provided at rest areas and heavy vehicle checking stations. 	Operation	All
	WM18	<ul style="list-style-type: none"> All operational waste would be managed in accordance with the RMS waste management procedures and Environmental Management System. 	Operation	All
	WM19	<ul style="list-style-type: none"> Green waste from highway maintenance activities would be collected and, where possible, recycled for mulch within the road reserve. 	Operation	All
	WM20	<ul style="list-style-type: none"> Collection and removal of roadside litter would be undertaken in accordance with the RMS Environmental Management System. 	Operation	All

Issue	Mitigation ID	Mitigation measure	Timing	Relevant section
	WM21	<ul style="list-style-type: none">Sediment removed from operational water quality basins would, where appropriate, be classified in accordance with the Waste Classification Guidelines (DECCW, 2009), and be disposed of in accordance with the <i>Protection of the Environment Operations (Waste) Regulation 2005</i>. Where possible, this material would be reused within the road corridor.	Operation	All

References

NSW Government 1998, *Environmental Management Systems – Guidelines*, NSW Department of Public Works and Services, Sydney, Australia.

Roads and Maritime Services (RMS) 2012, *Quality Assurance Specification G36 Environment Protection (Management System)*, Roads and Maritime Services, Sydney, Australia.