



M1 Princes Motorway Improvements, Picton Road to Bulli Tops

(Stage 1 – Picton Road to Bellambi Creek)

Review of environmental factors (REF)



**Roads &
Maritime**

M1 Princes Motorway Improvements, Bulli Tops to Picton Road (Stage 1 – Picton Road to Bellambi Creek) Review of environmental factors

December 2016

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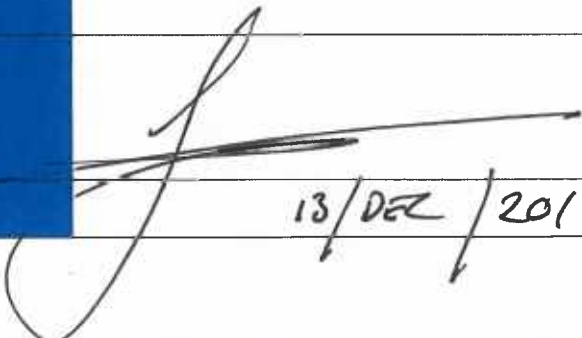
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Executive summary

The proposal

Roads and Maritime Services NSW (Roads and Maritime) propose to upgrade the M1 Princes Motorway (previously Mount Ousley Road) for around 8.3 kilometres, between Picton Road at Mount Ousley and Bulli Pass at Bulli Tops. The upgrade involves road widening and realignment of the M1 Princes Motorway from a four lane divided road (two lanes in each direction), to a six lane divided road (three lanes in each direction).

The upgrade of M1 Princes Motorway at Mount Ousley would be built in two stages. Stage 1 (southern section) extends between the Picton Road interchange and Bellambi Creek. Stage 2 (northern section) extends between Bellambi Creek and Bulli Pass at Bulli Tops.

This Review of Environmental Factors (REF) assesses the impacts of Stage 1 of the upgrade of the M1 Princes Motorway (the proposal). A separate REF will be prepared for Stage 2 of the M1 Princes Motorway upgrade.

Key features of the proposal include:

- Widening and realignment primarily on the eastern side of the existing alignment, to a six lane cross-section (three lanes in each direction)
- Widening sections of the existing road from four lanes to six lanes either side of Cataract Creek
- Realignment to the east of the existing road to provide six lanes from north of Picton Road to Cataract Creek, and from north of Cataract Creek to near the Bellambi Creek bridge
- Provision of a three metre wide shoulder for both carriageways
- Posted vehicle speed limit of 100 kilometres per hour
- Expansion of the road surface area including the replacement of safety barriers, relocation of road signage and infrastructure (such as permanent variable message signs)
- Realignment and earthworks including bank stabilisation works and environmental management measures
- Provision for Intelligent Transport Systems (ITS) infrastructure
- Water quality management measures and drainage structures
- Continued provision for public utilities within the proposal footprint, where practicable
- Property acquisition at various locations to provide construction and operational access to access tracks. (Wollongong Coal Limited, Endeavour Energy and WaterNSW)
- Temporary infrastructure to allow project works including site compounds, utility connections, sedimentation and erosion control, temporary access roads, temporary pavement for road traffic, stockpiling sites and other infrastructure as required

Need for the proposal

This section of the M1 Princes Motorway is a four lane road separated by a central median, has a posted vehicle speed limit of 100 kilometres per hour, and has an average annual daily traffic (AADT) of around 37,000 vehicles. Traffic on this section of the M1 Princes Motorway has a high proportion of heavy vehicles (around 13 per cent of AADT) due to its access and transport function for freight between Port Kembla, Sydney (including South West Sydney) and northern Illawarra collieries. Forecasts predict that heavy vehicle traffic will continue to grow at around 2.7 per cent per year until 2025.

The hilly alignment of the existing motorway results in several locations where heavy vehicles find it difficult to maintain a constant speed, leading to increased interactions between light vehicles and slower heavy vehicles. This can lead to travel inefficiencies, while the speed differentials between

light and heavy vehicles leads to road safety issues. The situation is frequently worsened by inclement weather and fog events, reducing road surface traction and visibility.

The increase in heavy vehicles, due to the expansion of Port Kembla and increased colliery operations, is expected to add further pressure to this section of the M1 Princes Motorway, as high speed light vehicles attempt to weave amongst an increasing number of lower speed heavy vehicles.

Several locations along the existing alignment have been identified as not meeting the current design objectives for a high speed road environment. The proposal involves realignment of the existing road in two sections. Where the proposal deviates from the current alignment, sections of existing road may be retained for operational uses such as use as heavy vehicle weighing or inspection stations, access roads, and or maintenance areas.

Proposal objectives and development criteria

The proposal would involve the realignment and widening of the M1 Princes Motorway between the Picton Road interchange and Bellambi Creek. The primary objectives of the proposal are to:

- Improve travel time and efficiency through additional lane capacity
- Improve road safety through enabling enhanced separation of slower moving and faster moving vehicles
- Provide for safe road and utility maintenance and access
- Increase reliability of access into and out of the Illawarra region and the Port Kembla, including for general freight, larger restricted access vehicles and high performance freight vehicles.

The development criteria for the proposal include:

- Typically 3.5 metre lanes unless otherwise required for heavy vehicle tracking
- Median barrier full length (other than emergency crossover provision)
- Three metre wide outside shoulders
- Median width of up to 2.5 metres for drainage and gutter provision
- Longitudinal drainage (including median drainage) as required
- Provision for future Smart Motorways/Managed Motorways infrastructure
- Typical road furniture such as barriers, fences and maintenance accesses as required
- Overall design to facilitate a general 100 kilometres per hour posted speed environment.

Options considered

Strategic options for the proposal were developed to meet the proposal objectives. Consideration was given to options both within and near to the existing road corridor.

The proposal constraints were identified and a route options analysis undertaken. Three strategic options were analysed for the proposal: a base case, an upgrade with alignment improvements, and an option for a major realignment between Picton Road and Bulli Tops.

Base case

A theoretical base case would involve the least possible upgrade to the existing M1 Princes Motorway alignment with only minor improvements and ongoing maintenance.

The base case alternative does not satisfy the fundamental objectives for the proposal, including delivering improvements to traffic efficiency, road safety and reliability of access into and out of the Illawarra region. The M1 Princes Motorway would continue to have efficiency and road safety problems under this option. This would have flow on effects to the Illawarra region and the local and state economy. The base case alternative would not provide a satisfactory solution from a strategic, regional, local, planning or transport context and would not meet the project objectives.

As a result, the base case option was not considered further.

Upgrade M1 Princes Motorway with alignment improvements

The upgrade involves road widening and realignment of the M1 Princes Motorway from a four lane divided road (two lanes in each direction), to a six lane divided road (three lanes in each direction).

The upgrade would include expansion of the road surface area, realignment and earthworks including bank stabilisation works and environmental conservation measures.

Various sub-options were prepared for differing alignment improvements which considered:

- Design elements including constructability in areas with high slopes, requirements for vertical and horizontal alignment, batter slopes and subsequent earthworks cut and fill balances
- Environmental issues relating to potential impacts to biodiversity, hydrology, water quality, and to soils in sections deviating from the existing alignment

This option would meet the proposal objectives and would address the proposals key issues, including:

- Improved travel time through additional lane capacity at known areas where heavy vehicle speeds drop below 40 kilometres per hour
- Improved road safety through enabling greater separation of slow and fast moving vehicles
- Improved access in and out of the Illawarra would be provided as the separation of commuters and heavy vehicles would result in more consistent travel times
- Road safety improvements through improved alignment superelevation, crossfall and road drainage

Various sub-options were considered for this strategic option in consideration of batter slopes and cut and fill quantities. Cut and fill estimates for the sub-options ranged from about 37,000 to 49,000 cubic metres of cut and about 67,000 to 89,000 cubic metres of fill

This option addresses impacts on the community that may include land acquisition and impacts to road users during works. Environmental impacts may include vegetation clearance, impacts to Sydney's drinking water catchment, and minor noise and air quality impacts during construction.

This is the preferred option as it best meets the project objectives, given the available funding profile.

Major realignment between Picton Road and Bellambi Creek

Strategic options were considered for building a new road significantly deviating from the existing M1 Princes Motorway alignment between Picton Road and Bellambi Creek, traversing WaterNSW (previously Sydney Catchment Authority) scheduled lands and Wollongong Coal Lands.

Various sub-options were prepared for a major realignment which considered:

- Design elements including constructability in areas with high slopes, requirements for vertical and horizontal alignment, batter slopes and subsequent cut and fill balances
- Environmental issues relating to potential impacts to biodiversity, hydrology, water quality, and soils in a largely undeveloped area
- The amount of roadworks required especially the earthworks would result in a substantially larger area of impact when constructing a new alignment as compared to upgrading along the existing alignment.

Construction of a major realignment between Picton Road and Bellambi Creek would meet the proposal objectives as:

- Improved travel time would result from an improved alignment and additional lanes for heavy vehicles as well as the reduction of travel distance
- Improved road safety through a slow vehicle lane where required and through the development of a design which meets the requirements of Roads and Maritime Services Austroads Guide Supplements (RTA/Pub.11.096)

- Reliability in and out of the Illawarra would be provided as the separation of commuters and heavy vehicles would result in more consistent travel times.

However, the option for a major realignment of this section of the M1 Princes Motorway would result in:

- Major land acquisition including land from both WaterNSW scheduled lands and from Endeavour Energy.
- Greater project cost which is outside the funding available for the project
- Progression of the project timeframe over a longer period due to a risk of requiring the relocation of major utility infrastructure

About 250,000 cubic metres and 67,000 cubic metres of cut and fill respectively, would be required in previously undeveloped areas.

This option would offer similar project benefits as the option to upgrade within the existing alignment. However, the functional benefits of a major realignment are outweighed by the greater environmental impacts, larger areas of land acquisition and significantly higher project costs associated with this option, and was not considered feasible.

Statutory and planning framework

This proposal is assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. In this review of environmental factors, Roads and Maritime also considers clause 228 of the *Environmental Planning and Assessment Regulation 2000* and matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) applies to this proposal. Clause 94 of the ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

Community and stakeholder consultation

A range of government agencies and stakeholders have been identified based on the potential environmental constraints identified for the proposal. Roads and Maritime has contacted the following stakeholders with a written invitation to provide input into the environmental assessment and project development:

- Wollongong City Council
- Office of Environment and Heritage (OEH)
- National Parks and Wildlife Service (NPWS)
- WaterNSW
- NSW Freight Industry Council
- Port Kembla Port Users Group
- Utilities providers
- Wollongong Coal.

In 2014, the National Parks and Wildlife Service and OEH were invited to attend an options selections workshop to consider the various design options and elements of the proposal.

In August 2015 an Access Workshop was convened to discuss and inform access needs. At the workshop were representatives of landowners, emergency services and authorities including:

- NSW Rural Fire Service
- NSW Police
- Wollongong Coal

- WaterNSW (formerly Sydney Catchment Authority)
- Telstra
- Optus Networks
- TransGrid
- Endeavour Energy.

While NPWS were unable to attend, a follow up meeting was held with a NPWS representative in early September 2015 to cover the issues discussed at the workshop.

Aboriginal cultural heritage consultation was undertaken in accordance with the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). A representative of the Illawarra Local Aboriginal Land Council (ILALC) participated in the field survey in accordance with Stage 2 of the PACHCI.

Responses and comments from the consulted government agencies and stakeholders were generally positive with all parties indicating support for the proposal and the improvements to safety and accessibility.

Environmental impacts

A number of detailed technical investigations were carried out to assess the potential impacts of the proposal and associated works and to identify safeguards to mitigate these impacts. The major environmental impacts associated with the proposal are related to:

- Traffic and transport
- Groundwater
- Surface water
- Biodiversity.

Traffic and transport

The proposal would relieve traffic congestion, reduce travel times and improve safety for all road users. Congestion and travel times are otherwise expected to worsen as development and growth occurs in the region.

Impacts to traffic would occur during works. Project works are expected to take about two years to complete. As a substantial proportion of the proposal would consist of a new alignment, about fifty per cent of the proposal would be constructed off-line which would minimise construction traffic impacts. The largest impacts to traffic would be the sections of the proposal that need on-line widening.

Bus route 887 operated by Busways (between Campbelltown and Wollongong) is the only public bus route which would be impacted by any temporary closure of the M1 during construction.

There are no pedestrian facilities such as footpaths in the proposal area. While cyclists are permitted to use the M1 Princes Motorway generally they access and exit the motorway further north at the interchange with Bulli Pass. During construction, a detour for cyclists using Bulli Pass would be in place.

There are no local roads or private residential properties near or intersecting with the proposal.

There is the potential for access restrictions or changes to access associated with the works, including a reduction in the width of hard shoulder. Fire trails and access tracks into the Cataract Dam catchment and the nearby power line easements and substation would also be affected during works. However, alternative access arrangements would be provided to ensure that access is available at all times.

Groundwater

Deep excavations, mainly large cuttings for the new alignment, would extend into the zone where shallow ephemeral aquifers are likely to occur. The directly impacted shallow ephemeral aquifers are subject to rapid draining and the impact has been assessed as minor.

The proposal involves excavation to a maximum depth of 10.5 metres, which is above the deeper regional groundwater aquifer (12 to 15 metres). As a result, there would be no impacts on this aquifer from the proposal.

Surface water

The proposal is located within Cataract Dam catchment, an area protected and managed by WaterNSW – and designated as a ‘special area’ due to its important function in maintaining good water quality in the area.

Changes to the local surface water system as a result of works may result in the temporary loss of drainage capacity and redistribution of stormwater flows. These may occur as a result of material stockpiles and works within flow paths or at culvert crossings. Water quality impacts from the pollution of stormwater run-off with eroded soil, sediments, fuels and other hazardous materials from the works site and equipment may also occur during work.

A neutral or beneficial effect (NorBE) assessment undertaken for the proposal concludes that a neutral or beneficial effect on water quality could be achieved, with improvements to water quality ranging from two to 100 per cent, through the provision of water management measures such as water quality basins, swales, vegetated channels and biofiltration swales. The types of water management measures and their locations would be determined during detailed design to ensure they can be feasibly and practicably implemented and maintained. Overall, the proposal would result in minimal improvements in water quality as the area impacted by the proposal is relatively small compared to the overall catchment of Cataract River and Reservoir.

There would be an improvement compared to the existing situation as the current road does not have any significant operational water quality control measures and operational measures are proposed.

Biodiversity

The biodiversity assessment identified that numerous upland headwater swamps that meet the definition of the Coastal Upland Swamp endangered ecological communities (EEC) occur in the proposal area. Six upland headwater swamps are located in close proximity to the proposal. The proposed works are not anticipated to have an overall effect on recharge to the underlying aquifer, stream baseflow or stream water quality where the currently temporary aquifers seep into local catchments. The upper Hawkesbury Sandstone regional aquifer is located at a depth of 12 to 15 metres below surface in the Brokers Nose area, which is below the proposed excavation depth of the M1 re-alignment works. As a result, it is not anticipated that the proposed roadworks will adversely affect the regional groundwater system.

The proposal would result in the removal of 28.29 hectares of remnant native vegetation and 20.01 hectares of highly modified vegetation (including roadside plantings, cleared areas and exotic dominated vegetation). Of the 28.29 hectares of remnant native vegetation 2.27 hectares is EEC (Coastal Upland Swamp Habitat) and the remaining 26.02 hectares is moderate to good condition native vegetation. Where possible, impacts on EEC and remnant vegetation would be minimised and hollow-bearing trees would be retained.

Species protected under the EPBC Act and *Threatened Species Conservation Act 1995* (TSC Act) which were observed in the study area or predicted to occur within the study area include the Gang Gang Cockatoo, Eastern Bentwing Bat, Greater Glider, Eastern Pygmy-Possum and Black-faced Monarch.

EPBC and Section 5A assessments have been undertaken for protected flora and fauna species, and EECs that have been recorded or predicted to occur within the study area and that have the potential to be affected by the proposal. The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the

Threatened Species Conservation Act 1995 or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.

Justification and conclusion

The proposal is located along a four kilometre section of the M1 Princes Motorway, on the Illawarra escarpment, and forms part of the National Land Transport Network. The M1 Princes Motorway in this location provides an important link for freight between Port Kembla, Sydney (including South West Sydney) and northern Illawarra collieries. It is forecast that heavy vehicle traffic will continue to grow at around 2.7 per cent a year until 2025.

The proposal would promote the social welfare of the community and a better environment by improving the capacity, safety and services of the M1 Princes Motorway.

The proposal is consistent with Government strategic planning at Commonwealth, State and regional levels. The proposal would improve safety by providing additional lanes and a central median to separate traffic in addition to improvements to intersections, including new signalised intersections.

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

The proposal is subject to a strategic assessment approval granted in September 2015 by the Commonwealth Minister for the Environment in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Part 5 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. In accordance with the approval, this REF addresses and considers potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the 'avoid, minimise, mitigate and offset' hierarchy. Consistent with the approval, a referral to the Commonwealth Department of the Environment and Energy for these matters is not required.

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Appendix E	Erosion and sedimentation management report
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1 Introduction

This section introduces the proposal and provides the context of the environmental assessment.

1.1 Proposal identification

Roads and Maritime Services NSW (Roads and Maritime) propose to upgrade the M1 Princes Motorway (previously Mount Ousley Road) for around 8.3 kilometres, between Picton Road at Mount Ousley and Bulli Pass at Bulli Tops. The upgrade involves road widening and realignment of the M1 Princes Motorway from a four lane divided road (two lanes in each direction), to a six lane divided road (three lanes in each direction).

The upgrade of the M1 Princes Motorway at Mount Ousley would be built in two stages. Stage 1 (southern section) extends between the Picton Road interchange and Bellambi Creek. Stage 2 (northern section) extends between Bellambi Creek and Bulli Pass at Bulli Tops.

This Review of Environmental Factors (REF) assesses the impacts of Stage 1 of the upgrade of the M1 Princes Motorway (the proposal). A separate REF will be prepared for Stage 2 of the M1 Princes Motorway upgrade.

The proposal is located along a four kilometre section of the M1 Princes Motorway, on the Illawarra escarpment, and forms part of the National Land Transport Network. The southern extent of the proposal is about 10 kilometres from Wollongong central business district (CBD), the northern extent about 14 kilometres north of Wollongong, and around 74 kilometres south of Sydney CBD.

The location of the proposal is shown in Figure 1-1. Chapter 3 describes the proposal in more detail.

This section of the M1 Princes Motorway has an average annual daily traffic (AADT) of around 37,000 vehicles, is a four lane road separated by a central median divide, and has a posted vehicle speed limit of 100 kilometres per hour. Traffic in this section of the M1 Princes Motorway has a high proportion of heavy vehicles (around 13 per cent of AADT) due to its access and transport function for freight between Port Kembla, Sydney (including South West Sydney) and northern Illawarra collieries. Forecasts show that heavy vehicle traffic will continue to grow at around 2.7 per cent per year until 2025.

The hilly alignment of the existing motorway, results in several locations where heavy vehicles find it difficult to maintain a constant speed, leading to increased interactions between light vehicles and slower heavy vehicles. This can lead to travel inefficiencies, while the speed differentials between light and heavy vehicles leads to road safety issues. The situation is frequently worsened by inclement weather and fog events, reducing road surface traction and visibility.

The increase in heavy vehicles due to the expansion of Port Kembla and increased colliery operations in the Illawarra is expected to add further pressure to this section of the M1 Princes Motorway, as high speed light vehicles attempt to weave amongst an increasing number of lower speed heavy vehicles.

The proposal is needed to:

- Improve travel time and efficiency
- Improve road safety through enhanced separation of slower moving and faster moving vehicles
- Increase reliability of access into and out of the Illawarra region and Port Kembla.

Several locations along the existing alignment have been identified as not meeting the current design objectives for a high speed road environment. The proposal involves realignment of the existing road in two sections. Where the proposal deviates from the current alignment, sections of existing road may be retained for operational uses such as use as heavy vehicle weighing or inspection stations, access roads, and or maintenance areas.

Key features of the proposal would include:

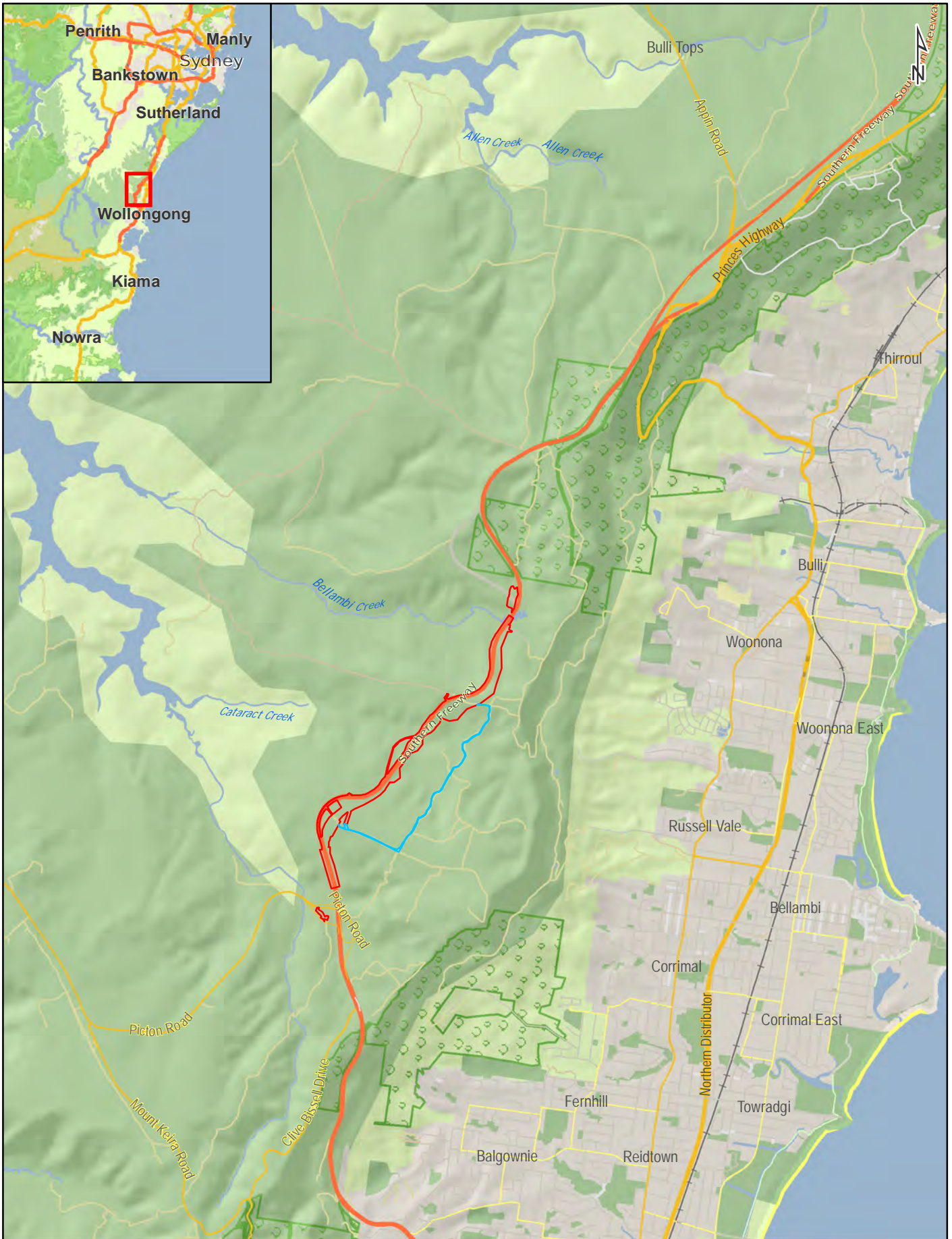
- Widening and realignment primarily on the eastern side of the existing alignment, to a six lane (three in each direction) divided road from Picton Road to south of Bellambi Creek bridge
- Widening sections of the existing road from four lanes to six lanes from:
 - Picton Road interchange to 300 metres north of Picton Road
 - 1.65 kilometres north of Picton Road to the Fire Trail (Access 7) location for around one kilometre
- Realignment to the east of the existing road to provide six lanes from:
 - 600 metres north of Picton Road to 1.65 kilometres north of Picton Road
 - 2.7 kilometres north of Picton Road to 70 metres south of Bellambi Creek bridge
- Provision of a three metre wide shoulder for both carriageways
- Posted vehicle speed limit of 100 kilometres per hour
- Expansion of the road surface area including the replacement of safety barriers, relocation of road signage and infrastructure (such as permanent variable message signs)
- Realignment and earthworks including bank stabilisation works and environmental management measures
- Four major cuts up to 475 metres long and up to 14 metres in height
- Three major fill embankments up to 275 metres long and up to 20 metres in height
- Provision for ITS infrastructure including:
 - Vehicle detection loops in the pavement
 - CCTV infrastructure
 - Emergency phones and truck stopping bays (with storage for 25 metre B-Double)
- Water quality management measures and drainage structures
- Continued provision for public utilities within the proposal footprint, where practicable.
- Property acquisition at various location to provide construction and operational access to access tracks. (Wollongong Coal Limited, Endeavour Energy and WaterNSW)
- Temporary infrastructure to allow project works including site compounds, utility connections, sedimentation and erosion control, temporary access roads, temporary pavement for road traffic, stockpiling sites and other infrastructure as required.

A detailed description of the proposal and detail of works to be undertaken is provided in Section 3.

The proposal would provide additional lanes to accommodate separation of high speed traffic from slow moving heavy vehicles, resulting in improved safety for road users, reduced travel times, and improved safety for cyclists by providing a consistent verge.

Stage 1 of the upgrade of M1 Princes Motorway at Mount Ousley has secured \$42 million funding under the Commonwealth's Infrastructure Investment Programme (previously the Nation Building 2 (NB2) program), together with another \$42 million funded by the NSW Government.

Subject to project approval, Stage 1 construction would commence in 2018 and be delivered over a 24 month construction period, during and outside of normal working hours. Construction staging options are described in Section 3.3.



- ▭ Construction footprint
- ▭ Construction light vehicle access track

M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1)

Location of the proposal **Fig. 1-1**

Source: Imagery from RMS



1.2 Purpose of the report

This Review of Environmental Factors has been prepared by SMEC Australia Pty Ltd (SMEC) on behalf of Roads and Maritime Services Southern Region. For the purposes of these works, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail protective measures to be implemented.

The description of the proposed work and associated environmental impacts have been undertaken in the context of clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (DUAP, 1995/1996), the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of:

- Section 111 of the EP&A Act that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of the Environment and Energy for a decision by the Commonwealth Minister for the Environment and Energy on whether assessment and approval is required under the EPBC Act.

2 Need and options considered

This section describes the justification for the proposal in terms of the strategic vision for the Illawarra region, as well as in relation to the objectives of the proposal.

2.1 Strategic need for the proposal

As described in Section 1.1, this section of the M1 Princes Motorway has an average annual daily traffic (AADT) of around 37,000 vehicles and a posted vehicle speed limit of 100 kilometres per hour. Traffic on this section of the M1 Princes Motorway has a high proportion of heavy vehicles (around 13 per cent of AADT) due to its access and transport function for freight between Port Kembla, Sydney (including South West Sydney) and northern Illawarra collieries. Forecasts predict that heavy vehicle traffic will continue to grow at around 2.7 per cent a year until 2025.

The hilly alignment of the existing motorway results in several locations where heavy vehicles find it difficult to maintain a constant speed, leading to increased interactions between light vehicles and slower heavy vehicles. This can lead to travel inefficiencies, while the speed differentials between light and heavy vehicles leads to road safety issues. The situation is frequently worsened by inclement weather and fog events, reducing road surface traction and visibility.

The increase in heavy vehicles due to the expansion of Port Kembla and increased colliery operations in the Illawarra is expected to add further pressure to this section of the M1 Princes Motorway, as high speed light vehicles attempt to weave amongst an increasing number of lower speed heavy vehicles.

The strategic background to the proposal is drawn from a number of wider strategic plans at the national, state and subregional level, as well as for transport and road infrastructure more generally. Applicable strategic plans and their relevance to the proposal are discussed below.

2.1.1 NSW State Infrastructure Strategy 2012-2032

The *NSW State Infrastructure Strategy 2012–2032* (State Infrastructure Strategy) (Infrastructure NSW, 2012) was released on 3 October 2012. The State Infrastructure Strategy is a 20 year strategy that identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth (Infrastructure NSW, 2012).

The State Infrastructure Strategy specifically identifies an upgrade of Mount Ousley Road (ie. the section of the M1 Princes Highway where the proposal is located) as a priority to cater for increased freight demand (p141).

The proposal has been developed to directly achieve one of the actions of the State Infrastructure Strategy.

2.1.2 NSW Long Term Transport Masterplan

The NSW Long Term Transport Master Plan (the LTTMP) outlines the NSW Government's direction for transport planning and investment for the next 20 years. It builds on the NSW Government's current transport commitments, bringing together land use and transport planning, to identify transport corridors which link the places between which people want to travel. It considers the level of demand along each corridor, the capacity of the corridor to meet current and future demand, and the type of transport service required to meet customer needs on that corridor.

The LTTMP identifies Mount Ousley and the M1 Princes Motorway as key transport links for commuter and freight and commits as a key action to:

"...continue to improve the F6 (M1), Princes Highway (M1) and Mount Ousley Road to boost capacity, improve travel time, support public transport operations and provide efficient freight connections to Port Kembla."

The proposal would contribute to the achievement of this key action of the LTTMP.

2.1.3 National Land Freight Strategy

In 2012, the Standing Council on Transport and Infrastructure released the *National Land Freight Strategy – A place for freight* (National Land Freight Strategy) (Commonwealth of Australia, 2012).

The objective of this Strategy is to improve the efficiency of freight movements across infrastructure networks, minimise the negative impacts associated with such freight movements and influence policy making relevant to the movement of freight. The Strategy's long term outcomes are to ensure:

- an efficient, productive and competitive national land freight system
- a sustainable land freight system that responds to growth and change
- policies that are affecting land freight are aligned and coherent across governments.

The Strategy identifies six major challenges facing freight today that require coordinated policy action and effort by governments and industry to:

- ensure there are long term and integrated plans in place for freight
- invest in the right infrastructure at the right time
- improve access, investment and charging arrangements for heavy vehicles
- create better and more consistent regulation
- enhance understanding of the freight task and its associated challenges
- build community understanding and support for the role of freight in society.

The M1 Princes Motorway in the area of the proposal has been designated as a national key freight route and consequently the National Land Freight Strategy is directly relevant to the proposal. The proposal would address one of the major challenges as it would invest in infrastructure that would improve the freight efficiency and safety performance on a national key freight route. The proposal would also achieve two of the desired outcomes by increasing the efficiency of a national key freight route and by providing investment in critical infrastructure which would enable future growth and improve the capacity of a national key freight route.

2.1.4 National Port Strategy

Infrastructure Australia together with the National Transport Commission developed the *National Ports Strategy – Infrastructure for an Economically, Socially and Environmentally Sustainable Future* (National Ports Strategy) (Infrastructure Australia 2011) in 2011. The objectives of the Strategy are to facilitate trade growth and improve the efficiency of port-related freight movement across infrastructure networks.

Many of the heavy vehicles using the section of the M1 Princes Motorway where the proposal is located, are delivering freight, materials and goods to and from Port Kembla. The proposal would result in improved efficiency of these port-related freight movements and therefore would meet one of the objectives of the Strategy.

2.1.5 National Road Safety Strategy in Australia 2011-2020

The *National Road Safety Strategy for Australia 2011-2020* (Australian Transport Council, 2011) presents a ten year plan to reduce the number of serious injuries and fatalities on Australian roads by 30 per cent. To achieve this target, four specific road safety actions or interventions have been identified, supported by immediate and future additional actions. Of these four actions, two have been identified as relevant to the proposal; 'safe roads' and 'safe speeds'.

'Safe roads' aims to reduce the risk of crashes occurring on Australia's roads and to lessen the severity of an injury if a crash does occur, through appropriate design and maintenance of roads and roadsides. The 'safe speeds' action aims to manage crash impact forces to within human tolerance and all road users complying with the speed limits by designing roads with speed limits that complement the local road environment.

The proposal has been designed in accordance with AustRoads road design guidelines, Roads and Maritime road design supplements and safety and traffic efficiency requirements to address the existing crash history (refer to Section 6.6) and aims to deliver immediate safety benefits. As a result, the proposal is considered to be consistent with, and would contribute towards, achieving the aims of the *National Road Safety Strategy for Australia 2011-2020*.

2.1.6 National Road Safety Action Plan 2015-2017

The *National Road Safety Action Plan 2015-2017* (Transport and Infrastructure Council 2014) was prepared to support the implementation of the *National Road Safety Strategy 2011–2020* (NRSS). It addresses key road safety challenges identified in a recent review of the strategy (NRSS Review) and details a range of priority national actions to be taken by governments over the three years 2015 to 2017.

One of the key actions of the Plan is to prioritise and treat high-risk rural and urban roads, focusing on the main crash types and vulnerable road users.

The section of the M1 Princes Motorway where the proposal is located has been identified as a high-risk road due to high proportion of heavy vehicles using the road, non-compliance with current road design guidelines, lack of climbing lanes for slow vehicles and the high frequency of fogs and high rainfall days. The proposal would meet the key action detailed above by improving the safety of the high risk road.

2.1.7 NSW Freight and Ports Strategy

The *NSW Freight and Ports Strategy* (Transport for NSW, 2013) sits underneath the NSW Long Term Transport Master Plan. It is a core component of NSW's overall strategic planning framework and supports the goals identified in NSW 2021. It includes the objective of delivering a freight network that efficiently supports the projected growth of the NSW economy.

The strategy identifies the proposal as a key project, acknowledging that this section of the M1 Princes Motorway is a key freight route providing the only access route for B-doubles into the Illawarra from the North.

Other road upgrades identified in the strategy include investigation of options for the construction of a grade-separated interchange at the junction of Mt Ousley Road and the Southern Freeway, and construction of a third southbound lane from the existing arrestor bed to the junction of Mt Ousley Road/the Southern Freeway.

Two other projects in the area are also identified in the strategy.

The M1 Masters Road Interchange is funded for planning. This project seeks to upgrade the M1 to a minimum of three lanes in each direction between Five Islands Road and Mt Ousley Road (a distance of seven kilometres) providing additional lane capacity to address traffic efficiency concerns. The project will also investigate options for the construction of a Masters Road flyover providing direct access from the M1 to Masters Road.

2.1.8 NSW Road Safety Strategy 2012-2021

As outlined within the *NSW Road Safety Strategy for NSW 2012-2021* (December 2012), NSW is committed to achieving a reduction in the fatality rate to 4.3 per 100,000 population by 2016, and at least a 30 per cent reduction in fatalities and a 30 per cent reduction in serious injuries by the end of 2021. Developing innovative and cost effective treatments for safe road issues are highly important to reaching the Strategy targets.

Based on the key factors that influence incidence and severity of road crashes in NSW, the Draft Strategy identifies initiatives for NSW to undertake. Of the key initiatives, those that would potentially be addressed as a result of the expected safety outcomes of the proposal include:

- Address heavy vehicle safety through effective transport planning to consider heavy vehicle routes around ports and through enabling the physical separation of slower heavy vehicles from faster light vehicles
- Reduce death and serious injury arising from the four key crash types: run-off-road, head-on,

intersection and pedestrians

- The construction of safe roads that match the specific environment, travel needs and road user behaviour contributes significantly to road trauma outcomes
- Ensure road safety is considered throughout the design, construction, maintenance, operation and audit of the road network for all road users including targeting treatments to address head-on, intersection, run-off-road crashes
- Continue to deliver Nation Building and State programs with road safety objectives, including the program of highway duplications
- Investigate infrastructure treatments to enhance road safety on the highway network for heavy vehicle drivers and to support enforcement activities

2.1.9 Illawarra-Shoalhaven Regional Plan

The Illawarra-Shoalhaven Regional Plan (NSW Government 2015) provides the strategic policy, planning and decision-making framework to guide the region to sustainable growth over the next 20 years. Underpinning the planning framework for the Plan are four key principles, one of which is to:

“integrate transport and land use planning, and support improvements in active transport (walking and cycling), public transport and transport infrastructure (including freight).”

The proposal is consistent with this principle as it would result in an improvement to transport infrastructure.

Features of the proposal have also been developed to meet a number of directions and actions in the Regional Plan including:

- Direction 4.3 - Manage and protect the Sydney Drinking Water Catchments
- Action 5.1.1 - Avoid, minimise and mitigate the impact of development on significant environmental assets.

2.1.10 Illawarra Regional Transport Plan

The Illawarra Regional Transport Plan (Transport for NSW 2014) is part of a suite of more detailed regional and modal plans that take direction from the NSW Long Term Transport Master Plan and provide more detail for specific issues in the Illawarra region. The Regional Transport Plan recognises that the M1 Princes Motorway (M1) has a high number of heavy vehicle crashes. One of the actions in the Regional Transport Plan is to improve the M1 to boost capacity, improve travel time, support public transport operations and provide efficient freight connections to Port Kembla.

The proposal is an action identified in the Regional Transport Plan.

2.1.11 Wollongong 2022: Our Community Strategic Plan 2012-2022

Wollongong 2022 is a long term community strategic plan for the city. The Plan plays a vital role in the future of Wollongong, and provides direction for the delivery of key projects and services, which will help meet the needs of the community.

The proposal aligns with the Plan’s ‘Community Goal 6: We Have Sustainable Affordable and Accessible Transport’ long term objective 6.2.4, that is, to pursue and implement opportunities to reduce travel time between Sydney and Wollongong.

The proposal would improve efficiency along the M1 Princes Motorway providing improved access between Sydney and Wollongong.

2.2 Existing infrastructure

2.2.1 M1 Princes Motorway

Until recently the M1 Princes Motorway was partly known as Mount Ousley Road, and partly the F6 Freeway. On the 9 August 2013, Roads and Maritime formally renamed the section of road from Waterfall to Albion Park Rail as the M1 Princes Motorway.

The M1 Princes Motorway between Mount Ousley and Bulli Tops is a controlled access road that connects the northern and southern sections of the Southern Freeway (F6) and serves as the main arterial route up/down the Illawarra Escarpment and the major entrance to Wollongong.

The posted speed limit along this section of the M1 Princes Motorway is 100 kilometres per hour, although travel speeds vary between heavy and light vehicles. There are a number of locations where the corridor is very steep and heavy vehicles are either travelling upgrade or downgrade in a low gear, and at relatively low speeds between 20 and 40 kilometres per hour. This is a noticeable speed difference to light vehicles which mostly travel between 70 and 100 kilometres per hour (refer to Appendix C – Traffic Modelling and Economic Appraisal).

The motorway is a four lane divided single carriageway with typical lane widths of up to 3.6 metres and a central median divide. A concrete median safety barrier is provided for the whole length to separate northbound and southbound traffic. A sealed shoulder runs parallel to the motorway with shoulder widths varying from around one metre to three meters. The current sealed shoulder width provides for cyclists, although this is not the preferred route for cyclists up or down the Illawarra Escarpment.

No grade separated interchanges are located within the proposal area. The nearest grade separated interchanges are provided at Picton Road, about 100 metres south of the proposal, and at the Princes Highway and Bulli Tops/Appin Road, about four kilometres and 5.5 kilometres north of the proposal respectively.

2.2.2 Existing cut and fill

The current earthworks balance (existing surface to design finished surface) is a 10,000 cubic metres fill deficit (cut is around 340,000 cubic metres and fill is around 330,000 cubic metres).

Four major cuts up to 475 metres long and up to 14 metres in height are proposed and three major fill embankments up to 275 metres long and up to 20 metres in height would be required.

2.2.3 Drainage infrastructure

Two major creeks flow in a westerly direction across the proposal area, being (from north to south) Bellambi Creek and Cataract Creek.

Stormwater runoff is currently directed to each of the creeks from the existing pavement, either through table drains or formed culverts. No water treatment structures exist in this section. Existing cross-drainage infrastructure along the length of the proposal is outlined in Table 2-1.

Table 2-1 Existing cross-drainage infrastructure

Watercourse	Location	Existing drainage infrastructure
Cataract Creek	About 1.8 kilometres south of Bellambi Creek.	Twin culverts up to 3.6 metre (diameter)

Stormwater runoff from the existing highway surface is managed by two main mechanisms, depending on the cross fall of the motorway, as follows:

- Draining over the edge of the pavement and down the embankment. The runoff is collected in natural channels and gullies before connecting to existing creek lines.
- Collected in kerb and gutter with a drain at the road edge and conveyed to the existing culvert locations outlined in Table 2-1.

2.2.4 Utilities and road signage

No water utilities and road signage and infrastructure (such as permanent variable message signage) have been identified within the proposal area.

Other public utilities located within the proposal area include a Wollongong Coal overhead power supply line. Further information relating to existing public utilities is provided in Section 3.5 and 6.10.

2.2.5 Private accesses

There are several private accesses along the length of the proposal. Direct access is provided from the motorway to lands owned and/or managed by WaterNSW, Endeavour Energy and Wollongong Coal owned mining lease areas.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The proposal would involve the realignment and widening of the M1 Princes Motorway between the Picton Road interchange and Bellambi Creek. The primary objectives of the proposal are to:

- Improve travel time and efficiency through additional lane capacity
- Improve road safety through enabling enhanced separation of slower moving and faster moving vehicles
- Provide for safe road and utility maintenance and access
- Increase reliability of access into and out of the Illawarra region and the Port Kembla, including for general freight, larger restricted access vehicles and high performance freight vehicles.

2.3.2 Development criteria

The development criteria for the proposal includes:

- Typically 3.5 metre lanes unless otherwise required for heavy vehicle tracking
- Median barrier full length (other than emergency crossover provision)
- Three metre wide outside shoulders
- Median width of up to 2.5 metres for drainage and gutter provision
- Longitudinal drainage (including median drainage) as required
- Provision for future Smart Motorways/Managed Motorways infrastructure
- Typical road furniture such as barriers, fences and maintenance accesses as required
- Overall design to facilitate a general 100 kilometres per hour posted speed environment.

2.3.3 Urban design objectives

Urban design objectives for the proposal include:

- Provide a road that is responsive to and integrated with the landscape
- Provide a well vegetated, natural road reserve to reinforce the existing qualities of the highway as a highway through bushland
- Provide an enjoyable and interesting highway.

Tract Consultants were engaged to prepare an Urban Design and Visual Impact Assessment report (UDVIA). The UDVIA is provided in Appendix D.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

Strategic options for the proposal were developed to meet the proposal objectives. Consideration was given to options both within and near to the existing road corridor.

The proposal constraints were identified and a route options analysis undertaken. Three strategic options were analysed for the proposal: a base case option, an upgrade with alignment improvements, and an option for a major realignment between Picton Road and Bulli Tops.

The strategic alternatives and several sub-options were analysed based on the proposal objectives (refer to Section 2.4.2) and the key issues identified in Table 2-2.

Table 2-2 Key issues considered for strategic alternatives

Issue	Option consideration/constraint
Design element	<ul style="list-style-type: none"> • Road safety <ul style="list-style-type: none"> - Superelevation considerations for prevention of aquaplaning. Superelevation is the extent by which the outside edge of a curve is raised to create a cross slope that helps vehicles to steer through the curve. It is measured as a percentage. • Constructability <ul style="list-style-type: none"> - Consideration of undercutting (where tie-ins to existing parts of the road cannot be achieved in the design). - Relocation or protection of utility assets. - Maintenance of two trafficable lanes in each direction while providing a safe work area behind barriers.
Environmental considerations	<ul style="list-style-type: none"> • Construction footprint <ul style="list-style-type: none"> - High slopes along the length of the proposal. • Biodiversity <ul style="list-style-type: none"> - Construction in vegetated areas near to, or within, WaterNSW scheduled lands. - Threatened species known to occur in the proposal area; Eastern Pygmy-possum and Coastal Upland Swamps (endangered ecological community). • Surface water and soils <ul style="list-style-type: none"> - Located within WaterNSW 'special area' land - Drainage is an existing issue in a couple of locations along the proposal length, in part due to the existing drainage design - Groundwater dependent ecosystems such as the Coastal Upland Swamps that adjoin the proposed road alignment.

2.4.2 Identified options

Three strategic options were originally considered to meet the objectives of the proposal, including:

- A base case option.
- Upgrade with alignment improvements
- Strategic options for major realignment between Picton Road and Bellambi Creek.

The options developed and assessed considered both Stage 1 and Stage 2 of the upgrade of the M1 Princes Motorway at Mount Ousley.

Base case

A theoretical base case would involve the least possible upgrade to the existing M1 Princes Motorway alignment with only minor improvements and ongoing maintenance.

Upgrade M1 Princes Motorway with alignment improvements

The upgrade involves road widening and realignment of the M1 Princes Motorway from a four lane divided road (two lanes in each direction), to a six lane divided road (three lanes in each direction).

The upgrade would include expansion of the road surface area, realignment and earthworks including bank stabilisation works and conservation measures.

Various sub-options were prepared for differing alignment improvements which considered:

- Design elements including constructability in areas with high slopes, requirements for vertical and horizontal alignment, batter slopes and subsequent earthworks cut and fill balances
- Environmental issues relating to potential impacts to biodiversity, hydrology, water quality, and soils in sections deviating from the existing alignment

Major realignment

Strategic options were considered for building a new road which would significantly deviating from the existing M1 Princes Motorway alignment between Picton Road and Bellambi Creek, traversing WaterNSW (previously Sydney Catchment Authority) scheduled lands and/or the Illawarra Escarpment State Conservation Area Wollongong Coal Lands. Various sub-options were prepared for a major realignment which considered:

- Design elements including constructability in areas with high slopes, requirements for vertical and horizontal alignment, batter slopes and subsequent cut and fill balances
- Environmental issues relating to potential impacts to biodiversity, hydrology, water quality, and soils in a largely undeveloped area
- The amount of roadworks required especially the earthworks would result in a substantially larger area of impact when constructing a new alignment as compared to upgrading along the existing alignment.

2.4.3 Analysis of options

The options described above have been considered in relation to the proposal objectives described in Section 2.3 and key issues outlined in Section 2.4.1.

Base case

The base case alternative does not satisfy the fundamental objectives for the proposal, including delivering improvements to traffic efficiency, road safety and reliability of access into and out of the Illawarra region. The M1 Princes Motorway would continue to have efficiency and road safety problems under this option. This would have flow on effects to the Illawarra region and the local and state economy. The base case alternative would not provide a satisfactory solution from a strategic, regional, local, planning or transport context and would not meet the project objectives.

As a result, the base case option was not considered further.

Upgrade M1 Princes Motorway with alignment improvements

This option would meet the proposal objectives and would address the proposals key issues, including:

- Improved travel time through additional lane capacity at known areas where heavy vehicle speeds drop below 40 kilometres per hour
- Improved road safety through enabling greater separation of slow and fast moving vehicles
- Improved access in and out of the Illawarra would be provided as the separation of commuters and heavy vehicles would result in more consistent travel times
- Road safety improvements through improved alignment superelevation, crossfall and road drainage
- Various sub-options were considered for this strategic option in consideration of batter slopes and cut and fill quantities. Cut and fill estimates for the sub-options ranged from about 37,000 to 49,000 cubic metres of cut and about 67,000 to 89,000 cubic metres of fill

This option addresses impacts on the community that may include land acquisition and impacts to road users during works. Environmental impacts may include vegetation clearance, impacts to Sydney's drinking water catchment, and minor noise and air quality impacts during construction.

Major realignment between Picton Road and Bellambi Creek

Construction of a major realignment between Picton Road and Bellambi Creek (Stage 1) would meet the proposal objectives as:

- Improved travel time would result from an improved alignment and additional lanes for heavy vehicles as well as the reduction of travel distance.
- Improved road safety through a slow vehicle lane where required and through the development of a design which meets the requirements of Roads and Maritime Services Austroads Guide Supplements (RTA/Pub.11.096)
- Reliability in and out of the Illawarra would be provided as the separation of commuters and heavy vehicles would result in more consistent travel times.

However, the option for a major realignment of this section of the M1 Princes Motorway would result in:

- Major land acquisition including land from both WaterNSW scheduled lands and from Endeavour Energy.
- Greater project cost which is outside the funding available for the proposal
- Progression of the project timeframe over a longer period due to a risk of requiring the relocation of major utility infrastructure
- About 250,000 cubic metres and 67,000 cubic metres of cut and fill respectively, would be required in previously undeveloped areas.

This option would offer similar project benefits as the option to upgrade within the existing alignment. However, the functional benefits of a major realignment are outweighed by the greater environmental impacts, larger areas of land acquisition and significantly higher project costs associated with this option, and was not considered feasible.

2.5 Preferred option

An upgrade to the M1 Princes Motorway with alignment improvements is the preferred option as it best meets the project objectives given the available funding profile and addresses all the key design issues for the proposal.

3 Description of the proposal

This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

Roads and Maritime propose to upgrade the M1 Princes Motorway (previously Mount Ousley Road) for around 8.3 kilometres, between Picton Road at Mount Ousley and Bulli Pass at Bulli Tops. The upgrade involves road widening and realignment of the M1 Princes Motorway from a four lane divided road (two lanes in each direction), to a six lane divided road (three lanes in each direction).

The upgrade of M1 Princes Motorway at Mount Ousley would be built in two stages. Stage 1 (southern section) extends between the Picton Road interchange and Bellambi Creek. Stage 2 (northern section) extends between Bellambi Creek and Bulli Pass at Bulli Tops.

This Review of Environmental Factors (REF) assesses the impacts of Stage 1 of the upgrade of the M1 Princes Motorway (the proposal). A separate REF will be prepared for Stage 2 of the M1 Princes Motorway upgrade.

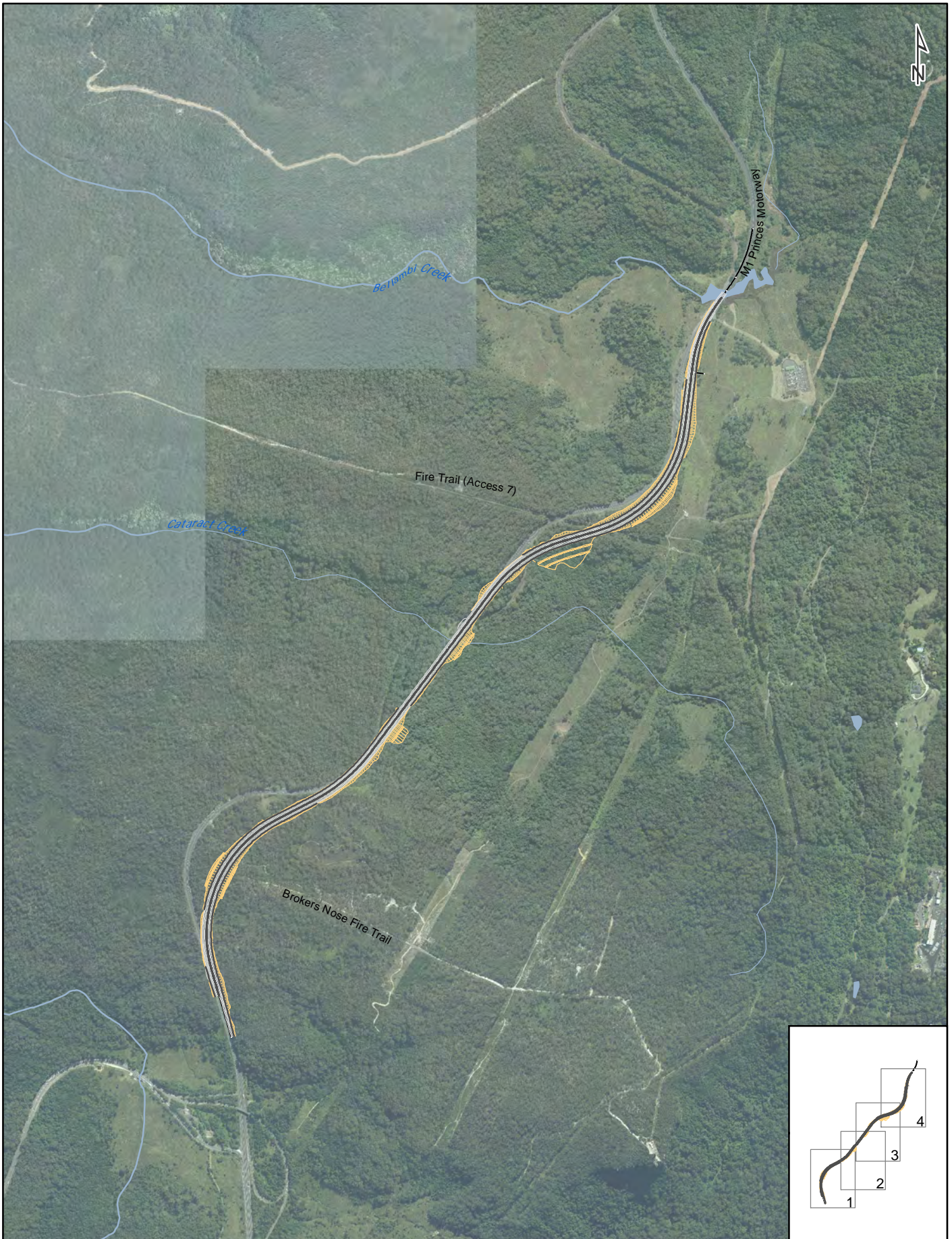
The proposal is shown in Figures 3-1 to 3-5 and illustrates the key features of the proposal.

Key features of the proposal would include:

- Widening and realignment primarily on the eastern side of the existing alignment, to a six lane (three in each direction) divided road from Picton Road to south of Bellambi Creek bridge
- Widening sections of the existing road from four lanes to six lanes from:
 - Picton Road interchange to 300 metres north of Picton Road
 - 1.65 kilometres north of Picton Road to the Fire Trail (Access 7) location for around one kilometre
- Realignment to the east of the existing road to provide six lanes from:
 - 600 metres north of Picton Road to 1.65 kilometres north of Picton Road
 - 2.7 kilometres north of Picton Road to 70 metres south of Bellambi Creek bridge
- Provision of a three metre wide shoulder for both carriageways
- Posted vehicle speed limit of 100 kilometres per hour
- Expansion of the road surface area including the replacement of safety barriers, relocation of road signage and infrastructure (such as permanent variable message signs)
- Realignment and earthworks including bank stabilisation works and environmental management measures
- Four major cuts up to 475 metres long and up to 14 metres in height
- Three major fill embankments up to 275 metres long and up to 20 metres in height
- Provision for ITS infrastructure including:
 - Vehicle detection loops in the pavement
 - CCTV infrastructure
 - Emergency phones and truck stopping bays (with storage for 25 metre B-Double)
- Water quality management measures and drainage structures
- Continued provision for public utilities within the proposal footprint, where practicable.
- Property acquisition at various locations to provide construction and operational access to

access tracks. (Wollongong Coal Limited, Endeavour Energy and WaterNSW)

- Temporary infrastructure to allow project works including site compounds, utility connections, sedimentation and erosion control, temporary access roads, temporary pavement for road traffic, stockpiling sites and other infrastructure as required.



M1 Princes Motorway Improvements -
Picton Road to Bulli Tops (Stage 1)

Key features of the proposal

Fig. 3-1

Source: Imagery from RMS

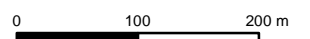
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M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1)

Key features of the proposal **Fig. 3-2**

Source: Imagery from RMS

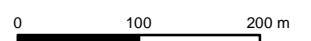




M1 Princes Motorway Improvements -
 Picton Road to Bulli Tops (Stage 1)

Key features of the proposal **Fig. 3-3**

Source: Imagery from RMS



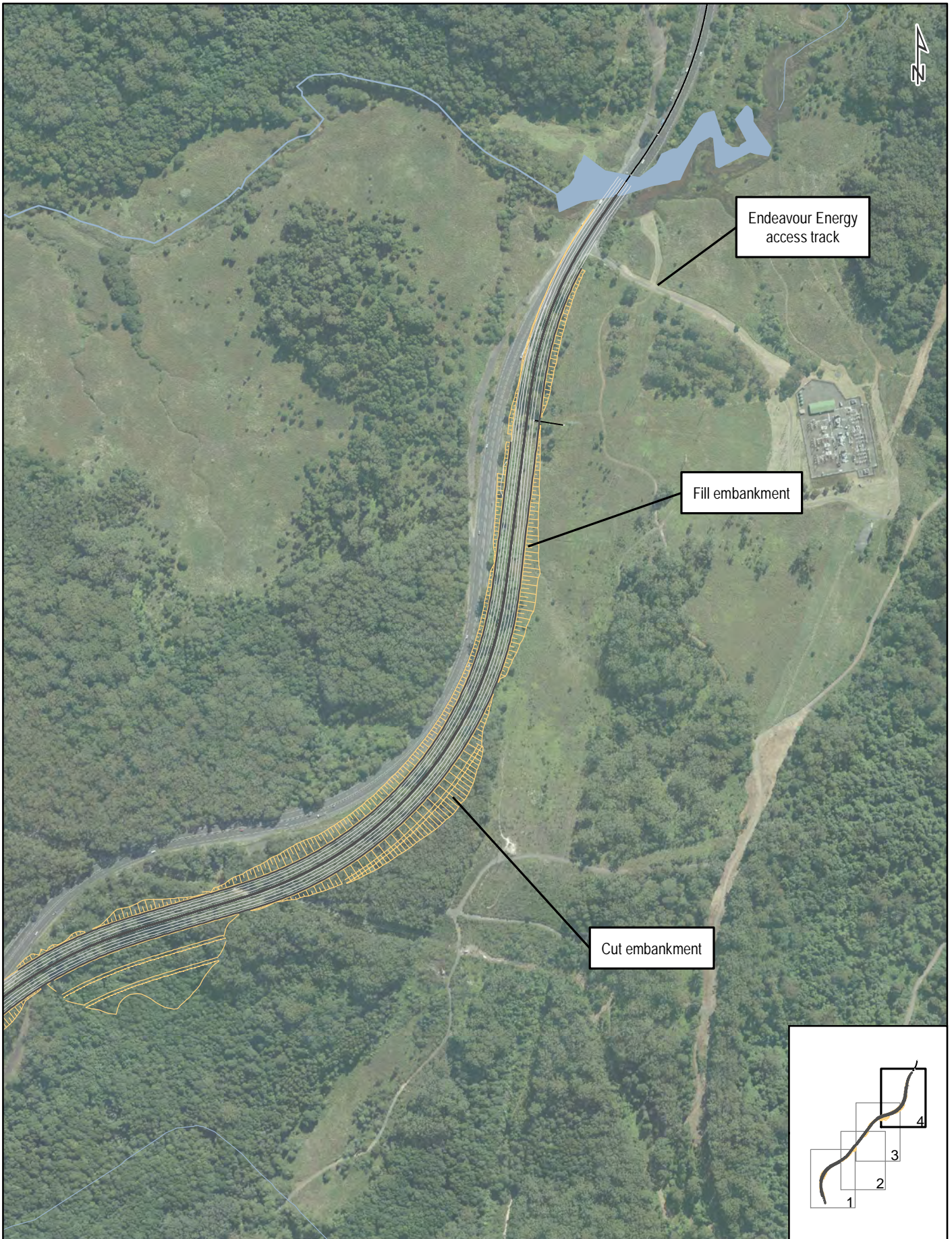


M1 Princes Motorway Improvements -
Picton Road to Bulli Tops (Stage 1)

Key features of the proposal **Fig. 3-4**

Source: Imagery from RMS

0 100 200 m

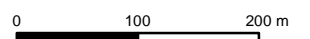


M1 Princes Motorway Improvements -
Picton Road to Bulli Tops (Stage 1)

Key features of the proposal

Fig. 3-5

Source: Imagery from RMS



3.2 Design

3.2.1 Design criteria

This section of M1 Princes Motorway has recently been approved as an A-double route. Where design data was available a passenger vehicle was used as the design vehicle. Typical cross-sections of the upgraded alignment are presented in Figure 3-1 and 3-2.

Design criteria that have been developed for the proposal are summarised in Table 3-1. Due to the existing alignment and topographical constraints not all design criteria can be met by the proposal at some locations.

Table 3-1 Design criteria

Criteria	Requirement
Motorway alignment and cross section	-
Design speed	100 kilometres per hour
Stopping sight distance	165 metres
Horizontal radius	460
Superelevation	6 per cent
Drainage	Pavement drainage design for 1-in-10 year ARI Cross drainage design for 1-in-100 year ARI
Grade	-
Lane width	3.5 metres
Shoulder width	3.0 metres
Median width	Minimum 1.0 metre
Batters	Fill batters are 2:1. Cut batters are at 0.25:1 with a 2 metre 10:1 bench at 6 metre heights
Design vehicle	Passenger car

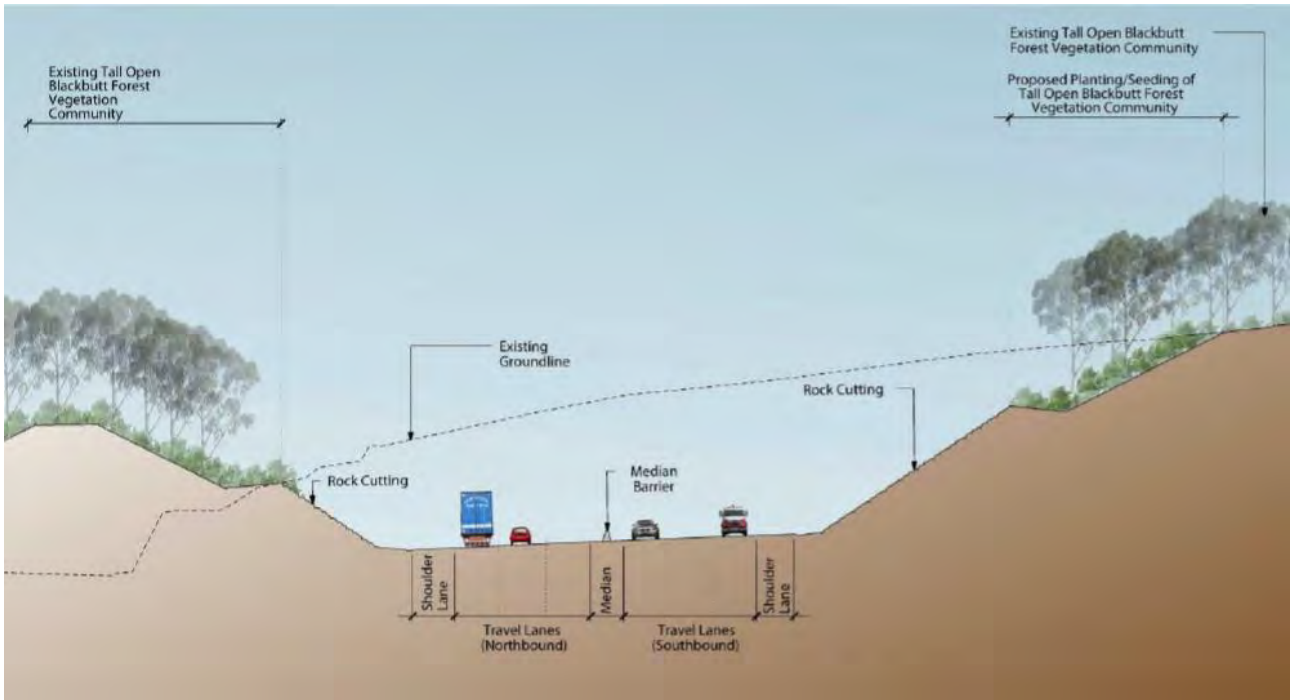


Figure 3-6: Typical cross section of the proposal (Cutting section) (Source: TRACT, 2016)

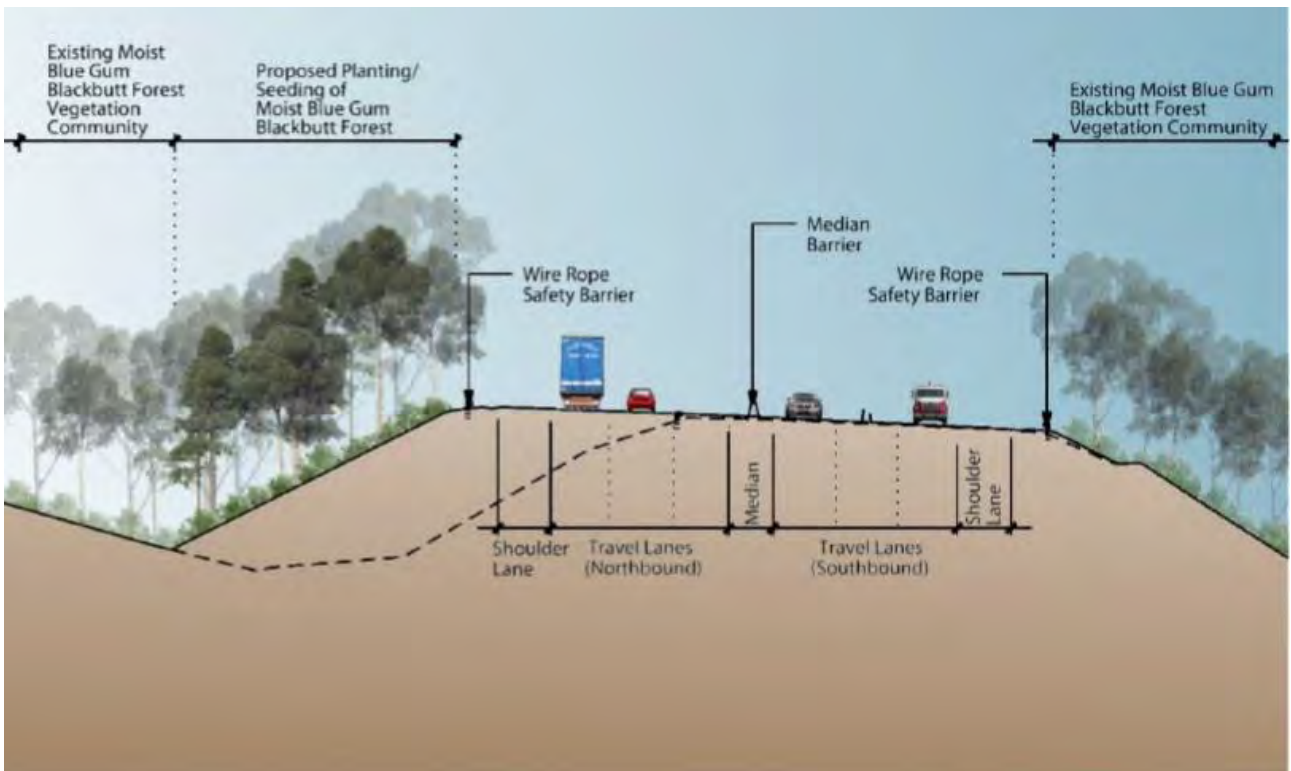


Figure 3-7: Typical cross section of the proposal (Fill section) (Source: TRACT, 2016)

3.2.2 Engineering constraints

Engineering constraints were identified as part of the concept design process. Key engineering constraints considered in the concept design include:

- This section of motorway is a divided multi-lane road, located in a 100 kilometres per hour posted speed limit, rolling rural environment. The existing carriageways have horizontal curves well below 460 metre radius, and with grades to around 10 per cent. The existing road does not meet current design guidelines for a 100 kilometres per hour travel environment.
- Alignment constraints vertically and horizontally including:
 - Minimising acquisition requirements of adjoining WaterNSW land scheduled lands, while allowing (providing) for sufficient long term access and maintenance capability
 - Superelevation considerations for prevention of aquaplaning.
 - Existing natural features, including topography and existing water courses/ drainage lines (specifically Cataract and Bellambi Creeks). To meet design criteria, large cuts and fills were required in many locations
- The route has recently been approved for A-double vehicles under a permit system:
 - Where design data is available, a passenger car was used as the design vehicle
 - Widening lanes to accommodate A-double have been provided
- Steep slopes of the Illawarra Escarpment, existing cuts and fill locations along the length of the proposal, and subsidence from surrounding underground mines.
 - The presence of existing utilities infrastructure including electricity (underground and overhead transmission easement) which may require adjustments, include Wollongong Coal power infrastructure
- Local weather conditions including high rainfall and fog events which significantly reduce road surface traction and visibility
- Construction staging of the project. The proposal would be generally constructed both offline and on the same alignment as the existing motorway. Where the upgrade involves widening of the existing road (online), this would pose construction staging challenges in order to provide a safe working environment while maintaining traffic flows in both directions

A constructability review was held as part of the project development. During the constructability review, the lessons learned from Northbound Acceleration Lane North of Picton Road project (0513.497.RC.2740), and their applicability to the project were discussed. Constraints identified included:

- The need to maintain four lanes of traffic flow during construction
- Construction of median drainage
- Breakdown strategies (during construction) for extensive lengths without shoulder
- Management of construction traffic switches
- Safe working widths for nearside and offside construction zones
- Speed management.

These issues and safety risks have influenced the design of the current proposal via both a constructability process and an ongoing Safety in Design process to produce an amended design which provides for safer construction and maintenance of the project, as well as allowing for a design which can be efficiently and cost-effectively built.

Engineering constraints and constructability issues would be subject to further consideration during detailed design. Many of the issues have been identified at the concept design stage, however future refinement during detailed design would be required to overcome the challenges identified for constructability.

3.3 Construction activities

3.3.1 Construction impact area

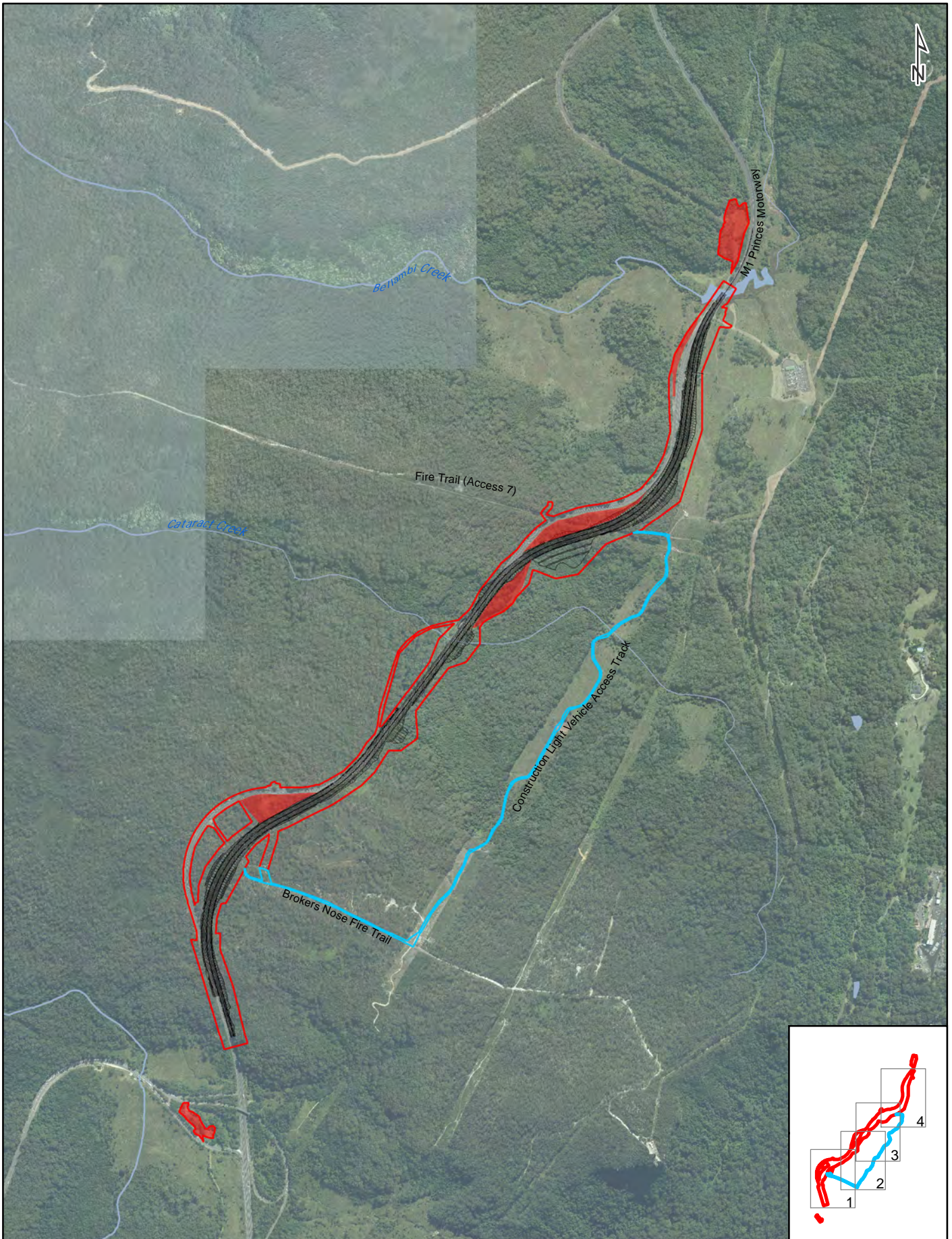
Figure 3-8 to Figure 3-12 show the construction impact area for the proposal. The figures illustrate the proposed construction area for the road widening as well as the construction compound areas. This is the area that is expected to be disturbed by vegetation removal, general road construction, operation of machinery and construction of access.

The construction impact area has been determined based on the project constraints and requirements detailed below:

- Steep terrain
- Endangered ecological communities
- Provision of erosion and sediment control measures
- Provision of adequate space for safe and efficient construction and access during construction
- Provision of adequate space for maintenance access
- Allowance for extra embankment areas to address potential geotechnical variability on site.

The final construction footprint will be developed and determined during detailed design to minimise clearing of vegetation.

An access track (Brokers Nose Fire Trail) would be used during construction by light vehicles to transport equipment and materials. The existing, cleared access track may require minor site preparation work to make good for construction vehicles, however no clearing of vegetation outside of the existing track alignment would be considered necessary.



- Ancillary site compounds
- Concept design
- Footprint**
- Construction footprint
- Construction light vehicle access track

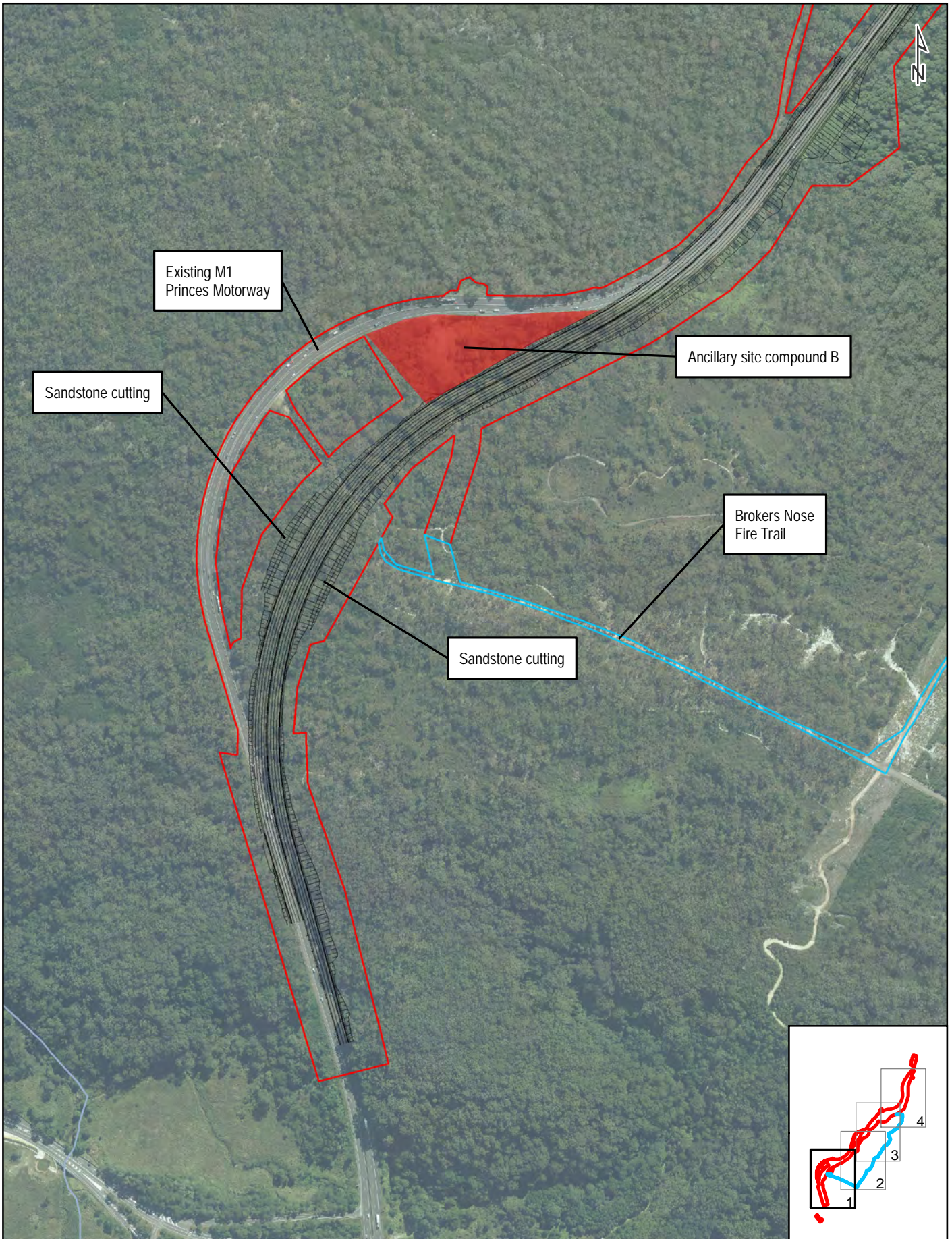
M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1)

Construction Impact Area

Fig. 3-8

Source: Imagery from RMS

0 100 200 m



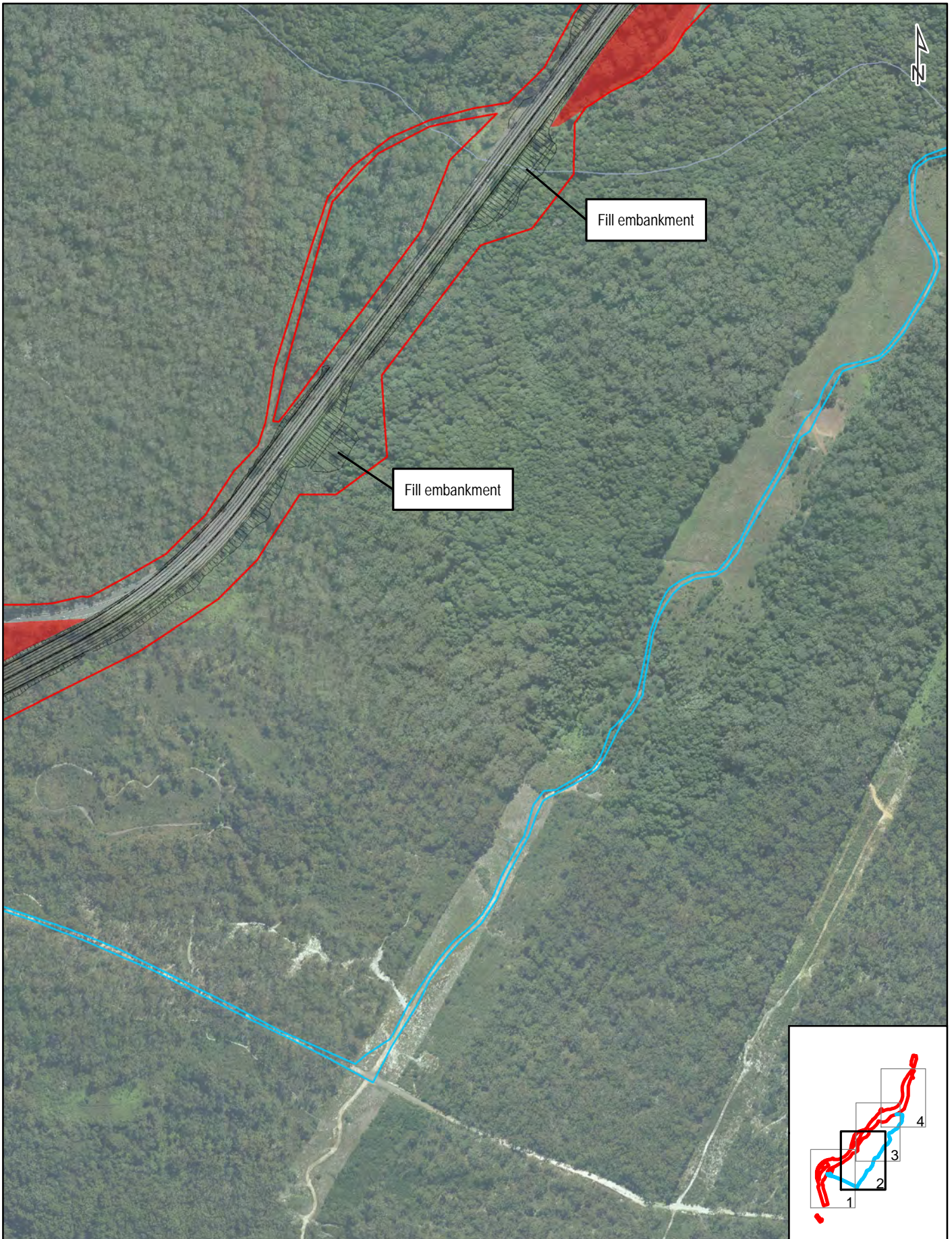
- Ancillary site compounds
- Concept design
- Footprint**
- Construction footprint
- Construction light vehicle access track

M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1)

Construction Impact Area **Fig. 3-9**

Source: Imagery from RMS





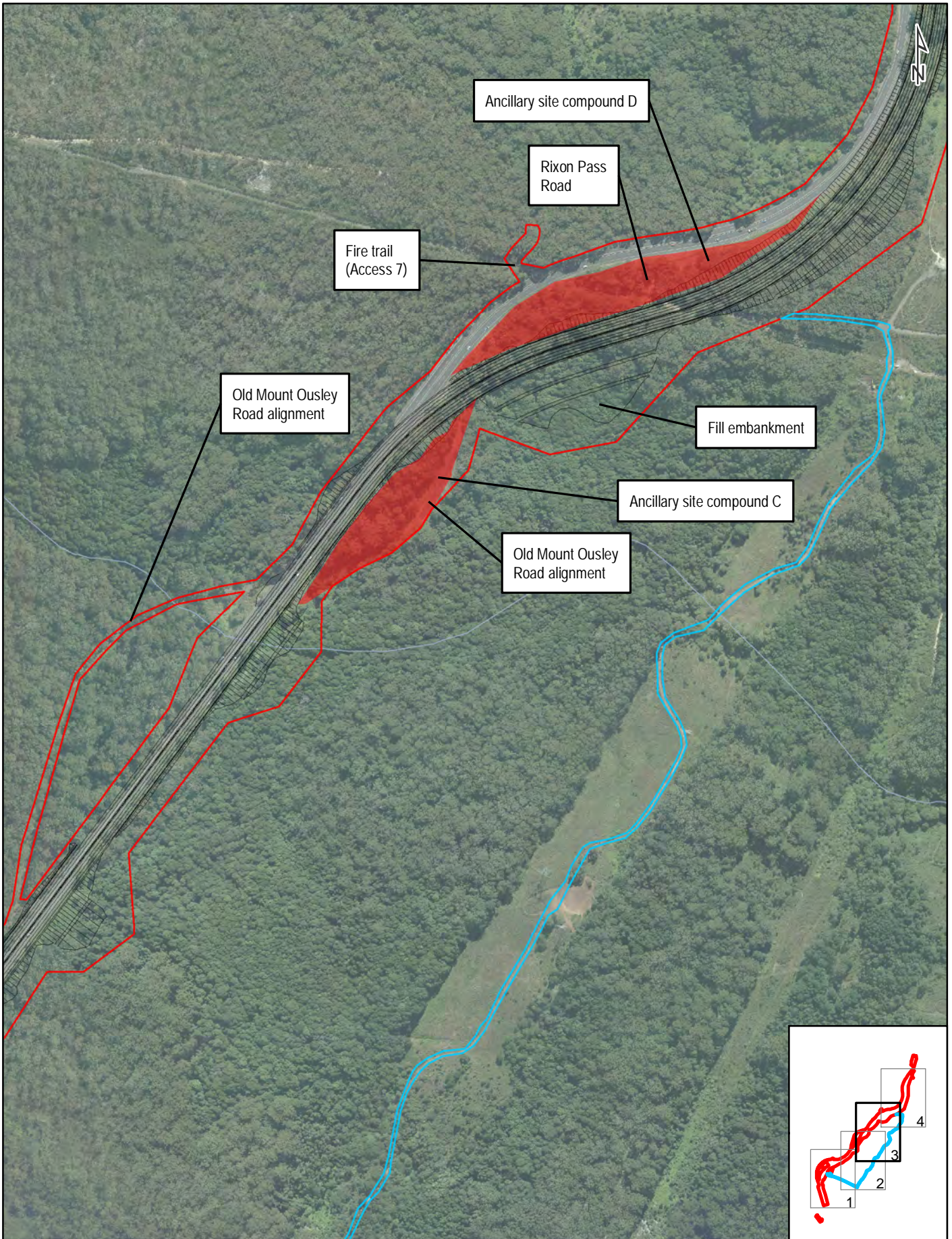
- Ancillary site compounds
- Concept design
- Footprint**
- Construction footprint
- Construction light vehicle access track

M1 Princes Motorway Improvements -
Picton Road to Bulli Tops (Stage 1)

Construction Impact Area **Fig. 3-10**

Source: Imagery from RMS





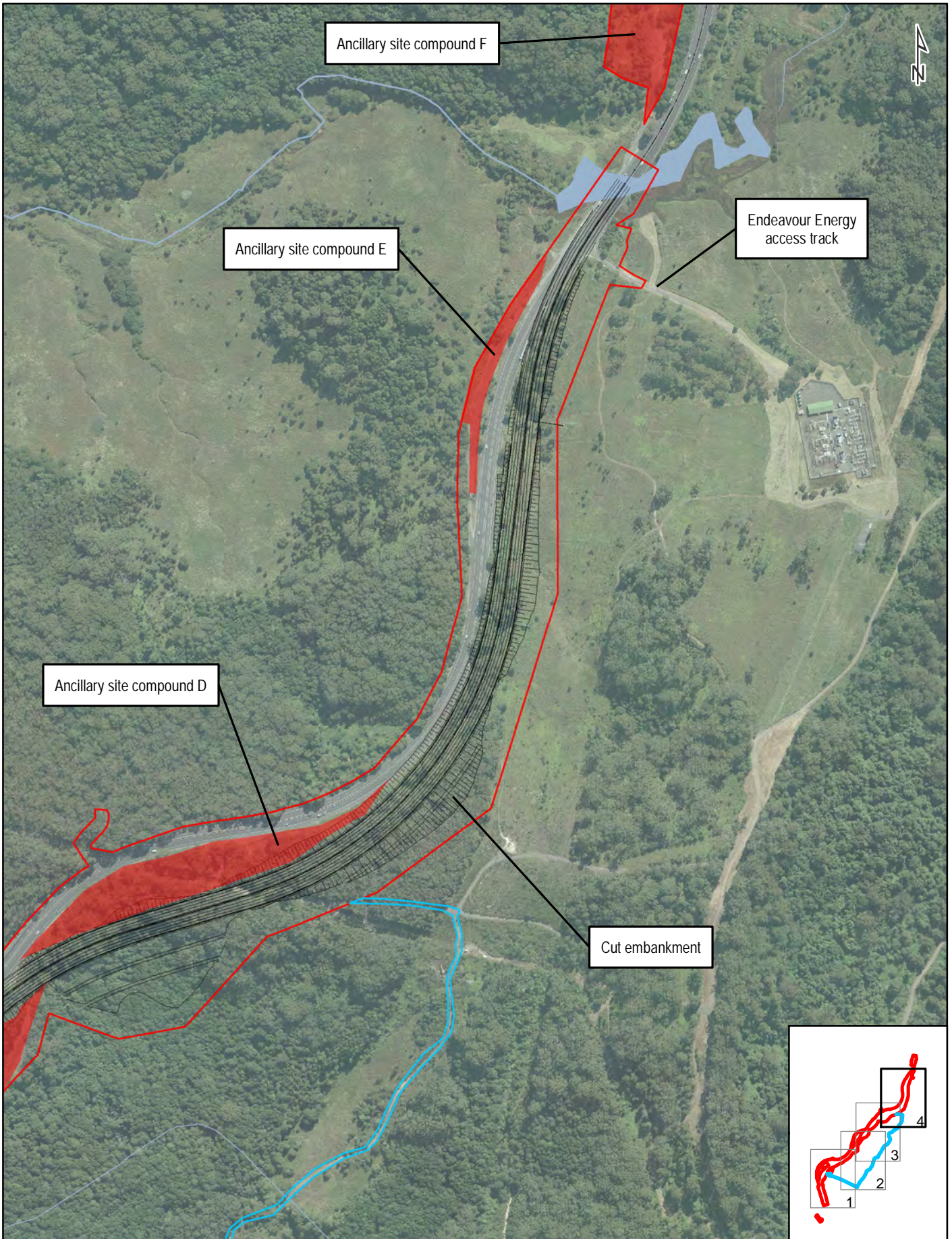
- Ancillary site compounds
- Concept design
- Footprint**
- Construction footprint
- Construction light vehicle access track

M1 Princes Motorway Improvements -
Picton Road to Bulli Tops (Stage 1)

Construction Impact Area **Fig. 3-11**

Source: Imagery from RMS





- Ancillary site compounds
- Concept design
- Footprint**
- Construction footprint
- Construction light vehicle access track

M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1)

Construction Impact Area **Fig. 3-12**

Source: Imagery from RMS



3.3.2 Work methodology

Details of the proposed pre-construction and construction activities are provided in Table 3-2. The methods used to construct the proposal would be conventional techniques employed on road projects, adapted to account for project-specific environmental and social constraints.

Local access requirements and the geotechnical conditions would influence the final choice of construction techniques to ensure the project is constructed in a safe, operationally functional and efficient manner. The types of equipment and plant requirements would be refined during detailed design and during the development of the construction methodology by the construction contractor.

Table 3-2 Potential pre-construction and construction activities

Component	Typical activities	Typical plant, equipment and materials
Preconstruction geotechnical investigations	<ul style="list-style-type: none"> • Test pitting • Bore hole drilling • Sample recording • Vehicle access • Minor vegetation impacts (low level clearing) • Seismic investigations • Potential for lane closures and other traffic management measures • Implementation of initial environmental safeguards including site sediment and erosion controls and pollution management measures appropriate to the activity. 	Four Wheel Drive vehicles, truck mounted drill rigs, small excavators and water carts
Site establishment	<ul style="list-style-type: none"> • Fencing of the construction areas of the road corridor. • Implementation of initial environmental safeguards including site sediment and erosion controls and pollution management measures. • Establishment of construction site facilities and access. • Additional surveys and geotechnical investigations as required. • Installation of temporary traffic controls and line marking. 	<p>Fences, portable sheds, portable toilets, road base and fuel storage tanks.</p> <p>Trucks, cranes, excavators, elevated work platform vehicle, backhoes and trenchers and small equipment.</p>
Survey	<ul style="list-style-type: none"> • Vehicle access • Minor vegetation trimming • Peg or marker installation 	Four wheel drive vehicle
Site preparation	<ul style="list-style-type: none"> • Vegetation clearing and grubbing. Processing (including recycling) of various materials for use in fencing or landscaping activities. • Stripping and stockpiling of topsoil for reuse. 	Trucks, bulldozers, scrapers, graders, excavators, backhoes, mulcher and small equipment.
Relocation / protection of services	<ul style="list-style-type: none"> • Relocation or protection of services. 	Trucks, cranes, excavators, elevated work platform vehicle, backhoes and trenchers and small equipment.

Component	Typical activities	Typical plant, equipment and materials
Earthworks	<ul style="list-style-type: none"> • Removal and stockpiling of spoil and unsuitable material • Earthworks, including drilling and blasting and movement of materials along the alignment from cutting to fill embankment areas. Based on estimates drawn from the concept design, it is predicted that there would be about 340,000 cubic metres of cut which would be reused as fill for the proposal • Excess spoil would be disposed of at a licensed facility within 25 kilometres of the site. Excess spoil generated by the proposal would be around 10,000 cubic metres • Batter treatments. The current and proposed road alignment sits depressed between batters of up to six metres high in some locations. 	<p>Trucks, bulldozers, excavators, scrapers, graders, water carts, compactors, rollers, blasting equipment, rock crushing equipment, and elevated work platform vehicle.</p> <p>Materials include site-won and imported earth and rock material.</p>
Drainage	<ul style="list-style-type: none"> • Preparation of construction diversion drains and temporary sedimentation ponds • Construction of road drainage structures, including culvert extensions. 	<p>Concrete pumps, cranes, excavators, trucks, trenching equipment, shoring equipment, small equipment.</p> <p>Materials include precast concrete pipes and pits, concrete, formworks</p>
Pavements including motorway widening	<ul style="list-style-type: none"> • Construction of pavement layers including sub-base, base and surfacing layer as well as sub-surface drainage 	<p>Graders, backhoes, trucks, water carts, vibratory compactors, trenching equipment, concrete agitator trucks, bitumen sprayers, material transfer vehicle, asphalt pavers, vibratory rollers and rubber-tyre rollers.</p> <p>Materials include road base and subbase material, subsoil pipes, concrete, asphalt, bitumen and bitumen emulsion.</p>
Other works	<ul style="list-style-type: none"> • Installation of safety barrier systems, temporary lighting, conduit, phone installation, fencing and roadside furniture • Landscaping • Line marking and raised pavement markers. • Sign posting. 	<p>Trucks, fencing and barrier materials, landscaping materials, cranes, line markers and small equipment.</p>
Finishing works	<ul style="list-style-type: none"> • Removal of temporary works • Progressive rehabilitation of disturbed areas by means of bank stabilisation using measures such as revegetation, geofabric, soil binders, 	<p>Trucks, excavators, backhoes, cranes, hand tools and landscaping materials.</p>

Component	Typical activities	Typical plant, equipment and materials
	jute matting and the like <ul style="list-style-type: none"> • Decommission, restoration and landscaping of temporary sites • Site clean-up and disposal of all surplus waste materials. 	

The construction of the proposal would be undertaken by a contractor(s), to be selected following a tendering process. Prior to the commencement of construction, a detailed work methodology would be refined and finalised. In addition, a Construction Environmental Management Plan (CEMP) would be developed, addressing environmental impacts associated with the construction of the proposal by the selected contractor.

3.3.3 Construction hours and duration

It is anticipated that construction of the proposal would be undertaken both during and outside of standard working hours. Standard hours adopted by Roads and Maritime Services are as follows:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and Public Holidays: no work.

The majority of works would be undertaken during standard working hours. However, works are also likely to be required outside standard working hours to minimise traffic impacts, including:

- General construction activities
- Delivery of materials or oversized structural elements, required outside of standard hours by the police or other authorities for safety reasons
- Construction and utility adjustment works requiring road occupancy and/or restricted outage timings
- Placement of asphalt wearing course
- Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

Prior to and during the construction period, Roads and Maritime would advise the travelling public of traffic and travel information on any changes to posted travel speed or major works. (Eg. 'LiveTraffic' online service).

3.3.4 Plant and equipment

A list of the indicative plant and equipment required for general construction activities, construction associated with the road embankments, drainage infrastructure and road pavement is provided in Table 3-2. It has been assumed that during each component of construction, the required plant and equipment such as vibrating and static rollers and excavators would be kept on site in designated compound areas. The exact storage requirements for the indicative plant and equipment would be confirmed during detailed design and assessed closer to the commencement of construction activities.

3.3.5 Earthworks

The proposal would require sections of cut and fill along most of the alignment proposed for road widening. Large sections of fill are proposed for road realignment works, as shown in Figures 3-8 to 3-12.

Four major cuts up to 475 metres long and up to 14 metres in height are proposed and three major fill embankments up to 275 metres long and up to 20 metres in height would be required

Current estimates are that about 330,000 cubic metres of fill would be required, and about 340,000 cubic metres of cut material would be generated by the proposal, resulting in an estimated surplus of about 10,000 cubic metres.

3.3.6 Source and quantity of materials

Construction would require various materials and pre cast elements including, but not limited to, the following:

- General fill (of varying quality) for use in earthworks
- Pavement materials, including verge material and road base and sub-base
- Materials for lining drainage channels
- Aggregate for use in concrete and asphalt
- Sand for use as backfill around pipes and for asphalt and concrete
- Cement and concrete
- Bitumen
- Geofoam
- Steel for use in reinforcement of structures
- Wood for use in formwork and other temporary structures
- Safety barriers, signage and other road furniture
- Road gantry's and equipment such as electronic speed signage, variable message signage and supporting infrastructure
- Emergency telephones
- CCTV facilities
- Lighting poles and lamps
- Geotextiles and geofabrics
- Fencing
- Erosion and sediment control materials including sediment fencing, geofabric and stormwater drain protection
- Utility materials
- Topsoil
- Water
- Pre-cast pits, pipes, culverts, and headwalls for drainage works
- Pre-cast barriers and other road furniture.

Construction materials would be sourced primarily onsite where possible, with the rest sourced from local commercial suppliers where feasible. The quantities of material required for the construction of the proposal would be refined during the detailed design phase of each of the two Stages of construction. Based on estimates drawn from the concept design, it is predicted that the following approximate quantities would be required for earthworks and construction:

- 340,000 cubic meters of cut which would be used for the proposal where suitable as fill
- 212,000 cubic meters of topsoil stripping
- 30,000 cubic meters of asphalt (including open grade asphalt and dense grade asphalt)
- 19,000 lineal meters of precast concrete for drainage structures (such as pipes, box culverts, concrete lining of open drains and other).

3.3.7 Traffic management and access

Construction of the proposal would require heavy vehicle movements. These would mainly be associated with transport of construction machinery and equipment, and the import and movement of road construction material.

Table 3-3 outlines the indicative heavy vehicle movements during major aspects of the construction phases of each stage of the proposal.

Table 3-3: Heavy vehicle movements during major aspects of construction

Construction activity	Anticipated duration	Heavy vehicles per day
<p>Earthworks</p> <ul style="list-style-type: none"> Removal and stockpiling of spoil and unsuitable material. Earthworks, including potential blasting and movement of materials along the alignment from cutting to fill embankment areas. 	<p>The majority of the earthworks would take place during the first 12 months of construction. Heavy vehicles would make use of the off-line sections of the alignment, which would alleviate traffic numbers along the M1 Princes Motorway during construction.</p>	105
<p>Pavements</p> <ul style="list-style-type: none"> Construction of pavement layers including sub-base, base and surfacing layers as well as sub-surface drainage. 	<p>The pavement construction will occur progressively in stages over 12 months following the completion of the corresponding earthworks, during the second half of the project timeframe.</p>	25

It is estimated that about 105 heavy vehicles would be required to access the site daily during the busiest construction phases, resulting in 20 vehicle movements during peak periods. Further minor vehicle movements would be required on site for other components of construction not outlined in

Table 3-3. The movement of workers, supervisors and the general movement of materials and small plant are estimated to generate a maximum of 30 to 50 small vehicle movements per day.

Construction staging would be managed to allow the majority of the proposal to be constructed off-line while still providing at least one trafficable lane in each direction for through traffic.

For the duration of construction the posted speed limit will be reduced to 80 kilometres per hour in both directions.

As part of construction and staging of the project, temporary road closures of the M1 Princes Motorway from Picton Road Interchange to Bulli Tops would be required. Temporary road closures would be occasional and short-term in duration (periods of less than 48 hours). Any temporary closure times would be coordinated with existing Roads and Maritime network maintenance and closure events where practicable, in order to minimise overall network disruption.

During temporary closures, the proposed alternate routes for motorists traveling to and from Wollongong and the surrounding area would be via Picton Road or Appin Road/Bulli Pass.

The proposed heavy vehicle detour would also be via Picton Road or Appin Road/Bulli Pass. Vehicles over 19 metres, including B-doubles are not permitted on Bulli Pass and would use Picton Road.

During construction of the proposal, the dates and details of closures would be determined and an alternative detour map would be developed as part of the communications strategy. This communications strategy would be made available to the public in the lead up to any planned closures.

Access to private properties and WaterNSW lands would be maintained, with the exception of during the temporary road closures during construction. Emergency access would be provided on all roads if required.

A Traffic Management Plan (TMP) would be prepared in accordance with Roads and Maritime Services Traffic Control at Work Sites (RTA, 2010) and Roads and Maritime Services Specification G10 – Traffic Management (RMS, 2015). The traffic management plan would provide details of the traffic management to be implemented during construction to ensure that traffic flow is maintained where possible. The TMP would also detail specific routes that construction traffic would follow throughout the construction phase. Traffic management measures outlined in Section 6.6 would also be implemented. The TMP would be reviewed by Roads and Maritime prior to implementation.

3.4 Ancillary facilities

3.4.1 Ancillary site compounds

The proposal requires the provision of six site compounds to act as a centre for construction coordination and communication, employee and visitor amenities and car parking. Site compounds may provide a mix of services, and provide both construction and administrative support. Six potential ancillary site compounds have been selected as illustrated in Figure 3-13.

Site compounds would also be used for the following:

- Storage of construction plant and equipment
- Storage of construction materials, including chemicals
- For ancillary facilities including staff amenities
- To temporarily store pre-cast concrete components, aggregates and mobile machinery for asphalt paving
- Provision of light duty vehicle parking areas.

Site compounds may also be co-located with stockpile sites (refer to Section 3.4.2).

The establishment of site compounds would form part of the site establishment works, and would include:

- Erection of site fencing, and establishment of erosion and sediment control measures
- Clearing and levelling the site to facilitate drainage
- Construction of hard stand areas, including dedicated hard stand for plant and equipment, plant inspection and maintenance, vehicle wash down, and bunded storage areas for fuels and chemicals
- Establishment of pre-fabricated or purpose built temporary offices, crib sheds and storage sheds, which may be supplemented by existing dwellings if present on the site
- Establishment of temporary utility connections, if not pre-existing and/or sewerage storage and pump out facility if no sewerage connection can be made.

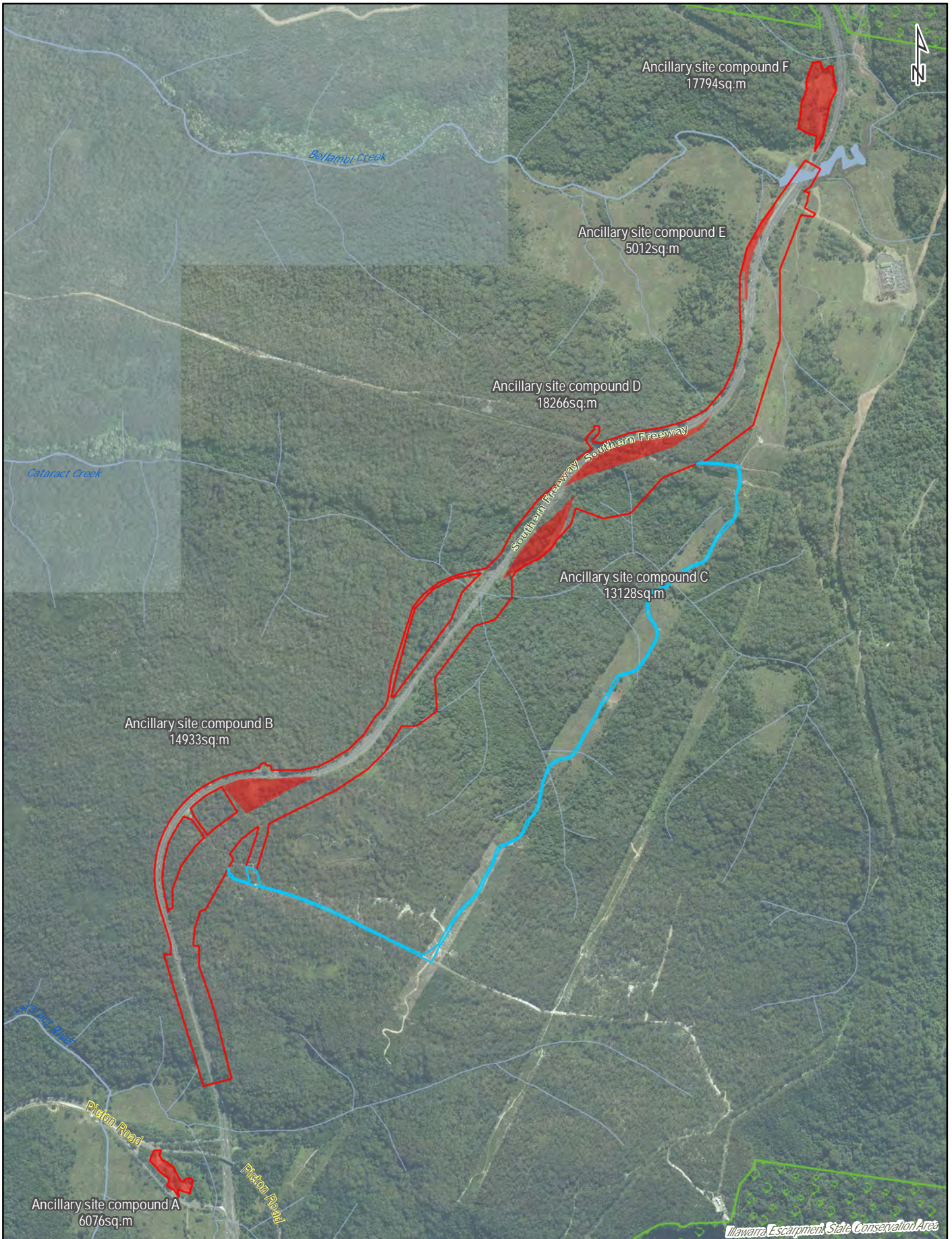
The location and layout of site compounds would be designed with consideration for the natural and built environment, and the location of sensitive receivers.

Access to the ancillary sites compounds would be from the existing motorway. No crossing right hand in or right hand out movements would be permitted, access would be limited to left in, left out only.

3.4.2 Stockpiles

Stockpiles would be required for the duration of construction. Construction stockpile sites would temporarily store materials for construction, or materials generated from within the construction site. This could include road base constituents, stripped topsoil, mulch, pre-cast concrete components and excess spoil unsuitable for project use. Potential compound sites, some of which would incorporate stockpile sites, have been selected as illustrated in Figure 3-13.

Stockpiles would be managed in accordance with the requirements of Roads and Maritime Services *Stockpile Site Management Procedure* (2011) and the *QA Specification R44 – Earthworks*. Site establishment activities for all stockpile sites would include activities such as the erection of site fencing and establishment of sediment and erosion control measures.



- Ancillary facility locations
- NPWS Estates
- Construction footprint
- Construction light vehicle access track

M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1)

Potential ancillary facility locations

Fig. 3-13

Source: Imagery from RMS

0 100 200 m

Locations of proposed ancillary facilities can be seen in Figure 3-13. The boundary of the assessment provides for ancillary facilities to be located adjacent to the M1 Princes Motorway, at existing hardstand areas such as the Picton Road interchange and along the remnant road alignment at Bellambi Creek.

The size and extent of stockpiles would be determined closer to the detailed design phase. The duration and particular functions of each stockpile would be determined by the contractor undertaking construction of the proposal and would be included in the CEMP.

3.4.3 Erosion and sediment controls

Potential locations for construction sedimentation detention basins have been allowed for in the construction impact area. Details of the temporary erosion and sediment controls would be included in the Erosion and Sediment Control Plan (ESCP), within the CEMP. The final number and location of water quality basins would be determined during detailed design in accordance with relevant policies and procedures (potential water quality basin locations are shown in Figures 3-1 to 3-5).

Sedimentation basins would be excavated at low-lying areas adjacent to the formation, close to natural watercourses. All sedimentation detention basins would be sized in accordance with the requirements of *Managing Urban Stormwater; 'Soils and Construction' Volume 1 4th Edition* (Landcom, 2004) and *Volume 2D – Main Road Construction* (DECC, 2008).

3.5 Public utility adjustment

A Dial-Before-You-Dig search was carried out in April 2012 to determine public utility providers with assets within the vicinity of the proposal. In the broader project area Endeavour Energy and TransGrid high voltage power transmission lines are present, but are not anticipated to be impacted.

A Wollongong Coal overhead power supply line crosses the alignment about 350 metres north of Fire Trail (Access 7).

3.6 Access adjustments

There are four existing access locations within the proposal area. All accesses are infrequently used fire trails or utility access points. The access points include:

- **Brokers Nose fire trail (Bulli track)** would be amended, as the current location would be impacted by a major cut
- **Fire trail (Access 7)** would be relocated due to the realignment of the road at its current location
- **Rixon Pass Road** would be relocated due to the realignment of the road at its current location
- **Endeavour Energy access track** be amended to improve sight distance and safety, particularly for vehicles exiting the substation lands.

To discuss and determine access needs, an Access Workshop was convened by the project team and held at Roads and Maritime offices in August 2015. At the workshop were representatives of landowners, emergency services and authorities including:

- NSW Rural Fire Service (RFS)
- NSW Police
- Wollongong Coal
- WaterNSW (previously SCA)

While National Parks and Wildlife Service (NPWS) were unable to attend on the day a follow up meeting was held with NPWS representative to cover the issues discussed at the group workshop, in early September 2015.

The workshop was held to describe to attendees the nature of the project and its current design status, to obtain initial feedback, and (predominately) to discuss the various access needs and locations on a case by case basis. This process enabled Road and Maritime to better understand

the access needs of the various stakeholders, including frequency of access, vehicle requirements, and other concerns. The Roads and Maritime project team also identified accesses of particular safety concern, which may benefit from re-routing, realignment or closure.

This access workshop was key in driving the design needs and outcomes for accesses from the project. In addition to off-alignment accesses, on-road emergency accesses (such as emergency vehicle access through the median) were discussed and identified.

From the access workshop Roads and Maritime has developed an access strategy to enable safe long term access for stakeholders, including appropriate sight distance and turn paths and access ways, access control (including gating and security), emergency management and incident safety (such as during an unplanned fire event), including for the construction period.

3.7 Property acquisition

Property impacts have been minimised where possible via design, however the proposal would require the acquisition of around 28.8 hectares of property for the minor adjustments in the alignment and widening of the motorway. Details of the areas of acquisition, owners of the properties and the existing land uses are presented in Table 3-4. It should be noted that the current estimates for property acquisition may be subject to amendments during detailed design. Any changes to property acquisition would be confirmed in consultation with the relevant landowners.

The preliminary adjusted road boundaries would be subject to confirmation following concept design finalisation. Property acquisition would be undertaken in accordance with *RTA's Land Acquisition Policy and the Land Acquisition (Just Terms Compensation) Act 1991*.

Table 3-4: Proposed property acquisition

Lot and DP	Current owner	Total area (m ²)	Acquisition type	Land use zone (LEP)
Lot 6 DP 793358	Wollongong Coal Limited (Gujarat NRE Coking Coal Ltd)	17,140	Partial acquisition	E2 - Environmental Conservation
Lot 1 DP 1186788	WaterNSW (Sydney Catchment Authority)	135,400	Partial acquisition	E2 - Environmental Conservation
Lot 34 DP 751301	Wollongong Coal Limited (Gujarat NRE Coking Coal Ltd)	36,800	Partial acquisition	E2 - Environmental Conservation
Lot 30 DP 751301	Wollongong Coal Limited (Gujarat NRE Coking Coal Ltd)	56,300	Partial acquisition	E2 - Environmental Conservation
Lot 31 DP 751301	Wollongong Coal Limited (Gujarat NRE Coking Coal Ltd)	30,100	Partial acquisition	E2 - Environmental Conservation
Lot 12 DP 736121	Endeavour Energy	12,500	Partial acquisition	E2 - Environmental Conservation

4 Statutory and planning framework

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

Clause 96 (1) permits development for the purpose of a road or road infrastructure facilities (other than development referred to in clause 94 (1) or 95) to be carried out with consent on land within a 'special area' within the meaning of the *Water NSW Act 2014*. As the proposal meets the definition of clause 94 (1) it can be undertaken without consent.

As the proposal is for a road and is to be carried out on behalf of Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

The proposal does not affect land or development regulated by State Environmental Planning Policy No. 14 - Coastal Wetlands, State Environmental Planning Policy No. 26 - Littoral Rainforests, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (Major Development) 2005.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in chapter 5 of this REF.

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 relates to the use of land within the Sydney drinking water catchment. Clause 12 of the SEPP requires consideration of whether or not an activity to which Part 5 of the EP&A Act applies will have a neutral or beneficial effect on water quality before carrying out the activity.

The Neutral or Beneficial Effect on Water Quality Assessment Guidelines (WaterNSW, 2015) supports the implementation of the SEPP by providing clear direction on what a neutral or beneficial effect means, how to demonstrate it, and how to assess an application against the neutral or beneficial effect on water quality test using the 'Neutral or Beneficial Effect on Water Quality Assessment Tool 2011' (the NorBE Tool).

A Neutral or Beneficial Effect (NorBE) assessment has been prepared for the proposal in accordance with the guideline. The assessment demonstrates that the proposal would achieve a neutral or beneficial effect water quality. A summary of the outcomes of the NorBE assessment is provided in the Erosion and Sediment Management Report (Appendix E) and is discussed in Section 6.1.

4.1.2 State Environmental Planning Policy No. 44 (Koala Habitat Protection)

The objective of the State Environmental Planning Policy No. 44 (SEPP 44) is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. The Policy requires the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat.

No characteristic scratching or scats were identified during the field surveys and the study area has not been identified in previous regional surveys as having resident Koala populations. Therefore, it is unlikely that the study area would be classified as core Koala habitat. None of the feed tree species forming core Koala habitat were found to be within the study area, as such the site is not considered to be potential Koala habitat under SEPP 44.

4.1.3 Local Environmental Plans

The Wollongong Local Environment Plan 2009 (Wollongong LEP) is the statutory planning document applying to all land within the Wollongong Council, with the exception of land under the provision of relevant State Environmental Planning Policies. The proposal is located mostly within land classified as SP2 Infrastructure (Road) and for the length of the proposal, the SP2 Infrastructure zone sits entirely within land classified as E2 Environmental Conservation. Where the road alignment widens beyond the existing road corridor, southbound from Bulli Pass, the proposal would enter into E2 zones.

The objectives of the SP2 Infrastructure zone is to provide for infrastructure and related uses; prevent development that is not compatible with or that may detract from the provision of infrastructure; and provide for key transport corridors. The proposal has been identified in the Wollongong LEP as being permissible with consent within the sections of the SP2 Infrastructure zone.

Objectives of the E2 Environmental Conservation are generally to protect the environmental significance of the land and to prevent development that could destroy, damage or otherwise have an adverse effect.

Where the proposal extends into the E2 zone, the proposal is prohibited as it is not it is not classified as an activity permitted with consent for Zone E2.

Notwithstanding, the proposal is permissible under Clause 94 of ISEPP and can be carried out by or on behalf of a public authority without consent.

Clause 7.2 of the LEP seeks to protect, maintain or improve biodiversity on lands that are identified as “Natural resource sensitivity—biodiversity” in the LEP. Clause 7.8 provides controls to protect, conserve and enhance the Illawarra escarpment. Safeguards and management measures provided in Section 7 of this REF would ensure the proposal is carried out in a manner that satisfies the objectives of these clauses.

4.2 Other relevant NSW legislation

4.2.1 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides that land may be reserved as a national park, nature reserve, historic site, state conservation area, regional park, Aboriginal area or karst conservation reserve. The provisions of the NPW Act therefore apply to the Illawarra Escarpment State Conservation Area.

However, Stage 1 of the proposal would not extend into areas which are part of the Illawarra Escarpment State Conservation Area. No revocation, recategorisation or adjustment of lands reserved under the NPW Act would occur during Stage 1 of the proposal.

The NPW Act provides the primary basis for the protection and unwarranted destruction of Aboriginal relics of high cultural significance. Aboriginal objects are protected under section 86 of the NPW Act. It is an offence to harm or desecrate an Aboriginal object, either knowingly (section 86(1)) or unknowingly (section 86(2)). Under section 90(1) of the NPW Act, the Chief Executive of the Office of Environment and Heritage (OEH) may issue an Aboriginal Heritage Impact Permit (AHIP). The regulation of these permits is provided in Part 6 of the NPW Act, including regulations relating to consultation (section 90N).

Roads and Maritime Services conducted a search of the Aboriginal Heritage Information Management System (AHIMS) database in accordance with the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI, Roads and Maritime Services 2011) on 23

October 2014. No items of Aboriginal Heritage were listed as being located within or near to the proposals construction impact area. As such, an Aboriginal Heritage Impact Permit would not be required to destroy or partially destroy sites prior to construction. A specialist report, including site investigations was undertaken for the proposal and is located in Appendix F.

4.2.2 Protection of the Environment Operations Act 1997

OEH is the responsible agency for the administration of the *Protection of the Environment Operations Act 1997* (POEO Act) in relation to air, noise, water, pollution and waste management. Under clause 48(1) an Environment Protection Licence (EPL) is required for scheduled activities as defined by Schedule 1 of the Act. Construction of a road greater than four lanes in width and for a distance of more than one kilometre in the metropolitan area is defined as a scheduled activity under the Act (Schedule 1, Part 1(35)(2a)). In addition, the proposal is likely to result in the extraction of more than 30,000 tonnes of material, and as such, is also classified as a scheduled activity under the Act (Schedule 1, Part 1 (19)(1)). An EPL would be required for the proposal and would be applied for through the NSW Environment Protection Agency (EPA). The construction and operation of the proposal would also be required to comply with Section 120 of the Act which makes it an offence to cause water pollution.

4.2.3 Water NSW Act 2014

The principal objectives of WaterNSW are to:

- Ensure that the catchment areas and the catchment infrastructure works are managed and protected so as to promote water quality the protection of public health and public safety, and the protection of the environment.
- Ensure that water supplied by it complies with appropriate standards of quality.
- Where its activities affect the environment, to conduct its operations in compliance with the principles of ecologically sustainable development contained in section 6 (2) of the *Protection of the Environment Administration Act 1991*.
- Manage the catchment infrastructure works efficiently and economically and in accordance with sound commercial principles.

WaterNSW (formerly Sydney Catchment Authority and State Water) owns and manages land and catchment management assets on land dedicated under the *Water NSW Act 2014*. Part 4 of the *Water NSW Act 2014* allows for the declaration of 'special areas' to protect water storages, such as drinking water catchments.

In accordance with the Water NSW Regulation 2013, WaterNSW regulates certain activities in 'special areas', including the introduction of wastes and the pollution of waters. The consent of WaterNSW under Clause 9 of the Regulation is required to carry out these activities in a 'special area'.

The proposed work would be undertaken within a WaterNSW 'special area', as identified in Schedule 1 of the Water NSW Regulation 2013. Roads and Maritime would continue to liaise with WaterNSW in regard to access and work for the proposal within the 'special area'.

4.2.4 Water Management Act 2000

The *Water Management Act 2000* (WM Act) aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. Under section 91E(1) of the WM Act, a person who carries out a controlled activity in, on or under waterfront land, and who does not hold a controlled activity approval for that activity, is guilty of an offence.

The proposal is located on land within the Greater Metropolitan Region Unregulated River Water Sources water sharing plan. During construction, any water that is required would not be sourced from waterways in close proximity to the study area, and consideration would be given to other sources, such as local town water and construction sedimentation basins. Where a proposal requires

access to water from a water source that is regulated by a NSW water sharing plan, consideration needs to be given as to what, if any, approvals under the WM Act may be required.

In accordance with clause 38 of the *Water Management (General) Regulation 2011* Roads and Maritime, as a roads authority, is exempt from requiring approval for water use for the purpose of the proposal.

The works are within 40 metres of Bellambi and Cataract Creek waterways and are therefore designated as a 'controlled activity' under the Act. Approval from the Department of Primary Industry is required for 'controlled activities'. However, in accordance with clause 38 of the *Water Management (General) Regulation 2011* Roads and Maritime, as a roads authority, is exempt from requiring approval for 'controlled activities' associated with the proposal.

4.2.5 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) is administered by OEH and serves to protect threatened species, communities and critical habitat listed as endangered, vulnerable or extinct in NSW. A species impact statement (SIS) must be prepared if it is determined under section 5A of the EP&A Act (the seven part test) that there is likely to be a significant impact on any threatened species, populations or ecological communities.

Seven part tests to address the requirements of section 5A of the EP&A Act have been prepared for all listed threatened species or endangered ecological communities (EEC) that would be potentially impacted (refer to Appendix H). These tests have confirmed that there are no significant impacts anticipated on any threatened species, populations or ecological communities as a result of this proposal. Therefore no SIS is required to be prepared with respect to the works.

4.2.6 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the protection and conservation of NSW's environmental heritage. Under the Act, an item is defined as a place, building, work, relic, moveable object or precinct and a relic is defined as any deposit, artefact, object or material evidence that:

- relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and
- is of State or local heritage significance.

State significant items are listed on the NSW State Heritage Register (SHR) are given protection under the Heritage Act against activities that may damage or affect its heritage significance. No items within Stage 1 of the proposal are listed on the SHR.

Section 139 requires an excavation permit to disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation would or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed. A permit is also required to disturb or excavate any land on which the person has discovered or exposed a relic. An excavation permit would not be required for the proposal as the study area has been assessed as having no archaeological potential – refer to the Statement of Heritage Impact (SOHI) (Appendix G). In the event that an unknown or potential Aboriginal object/s, including skeletal remains, are found during construction, the *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) will be followed.

Non-Aboriginal heritage issues are discussed further in Section 6.8.

4.2.7 Noxious Weeds Act 1993

Under section 13 of the *Noxious Weeds Act 1993*, public authorities are required to control noxious weeds which are likely to spread to adjoining land. As a public landowner, Roads and Maritime Services has responsibility for noxious weed control within the road reserve and any land which they own.

Three species declared as noxious under the *Noxious Weeds Act 1993* in Wollongong LGA were identified within the construction impact area. All noxious weeds identified were listed as Class 4,

requiring that the growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction.

Safeguards and management measures applicable to noxious weeds are discussed in Section 6.4, Section 7, and Appendix H.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix A and chapter 6 of the REF.

The proposal is subject to a strategic assessment approval granted in September 2015 by the Commonwealth Minister for the Environment in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Part 5 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. In accordance with the approval, this REF addresses and considers potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the 'avoid, minimise, mitigate and offset' hierarchy. Consistent with the approval, a referral to the Commonwealth Department of the Environment and Energy for these matters is not required.

Potential impacts to these biodiversity matters are also considered as part of chapter 6 of the REF and Appendix H.

Findings – matters of national environmental significance (other than biodiversity matters)

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment and Energy under the EPBC Act.

Findings – nationally listed biodiversity matters

The assessment of the proposal's impact on nationally listed threatened species, populations, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. Under clause 94 of the ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Part 5 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under clause 111 of the EP&A Act to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

5 Consultation

This chapter discusses the consultation carried out to date for the proposal and the consultation proposed for the future. The description contains the consultation strategy or approach used and the results of consulting with the community, the Aboriginal community and relevant government agencies and stakeholders.

5.1 Consultation strategy

During development of the proposal, consultation with the community and government agencies has been undertaken. The consultation techniques have been guided by Roads and Maritime *Community Involvement and Communications: A resource manual for staff* (Roads and Maritime, 2012). A Communications and Community Involvement Plan (Roads and Maritime, 2014b) has been prepared as a working document to plan, implement and manage communication and consultation activities to support key project stages and milestones.

5.2 Community involvement

In accordance with the communications and community involvement plan for the project, Roads and Maritime has carried out a number of community engagement activities during development of the project. This includes:

- The preparation and distribution of a community update on the project in October 2015
- Public ‘vox pop’ (ad hoc) surveys (results of the surveys are presented in Appendix B)
- Updates to the project website
- Engagement with customers of the mobile café van at the northbound rest stop on Mount Ousley on four separate discussions April and May 2016
- Various media releases with coverage on local radio and television

To date community feedback has been positive.

Table 5-1 provides more information on the summary of issues raised by the community and responses where these issues are addressed in the REF.

Table 5-1: Summary of issues raised by the community

Group	Issue raised	Response/REF reference
Residents	<ul style="list-style-type: none">• No residents are located along the proposal extent	N/A
Local Business	<ul style="list-style-type: none">• No local businesses are located along the proposal extent	N/A
Wollongong City Council	<ul style="list-style-type: none">• Support for the proposal	N/A

Group	Issue raised	Response/REF reference
Wollongong Coal Limited	<ul style="list-style-type: none"> Support for the proposal Access requirements to be considered 	<p>From the access workshop held in August 2015, Roads and Maritime has developed an access strategy to enable safe long term access for stakeholders, including appropriate sight distance and turn paths and access ways, access control (including gating and security), emergency management and incident safety (such as during an unplanned fire event), including for the construction period.</p> <ul style="list-style-type: none"> Access adjustments (Section 3.6) Traffic and transport (Section 6.6) Land use, utilities and property access (Section 6.11)
WaterNSW	<ul style="list-style-type: none"> Environment and water quality protection matters to be considered for construction and operation and maintenance phases 	<p>Environment and water quality protection measures for the proposal have been considered and are detailed in Section 7.2.</p> <ul style="list-style-type: none"> Soils, topography and geology (Section 6.1) Surface water quality (Section 6.2) and Erosion and Sediment Management Plan (Appendix E) Groundwater (Section 6.3)
NSW NPWS	<ul style="list-style-type: none"> Access control Access during events (eg. fire emergency) from and to the NPWS estate Environmental impacts of the proposal requires management 	<p>From the access workshop held in August 2015, Roads and Maritime has developed an access strategy to enable safe long term access for stakeholders, including appropriate sight distance and turn paths and access ways, access control (including gating and security), emergency management and incident safety (such as during an unplanned fire event), including for the construction period.</p>
NSW RFS	<ul style="list-style-type: none"> Access during events (eg. fire emergency) from and to the NPWS estate 	<ul style="list-style-type: none"> Access adjustments (Section 3.6) Traffic and transport (Section 6.6) Land use, utilities and property access (Section 6.11) Environmental management (Section 7)
Police NSW	<ul style="list-style-type: none"> Maintenance of crossover accesses 	<p>A Traffic Management Plan would be developed and include measures to facilitate emergency vehicle access through the site (including appropriately spaced divides in the central median), as well as access into or from adjacent lands in the event of an incident (eg. vehicle crash).</p> <ul style="list-style-type: none"> Traffic and transport (Section 6.6) Hazards and risks (Section 6.13)

Group	Issue raised	Response/REF reference
Public 'vox pop' surveys	<ul style="list-style-type: none"> Support for the proposal Management of traffic during construction 	<p>As part of construction and staging of the project, a temporary road closure the M1 Princes Motorway from Picton Road Interchange to Bulli Tops would be required. Temporary road closures would be occasional and short-term in duration (periods of less than 48 hours).</p> <p>During temporary closures, the proposed alternate routes for motorists traveling to and from Wollongong and the surrounding area would be via Picton Road or Appin Road/Bulli Pass.</p> <p>The proposed heavy vehicle detour would also be via Picton Road or Appin Road/Bulli Pass. Vehicles over 19 metres, including B-doubles are not permitted on Bulli Pass and would use Picton Road.</p> <p>During construction of the proposal, the dates and details of closures would be determined and an alternative detour map would be developed as part of the communications strategy. This communications strategy would be made available to the public in the lead up to any planned closures.</p> <ul style="list-style-type: none"> Traffic management and access (Section 3.3.7) Traffic and transport (Section 6.6) Appendix B (survey results)
Road users (Engagement with customers of the mobile café van at the northbound rest stop on Mount Ousley)	<ul style="list-style-type: none"> Support for the proposal 	N/A

5.3 Aboriginal community involvement

Aboriginal community consultation is an integral part of the assessment of Aboriginal cultural heritage significance. Consultation was undertaken in accordance with the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime, 2011).

Initial consultation to identify local Aboriginal parties was undertaken by Roads and Maritime with the Illawarra Local Aboriginal Land Council (ILALC) in accordance with Stage 1 of the PACHCI. It was confirmed that the proposal area is located within the boundaries of the ILALC area.

A Native Title search was requested on the 17 October 2016 by SMEC. The results indicated that there were no Native Title claims granted or registered for consideration within the proposal area.

A representative of the ILALC participated in the field survey in accordance with Stage 2 of the PACHCI. The fieldwork methodology and details of the proposal were discussed with the participants, and topographic maps and aerial photographs were made available to guide the survey.

The results of the survey and the proposed recommendations were discussed with Mr Tungai in the field, and no objections were raised. ILALC was invited by Roads and Maritime to prepare a cultural heritage survey report advising on Aboriginal cultural heritage issues that may arise as a result of the proposal, in accordance with Stage 2 of the PACHCI. ILALC did not provide a report.

Further detail on Aboriginal cultural heritage consultation, is included in Appendix F.

5.4 ISEPP consultation

Part 2, Division 1 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Specifically, clauses 13, 14, 15 and 16 require that public authorities undertake ISEPP consultation when proposing to carry out development without consent.

Clauses 13, 14 and 15 have been considered in relation to the proposal. ISEPP consultation requirements identified are listed in Table 5-2.

Table 5-2: Summary of consultation requirements under the Infrastructure SEPP

Relevant clause	Response
Clause 13 applies to development carried out by or on behalf of a public authority that this Policy provides may be carried out without consent if, in the opinion of the public authority, the development:	
(a) will have a substantial impact on stormwater management services provided by a council.	No. The proposal is not located on lands on which stormwater management services or infrastructure is provided by Wollongong City Council.
(b) is likely to generate traffic to an extent that will strain the capacity of the road system in a local government area.	No. The proposal may temporarily result in increased traffic during construction which would have a temporary impact on the existing operation of the M1 Princes Motorway during this period. While there would be an increased number of heavy vehicles on the motorway during construction, the number of construction vehicles is minor compared to the existing AADT of 37,000. As such, construction of the proposal would not result in a strain on the capacity of the road system. In the long-term, the proposal would improve the capacity of the road by providing additional lane capacity and providing for the separation of light and heavy vehicles, for current and future traffic volumes.
(c) involves connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council.	No. The proposal would not impact on the capacity of a sewerage system provided by Wollongong City Council or the connection into such a system.
d) involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council.	No. Water would be required during construction for the management of dust. The source of this water would be determined during the detailed design phase of the proposal. Formal consultation with Wollongong City Council is not required on this item at this stage.
e) involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential.	No. The proposal would not involve the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic.

Relevant clause	Response
(f) involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the Roads Act 1993 (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath).	No. The proposal is not located on or near to an existing road or footpath managed by Wollongong City Council.
Clause 14	
Is likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area.	<p>Yes.</p> <p>Local heritage items Two items of local heritage significance (listed in Schedule 5, Part 1, Clause 5.10 of the Wollongong LEP (2009)) are located within the study area of Stage 1.</p> <p>Item Number 61064 archaeological site - Cataract Site of former "Biddulph Farm" Lot 30, DP 751301. The site is located on both sides of the road corridor at the Mt Ousley Road intersection with Rixons Pass Road. The proposal is not expected to impact any elements of built heritage significance or unearth any archaeological remains within the study area.</p> <p>There are currently no visual characteristics of the former farm site that contribute towards its heritage value within the study area. Furthermore, the proposal would not impact any views or vistas relating to this item.</p> <p>The curtilage of this heritage item is likely to be reduced by 32,550 square metres or 6.24 per cent (Artefact, 2016c).</p> <p>Item Number 6518, landscape heritage item. Rixons Pass Road extends from the M1 Princes Motorway in the west for about 860 metres before it reaches the Illawarra escarpment and joins with Old Mountain Road from the north.</p> <p>The proposal would not impact any known archaeological remains associated with Rixons Pass Road.</p> <p>Formal consultation with Council is required under this clause.</p>
Clause 15	
Development that is to be carried out on flood liable land that may be carried out without consent and that would change flood patterns other than to a minor extent.	No. The proposal would not involve development in an area that is considered to constitute flood liable land.
Clause 16 of the Infrastructure SEPP states that a consent authority must not carry out any of the following development without giving written notice to the specified authority and taken their responses into consideration:	
(a) development adjacent to land reserved under the National Parks and Wildlife Act	Yes. The proposal site is located adjacent to land reserved under the <i>National Parks and Wildlife Act</i>

Relevant clause	Response
1974 - Office of Environment and Heritage.	1974. The Illawarra State Conservation Area is located around 400 metres north of Bellambi Creek. Formal consultation with OEH is required under this clause.
(b) development adjacent to a marine park declared under the Marine Parks Act 1997 - the Marine Parks Authority.	No. The proposal site is not located adjacent to a marine park declared under the <i>Marine Parks Act 1997</i> .
(c) development adjacent to an aquatic reserve declared under the Fisheries Management Act 1994 - the Department of Environment and Climate Change.	No. The proposal site is not located adjacent to an aquatic reserve declared under the <i>Fisheries Management Act 1994</i> .
(d) development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998 - the Sydney Harbour Foreshore Authority.	No. The proposal site is not located foreshore area within the meaning of the <i>Sydney Harbour Foreshore Authority Act 1998</i> .
(e) development comprising a fixed or floating structure in or over navigable waters - the Maritime Authority of NSW.	No. The proposal is not development that would comprise a fixed or floating structure in or over navigable waters.
(f) development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act) - the NSW Rural Fire Service.	No. The proposal is not development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land.

Consultation with Wollongong City Council and OEH has been undertaken under the requirements of the ISEPP, with respect to Clause 13(1)(b) and Clause 16(2)(a) respectively.

A letter was sent to Wollongong City Council on 27 November providing information on the proposal and seeking comment. A copy of the letter sent to Council is included in Appendix B.

OEH has been consulted on various aspects of the proposal, commencing during early project development. This includes involvement in the options selection process and access discussions.

Issues raised by Council and OEH are discussed in Table 5-3.

5.5 Government agency and stakeholder involvement

A range of government agencies and stakeholders have been identified based on the potential environmental constraints identified for the proposal. Roads and Maritime has contacted the following stakeholders with a written invitation to provide input into the environmental assessment and project development:

- Wollongong City Council
- Office of Environment and Heritage
- National Parks and Wildlife Service
- WaterNSW
- NSW freight Industry Council
- Port Kembla Port Users Group
- Utilities providers.

In 2014, the National Parks and Wildlife Service and OEH were invited to attend an options selections workshop to consider the various design options and elements of the proposal.

- In August 2015 an Access Workshop was convened to discuss and inform access needs. At the workshop were representatives of landowners, emergency services and authorities including: NSW RFS
- NSW Police
- Wollongong Coal
- WaterNSW (formerly SCA)
- Telstra
- Optus Networks
- TransGrid
- Endeavour Energy

While NPWS were unable to attend, a follow up meeting was held with a NPWS representative in early September 2015 to cover the issues discussed at the workshop.

The Access Workshop was held to describe to attendees the nature of the project, to obtain initial feedback, and (predominately) to discuss the various access needs and locations on a case by case basis. This process enabled Roads and Maritime to better understand the access needs of the various stakeholders, including frequency of access, vehicle requirements, and other concerns. The Roads and Maritime project team also identified accesses of particular safety concern, which may benefit from re-routing, realignment or closure.

Responses and comments from the consulted government agencies and stakeholders were generally positive with all parties indicating support for the proposal and the improvements to safety and accessibility. Details of the specific issues raised by the government agencies and other stakeholders, and where these issues are addressed in the REF, are provided in Table 5-3.

Table 5-3 Summary of government agencies and other stakeholders issues raised

Aspect	Issue raised	Response/REF reference
Wollongong City Council		
Design	General support for Stage 1 of the project.	N/A
Office of Environment and Heritage		
Design	Concern was raised by a representative of the Office of Environment and Heritage at an options selection workshop. The concern related to potential impacts to old road alignment near the northern extents of the proposal area that would be affected by some proposal options being considered. In response Roads and Maritime undertook further investigations into the old road alignment and considered potential impacts to the old road alignment during preferred option selection.	Northern section of the proposal area relates to Stage 2 of the proposal. Project justification provided in Section 2.4.3
National Parks and Wildlife Service		
Design	Concern was raised by a representative of the National Parks and Wildlife Service at an options selection workshop. The concern related to potential impacts to old road alignment near the northern extents of the proposal area that would be affected by some proposal options being considered. In response Roads and Maritime undertook further investigations into the old road alignment and considered	Northern section of the proposal area relates to Stage 2 of the proposal. Project justification

Aspect	Issue raised	Response/REF reference
	potential impacts to the old road alignment during preferred option selection.	provided in Section 2.4.3
WaterNSW (formerly SCA)		
Access to WaterNSW controlled areas	The WaterNSW controlled area access requirements were discussed with the former SCA representatives prior to undertaking REF fieldwork. A formal written application to access the SCA controlled areas was prepared for the purposes of undertaking environmental surveys informing this. Conditional access approval was provided by the SCA on the 6 November 2013.	Roads and Maritime would continue to liaise with WaterNSW in regard to access and work for the proposal within the 'special area'.
NSW Freight Industry Council		
Design	General support for the proposal – no issues raised to date	N/A
Port Kembla Port Users Group		
Design	General support for the proposal – no issues raised to date	N/A
Utilities providers		
Design	Positive feedback was received, along with the need to advise at the REF display stage.	N/A

5.6 Ongoing or future consultation

This REF is to be placed on public display and community comments would be invited. Information sessions would also be held during the display period. Details of these information session dates and locations would be advertised prior to the events and issued in a Roads and Maritime Community Update as well as through the local media.

Issues raised by agencies and the community at these information sessions or in submissions received during display of the REF will be considered by Roads and Maritime. Relevant agencies or community respondents may be further consulted in response to their issues, if relevant, and would be informed in the event there are any major design changes following determination.

Other consultation activities that would be carried out include the following:

- Consultation with key stakeholders to assist in managing impacts during construction
- Follow-up meetings to discuss access arrangements with directly affected landholders
- On-going meetings with Illawarra Council, government agencies, utility providers, bus operators, adjacent landowners and community stakeholders as required
- Ongoing updates of the project website as required.

Ongoing consultation activities would be conducted in accordance with the Communications and Community Involvement Plan (Roads and Maritime, 2014b) prepared for the proposal.

6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the guidelines *Is an EIS required?* (DUAP 1995/1996) as required under clause 228(1) of the *Environmental Planning and Assessment Regulation 2000* and the *Roads and Related Facilities EIS Guideline (DUAP 1996)*. The factors specified in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* are also considered in Appendix A.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Soils, topography and geology

6.1.1 Existing environment

Geology

The proposal area is located within the Sydney Basin, a large sedimentary basin extending from Newcastle to Batemans Bay and west to Lithgow. The upper geological layers of the study area are dominated by the Hawkesbury Sandstone unit, the predominant sandstone layer of the Sydney Basin. The eastern portion of the study area is interspersed with small regions of Narrabeen Group sandstones, including Newport and Garie formations, as well as small regions of Bulga Sandstone (Stroud et al 1985).

Underlying the Sydney Basin sandstone units beneath the proposal area are units of the Illawarra Coal Measures. These predominantly consisted of the Sydney Subgroup and the Pheasants Nest Formation. The Sydney Subgroup included interbedded quartz-lithic sandstone, grey siltstone, and claystone, carbonaceous claystone, clay, laminate, and coal (Stroud et al 1985). The Pheasants Nest Formation consisted of interbedded lithic sandstone, coal, carbonaceous claystone, siltstone, and claystone (Stroud et al 1985).

Historic underground coal mining has been carried out within the Wollongong Coal Lease (WCL) "Russell Vale East" mining area. WCL are currently in the process of applying for approval of the expansion of Russell Vale East underground mine. None of the current application workings underlie the proposal. No further future mining has been proposed within the study area.

Soils

There are three soil landscape groups along the alignment of the proposal (Soil Landscape Series Sheet 9029-9129 (Hazelton et al. 1990)). The soil landscape groups include:

- *Lucas Heights (Lh)* – At the Bellambi Creek crossing area soils are potentially in a transitional zone between Lh and Hawkesbury soil landscape. Soils of the Mittagong Formation occur as a shallow layer over Hawkesbury sandstone and consist of interbedded shale, laminate and fine to medium-grained quartz sandstone. Moderately deep hardsetting Yellow Podzolic Soils and Yellow Soloths occur on ridges and plateau surfaces, Lateritic Podzolic Soils on crests Yellow earths on shoulders of plateaux and ridges and earthy sands on valley flats. Erosion hazard is categorised as high.
- *Warragamba (Wb)* – Further to the north, on the lower slopes drained by Cataract Creek, the soils are derived from Narrabeen Sandstone of the Warragamba Group, consisting of fine-grained lithic sandstone occasionally interbedded with thin shale lenses. Shallow to deep Lithosols occur on crests, Brown Earths and Red Podzolic soils on upper slopes and Yellow Podzolic soils on lower slopes. Erosion hazard is categorised as extreme.
- *Hawkesbury (Ha)* – On the upper slopes and ridge lines, the Hawkesbury Sandstone Group is apparent, with broad sandstone outcrops and small cliffs. Soils are derived from medium- to

coarse – grained quartz sandstone with minor shale and laminate lenses. Shallow discontinuous Lithosols/Siliceous sands occur in association with rock outcrops, while Earthy Sands, Yellow Earths and locally deep sands occur over the sandstone. Erosion hazard is categorised as high.

No salinity risk or acid sulphate soils occur within these soil landscapes.

There are no known or registered areas of contamination within or adjacent to the proposal area.

There is the potential to encounter asbestos during construction due to previous allowed construction materials and practices, however there is no direct evidence that the proposal area contains asbestos waste.

Topography

The dominant landform feature of the Illawarra, an escarpment comprising a large vertical exposure of Sydney Basin sedimentary units, runs through eastern portion of the proposal area. The M1 Princes Motorway follows the contour of the Illawarra Escarpment and is located just to its west, atop the associated plateau. The Illawarra Escarpment in this region features an outlying high point called Mount Keira (464 metres above sea level (ASL)), located south of the study area. The crest of Mount Keira is formed by a remnant layer of Hawkesbury Sandstone that has remained more resistant to erosion than the surrounding sandstone.

The southern and most northern extent of the proposal would be at the same elevation of about 330 metres ASL. There are two ridges which cross the proposal – one just south of Bellambi Creek and the other south of Cataract Creek. These ridges are 40 to 50 metres higher than the rest of the proposal area.

6.1.2 Potential impacts

Construction

Construction activities that have the potential to impact on soils and geology include:

- Pavement removal
- Underground service relocation
- Ancillary site preparation and operation
- Bulk excavation and haulage
- Removal of vegetation on embankments and batter slopes
- Culvert extensions and restoration
- Embankment and batter construction, access and stabilisation
- Generation of building and construction waste
- Importing, handling, stockpiling and transporting material resources
- Plant maintenance
- General waste generation from compounds
- Clearing, grubbing and construction of site access tracks during construction.

During construction, there would be potential for sediment generation from activities such as excavation and vegetation removal which may runoff into receiving water environments during rainfall events.

New alignment cut and fill locations would receive run off from well vegetated up slope catchments requiring upstream diversion and temporary or sacrificial crossings to minimise contact with exposed soil areas. This would require cut and fill in the Hawkesbury Sandstone and associated shallow colluvial soils.

Staged construction reduces the area of exposed soil and would retain drainage controls of clean water on existing pavements and stabilised areas. Potential impacts to soils and geology include but are not limited to:

- Increased sediment loading, including increased turbidity, and an increased potential for the transport of contaminants bound to sediment particles.
- Soil erosion as a result of exposure to wind and water runoff, removal of topsoil, exposure of buried structures, sedimentation, increased turbidity levels in waterways and the local stormwater system.

These impacts would be managed with the safeguards and management measures detailed in Table 6-1.

A Preliminary Erosion and Sedimentation Assessment (PESA) (Appendix E) was undertaken for the proposed works in accordance with the Roads and Maritime *Erosion and Sedimentation Risk Assessment Procedure* (RTA, 2004). This procedure considers the proposed construction works to be high risk as the works trigger the following criteria:

- Soil erodibility and erosion hazard has been mapped as very high for some parts of the proposal.
- Illawarra Escarpment State Conservation Area is located to the north of the proposal.
- The entire proposal is within the WaterNSW 'special area' set aside for providing drinking water for Sydney.

The potential erosion hazard of the catchment being disturbed is classed as a high risk hazard (determined from the Blue Book) due to the steep slopes and high rainfall erosivity.

The level of soil erosion hazard at a site is an interaction between soil erodibility, rainfall erosivity and slope. An increase in slope can increase the sites rainfall erosivity potential. In the absence of mitigation, the combination of steep slopes and high intensity rainfall could lead to a severe to extreme soil loss potential for sections of the proposal, if not appropriately mitigated. Potential impacts to surface water quality are discussed further in Section 6.2.

Potential impacts in relation to contamination associated with the construction of the proposal include:

- Increasing waste amounts from improper practices such as poor fill management
- Contaminated or hazardous waste not being correctly disposed of
- Adverse effects on human health (construction personnel and the travelling public)
- Release of contaminant from construction plant and equipment into underlying soils and groundwater
- Movement of contaminated sediments into waterways
- Adverse effects on flora and fauna.

Operation

The main risks associated with the operation of the proposal include the mobilisation of unconsolidated materials (at features such as batters and energy dissipation measures at drainage outlets) if disturbed surfaces are not stabilised or successfully revegetated during construction.

In addition there is potential for accidental spillage of hazardous materials during the operational stage of the proposal. Without satisfactory means of containment, the spillage of contaminants could pass rapidly into the soils and drainage systems and impact downstream ecosystems. Spills of chemicals or petrol in accidents can impact the ecology of waterways and terrestrial ecosystems.

The likelihood of a potential spill of hazardous substances would be minimised as a result of the motorway upgrade and improved road design standards, as well as through implementing the relevant safeguards and management measures identified in Section 6.3.3.

6.1.3 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential soil erosion and contamination impacts. These safeguards and management measures have been identified Table 6-1 below.

Table 6-1: Soils, topography and geology safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Erosion and sedimentation	Work areas are to be stabilised progressively during the works.	Contractor	Pre-construction/construction	
Erosion and sedimentation	The maintenance of established stockpile sites during construction is to be in accordance with the <i>Roads and Maritime Services Stockpile Site Management Guideline</i> (EMS-TG-10).	Contractor	Pre-construction/construction	
Erosion and sedimentation	<p>A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.</p> <p>The SWMP will be reviewed by a soil conservationist on the Roads and Maritime list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services.</p> <p>The SWMP should contain at a minimum the following elements:</p> <ul style="list-style-type: none"> • Consideration of appropriate erosion and sediment control. • Consideration of appropriate erosion and sediment controls at ancillary sites with particular consideration of sediment basins at sites where material processing or stockpiling would occur. • Procedure to be developed for early warnings of imminent and severe weather approaching site and response required by site for preparation of the forecasted event 	Contractor	Pre-construction/construction	<p>Core standard safeguard SW1</p> <p>Section 2.1 of QA G38 <i>Soil and Water Management</i></p>

	<ul style="list-style-type: none"> • Identification of site conditions or construction activities that could potentially result in erosion and associated sediment runoff. • Methods to minimise potential adverse impacts of construction activities on the water quality within surrounding waterways. • Details of specific measures to protect sensitive areas including drinking water catchments and sensitive vegetation such as (EECs). • Details of measures to minimise any adverse impacts of sedimentation on the surrounding environment. • Details of measures to minimise soil erosion caused by all construction works including clearing, grubbing and earthworks. • Details of measures to provide spill management and basin discharge procedures • Details of measures to make site personnel aware of the requirements of the SWMP by providing information within induction, toolbox and training sessions. • Details of the roles and responsibilities of personnel responsible for implementing the SWMP. • Details of measures for the inspection and maintenance of construction phase water treatment devices and structures. 			
Erosion and sedimentation	<p>A site specific Erosion and Sediment Control Plan/s (ESCP) will be prepared and implemented as part of the SWMP</p> <p>The plan will include site specific erosion and sediment controls, size and locations of sedimentation basins (as well as detailed erosion and sedimentation control design), arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</p>	Contractor	Pre-construction/construction	<p>Core standard safeguard SW2</p> <p>Section 2.2 of QA G38 <i>Soil and Water Management</i></p>

Erosion and sedimentation	Roads and Maritime will develop an ESCP in parallel during the concept/detailed design phase in consultation with WaterNSW.	Roads and Maritime/Design contractor	Detailed design	
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Other safeguards and management measures that would address soil impacts are identified in Section 6.2.4. – Surface water.

6.2 Surface water – water quality and hydrology

Detailed assessments of the potential impacts on surface waters from the proposal are presented in Appendix E - Erosion and Sedimentation Management Report (ESMR) (including Neutral or Beneficial Effect (NorBE) assessment) and Appendix I - Stream, Swamp and Groundwater Assessment. These assessments are summarised in the following sections.

6.2.1 Methodology

The following design guidelines and management procedures were used to assess potential surface water quality impacts and develop safeguards for minimising impacts during the construction and operational phases of the proposal:

- Australian Water Quality Guidelines (ANZECC & ARMCANZ, 2000)
- Managing Urban Stormwater-Volume 2D Main Road Construction (DECCW 2008)
- Managing Urban Stormwater- Soils and Construction, Volume 1, 4th Edition (referred to as the Blue Book) (Landcom 2004)
- Relevant Austroads and Roads and Maritime policies, guidelines and procedures:
 - *Roads and Maritime Water Policy*
 - *Erosion and Sedimentation Management Procedure (RTA, 2008)*
 - *Code of Practice for Water Management. Road Development and Management (1999).*
- Neutral or Beneficial Effect on Water Quality Assessment Guideline (Sydney Catchment Authority, 2015).

Using the guidelines above, a concept design of construction and operational water quality management measures was developed to ensure that management measures could achieve the required performance objectives, and that the proposal footprint included land for management measures such as sediment basins during construction.

As the proposal is located within the catchment of Cataract Dam, which supplies drinking water and is managed by WaterNSW, a module 5 NorBE water quality assessment has been prepared for the proposal using the tools and guidelines mandated by WaterNSW.

Catchment modelling undertaken for the NorBE assessment and the Stream, Swamp and Groundwater Assessment (Geoterra, 2016) contain some information on potential downstream flooding impacts.

6.2.2 Existing environment

Water catchment

The proposal is located within the catchment of Cataract Dam, a drinking water reservoir in the Upper Nepean River catchment. Cataract Dam (and reservoir) is one of the five Sydney metropolitan dams which supply drinking water to Sydney and Wollongong. The catchments of Sydney metropolitan dams are protected and managed by WaterNSW – and are designated as ‘special areas’ due to their important function in maintaining good water quality in the dams.

There is a small dam downstream of the proposal area on Bellambi Creek called the Charlesworth Dam. This dam no longer supplies water for coal mining operations in the region.

Surface water from the proposal area eventually flows to the west, however may initially flow east or south before joining a waterway that flows to the west. The catchment and creeks crossed by the proposal are presented in Figure 6-1.

Waterways

The proposal area crosses first and second order tributary creeks that drain into the third, and subsequently the fourth order catchment of Cataract Creek, and the third order channel of Bellambi Creek. It contains headwater reaches of steep gradient valleys that drain off the western slopes of the Illawarra Escarpment into Cataract Reservoir, predominantly within the Cataract Creek catchment, and to a lesser degree, the Bellambi Creek catchment.

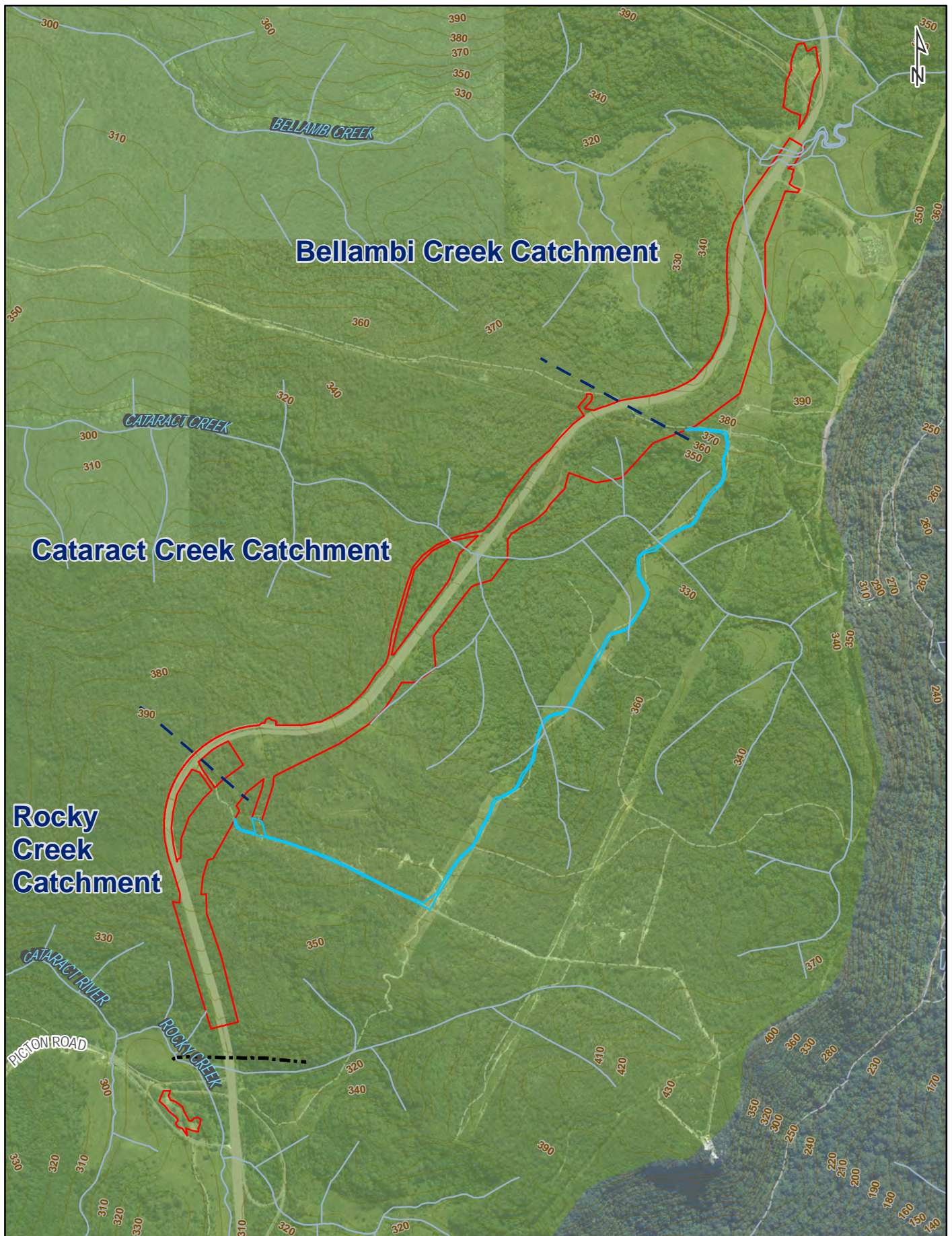
Cataract Creek is a fourth order stream for most of its length and is approximately 5.5 kilometres long from its headwaters to the full supply level of Cataract Reservoir. Cataract Creek runs in a westerly direction. The main channel decreases in elevation from approximately 340 to 285 metres Australian Height Datum (AHD), with the channel being relatively gently sloping at a gradient of 0.9 per cent for most of its length, except for a 0.5 kilometre reach in its headwaters, which slopes at 2.5 per cent. The proposal contains two major cuts in the creek's catchment, with one located in the headwaters of the catchment in the vicinity of Brokers Nose, and a second in the headwater and mid slopes near the watershed boundary with Bellambi Creek. The proposed works do not intersect any defined stream channels at Brokers Nose, and only a single headwater channel of a first order gully near the watershed with Bellambi Creek.

Bellambi Creek is a third order stream upstream for the first 5.5 kilometres, then fourth order to the Cataract Reservoir backwater. Bellambi Creek runs in a westerly direction. It is approximately 6.4 kilometres long from its headwaters to the full supply level of Cataract Reservoir. Channel elevations fall from approximately 453 to 286 metres AHD, with the channel being relatively gently sloping at a gradient of 0.6 per cent, except for the first one kilometre upstream reach, which slopes at around 2.8 per cent. Only minor road works are proposed in its catchment.

A minor unnamed creek runs in a north-westerly for 800 metres under the proposal, before entering Bellambi Creek.

Rocky Creek is a small westerly flowing tributary of Cataract River which is at the southernmost extent of the proposal area.

All the creek catchments are within the protected 'special area' of Cataract Reservoir. The creek catchments are primarily forested, however there are some areas that have been cleared for roads, high voltage power lines and colliery ventilation shafts. These activities are limited in extent and unlikely to have significant impacts on water quality.



- Catchment Dividers
- Streams/drainage lines
- - - Project extents
- Sydney Catchment Authority Special Area
- Contours (10m)
- Construction footprint
- Construction light vehicle access track

M1 Princes Motorway Improvements -
Picton Road to Bulli Tops (Stage 1)

Surface water features and catchments

Fig. 6-1

Source: Imagery from RMS

0 100 200 m

Water quality

Water quality is monitored regularly in Cataract River about three kilometres downstream of the proposal area. Monitoring results indicate that water quality in the river is good with all measured parameters in 2012 to 2013, complying with water quality guidelines (ANZECC & ARMCANZ 2000). Typically river water was slightly acidic and had a very low turbidity. Good water quality would be expected in the Cataract River due to the protection of the catchment from development.

The Cataract River and its tributaries are classified as sensitive waterways as they flow into a drinking water supply dam and their existing water quality is good.

Based on a single monitoring event conducted by Geoterra in May 2016, Bellambi Creek was exceeded the ANZECC 2000 Upland Freshwater Stream and/or 95 per cent protection level for aquatic ecosystems criteria for pH, total nitrogen, total phosphorous, copper and zinc.

Hydrology

Flow monitoring has been undertaken in Cataract Creek, up and downstream of the proposal (Geoterra 2016). The results of the monitoring are summarised in Table 6-2. Upstream of the proposal, runoff contributes a small proportion of flow, indicating the upstream catchment is small in size. The median flow rates indicate that baseflow (predominately from groundwater) contributes the majority of the flow. Average flow rates are influenced by a few large events.

Table 6-2: Cataract Creek stream flow summary (ML/day)

Site	Average (ML/day)			Median (ML/day)		
	Runoff	Baseflow	Total	Runoff	Baseflow	Total
Upstream	1.7	0.8	2.5	0.04	0.49	0.71
Downstream	4.2	2.0	6.2	0.11	1.22	1.78

6.2.3 Potential impacts

Construction

The potential construction impacts may include but are not limited to:

- Changes to the local surface water system resulting in temporary loss of drainage capacity and redistribution of stormwater flows. These may occur as a result of material stockpiles and works within flow paths or at culvert crossings
- Water quality impacts from the pollution of stormwater run-off with eroded soil, sediments, fuels and other hazardous materials from the construction site and equipment
- Spills of fuels or chemicals which have been inadequately managed which find their way into waterways.

Any temporary changes in the local surface water drainage system would be managed as part of the overall Soil and Water Management Plan prepared for construction. Any impacts on drainage would be minor and can be managed effectively through a Soil and Water Management Plan.

To reduce any impacts of sediment laden stormwater runoff on water quality in adjacent waterways, erosion and sedimentation control measures would be designed in accordance with the Blue Book (Landcom, 2004). The Erosion and Sedimentation Management Report (Appendix E) developed for the proposal considered the indicative locations and sizes of sedimentation basins required during construction. The key criterion in designing (Type D and F) sedimentation basins is the nominated five-day duration percentile event which for sensitive environments is the 85th percentile (DECCW, 2008). This applies to construction periods from six months to three years in duration and assumes that 50 milligrams per litre of suspended solids is the discharge criterion to be achieved. Enhanced

erosion and sedimentation controls can be used to reduce the nominated five-day duration percentile event to the 80th percentile and therefore reduce the sedimentation basin size.

The sedimentation basins would be larger than typically found on other similar road projects due to the nature of the terrain and soils and the high annual rainfall of the proposal area. Clearing of vegetation would be required in some locations to allow for the construction and maintenance of construction sedimentation basins. The option for retaining construction basins as operational basins would be further investigated during detailed design, and would be undertaken in consideration of the obligation to achieve a suitable NorBE in WaterNSW lands.

A construction sedimentation basin designed to an 80th percentile five day event would overflow on average six to eight times a year (DECCW 2008). While this would result in partially treated runoff from the construction site discharged into receiving waters, this would only occur during major rainfall events when flows in the receiving waters would be high, diluting the basin discharges. Monitoring of receiving waters and adaptive erosion and sedimentation control techniques would also be required to minimise risks to local receiving waters.

While there may be some risk of impacts in the local waters (Bellambi Creek, Cataract Creek and their tributaries) immediately downstream of the construction areas, overall the risk to water quality in the Cataract Reservoir would be negligible. The risk to water quality would be negligible due to the small proportion of the total catchment of Cataract Reservoir (less than one per cent) affected and the relatively short-time frame of construction of the proposal over two years.

Spills or incorrect management of fuels and chemicals used during construction could result in these substances entering surface water flows. Management measures to reduce the occurrence and impact of spills or leaks of fuels and chemicals are detailed in section 6.3.4.

Operation

Changes to hydrology in Bellambi and Cataract Creeks and their associated tributaries may result due to altered run-off from the new alignment and the provision of new culverts, pipes and drainage infrastructure. Drainage management measures would be investigated during detailed design to ensure changes to the existing hydrology are minimised.

Impacts on water quality from road operation can be directly influenced by road maintenance activities, vehicle movement and wear. Main risks are associated with mobilisation of unconsolidated materials if disturbed surfaces not stabilised or successfully revegetated.

Once the proposal is paved and disturbed areas are revegetated, runoff from the proposal would contain substantially less pollutants compared with the construction period. However, sediment and suspended solids from road runoff can cause impacts on the receiving environment. Physically, sediment interferes with the respiration and feeding of aquatic plants and animals. Other potential pollutants such as nutrients, heavy metals and organic substances, are adsorbed to, and travel with, sediments. Heavy metals of concern in road runoff include cadmium, chromium, copper, nickel, lead and zinc. The concentrations of metals found in road runoff, especially from heavily trafficked areas, are commonly far in excess of water quality guidelines (ANZECC (2000)).

A concept operational water management system was developed (refer to Appendix E, Section 6.3.1) to identify potential treatment measures to allow a NorBE assessment on water quality to be undertaken. Typical proposed water quality management measures could include water quality basins, swales, bio filtration swales and vegetated channels. Proposed water quality management measures would be considered and determined in detailed design to ensure they can be feasibly and practicably implemented and safely maintained.

Using the concept operational water quality treatment system detailed in Appendix E, a NorBE assessment was undertaken and the results are summarised in Table 6-3. The NorBE assessment concludes that a neutral or beneficial effect on water quality could be achieved, with improvements to water quality ranging from 2 to 100 per cent, through the provision of various water quality management measures detailed above. Overall, the proposal would result in minimal improvements in water quality as the area impacted by the proposal is relatively small compared to the overall catchment of Cataract River and Reservoir.

There would be an improvement compared to the existing situation as the current road does not have any operational water quality control measures such as basins.

The operational basins would also be reviewed during the detailed design process to determine whether any of the basins needs to be designed to capture large spills (such as from a fuel tanker accident). This is unlikely to be required as the creeks and drainage lines are minor, only have intermittent flow and are at least four kilometres from Cataract Dam.

Table 6-3: Reduction on pollutants loads and changes in flows with operational management system

Per cent reduction in flow and pollutant loads			
Parameter	Bellambi Creek catchment	Cataract Creek catchment	Rocky Creek catchment
Flow (ML/yr)	-15%	-2%	-33%
Peak flow (m ³ /s)	34%	17%	42%
Total Suspended Solids (kg/yr)	60%	29%	76%
Total Phosphorus (kg/yr)	40%	25%	56%
Total Nitrogen (kg/yr)	2%	6%	5%
Gross Pollutants (kg/yr)	100%	100%	100%

Table 6-3 also shows that overall flows would increase from each catchment as there would be a higher proportion of impervious area with the proposal, resulting in higher runoff volumes and less ground infiltration of rainfall. Methods to manage higher runoff volume would be investigated and developed during detailed design. While some erosion protection would be required at the outlets of basins into drainage lines or creeks, it would be localised – and the majority of the waterways would experience no greater erosion with the proposal. As the proposal would impact on less than one per cent of the Cataract Reservoir, the overall impacts on water quantity and hydrology would be negligible.

6.2.4 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential surface water quality impacts. These safeguards and management measures have been identified in Table 6-4. Further safeguards and management measures proposed to avoid, minimise or manage potential soil erosion are provided in Table 6-1.

Table 6-4: Surface water – water quality and hydrology safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Operational water quality	<p>Detailed design will seek to minimise water quality impacts by incorporating the following design principles:</p> <ul style="list-style-type: none"> • Vegetated drainage lines should be used in preference to engineered structures wherever practicable • Operational water quality control measures will be developed to ensure that a neutral or beneficial effect on water quality is achieved. • Water treatment structures should be designed to be accessible for structural and vegetation maintenance and for removal of sediment. • Appropriate energy dissipation and scour prevention measures will be incorporated downstream of culverts and other drainage structures to minimise soil erosion. 	Roads and Maritime	Detailed design	
Construction water quality impacts	<p>A Surface Water Quality Monitoring Program will be designed and implemented to detect and respond to any changes in water quality in Bellambi Creek and Cataract Creek waterways downstream of the proposal during construction.</p> <p>The Program will include monthly and post rainfall visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) to identify any potential spills or deficient erosion and sediment controls.</p>	Contractor	Pre-construction/ construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Local water quality impacts	<p>If an incident (eg spill) occurs, the Roads and Maritime Services <i>Environmental Incident Classification and Reporting Procedure</i> is to be followed and the Roads and Maritime Services Contract Manager notified as soon as practicable.</p> <p>Roads and Maritime would immediately advise WaterNSW on the WaterNSW incident number 1800 061 069.</p>	Contractor	Construction	
Local water quality impacts	Spill kits, including hydrocarbon absorbent booms would be kept at the ancillary site compounds in clearly marked and accessible locations	Contractor	Construction	
Local water quality impacts	The refuelling of plant and equipment would occur in designated impervious bunded areas. Bunded areas will be located as far as possible from drainage lines or waterways.	Contractor	Construction	

Other safeguards and management measures that would address surface water impacts are identified in section 6.1.3 – Soils, topography and geology and 6.3.4 – Groundwater.

6.3 Groundwater

Roads and Maritime commissioned GeoTerra to prepare a Stream, Swamp and Groundwater Assessment of the proposal. The Assessment is available in Appendix I, and a summary is provided below.

6.3.1 Methodology

Desktop assessments, field monitoring and laboratory analysis were used to prepare a baseline and impact assessment of the shallow and deeper groundwater systems, perched upland swamps and streams. The objectives of the assessment were to determine:

- the current standing water levels and water quality within the upland swamps and shallow Hawkesbury Sandstone
- any observed or inferred groundwater discharge zones into local streams and the presence of any groundwater dependent ecosystems (other than upland swamps)
- the baseline status and potential impacts from the proposal on the local streams, swamps and groundwater systems
- measures to avoid, mitigate and/or remediate potential impacts on the swamp, stream and groundwater resources
- groundwater, swamp and stream monitoring procedures that will measure any impacts on the systems.

Relevant legislation and guidelines

The assessment was prepared with reference to the following documents:

- National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
- NSW State Groundwater Policy Framework Document (NSW Department of Land and Water Conservation (DLWC))
- NSW State Groundwater Quality Protection Policy (DLWC)
- NSW Draft State Groundwater Quantity Management Policy (DLWC)
- NSW Groundwater Dependent Ecosystem Policy (DLWC)
- Water Management Act 2000
- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 (NSW Office of Water – NOW)
- NSW Aquifer Interference Policy (NOW).

6.3.2 Existing environment

Water related features in the proposal area which interact with groundwater resources include:

- “losing” streams in the headwaters of the catchment, where stream/swamp water permeates into the underlying Hawkesbury Sandstone aquifer, and “gaining” streams in the main valleys reaches where aquifers discharge in the waterways
- headwater swamps within the Cataract Creek catchment that contain shallow (<0.9 metres deep) perched, ephemeral, highly variable water levels
- shallow, perched, ephemeral aquifers within the upper (<20 metres deep) Hawkesbury Sandstone
- a regional groundwater water table which has been intersected between 13 to 48 metres below the surface within the Hawkesbury Sandstone. The regional aquifer has been shown to be

hydraulically separated from the upland swamps by unsaturated, weathered Hawkesbury Sandstone.

Waterways

Waterways within the proposal area are described in Section 6.2.2.

Swamps

The biodiversity assessment identified that numerous upland headwater swamps that meet the definition of the Coastal Upland Swamp EEC occur in the proposal area. Six upland headwater swamps are located in close proximity to the proposal (refer to Figure 6-2).

The assessment found that the complexity and variability of the swamp vegetation communities, was high. Some swamps have a fully developed, saturated, humic sandy clay matrix up to 1.6 metres deep while other swamps are essentially dry, shallow sandy clay depressions with a high proportion of sandstone and a thin weathered, colluvial, sandy clay soil profile. The swamps adjacent to, or within, the proposal area have a maximum depth of 0.95 metres and are generally small, dry and without significant humic soil development.

The swamps occur in either headwater tributary valleys that are characteristically derived from sand erosion from sandstone dominated ridgelines or along the riparian zone of major creeks. The upland headwater swamps have relatively small upstream catchments, with their saturation relying on rainfall recharge directly into the sandy sediments, as well as seepage from upslope Hawkesbury Sandstone aquifers.

Regional groundwater flow within the Hawkesbury Sandstone is hydraulically beneath, and separated by between 12 to 15 metres from the base of the swamps. Shallow ephemeral aquifers in the Hawkesbury Sandstone may be hydrologically connected to swamps in some locations.

Piezometers were installed in eight locations in swamps within the proposal area. The piezometers in swamps that had poorly developed soil humic layers (and were generally small in size) were dry. In larger swamps in areas with well-developed soil humic layers, groundwater was measured up to 0.5 metres in depth.

Groundwater resources

Relevant hydrogeological domains within the proposal area include:

- hydraulically disconnected (perched) upland swamps (as discussed above)
- the hydraulically disconnected (perched), ephemeral, weathered Hawkesbury Sandstone aquifers
- the deeper Hawkesbury Sandstone, and the underlying Bulgo Sandstone, Newport and Garie Formations and Bald Hill Claystone.

The main aquifer is the deeper Hawkesbury Sandstone aquifer which, although having generally low permeability, can provide relatively high groundwater yields. Regional water levels within the sandstone result from interaction between rainfall infiltration (recharge) through the shallow weathered zone into the deeper Hawkesbury Sandstone and drainage channels from the aquifer to streams which result in seepage that constrain groundwater levels. Evapo-transpiration losses from deep and shallow rooted vegetation would also reduce the groundwater levels to varying degrees.

Ephemeral perched aquifers can occur within the upper 20 metres of the Hawkesbury Sandstone following extended rainfall periods. These are generally hydraulically disconnected from the underlying regional aquifer. After rainfall, water levels in shallow aquifers respond by rising, while in dry periods, levels decrease through seepage to the local watercourses.

Measured standing water levels in the Hawkesbury Sandstone range from to six metres to 39 metres below the ground surface. Water quality in the Hawkesbury Sandstone generally has low salinity and is relatively acidic pH (3.22 to 5.45 pH units) and can contain high iron levels up to 12 milligrams per litre. There are no private bores or wells located within close proximity to the proposal.

There are six groundwater piezometers with the proposal area. Five of the piezometers have been installed by the coal mine operators to monitor the impacts of their operations and one has been installed by Roads and Maritime to provide background information for the proposal.

Water levels in the piezometers have been measured since mid-November 2009. The data indicates that water levels are highly responsive to rainfall, principally in locations affected by subsidence-related fracturing over the mine workings.

Based upon an assessment of groundwater data and the proposal design, the regional groundwater aquifer is below the 6.5 metres deep excavation zone of the proposal near the Brokers Nose, and that the regional aquifer lies beneath the maximum roadworks excavation depth of 10.5 metres.

Historic and proposed mining

The proposal area has been subject to historic underground coal mining within the WCL “Russell Vale East” mining area. Two seams have been historically mined within the WCL lease area:

- Balgownie Seam – mining here included both bored and pillar and longwall extraction which occurred underlying the proposal
- Wongawilli Seam – mining here included longwall extraction which occurred underlying the proposal.

The Roads and Maritime commissioned stream, swamp and groundwater assessment of the proposal identified the following impacts of the historic mining activities (Geoterra, 2016):

- Streams – no definitive effects from underground coal mining subsistence effects on streams within the study area. However, there is a probably link between high iron hydroxide levels in Cataract Creek and subsidence
- Swamps – no definitive effects have been observed from underground coal mining and swamps within the study area
- Groundwater – within the study area there has been an increased responsiveness of the regional groundwater table to wet/dry period influences as an effect of underground coal mining. This is associated with the fractured lithologies resulting from subsidence of the Hawkesbury Sandstone caused by underground coal mining.

WCL are currently in the process of applying for approval of the expansion of Russell Vale East underground mine. Proposed future mining associated with the Russell Vale East underground mine is located outside the proposal area. Completed mining (Wonga Mains) underlies the proposal.

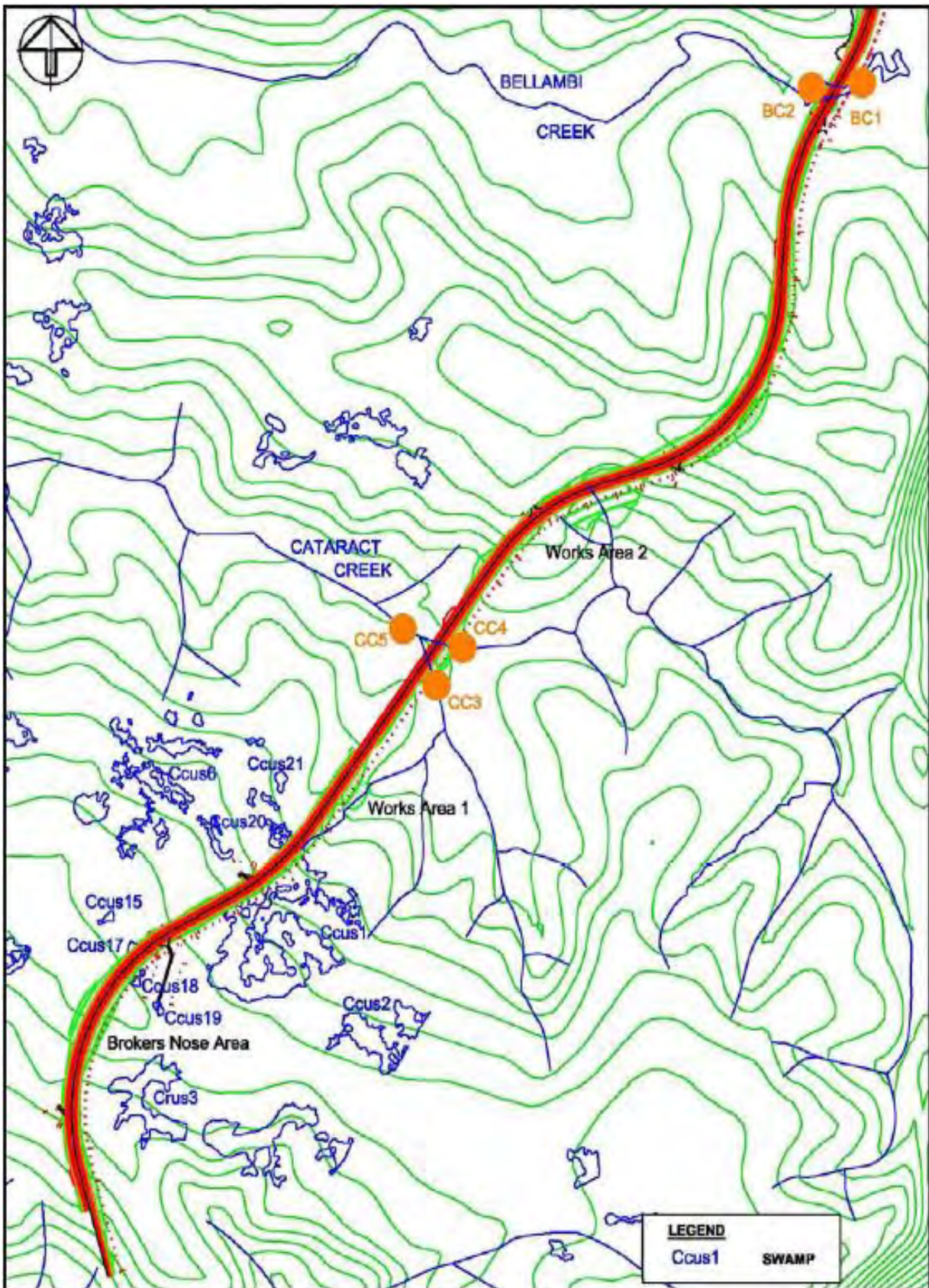


Figure 6-2: Swamps and streams within Stage 1 study area (Source: GeoTerra (2016))

6.3.3 Potential impacts

Potential impacts on groundwater during construction are similar to the impacts on groundwater during operation of the proposal. These include:

- Deep excavations which extend into the shallow ephemeral groundwater aquifers
- Deep excavations which extend into the deeper regional groundwater aquifers
- Changes in the base flows of streams that rely on groundwater inflows
- Pollution of groundwater aquifers
- Direct and indirect impacts on swamps.

Impacts on shallow ephemeral groundwater aquifers

Deep excavations, mainly large cuttings for the new alignment, would extend into the zone where shallow ephemeral aquifers are likely to occur. Typically this would result in seepage from the rockface walls in the cuttings after rainfall. While the directly impacted shallow ephemeral aquifers would drain more rapidly, the impact would be minor as (GeoTerra, 2016):

- The area of impact of the proposal is relatively minor compared to the remaining similar environment
- The shallow ephemeral aquifers are not connected directly to the more important regional aquifer
- Any seepage would be returned to the environment through the proposal's drainage and water management system
- The shallow ephemeral aquifers generally are episodic in occurrence and directly related to rainfall.

Impacts on deeper regional groundwater aquifer

The regional groundwater aquifer is below the 6.5 metres deep excavation zone of the proposal near the Brokers Nose, and that the regional aquifer lies beneath the maximum roadworks excavation depth of 10.5 metres.

As the proposal does not involve excavation into the deeper regional groundwater aquifer, there would be no impacts on this aquifer from the proposal.

Changes in stream base flow

No impacts on stream base flows would be expected as:

- Deeper regional aquifers which provide base flow to streams would not be impacted
- Any seepage water from shallow ephemeral aquifers would be returned to the environment through the proposal's drainage and water management system
- The proposal only directly impacts minor drainage lines of Cataract Creek and no substantial cuttings are planned in the Bellambi Creek catchment.

Pollution of aquifers

Pollution of aquifers could result from spills of fuels or chemicals, or from the infiltration of stormwater runoff from the road surface which may contain hydrocarbons and heavy metals. These risks would be mitigated by the provision during construction and operation of water management systems designed to meet relevant standards and guidelines for water quality protection. As the proposal is located in the protected catchment of Cataract Reservoir, water quality protection measures would be developed in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000).

Impacts on swamps

Upland swamps which would be directly impacted by the proposal are all located in the Brokers Nose area (see Figure 6-2). The assessment of the biodiversity impacts of the proposal on swamps is presented in Section 6.2.3.

Swamp 1 (Ccus 1)

Approximately eight per cent of the 4.81 hectare Swamp 1 would be impacted by a mixture of backfilling (four metres) and excavation (2.4 metres). The backfilled and excavated areas occur along the western swamp edge, which drains downslope to the northeast, parallel to the proposal.

There is a 27 metre difference in elevation between the top and bottom of Swamp 1.

The proposal would result in an excavation of up to 2.4 metres deep along the western edge of the swamp, which would drain the western portion of Swamp 1 into the road corridor. However, as the swamp has a substantial elevation difference between the top and bottom, only a small area of the groundwater supporting the swamp would be impacted.

Swamp 15 (Ccus 15)

The 0.06 hectare Swamp 15, which is approximately 80 metres west of the proposal, would not be impacted by the proposal.

Swamp 17 (Ccus 17)

The 0.07 hectare Swamp 17 would be completely removed by the proposal as it is located in the new alignment. It is up to 0.95 metre deep, with no standing water, although it would recharge then subsequently lose its standing water in relatively short time frames after sufficient rainfall.

Swamp 20 (Ccus 20)

Swamp 20, which is 0.55 hectares in extent, is located immediately west and downslope of the proposal. Based upon the current design, no direct impacts on the swamp would be expected.

Overall the impacts of the proposal on the swamps would be low and would not be significant. Further assessment of biodiversity impacts are presented in section 6.4.3.

6.3.4 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential groundwater quality impacts. These safeguards and management measures have been identified in Table 6-5.

Table 6-5: Groundwater safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Pollution or reduction in stream base flows	Drainage systems and water management measures will be designed to reduce any sediment-related pollution of stream/aquifers and any reduction in base flows.	Roads and Maritime/Contr actor	Detailed design	Additional safeguard

Other safeguards and management measures that would address groundwater impacts are identified in Section 6.2.4 (Surface water) and Section 6.4.4 (Biodiversity).

6.4 Biodiversity

Roads and Maritime commissioned SMEC to undertake a flora and fauna survey and Biodiversity Assessment of the proposal, targeting threatened species and communities that potentially occur in the study area. The Biodiversity Assessment is available in Appendix H, and a summary is provided below.

6.4.1 Methodology

Desktop review

A desktop review was undertaken prior to the commencement of field surveys and included database searches and a review of relevant literature to identify a spectrum of State and Commonwealth-listed threatened species, populations and ecological communities previously recorded in the vicinity of the study area. Results from the literature review were used to inform the baseline and targeted flora and fauna surveys undertaken as part of this updated biodiversity assessment report.

The following databases and resources were investigated:

- NSW Office of Environment and Heritage Atlas of NSW Wildlife Database (BioNet) within a 10 kilometre radius of the site (March, 2016)
- Protected Matters Report that documents all Matters of National Environmental Significance (MNES) within 10 kilometres of the site. MNES include threatened species, communities and migratory species which are listed under the EPBC Act (Department of the Environment) (March, 2016)
- NSW National Parks and Wildlife Service (NPWS) (2003) The Native Vegetation of the Woronora, O'Hare's and Metropolitan Catchments, NSW NPWS, Sydney
- NSW National Parks and Wildlife Service (NPWS) (2002) Native Vegetation of the Illawarra Escarpment and Coastal Plain, NSW NPWS, Sydney
- The Native Vegetation of the Sydney Metropolitan Area, Office of Environment Heritage NSW, Hurstville (OEH, 2013)
- Draft Upland Swamp Environmental Assessment Guidelines, Office of Environment and Heritage, Hurstville (OEH, 2012)
- Lesryk Environmental Consultants (2010) Flora and Fauna Assessment Mt Ousley Climbing Lanes, prepared for NSW Roads and Maritime Services
- Biodiversity Technical Study M1 Princes Motorway Climbing Lanes. Report prepared for RMS, December 2014 (SMEC, 2014)
- NSW Department of Primary Industries Noxious Weeds List (DPI 2014)
- Draft Upland Swamps Offsets Policy (Integrated Mining Proposal) – NSW Department of Planning (2015)
- Russell Vale Coal Expansion major project proposal (ERM 2013).

Flora

Survey methods for the terrestrial ecological investigations are detailed below and were consistent with the *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)* (DEC, 2004).

Vegetation mapping

The Woronora Vegetation Information System (VIS) regional vegetation mapping (NPWS, 2002) was used to provide the initial base vegetation map for the study area. Adjustments to the NPWS (2002) vegetation linework were subsequently made following the completion of the flora surveys and were limited to those areas that were ground-truthed by SMEC botanists (this being the vicinity of the BioBank plots within the study area).

BioBank surveys

Ten BioBank plots were surveyed by SMEC ecologists during initial studies of the proposal area in November 2013.

These were supplemented with an additional 12 plots/transects surveyed during 19 to 22 October 2015 and 20 January 2016, to satisfy the BioBanking Assessment Methodology (BBAM) (OEH, 2014) minimum survey requirements (refer to Figure 6-3). These plots were spread across the entire proposal area. Data was collected according to BBAM and included 20 by 20 metre plot-based full floristic surveys and 20 by 50 metre plot and transect sites.

Threatened flora surveys

There were no threatened flora species recorded in the initial November 2013 surveys. Additional targeted threatened flora surveys were carried out by SMEC ecologists on 9 to 10 November 2014 via random meander transects (Cropper, 1993) in suitable habitat types within the study area. These surveys targeted threatened flora previously recorded in the vicinity of the study area (eg. *Pultenaea aristata*). No threatened flora species recorded during these surveys.

Fauna

Baseline and targeted threatened fauna and habitat surveys were undertaken by SMEC ecologists in November 2013 and 19 to 30 October 2015. Nestboxes were installed in January 2016 and additional targeted surveys for the Eastern Pygmy-possum (EPP) were conducted during April and May 2016.

Habitat assessment

The fauna habitat assessment was conducted over a three day period (25, 26 and 28 November 2013) to assist in determining the likelihood of presence of threatened fauna species. Habitat characteristics considered include the presence of hollow bearing trees, fallen logs, leaf litter and other ground debris, drainage lines, ponds, the structure of vegetation communities and the presence of fruiting/flowering plant species to assess the habitat suitability for a range of fauna species.

Using the random meander technique, searches were carried out for signs of fauna activity such as tracks, scats, scratches and notches on trees, as well as any opportunistic sightings, to identify the presence of common and threatened fauna species.

Habitat information recorded at each sampling site included: height and density of vegetation layers, leaf litter, fallen timber, tree hollows (position on tree and size), stags, rock shelves, soil type, presence of water and any human-made habitats.

A hollow bearing tree assessment was conducted on 26 to 30 October 2015 within the proposed construction footprint. The information recorded included: (Global Positioning System) GPS location of the tree, species name, size and type of hollow, approximate height of hollow, and photograph of each tree. Hollow bearing tree locations are mapped in Figure 8 of Appendix H.

Fauna surveys

Fauna surveys were undertaken from 19 to 30 October 2015 throughout the study area. Climatic variables such as rainfall, temperature, wind speed, moon phase and cloud cover at the time of the survey were recorded along with time and duration of the surveys. The study area included four fauna survey Sites 2A, 3, 4 and 5 (refer to Figure 6-3).

Additional observational data was recorded including opportunistic fauna sightings, identification of predator scats and mammal markings. The following methods were employed during the surveys:

- **Ultrasonic bat detection** - surveys were undertaken all night (eight hours) for two nights per site to maximise species detection.
- **Call playback** - calls played during the survey included four owl species: Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*) and Sooty Owl (*Tyto tenebricosa*) as well as Sugar Glider (*Petaurus breviceps*) and Yellow-bellied Glider (*Petaurus australis*). Call playback of recordings was undertaken at all sites except site 2A.

- **Spotlighting** - this survey consisted of two survey events for each site carried out on separate nights to survey for nocturnal mammals and birds. Spotlighting was carried out at all sites except site 2A.
- **Birds** - surveys were undertaken for both diurnal and nocturnal birds. Area searches with a species time curve were used to survey diurnal bird species during their peak activity time, usually at dawn. Bird surveys were carried out at all sites except site 2A.
- **Amphibians** - day and night habitat searches were conducted over two separate nights at two sites with nocturnal call playback and aural searches. Species targeted were Green and Golden Bell Frog, Little John's Frog, Giant Burrowing Frog, Red-crowned Toadlet and Stuttering Frog.
- **Mammals** - mammals were surveyed at each of the main sites through a combination of nocturnal spotlighting and camera traps. In addition to this characteristic marks were also recorded during habitat assessment including scratches, scats, dens, hollows latrine sites. Mammals were surveyed at each of the main sites (excluding site 2A).
- **Reptiles** - Day and night habitat searches were conducted at all sites except site 2A. Opportunistic sightings were noted when encountered.

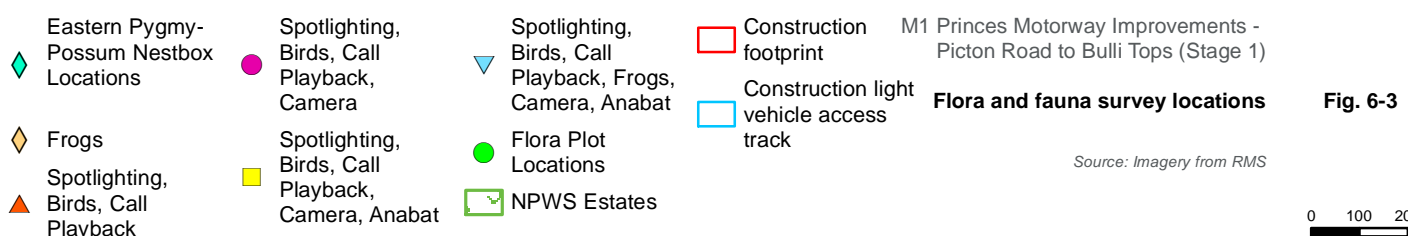
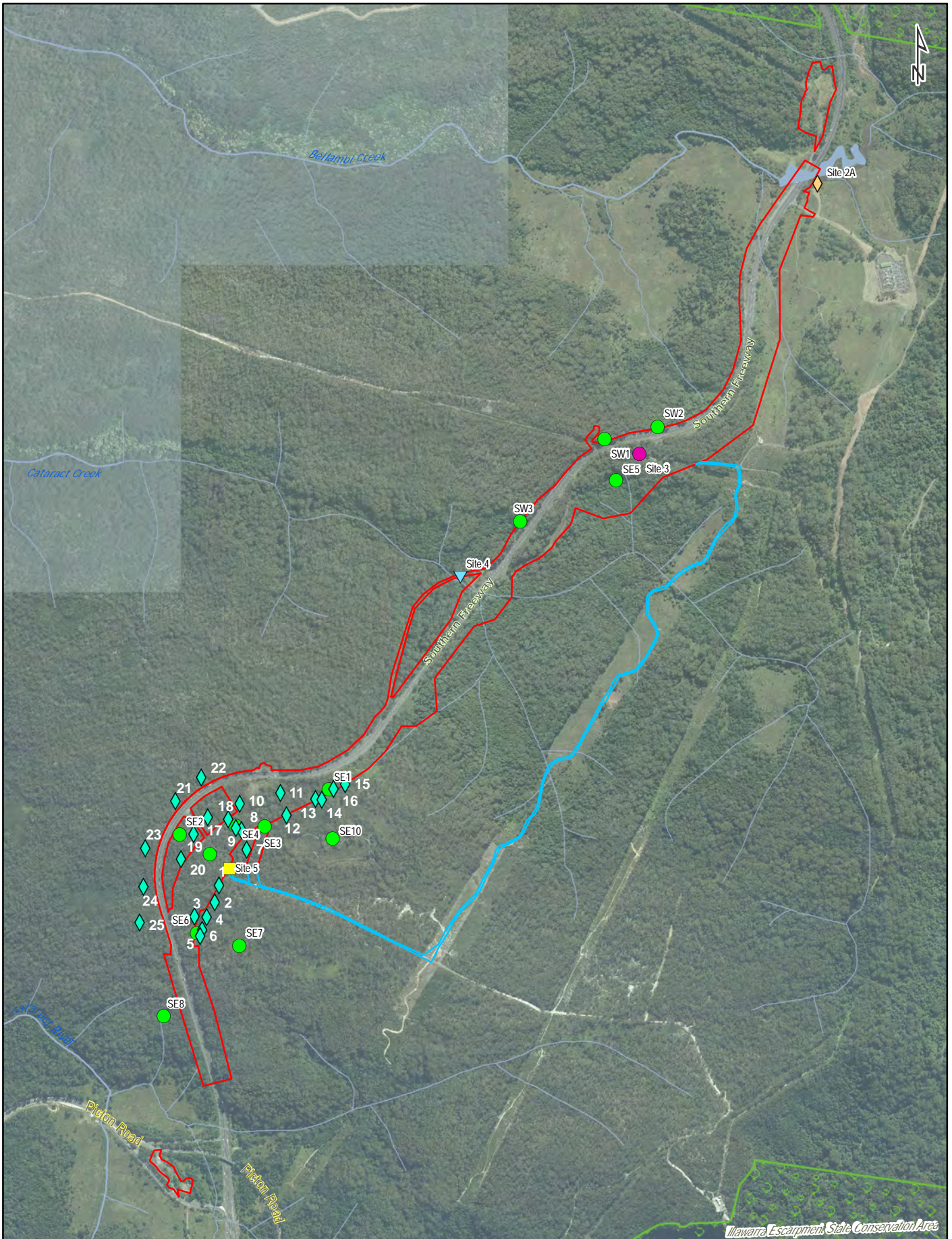
Targeted EPP surveys were undertaken in autumn 2016. Twenty-five nest boxes for the EPP were installed in January 2016 (refer to Figure 6-3). Surveys were undertaken for the EPP during autumn 2016 incorporating nest box checks and Elliot trapping. Table 6-6 summarises the survey effort.

Table 6-6: Summary of survey effort for the EPP

	Week 1	Week 2	Total
Dates	11/4/16 to 15/4/16	26/5/16 to 30/4/16	10 days
Traps	60 traps, 4 nights	60 traps, 4 nights	480 trap nights
Nest boxes	25, 2 checks	25 boxes, 2 checks	100 nest boxes

Elliot Traps were installed in flowering *Banksia ericifolia* trees during both weeks of the nest box checking. The 60 traps were arranged in ten grids of six traps.

Traps were baited with rolled oats, peanut butter and honey. Diluted honey was sprayed around the entrance to each trap. Traps were checked daily, commencing at dawn. All species captured were recorded.



6.4.2 Existing environment

Habitat types

Vegetation types within the study area included tall open Eucalypt forest with limited midstorey and groundcover; and Coachwood Warm Temperate Rainforest with a closed canopy; open midstorey and limited groundcover. In the south west there was a large area of Sandstone Scribbly Gum Woodland vegetation with a relatively open mid-storey containing *Banksia* species, and approximately 50 per cent groundcover; and associated Coastal Upland Swamps, with a very dense but low canopy of less than four metres height containing Banksias and Tea-tree species; a dense shrubby mid-storey and a 100 per cent groundcover of sedges and grasses.

The proposal area is not registered as critical habitat under NSW or Commonwealth legislation.

Habitat features

Fallen logs, coarse woody debris, hollow-bearing trees and rocks were identified in the study area and several wombat burrows were observed. The scribbly gum woodland contained occasional rocks and a large rock-shelf covered in leaf litter. The rock-shelf provides potential habitat for the threatened Rosenberg's Goanna (*Varanus rosenbergi*) as well as the Red-crowned Toadlet (*Pseudophryne australis*) and possibly the Spotted-tailed Quoll (*Dasyurus maculatus*). This vegetation also provides foraging habitat for a number of microbats and owls.

There were 191 hollow bearing trees recorded in the proposal footprint. (Refer to Figure 8 in Appendix H for hollow bearing tree locations). Hollows are an important habitat requirement for a number of threatened species including Little Lorikeets (*Glossopsitta pusilla*), Powerful Owl (*Ninox strenua*); Barking Owl (*Ninox connivens*), Eastern Pygmy-possum (*Cercartetus nanus*) and various microbats. Hollows ranged in size and included 59 small, 179 medium, 87 large and 41 extra-large. Of the 191 trees recorded, 23 had fissures. Five of these trees were observed to be old growth trees with diameter at breast heights (DBH) around 1.5 metres. Around 70 of these hollows were located in the Scribbly Gum Woodland and Coastal Upland Swamp areas providing breeding habitat for these species and EPP.

The upland swamp vegetation and adjacent rock ledges provides suitable habitat for a number of threatened species including the Southern Brown Bandicoot (*Isoodon obesulus*), the EPP and possibly Rosenberg's Goanna. The Grey-headed Flying Fox (*Pteropus poliocephalus*) is known to forage on nectar from Banksias and Melaleucas.

Aquatic habitat

Aquatic habitat exists in two tributaries to Cataract Creek which cross the study area. Cataract Creek itself flows west to meet the Cataract River. A tributary to Rocky Creek also crosses the very southern tip of the study area flowing west. The rainforest contained a small waterway which was partly fed by a stormwater drain. No riparian vegetation was found bordering the creek. Though not optimal habitat, it could be utilised by the threatened Southern Myotis (*Myotis macropus*). Drainage channels occurred within the Coastal Upland Swamp and Scribbly Gum Woodland areas containing up to 30 centimetres of water (in November 2014).

Threatened flora

A total of 28 flora species and two endangered flora populations listed under the TSC and/or EPBC Acts have been historically recorded within 10 kilometres of the study area. Based on a habitat assessment, these 28 species and two populations were filtered to determine a shortlist of species and populations that would potentially occur in the study area. The assessment is outlined in the likelihood of occurrence table provided in Appendix C of the Biodiversity Assessment (Appendix H).

Species that were assessed as having a medium to high chance of occurring within the study area include:

- *Acacia bynoeana* (Bynoe's Wattle)
- *Cryptostylis hunteriana* (Leafless Tongue-orchid)
- *Daphnandra johnsonii* (Illawarra Socketwood)
- *Epacris purpurascens* var. *purpurascens*
- *Grevillea parviflora* subsp. *Parviflora* (Small-flower Grevillea)
- *Pomaderris adnata*
- *Pultenaea aristata* (Prickly Bush-pea)

Targeted searches undertaken throughout the study area did not detect any TSC Act or EPBC Act listed threatened flora species.

One rare or threatened Australian plants (ROTAP) taxon, *Darwinia grandiflora*, was recorded in three plots SE2, SE4 and SE9, scattered throughout the Scribbly Gum Woodland and Coastal Upland Swamp habitats within the study area. Two locations of *Darwinia grandiflora*, (SE4 and SE9) are located within the proposed construction footprint and would be directly impacted by the works. Locations of recorded *Darwinia grandiflora* are shown on Figure 6-4.

It is noted, however, that *Pultenaea aristata*, listed as vulnerable under both the TSC Act and EPBC Act, although not recorded during threatened species surveys carried out by SMEC, has been recorded as part of the Russell Vale coal mine expansion flora assessment in the Coastal Upland Swamp areas by Biosis in 2012 and by ERM in 2013 and was recorded in the Wonga East mining domain area. The closest record is approximately 600 metres west of the proposal study area (ERM, 2013).

Threatened fauna

Sixty threatened fauna species have been recorded within 10 kilometres of the study area, of which 59 are listed under the TSC Act and 23 under the EPBC Act. The study area was deemed to provide suitable habitat and availability of resources for 24 of these species. Species that have a medium to high chance of occurring, or which have been observed within the study area include:

- *Heleioporus australiacus* (Giant Burrowing Frog)
- *Litoria littlejohni* (Littlejohn's Tree Frog)
- *Pseudophryne australis* (Red-crowned Toadlet)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Callocephalon fimbriatum* (Gang Gang Cockatoo)
- *Petroica boodang* (Scarlet Robin)
- *Petroica phoenicea* (Flame Robin)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Glossopsitta pusilla* (Little Lorrikeet)
- *Hieraaetus morphnoides* (Little Eagle)
- *Ninox strenua* (Powerful Owl)
- *Tyto tenebricosa* (Sooty Owl)
- *Tyto novaehollandiae* (Masked Owl)

- *Myotis macropus* (Southern Myotis)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat)
- *Mormopterus norfolkensis* (Eastern Freetail Bat)
- *Platyrrhinus vittatus* (Greater Broad-nosed Bat)
- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Petaurus australis* (Yellow-Bellied Glider)
- *Petauroides volans* (Greater Glider)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Hoplocephalus bungaroides* (Broad-headed Snake)
- *Varanus rosenbergi* (Rosenberg's Goanna)

There are records of three fish species occurring in the Wollongong local government area that are threatened under the FM Act: Macquarie Perch (*Macquaria australasica*), Trout Cod (*Maccullochella macquariensis*) and Australian Grayling (*Prototroctes maraena*). Macquarie Perch is the only one of these species shown to have an indicative distribution within the vicinity of the study area in the nearby Cataract River system (DPI 2015), however, there is a lack of suitable habitat within the study area itself.

During site surveys from the 19 to 23 October 2015, a total of 33 vertebrate fauna species were recorded. A summary of the fauna results for the Stage 1 study area is provided in Appendix B of the Biodiversity Assessment in Appendix H. Five threatened fauna species including a probable recording of the vulnerable Eastern Bentwing-bat and one migratory species were identified (refer to Table 6-7) within the study area. Locations of the threatened fauna species are shown in Figure 6-4.

Table 6-7: Threatened and migratory fauna species recorded in the study area

Scientific name	Common name	TSC Act	EPBC Act	Confidence	Survey
<i>Callocephalon fimbriatum</i>	Gang Gang Cockatoo	Vulnerable	-	confirmed	19-30 October 2015
<i>Monarcha melanopsis</i>	Black-faced Monarch	-	Migratory	confirmed	19-30 October 2015
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	Vulnerable		probable	19-30 October 2015
<i>Cercartetus nanus</i>	Eastern Pygmy-Possum	Vulnerable		confirmed	11-15 April 2016
<i>Petauroides volans</i>	Greater Glider		Vulnerable	confirmed	20-22 October 2015

Migratory species

The results of the 10 kilometre database searches included numerous migratory species. A number of species have not been considered as part of this assessment due to the low likelihood that the terrestrial environment in the proposal area would provide necessary habitat requirements. Species that may be affected offsite by the proposal have been retained. Species removed include pelagic seabirds (eg albatross and petrel spp.), migratory wetland specialists and marine species.

Threatened fauna surveys conducted on 19 to 23 October 2015 recorded one migratory species, Black-faced Monarch (*Monarcha melanopsis*) at Site 3 in the Stage 1 study area. This species was also recorded by Lesryk Environmental Consultants (2010). The Rufous Fantail (*Rhipidura rufifrons*) was assessed as having a medium chance of occurring in the study area.

Vegetation communities

A total of 224 native flora species and five exotic species were recorded as present within the 22 Biobanking Plots across the study area, supporting a total of seven vegetation communities. All seven of the vegetation communities exist within the study area. One-hundred and seventy (170) native species and zero exotic species were recorded from 13 biobanking plots. A full floristic list is provided in Appendix A of the Biodiversity Assessment (Appendix H). Vegetation community classification follows that of the Woronora, O'Hare's and Metropolitan Catchment (NPWS 2003). The seven vegetation communities are described below.

Coachwood Warm Temperate Rainforest

The Coachwood Warm Temperate Rainforest was recorded along rocky gully lines and sheltered gully slopes associated with Cataract and Bellambi Creeks and their tributaries in the Stage 1 study areas, on moist sands and loamy sands, often behind steep road embankments.

This plant community has some floristic affinity with the TSC-listed EEC 'Illawarra Escarpment Subtropical Rainforest', it is not considered representative of the EEC based on the absence of key subtropical canopy species, the absence of clay topsoils and its position on the plateau rather than the more sheltered aspects of the escarpment slopes (where the EEC typically occurs). Notwithstanding the above, OEH regards all remaining rainforest stands as 'rare', being of high conservation value.

This plant community represents potential habitat for the TSC Act listed rainforest shrub, *Daphnandra johnsonii*. This species was not detected during the targeted threatened flora surveys undertaken in spring 2013 (northern section) or November 2014 (southern section).

Escarpment Edge Silvertop Ash Forest

Escarpment Edge Silvertop Ash Forest was recorded on generally free draining sands and loamy sands in the northern section of the study area on partially exposed hillslopes.

This plant community is not considered to be analogous with any TSC Act or EPBC Act listed EECs.

No threatened species were recorded as part of the targeted threatened flora surveys nor are any known to be closely associated with this plant community in general on the eastern plateau edge.

Exposed Sandstone Scribbly Gum Woodland

Exposed Sandstone Scribbly Gum Woodland was recorded on freely draining sands in the southern section of the Stage 1 study area on exposed ridges on the eastern and western sides of Mount Ousley Road south of Cataract Creek.

This plant community is not considered to be analogous with any TSC Act or EPBC Act listed EECs.

No TSC Act EPBC Act listed threatened flora species were recorded as part of the targeted threatened flora surveys conducted in spring 2013 or spring 2014. This plant community is considered potential habitat for the TSC-listed shrubs *Epacris purpurascens* var. *purpurascens* and *Pultenaea aristata*.

One ROTAP species was recorded in this plant community in plots SE2 and SE9, this being the prostrate shrub *Darwinia grandiflora* (ROTAP classification = 2RCi), which was in flower during the baseline surveys.

Moist Blue Gum-Blackbutt Forest

Moist Blue Gum – Blackbutt Forest was recorded on moist sands and loamy sands predominantly in the northern section of the study area on sheltered hillslopes north of Cataract Creek.

This plant community is not considered to be analogous with any TSC Act or EPBC Act listed EECs.

No TSC Act or EPBC Act listed threatened flora species were recorded as part of the targeted threatened flora surveys conducted in spring 2013 or spring 2014. This plant community is considered potential habitat for the ROTAP-listed shrub, *Hibbertia nitida*.

Tall Open Blackbutt Forest

Tall Open Blackbutt Forest was recorded on freely draining sands and loamy sands predominantly in the northern section of the study area on the eastern side of Mount Ousley Road on partially exposed ridges north of Cataract Creek.

This plant community is not considered to be analogous with any TSC Act or EPBC Act listed EECs.

No TSC Act or EPBC Act listed threatened flora species were recorded as part of the targeted threatened flora surveys conducted in spring 2013 or spring 2014. This plant community represents potential marginal habitat for the threatened shrub *Pultenaea aristata*, although this shrub was assessed to be much more closely associated with Scribbly Gum Woodlands and upland swamp communities on the plateau.

Sandstone Gully Peppermint Forest

Sandstone Gully Peppermint Forest was recorded on moist sands and loamy sands predominantly in the southern section of the study area on the western side of Mount Ousley Road on sheltered hillslopes south of Cataract Creek.

This plant community is not considered to be analogous with any TSC Act or EPBC Act listed EECs.

No TSC/EPBC-listed threatened flora species were recorded as part of the targeted threatened flora surveys conducted in spring 2013 or spring 2014. This plant community represents potential habitat for the ROTAP shrub *Hibbertia nitida*.

Upland Swamps

Upland Coastal Swamp variants were recorded in the southern portion of the study area on the eastern side of the existing Mount Ousley Road on moist sands and loamy sands, at the uppermost headwaters of unnamed tributaries of Cataract Creek. This plant community overlies a shallow perched aquifer system and becomes inundated following rainfall for short durations. A number of community variants were recorded and sampled within the study area, corresponding to the spectrum of hydraulic gradients experienced by the community, with Banksia thickets colonising the 'drier' swamp areas through to the sedgeland which colonise the 'wetter' swamp areas. The Fringing Eucalypt Woodland variant is considered a transitional community between the free draining Scribbly Gum Woodlands and the drier upland swamp variants.

Four upland swamp community variants were identified during surveys (refer to Figure 6-4):

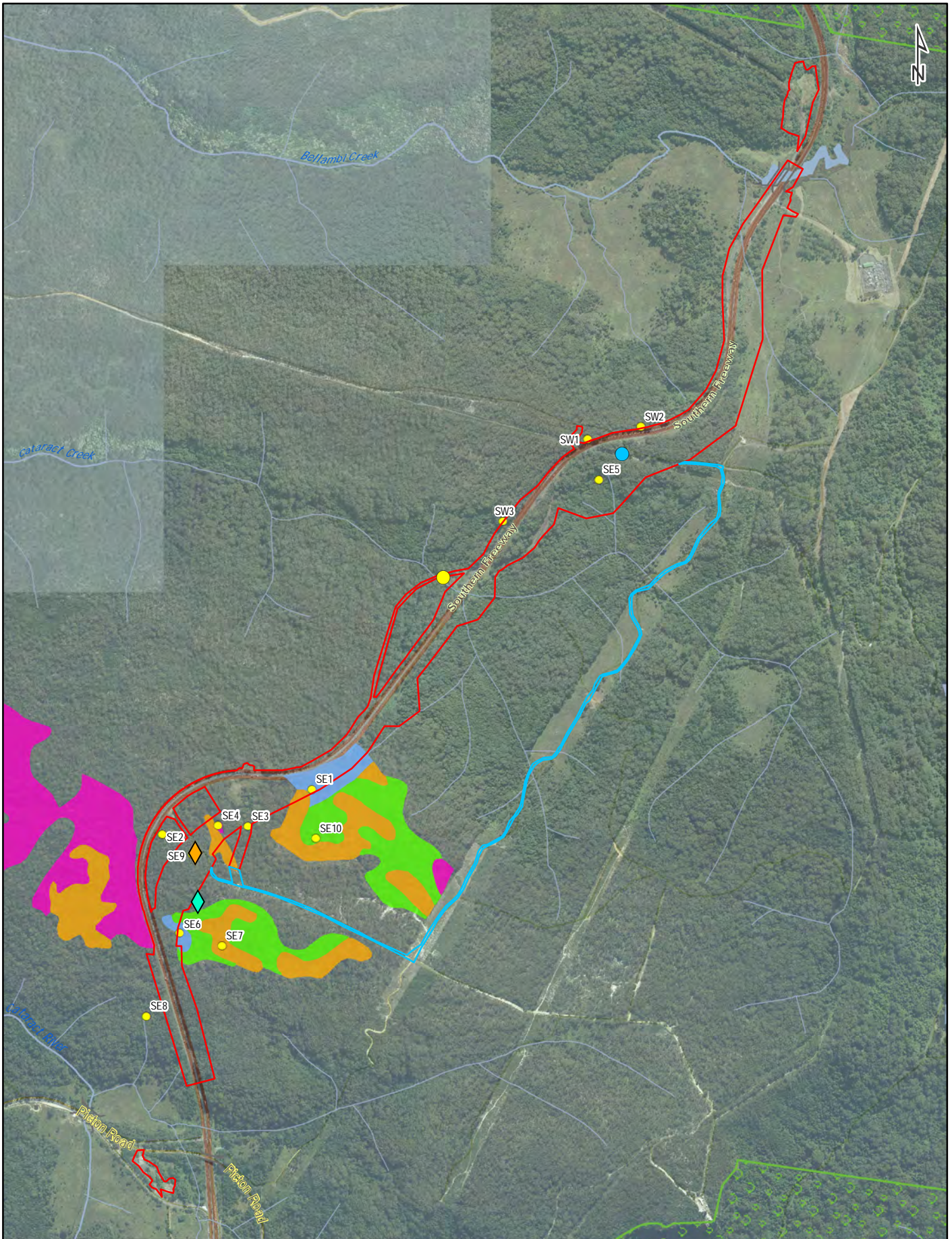
- Banksia Thicket
- Tea Tree Thicket
- Sedgeland Heath Complex – Cyperoid Heath
- Fringing Eucalypt Woodland.

All four upland swamp community variants are considered potential habitat for the shrub, *Pultenaea aristata*. This species was not detected during the baseline and targeted threatened flora surveys

undertaken by SMEC in 2013 and 2014, although this species has been recorded locally in Coastal Upland Swamp and Scribbly Gum Woodland habitats as part of the ecological investigations for the Russel Vale underground coal mine expansion proposal (Biosis, 2012). The ROTAP species *Darwinia grandiflora* (ROTAP classification = 2RCi), which was in flower during the baseline surveys was recorded in the Banksia Thicket variant.

All four community variants are listed in the VIS 2.1 *Classification database* as equivalent to both the TSC Act and EPBC Act listed EEC 'Coastal Upland Swamp in the Sydney Basin Bioregion' (OEH, 2016).

Coastal Upland Swamps and associated flora and fauna species can be considered groundwater dependent ecosystems. The threatened species profile for this community describes Coastal Upland Swamps as occurring primarily on impermeable sandstone plateaux with shallow groundwater aquifers in the headwaters and impeded drainage lines of streams, and on sandstone benches with abundant seepage moisture. The final determination for this community notes that vegetation boundaries of upland swamps are not static but will shift according to localised hydrology, including surface and shallow groundwater hydrology.



- | | | | | |
|-----------------------------------|----------------------------------|---|---|--|
| ◆ Eastern Pygmy-Possum | ● Little Eagle | ■ Upland Swamps: Fringing Eucalypt Woodland | □ Construction footprint | M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1) |
| ◆ Eastern Bentwing-bat (probable) | ■ NPWS Estates | ■ Upland Swamps: Sedgeland-Heath Complex | □ Construction light vehicle access track | |
| ● Gang-gang Cockatoo | ● Flora Plot Locations | ■ Upland Swamps: Tea-Tree Thicket | | |
| ● Greater Glider | ■ Upland Swamps: Banksia Thicket | | | |
| | | | | |

Location of EECs and threatened species

Source: Imagery from RMS

Fig. 6-4

0 100 200 m

Weeds

Lesryk Environmental Consultants (2010) recorded three weed species in the study area reported to be listed as noxious in the Wollongong LGA under the *Noxious Weeds Act 1993*. These were:

- *Eragrostis curvula* (African Lovegrass) (not currently listed as Noxious for Wollongong LGA)
- *Rubus ulmifolius* (Blackberry) (Class 4)
- *Lantana camara* (Lantana) (Class 4).

The 2014 SMEC surveys small areas dominated by weed species adjacent to the existing road, occupying only about 1 hectare of the entire study area. Noxious species observed include *Rubus fruticosus* (Blackberry) (Class 4) and *Lantana camara* (Lantana) (Class 4) and the following environmental weed species (not listed as noxious) were observed:

- *Ageratina adenophora* (Crofton Weed)
- *Bidens pilosa* (Cobblers Pegs)
- *Chloris gayana* (Rhodes Grass)
- *Ehrharta erecta* (Panic Veldtgrass)
- *Foeniculum vulgare* (Fennel)
- *Gomphocarpus fruticosus* (Narrow leaf cotton bush)
- *Hydrocotyle bonariensis*.
- *Ligustrum sinense* (Small-leaved Privet)
- *Olea europa* subsp. *cuspidata* (African Olive)
- *Pennisetum clandestinum* (Kikuyu)
- *Solanum mauritianum* (Wild Tobacco)
- *Tagetes minuta* (Stinking Roger)

Class 4 weeds are plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

Wildlife connectivity corridors

The study area is within a Regional Biodiversity Corridor identified in DECC (2007) Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region. These corridors take into account the key pathways, fauna linkages and landuse of the region to provide a network of longitudinal, latitudinal and altitudinal links and connections between the key landscapes of the area.

The study area is within the Illawarra Escarpment Moist Forest corridor (DECC, 2007). This corridor links a narrow band of moist escarpment forests, including wet sclerophyll forests and rainforest, which run along a latitudinal expanse from the Royal National Park to south of Kangaroo Valley. This corridor also covers an altitudinal gradient of several hundred meters linking the coastal lowlands to the sandstone plateaux. The same corridor is identified in the Hawkesbury Nepean Catchment Management Authority's Catchment Action Plan (2013) as a priority for investment in native vegetation management.

The Illawarra Biodiversity Strategy Volume 2 (Illawarra Councils, 2011) also identifies this corridor as continuing the length of the Illawarra Escarpment from the Royal National Park in the north, and continues to the south along the Escarpment through Shellharbour and Kiama LGAs, south to the Shoalhaven, where it ends at Cambewarra in the south. It is the largest continuous core conservation

area in the Illawarra region, with the eucalypt forests providing quality habitat for bird, arboreal mammal, and reptile and bat assemblages.

6.4.3 Potential impacts

Impacts occur as a result of direct intervention or changes arising from indirect changes to the biophysical and ecological processes that support biodiversity values within the study area. For this proposal, the biodiversity values of the study area would be affected by a variety of indirect and direct impacts throughout the construction and operation phases of the proposal.

The potential impacts associated with this proposal and identified in this section consider:

- Direct impacts to biodiversity from construction activities include:
 - Excavation activities including road alignment,
 - Construction of access tracks to cut and fill locations
 - Modification to or introduction of culverts and pipes, resulting in changes to hydrology
 - Potential off-site mobilisation of sediments, dust, and contaminants from spills.
- Indirect impacts to biodiversity from construction activities include:
 - Potential weed invasion into areas surrounding construction
 - Downstream changes to hydrology from cuts/fills
 - Potential invasion of pathogens through construction personnel and vehicles
 - Mobilisation of sediment and dust downslope of the construction area, resulting in smothering of vegetation
- Other anthropogenic activities that influence cumulative impacts to biodiversity in the area.

Impacts have been split between flora and fauna impacts during construction and operation and are presented below.

Flora impacts

The proposal would result in the removal of native vegetation recorded within the construction footprint from construction activities such as excavation and land clearing for the road re-alignment. The proposal also has the potential to result in the following indirect impacts to retained vegetation adjoining the construction footprint:

- Altered hydrology from deep excavations which may extend into the zone where shallow ephemeral aquifers may occur and which may in turn result in changes to the species composition and areal extent of groundwater dependent ecosystems such as the upland swamps that adjoin the proposed road alignment. The proposed works would not have a significant overall effect on recharge to the underlying aquifer supplying the Coastal Upland Swamp community (Geoterra, 2016) (Refer to Section 6.3.3). Therefore, a significant impact on the long term survival of the Coastal Upland Swamp community in the study area is unlikely to be impacted by the proposal.
- Surface water flow and temporary changes to drainage capacity can lead to the discharge of untreated runoff from construction and operation, which has the potential to introduce weeds and pathogens into retained habitats without adequate treatment.
- Movement of sediment downslope of the construction zone, during establishment of landscaping which has the potential to smother retained vegetation
- An increase in biotic and abiotic edge effects
- Dust deposition on vegetation and soils during construction.

Direct and indirect flora impacts predicted for the proposal are outlined below.

Loss of vegetation/habitat

The proposal would result in the removal of 28.29 hectares of remnant native vegetation and 20.01 hectares of highly modified vegetation (including roadside plantings, cleared areas and exotic dominated vegetation). Of the 28.29 hectares of remnant native vegetation 2.27 hectares is EEC (Coastal Upland Swamp Habitat) and the remaining 26.02 hectares is moderate to good condition native vegetation.

Roads and Maritime is committed to offsetting impacts associated with the proposal in line with its biodiversity offsetting guidelines (RMS, 2011) and in general accordance with the OEH principles for the use of biodiversity offsets in NSW.

Offsetting would focus on the Coastal Upland Swamp EEC and the native vegetation with the potential to support threatened species to be impacted by the proposal and be described in a Biodiversity Offset Strategy for the project.

The approximate extent of each vegetation community proposed for removal as a result of the proposal is listed in Table 6-8 below.

Table 6-8: Native vegetation clearance summary

Vegetation community	TSC Act	EPBC Act	Area to be cleared
Coachwood Warm Temperate Rainforest	-	-	3.69 ha
Escarpment Edge Silvertop Ash Forest	-	-	1.58 ha
Exposed Sandstone Scribbly Gum Woodland	-	-	8.50 ha
Moist Blue Gum - Blackbutt Forest	-	-	4.13 ha
Tall Open Blackbutt Forest	-	-	6.93 ha
Sandstone Gully Peppermint Forest	-	-	1.19 ha
Upland Swamps: Tea-tree Thicket	Endangered	Endangered	1.54 ha
Upland Swamps: Fringing Eucalypt Woodland	Endangered	Endangered	0.16 ha
Upland Swamps: Sedgeland-Heath Complex	Endangered	Endangered	0.51 ha
Upland Swamps: Banksia Thicket	Endangered	Endangered	0.06 ha
Total			28.29 ha

Note: sum of areas with each area rounded up to two decimal places. (Source: SMEC, 2016)

Loss of rare flora

The proposal would result in the removal of three clusters of the ROTAP species, *Darwinia grandiflora*, a prostrate shrub recorded in the Scribbly Gum Woodlands and Coastal Upland Swamp communities within the construction footprint. This species is considered rare chiefly due to its restricted distribution to the Woronora Plateau and the Illawarra.

Altered hydrology

The Coastal Upland Swamps situated within and adjoining the proposed footprint may be subject to potential changes in hydrology as a result of the proposal. The size of swamps and the ecological and hydrological functions of swamps are dependent on groundwater. The floristic composition of swamps is also highly correlated with a gradient of soil moisture (SMEC, 2016).

Surface run-off discharges during construction and operation has the potential to increase nutrient concentrations being discharged into waterbodies, which in turn, may result in an increase in weed recruitment and dispersal into retained vegetation without adequate treatment.

The proposed works are not anticipated to have an overall effect on recharge to the underlying aquifer, stream baseflow or stream water quality where the currently temporary aquifers seep into local catchments (Geoterra, 2016). The upper Hawkesbury Sandstone regional aquifer is located at or deeper than 13 metres below surface in the Brokers Nose area, which is below the proposed excavation depth of the M1 re-alignment works. As a result, it is not anticipated that the proposed roadworks will adversely affect the regional groundwater system (Geoterra, 2016).

Habitat fragmentation

Habitat fragmentation has the potential to adversely impact upon retained native vegetation adjoining the construction footprint through a reduction in patch size. Fragmentation can reduce species richness and can alter interactions between species, such as pollination, seed dispersal and herbivory. A reduction in patch size can result in the loss of species that are area sensitive, meaning they demonstrate significant decreases in probability of occurrence as habitat area decreases because they have certain minimum physical area requirements that are not met in smaller patches. Some of these area sensitive species may also be 'edge sensitive'.

Linear infrastructure such as roads can also result in the genetic isolation of existing populations of some plant species that comprise a particular ecosystem. Populations that become isolated, both physically and genetically, may face an increased risk of extinction. Genetic isolation of plant populations can occur if the 'gap' resulting from road easements limits or prevents normal pollination and seed dispersal mechanisms from taking place. Easements, may, for example, limit myrmecochory (seed dispersal by ants) dispersal mechanisms on some species of *Acacia* where in some particular types of forest, ants are unwilling to cross easement gaps.

It is considered that the plant species that may become isolated or subject to a reduced gene flow between fragments (by the proposed easement), are few in number, given:

- The pollination and dispersal mechanisms that are known to operate in the dry and moist sclerophyll forests (recorded in the study area). For example, bird (eg honeyeater) and insect pollinators of temperate eucalypt forests are mobile and would not likely view relatively small easement gaps (<100 m) as significant barriers to movement.
- Field observations on the floristics of forested habitats already subject to existing fragmentation adjoining the existing road alignment exhibited similar species composition and numbers along both forest edges and interiors, suggesting no significant barrier effects had occurred.

Edge effects

Murcia (1995) identifies both abiotic and biological edge effects. Abiotic edge effects are those that relate to changed environmental conditions within the remnant vegetation and include changes to air moisture and temperature, solar radiation levels, soil moisture and temperature as well as changes to wind speed and pattern. Biological edge effects involve changes in species abundance and distribution, either directly due to changed environmental conditions at the forest edge or

indirectly through changes in species interactions such as pollination and seed dispersal (Murcia 1995).

Forest edges are sometimes associated with high species diversity (grassland/forest habitats), it is now understood that edge effects are detrimental to a wide range of flora and fauna (Murcia 1995). Linear infrastructure such as roads typically allow more sunlight and wind into the near edge forested habitats and it has been found that these effects penetrated up to 150 metres into a forested community from the easement edge, ultimately resulting in a denser shrub understorey and vine components. Murcia (1995) and Laurance (1991) also note that edge effects vary considerably in the distances of penetration, depending on such factors as the type of edge effect measured, the vegetation community being affected, the characteristics of the surrounding environment (eg. pasture, cropland, urban) and the time since edge was created.

It is often difficult to attribute a sole factor such as edge effects to vegetation disturbance such as weed invasion and changes in species abundance and composition (I. Mamott pers. obs.). Often additional contributing factors play a role in vegetation disturbance, in particular, grazing, slashing, fire regimes and increased human disturbance.

Based on field investigations, weed invasion and other edge effects appear generally restricted to the first 10 to 20 metres from the edge of the existing road alignment. The weed zone is not expected to increase as a result of the proposal, assuming the mitigation measures proposed in Section 6.4.4 are implemented.

Erosion and sedimentation

Vegetation clearing and major earthworks associated with the proposal have the potential to result in erosion and sedimentation of downslope creeklines and upland swamps. Without adequate management, sedimentation can smother and kill vegetation and can act to reduce creek line flows.

Dust impacts

The proposal has the potential to smother and damage vegetation through windborne deposition of dust generated from major earthworks (construction) activity in the absence of adequate management.

Fauna impacts

Wildlife connectivity and habitat fragmentation

The study area has been identified as part of an important Regional Biodiversity Corridor – Illawarra Escarpment Moist Forests (DECC 2007, HNCMA 2008 & Illawarra Councils 2011). The removal of vegetation to accommodate the realignment and widening of the motorway would inevitably affect connectivity to some degree. Based on the relative size of the regional corridor and the proposal area this impact is expected to be negligible for most species.

The existing road includes a central concrete wall throughout the length of the alignment which currently constitutes a barrier to east-west fauna movement, particularly for ground-dwelling and arboreal mammals. The proposed widening and realignment is unlikely to significantly increase the barrier effect of the existing motorway for the majority of the alignment. The exception to this is in the southern-most section where the realignment results in an 'island' of habitat remaining between the old and new sections of road. In this location the quality of the island is likely to be reduced by virtue of edge effects from all sides effectively increasing the overall width of the east-west barrier for ground-dwelling and arboreal mammals.

Existing culverts running underneath the motorway may support some cross highway movement. These structures are likely to provide opportunity for movement and breeding of some native species such as reptiles, rodents and frogs. Most culverts are considered to be too long however to provide meaningful connectivity for most arboreal or ground-dwelling mammals

All realigned sections of the road occur over ridgelines running perpendicular to the road direction. As such connectivity within habitats limited to these ridgelines is likely to be relatively more disrupted. Such barriers will be up to 225 metres in width.

The construction of the proposed cutting would result in the reduction in aerial extent of the Upland Swamp vegetation situated on the eastern side of the existing Mount Ousley Road and would further isolate retained swamp habitat in the central smaller swamp similarly situated. Given that this location includes some of the only Coastal Upland Swamp habitat for several kilometres north or south, the probability of regular ecological interaction with other areas of upland swamp habitat is low and disruption to connectivity in this location is likely to have implications on local ground-dwelling populations.

The proposal would result in the fragmentation (ie. reduction in extent) and isolation of the preferred Eastern Pygmy-possum habitat mapped within and adjoining the proposed footprint. Bladon, Dickman and Hume (2002), in their study of habitat fragmentation effects on the species in northern NSW, found that even modest preferred habitat clearing resulted in markedly reduced Eastern Pygmy-possum capture rates (in traps), population sizes and juvenile/sub adult recruitment (into an existing population). Extensive higher quality habitat is present to the east of the study area and with the incorporation of recommended mitigation measures into the project design including a fauna connectivity strategy, Nest Box Management Plan and mitigation monitoring, this would likely minimise the impacts to this species as a result of the proposal. The potential for wildlife connectivity structures such as fauna underpasses within the realignment would be investigated during detailed design. Any such structures would be developed in consultation with a suitably qualified and experienced ecologist, OEH and Roads and Maritime as part of a fauna connectivity strategy.

A total of 191 hollow-bearing trees would require removal from within the Stage 1 construction footprint. This may impact on the existing EPP population as well as other arboreal fauna.

Injury and mortality

Habitat clearing to accommodate the motorway improvements may lead to incidences of fauna injury or mortality through interactions with vehicles. Although the existing motorway already poses a threat to native fauna for injury and mortality, it is likely that the risk would be higher during construction, particularly during habitat removal when fauna would be forced to relocate. Given the proposal would involve habitat clearing directly adjacent to the existing motorway, this may result in an increase in ground-dwelling mammals being injured or killed by cars in the short-term.

Noise, vibration and light

For the majority of the road widening, it is unlikely the proposal would result in changes to existing levels of noise, vibration and light from the existing M1 Princes Motorway. The exception to this would be in the southern section where the road is realigned to the east of the existing road to provide six lanes from north of Picton Road for about one kilometre and again at 2.7 kilometres north of Picton Road to 70 metres south of Bellambi Creek bridge.

These realigned sections would potentially impact resident native fauna, in particular nocturnal woodland bird and mammal species such as those recorded during fauna surveys eg. Greater Glider, Eastern Pygmy-possum, Owlet-nightjar and bat species. Bat species are particularly sensitive to any change in lighting. Considering the availability of adjacent and surrounding habitat, the impact is

unlikely to be significant and during construction there is potential for some resident native fauna to temporarily avoid habitats directly adjacent to the proposal.

Impacts from relevant key threatening processes

The following ten Key Threatening Processes (KTPs) listed under the TSC Act are considered potentially relevant to the proposal:

- Bushrock removal
- Clearing of native vegetation
- Competition and habitat degradation by feral goats (*Capra hircus*)
- Herbivory and environmental degradation caused by feral deer
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- Invasion and establishment of exotic vines and scramblers
- Invasion, establishment and spread on Lantana (*Lantana camara*)
- Invasion of native plant communities by exotic perennial grasses
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees.

These are discussed further in the relevant Section 5A Assessments for those subject threatened species provided as Appendix D in the Biodiversity Assessment in Appendix H.

Conclusion on significance of impacts

Section 5A assessments have been undertaken for a total of 24 fauna species, seven flora species and two EEC listed under the TSC Act that have been recorded or predicted to occur within the study area and that have the potential to be affected by the proposal.

EPBC assessments have also been undertaken for a total of one EEC and five fauna species (including two migratory species – Black-faced Monarch, Rufous Fantail) listed under the EPBC Act that have been recorded or predicted to occur within the study area and that have the potential to be affected by the proposal.

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.

A list of those species and EEC subject to the Section 5A and EPBC Assessments as well as the assessment conclusions is provided in the Biodiversity Assessment in Appendix H (Tables 5 and 6).

Table 6-9: Summary of biodiversity assessment conclusions

Is there a real chance that the activity threatens the long-term survival of nationally listed biodiversity matters?	No
Has the consistency of the activity with relevant recovery plans, threat abatement plans, conservation advices and guidelines provided by the Australian Government been considered?	Yes
Can suitable offsets be secured?	Yes - suitable offsets can be found but a credit variation may be required

6.4.4 Safeguards and management measures

The following mitigation measures have been prepared to address the specific direct and potential indirect impacts outlined in Section 6.4.3. In line with the hierarchy of avoid, minimise, mitigate and offset, the proposed mitigation measures seek to minimise and mitigate the predicted impacts, generally in accordance with the *Roads and Maritime Biodiversity Guidelines* (RTA, 2011). It is understood that Roads and Maritime would be incorporating additional, proven mitigation measures to minimise the direct impacts to Upland Coastal Swamps EEC and EPP habitat, these are detailed in the mitigation and management measures below.

Roads and Maritime is committed to offsetting impacts associated with the proposal in line with its biodiversity offsetting guidelines (RMS, 2011) and in general accordance with the OEH principles for the use of biodiversity offsets in NSW.

The quantum of offsets will be established using the OEH BioBanking Credit Calculator v4.0 and the methods for establishing and securing offset credits would be described in a Biodiversity Offset Strategy (BOS) produced following approval of the proposal.

Safeguards and management measures would be implemented to avoid, minimise or manage potential biodiversity impacts. These safeguards and management measures have been identified in Table 6-10.

Table 6-10: Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
General biodiversity impacts	<p>A Flora and Fauna Management Plan (FFMP) will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> • plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas (a map showing the Coastal Upland Swamp EEC and other native vegetation to be retained) • management strategies for pre-construction, construction activities including control measures for the pre-clearing process • requirements set out in the <i>Landscape Guideline</i> (RTA, 2008) • pre-clearing survey requirements including specific requirements for protected fauna (Ecological pre-clearing surveys to be undertaken prior to the commencement of the clearing, comprising searches for nest sites, maternal roosting sites for microchiropteran bats, and breeding sites for large forest birds such as Owls and the Glossy Black-Cockatoo) by a suitably qualified ecologist in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (Pre-clearing process) (RTA, 2011) 	Contractor	Pre-construction	<p>Core standard safeguard B1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<ul style="list-style-type: none"> procedures for unexpected threatened species finds and fauna handling protocols to manage weeds and pathogens proposed strategies for re-use of coarse woody debris and bushrock fauna rescue and release procedure. 			
General biodiversity impacts	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Roads and Maritime/Contractor	Detailed design/pre-construction	Core standard safeguard B2
Native vegetation	Detailed design will seek to minimise the construction footprint to the extent possible. A Clearing Limits Report (or similar) will be prepared which identifies reduced clearing limits achieved by detailed design, compared to the original planned clearing limits. The report will clearly explain / justify the proposed clearing limits at any locations that a reduction cannot be achieved, or only minor reductions can be achieved. The report will be approved by the Roads and Maritime Environment Manager.	Roads and Maritime/Contractor	Detailed design/pre-construction	
Native vegetation	<p>Ensure exclusion zones areas are established prior to vegetation clearing through fencing and signage and these Management of exclusion zones should address the following matters:</p> <ul style="list-style-type: none"> Ensure that any trees to be felled to establish exclusion zones are felled away from the 	Contractor	Pre-construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<p>exclusion zone and not into retained bushland habitats</p> <ul style="list-style-type: none"> • Signs should be clearly visible from a distance of at least 20 metres and be general in nature, such as 'Exclusion Zone' or 'Environmental Protection Zone' • No clearing, stockpiling of plant and material shall take place in the established exclusion zones • Regular inspections of exclusion zone boundaries, and repairs to fencing should be undertaken. Additional checks should be undertaken following storms where there is a higher risk of material falling on fencing. Where possible, inspections of exclusion zones should form part of regular site environmental checks • Communication of the locations and purpose of the exclusion zones should be provided to all site staff (eg in toolbox talks and formal inductions). 			
ROTAP species - <i>Darwinia grandiflora</i>	Investigate options for salvage of the <i>Darwinia grandiflora</i> plant. Consultation with the local botanic gardens and council would be undertaken to investigate opportunities to collect seed from the plant or accepting individual plants that can be salvaged.	Roads and Maritime/Contractor	Pre-construction/construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Native vegetation	Landscape and Urban Design Plan to be prepared following project approval. This is to include: <ul style="list-style-type: none"> • Areas that are to be revegetated • Areas that are to be stabilised • Procedures for progressive stabilisation of cleared areas • Topsoil requirements for revegetation • Ensure plant species used for revegetation are suitable for the habitat and where practicable indigenous species may be used. 	Road and Maritime	Detailed design/construction/post-construction	
Native vegetation	Management of access into the project area through gating/fencing of existing tracks to reduce the impacts of human disturbance and dumping on the retained vegetation adjacent to the site.	Contractor	Construction	
Invasive species and pathogens	The Site Erosion and Sediment Control Plan will be implemented in accordance with the Blue Book (Landcom 2004) during construction to minimise the movement of the soil borne organism, <i>Phytophthora cinnamomi</i> and weed seeds.	Contractor	Construction	
Invasive species and pathogens	A Weed Management Plan (WMP) will be developed for the site as part of the CEMP and in accordance with the Biodiversity Guidelines-Guide 6 (RTA, 2001). It will include, but not be limited to: <ul style="list-style-type: none"> • A procedure for stockpile management • Requirements for the use of pesticides • Wash down procedure for vehicles to prevent the spread of weeds 	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<p>Undertake weed management and control in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA 2011) during and post-construction.</p> <p>Stockpiling of topsoil from cleared areas for re-use in site revegetation is only to be sourced from areas classified as 'weed free' by a site ecologist.</p>			
Invasive species and pathogens	<p>Establish a protocol to prevent introduction or spread of <i>Phytophthora cinnamomi</i> and Myrtle Rust consistent with <i>Roads and Maritime Biodiversity Guidelines - Guide 7 (Pathogen Management)</i> (RTA, 2011) during construction. The protocols used should be either the <i>Sydney Region Pest Management Strategy</i> or Best Practice Guidelines for <i>Phytophthora cinnamomi</i> (DECC 2008) and the DPI handout prepared for Myrtle rust response 2010–11: <i>Preventing spread of Myrtle Rust in bushland</i> or the OEH Interim management plan for Myrtle rust in bushland (2011).</p>	Contractor	Construction	
Habitat corridor and wildlife connectivity fragmentation	<p>Produce a fauna connectivity strategy in consultation with Roads and Maritime environmental staff and an experienced fauna consultant to investigate and determine what types of wildlife connectivity structures will be included in the detailed design and facilitate the movement of threatened species.</p> <p>Target species include forest owls, Glossy Black Cockatoo, Little Lorikeet, Gang-gang Cockatoo,</p>	Roads and Maritime/Contractor	Detailed design	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<p>microchiropteran bats, Greater Glider, Yellow-bellied Glider and Eastern Pygmy-possum. The fauna connectivity strategy will consider:</p> <ul style="list-style-type: none"> • Enhancing the likelihood of culvert use with fauna exclusion fencing to funnel wildlife towards culvert openings and promote tree growth near entrances to encourage use of culverts as wildlife underpasses and reduce barrier effect of the motorway. • Retention of large glide trees adjacent to the road to facilitate Glider movement. • The location of the fauna exclusion fencing to be determined and shown on the detailed design. 			
Habitat corridor and wildlife connectivity fragmentation	A monitoring program will be designed and implemented to assess the effectiveness of fauna connectivity measures installed (once determined).	Roads and Maritime	Detailed design/post-construction	
Loss of fauna habitat areas	<p>Undertake staged habitat removal of hollow-bearing trees in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011). All habitat trees proposed for removal shall be tagged in the field with surveyors flagging tape and spray paint and clearly mapped for clearing Contractors. Felled habitat trees should be relocated into suitable retained habitats, where practicable, under the supervision of the project ecologist.</p> <p>Lost hollows shall be replaced by the installation of nest boxes in suitable habitats at a 1:1 ratio</p>	Contractor	Pre-construction/construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	prior to their felling in accordance with the Nest Box Management Plan.			
Loss of fauna habitat areas	<p>A Nest Box Management Plan would be prepared in accordance with the <i>Roads and Maritime Biodiversity Guidelines- Guide 8 (Nestboxes)</i> (RTA 2011) and in consultation with a suitably experienced Fauna ecologist, to ameliorate the reduction in habitat features and loss of tree hollows.</p> <p>Target species for nest boxes would include forest owls, Glossy Black Cockatoo, The Little Lorikeet and the Gang-gang Cockatoo, microchiropteran bats and Greater Glider, Yellow Bellied Glider and Eastern Pygmy-possum.</p> <p>The Nest Box Management Plan is to ensure no net loss of suitable Eastern Pygmy-possum habitat occurs as a result of hollow-bearing tree removal. Eastern Pygmy-possum nest boxes would be installed in suitable habitats at a frequency of one every 30-50 metres.</p> <p>Undertake post-construction nest box installation maintenance and monitoring checks in accordance with the prepared Nest Box Management Plan and Roads and Maritime Biodiversity Guidelines (RTA, 2011).</p>	Contractor	Pre-construction/during construction/post construction	
Protected fauna	In the unlikely event any nest sites of the larger sized birds such as the Square-tailed Kite and other raptors, Powerful Owl, and Masked Owl are	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	located within the clearing area, the clearing contractor will move the nest from the construction site to the nearest suitable area outside of the construction site under direction of an ecologist.			
Coastal Upland Swamps	<p>An Upland Swamp Management Plan will be developed that will incorporate measures to minimise the impacts on Upland Swamps. This will include:</p> <ul style="list-style-type: none"> • Identification of impacts to upland swamps • Methods to minimise impacts on upland swamps • Undertake a monitoring program at upland swamp locations prior to, during and for 12 months following, construction. 	Contractor/Roads and Maritime	Pre-construction/construction/post construction	
Coastal Upland Swamps	<p>As part of an Upland Swamp Management Plan, post construction checks in line with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA 2011), will be implemented as part of the plan and will consider but not be limited to:</p> <ul style="list-style-type: none"> • Assessing the effectiveness of bunding revegetation and ensure no indirect impacts on surrounding Upland Swamps have occurred as a result of the works. <p>Should indirect impacts be encountered, remedial actions will be investigated and if practicable implemented.</p>	Contractor/Roads and Maritime	Pre-construction/construction/post construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Coastal Upland Swamps	Spill management policy / guidelines to be followed to protect the retained Coastal Upland Swamp vegetation from any spills during construction of batters.	Contractor/Roads and Maritime	Construction	
Coastal Upland Swamps	Batters between the new road cuttings and remaining swamps will be established to minimise impacts to the remaining Coastal Upland Swamps by preventing draining of the dissected Coastal Upland Swamps	Contractor/Roads and Maritime	Construction	
Coastal Upland Swamps	The Landscape and Urban Design Plan is to incorporate progressive construction revegetation and restoration of cleared areas of Coastal Upland Swamp EEC in accordance with <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011). In particular, revegetating the batters installed with species associated with that particular swamp to prevent drainage of the Coastal Upland Swamps Stockpiled topsoil and/or tubestock planting will be used where appropriate.	Roads and Maritime	Construction	
Eastern Pygmy-possum	The Fauna Connectivity Strategy plan within the Construction FFMP will incorporate all of the mitigation measures, monitoring and control measures specific to Eastern Pygmy-possum in line with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011). These are to include: <ul style="list-style-type: none"> Measures to mitigate habitat fragmentation: including removal of concrete barriers on the 	Contractor	Pre-construction/construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<p>old road alignment at the southern end of the project to provide additional connectivity for the existing Eastern Pygmy-possum population to the wider locality.</p> <ul style="list-style-type: none"> Enhance likelihood of culvert use with fauna fencing to funnel wildlife towards culvert openings and promote tree growth near entrances to encourage use of culverts as wildlife underpasses and reduce barrier effect of the motorway. <p>The Nest Box Strategy will incorporate specific measures to ensure no net loss of suitable Eastern Pygmy-possum habitat as a result of hollow-bearing tree removal within their habitat in accordance with the <i>Roads and Maritime Biodiversity Guidelines - Guide 8</i> (nestboxes) (RTA, 2011). And in consultation with a suitably experienced Fauna ecologist Twenty five EPP nestboxes are currently installed within the study area within suitable habitat and those not within the construction footprint can be retained.</p> <p>Undertake post-construction nest box installation maintenance and monitoring checks in accordance with the prepared nest box strategy and <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011).</p>			

6.5 Air quality

6.5.1 Methodology

The NSW EPA regulates emissions from the construction of roads, and generally traffic emissions are regulated via national motor vehicle and fuel standards that limit the emissions produced by vehicles.

A qualitative assessment of potential changes in local air quality during the construction and operation of the proposal is provided in this section. Potential impacts on local air quality were identified and assessed through a review of:

- Desktop searches of:
 - NSW Annual NEPM Compliance Reports (OEH, 2013) on 4 August 2016
 - Local meteorological data.
- Identification of sensitive receivers through desktop assessment
- Review of construction methods for the proposal, in consideration of the construction impact area
- Review of the Traffic and Transport Assessment (Hyder, 2015) prepared for the proposal
- Consideration of potential pollutants generated during both the construction and operational phases of the proposal.

6.5.2 Existing environment

Air quality within the study area is typical of an arterial road within a rural environment. Predominant emission sources contributing to air quality in the locality include vehicles travelling on the M1 Princes Motorway, back burning operations and bushfires.

Sensitive receivers include known or likely future locations where people are likely to work or reside. This includes but is not limited to dwellings, schools, hospitals, offices or public recreational areas. Sensitive receivers were not identified within 100 metres of the proposal.

Particulate matter

Types of dust may be differentiated according to particle size. Particles with diameters less than or equal to 10 micrometres (μm) are commonly referred to as PM10 and total suspended particles (TSP) typically refers to particles within larger diameter ranges (10 to 50 μm). Particle size is an important factor influencing the dispersion and transport of dust in the atmosphere and its impacts on human health.

The OEH operates a network of air quality monitoring stations at various locations around the State. The closest, most representative station to the proposal is located at Wollongong, around five kilometres to the south east of the proposal.

PM10 levels recorded at the OEH Wollongong station between 2011 and 2013 indicates that, in recent years (specifically 2010 to 2012), the ambient air quality criteria for 24 hour maximum concentrations as outlined within the National Environment Protection Measure for Ambient Air Quality (AAQ NEPM) (Australian Government, 1998) were met. In 2013, the standard was exceeded on six days of the year at the Wollongong station, including three days during the New South Wales bushfire emergency (17 October to 11 November). In 2014, the standard was not exceeded in Wollongong for the entire year.

Climate

The climate of the study area is characterised by warm to hot summers and cool to mild winters. The study area is located near to the ridgeline of the Wollongong escarpment which experiences high rainfall, inclement weather and fog events, known to reduce visibility for road users.

Climate data obtained from the Bureau of Meteorology (4 August 2016) for the nearest monitoring station, Wollongong University (station 068188), is summarised in Table 6-11.

Table 6-11: Climate data Wollongong University Station (1970-2008)

Data (units)	Average monthly minimum (respective month)	Average monthly maximum (respective month)	Average annual
Rainfall (mm)	63.4	160.4	1345.6
Mean temperature (degrees Celsius)	25.6 (January and February)	17.0 (July)	13.3 – 21.8
Mean 9am wind speed (kilometres per hour)	7 kilometres per hour (January and February)	11.3 kilometres per hour (September)	9.1
Mean 3pm wind speed (kilometres per hour)	9.8 kilometres per hour (May)	14.8 kilometres per hour (November)	12.7

(Source: OEH website accessed 4 August 2016)

6.5.3 Potential impacts

Construction

Construction of the proposal would be generally comprised of the following activities:

- Site establishment including vegetation clearance
- Relocation / protection of services
- Site preparation
- Earthworks
- Drainage and sediment controls
- Construction of pavement including motorway widening
- Site rehabilitation.

Sources of air emissions associated with construction would include excavation works and the formation of stockpiles, as well as combustion emissions from plant and equipment. Typical plant and equipment used during construction may include, but not be limited to excavators, bobcats, dozers, rollers, and asphalt trucks. A list of plant and equipment, based on similar road construction projects is provided in Table 3-2.

Pollutants emitted during construction would consist primarily of dust, as well as products of fuel combustion during operation of vehicles and equipment. Odours generated during the application of asphalt as part of construction may be temporarily perceptible by passing vehicles.

The temporary increase in construction traffic volumes along the M1 Princes Motorway, anticipated to be an additional 105 heavy vehicles per hour over a 12 hour working day, is not expected to be distinguishable against existing traffic volumes. As such, additional truck movements associated with construction are not expected to cause significant air quality impacts.

As reported in the AAQ NEPM existing ambient 24 hour PM₁₀ concentrations in the area have exceeded the national standards on occasion. Localised impacts to air quality, including dust and combustion emissions, may be experienced at construction sites. However, the nature of such impacts would be minor, short-term and temporary.

Provided appropriate safeguards and management measures (refer to Section 6.6.4) are implemented, it is expected that the proposal would have a negligible adverse impact on local air quality.

Operation

As discussed in Section 6.5.2, there are no sensitive receivers such as residential properties or schools located within 100 metres of the proposal. The proposal is therefore not expected to result in local air quality impacts to any sensitive receivers. The proposal would also not result in an increase in traffic above traffic growth already predicted. No changes to regional air quality are therefore expected.

6.5.4 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential air quality impacts. These safeguards and management measures have been identified in Table 6-12 below.

Table 6-12: Air quality safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
General air quality impacts	<ul style="list-style-type: none"> An Air Quality Management Plan (AQMP) will be prepared for construction of the Proposal and implemented as part of the CEMP. The plan would detail air quality control measures and procedures to be undertaken during construction. 	Contractor	Construction	
Impacts on local air quality during construction.	<ul style="list-style-type: none"> Areas of exposed surfaces are to be minimised through construction site planning and programming, to reduce the area of potential construction dust emission sources. Control measures would be implemented in order to minimise dust from stockpile sites. Dust suppression measures, such as the use of water carts or soil binders, would be used on any unsealed surfaces and other exposed areas. All trucks would be covered when transporting materials to and from the site. Construction activities that would generate dust would be avoided or modified during high wind periods. Work activities would be reviewed if the dust suppression measures are not adequately restricting dust generation. Rehabilitation of completed sections would be progressively undertaken. 	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Exhaust emissions	<ul style="list-style-type: none"> • Construction plant and equipment would be maintained in good working condition in order to limit impacts on air quality. • Where practicable, vehicles will be fitted with pollution reduction devices. 	Contractor	Construction	

6.6 Traffic and transport

Roads and Maritime commissioned Hyder to prepare a Traffic and Economic Assessment of the proposal. The Assessment is available in Appendix J, and a summary is provided below.

6.6.1 Methodology

Traffic data and models

For the purpose of the traffic assessment, traffic data and models were sourced from Roads and Maritime and updated to reflect 2014 traffic conditions. The updated traffic model included the recently completed northbound overtaking lane to the north of Bulli Tops and a northbound acceleration lane from Picton Road onto the M1 Princes Motorway.

The study area included the 8.3 kilometres section of the M1 Princes Motorway between Bulli Tops and Picton Road. The section is currently a four lane divided road (two lanes in each direction) with speed limits of 100 kilometres per hour. Currently, the M1 Princes Motorway within the study area carries about 37,000 vehicles per day.

New traffic surveys were also undertaken in 2014 and included intersection turning movement counts (car and heavy vehicles) and travel time surveys.

Future traffic numbers and performance were modelled for the base case (no upgrade), at opening after the upgrade (2018), ten years after opening (2028) and 20 years (2038) after opening.

Traffic growth

Traffic numbers between 1996 and 2014 on the M1 Princes Motorway have grown consistently at about two per cent per annum.

Proposed future activities and development in the region was also identified and used to estimate future traffic growth. The future activities and development that would contribute to future growth include:

- A projected growth of 38,000 new households in the Illawarra to 2036, primarily to the south of Wollongong (including the proposed West Dapto development), to include 17,000 new households
- Further development of the Port Kembla car import terminal. Currently the terminal receives and consigns 847,000 vehicles per annum to diverse locations in western and eastern Sydney. This is expected to increase to 1.3 million vehicles by 2036
- Upgrading of coal infrastructure at Port Kembla such that capacity is expected to increase by about 40 per cent. The M1 Princes Motorway is the primary route for the transport of coal by road from surrounding mines to the port
- Expansion of the University of Wollongong, including its Innovation Campus.

Based on these future activities and developments, the traffic assessment assumed a growth rate of two per cent per annum for light vehicles and four per cent per annum for heavy vehicles until 2038.

Traffic performance

Traffic performance of the base case and with the proposal was assessed for future years 2018, 2028 and 2038. Key traffic criteria used to assess the performance of the proposal include:

- Motorway performance – The key objective of the proposal is to improve travel time and efficiency on the M1 Princes Motorway for both freight and commuter movements by providing additional lane capacity. This has been quantified in term of average travel times and travel speeds on the motorway in both travel directions.
- Motorway level of service – The proposal would aim to increase reliability of the M1 Princes Motorway and to support future traffic growth. This has been quantified in term of midblock level of service of the motorway for year 2038 (20 years after opening).

6.6.2 Existing environment

Road Network

The section of the M1 Princes Motorway subject to the proposal has no cross streets, intersections, interchanges, overpasses or underpasses. However there are a number of fire trials and maintenance accesses for service providers which intersect with this section of the M1 Princes Motorway. The nearest intersection is the Picton Road interchange to the south of the proposal area.

Traffic volumes

In 2014 the M1 Princes Motorway between Bulli Tops and Picton Road carried about 37,000 vehicles per day. The heavy vehicle proportion was about 13 per cent of the total traffic. The northbound hourly flow on the M1 Princes Motorway was about 1,800 vehicles in the morning peak. The southbound hourly flow on the M1 Princes Motorway was slightly less than 1,800 vehicles in the afternoon peak. In the morning and afternoon peak, heavy vehicles comprised about nine per cent of peak hour traffic.

Traffic performance

Traffic performance and safety impacts are caused by the laden heavy vehicles climbing and descending the steep grades of the M1 Princes Motorway. While the majority of heavy vehicles use the kerbside lane, often the right lane is used by other heavy vehicles passing slower vehicles in the kerbside lane. This has a 'knock-on' effect for general traffic, generating the need for weaving manoeuvres and braking. These actions result in increased travel times for all vehicles and the potential for more vehicle crashes.

Table 6-13 below shows average travel speed and travel time on the M1 Princes Motorway between Bulli Tops and Picton Road for light and heavy vehicles. The data indicates that travel speed for heavy vehicles are substantially lower than the posted speed. In peak period, the travel speed is about 80 to 90 kilometres per hour for light vehicles and about 50 to 60 kilometres per hour for heavy vehicles. The average travel speeds on the motorway section are approximately 25 per cent lower than the posted speed limited of 100 kilometres per hour.

Table 6-13: Existing Travel Speed and travel time on the M1 Prince Motorway between Bulli Tops and Picton Road

Vehicle Type	Travel Speeds (km/h)		Travel Times (minutes)	
	Northbound	Southbound	Northbound	Southbound
Light Vehicles	86	89	5.8	5.6
Heavy Vehicles	54	62	8.9	7.7

Crash data

Crash data from the relevant section of the M1 Princes Motorway for a period of five years (August 2009 to October 2013) were analysed. In the five year period a total of 112 crashes were recorded. These crashes included two fatal crashes and 27 crashes which caused injury. The historical crash data indicates that a high number of crashes are run-off road, rear-end and lane change type of crashes.

Crashes on the M1 Princes Motorway between Bellambi Creek and Picton Road in the five year period were estimated to cost the community and government approximately \$22.23 million.

6.6.3 Potential impacts

Construction

Construction compounds

There is potential for traffic impacts associated with the construction compounds. The location of the construction compounds would be confirmed during the detailed design. Access arrangements would need to be determined as part of the Traffic Management Plan (TMP).

Construction traffic impacts

Potential impacts caused by construction traffic include:

- Increased travel times due to reduced speed limits around construction sites
- Increased travel time due to increased truck and construction machinery movements
- Temporary closures of lanes with the potential for related increased travel times due to the reduced travel speed and capacity

Heavy vehicles would be required for delivery of construction materials, removal or spoil, delivery of construction equipment and machinery and various other activities.

The movement of material would be managed through the scheduling of deliveries and availability of fleet. The aim being to minimise the number of haulage and delivery vehicles required during peak periods and weekends. The delivery of oversized materials such as gantries would occur at night time to minimise disruption to traffic flow.

Traffic impacts are expected to comprise the following:

- Full and partial temporary closures during non-peak periods
- Reduced speeds of 40 kilometres per hour during construction
- Traffic delays due to temporary closure of lanes
- Minor increase in road traffic due to construction vehicle deliveries.

As around 50 per cent of the proposal would consist of a new alignment, the proposal would largely be constructed off-line which would minimise construction traffic impacts. The largest impacts would be the sections of the proposal that are undergoing on-line widening.

Public transport

Bus route 887 operated by Busways (between Campbelltown and Wollongong) is the only public bus route which would be impacted by any temporary closure of the M1 during construction.

Pedestrians and cyclists

There are no pedestrian facilities such as footpaths in the proposal area. While cyclists are permitted to use the M1 Princes Motorway generally they access and exit the motorway further north at the interchange with Bulli Pass. During construction, a detour for cyclists using Bulli Pass would be in place.

Local roads and properties

There are no local roads or private residential properties near or intersecting with the proposal.

Emergency and other services

There is the potential for access restrictions or changes to access associated with construction of the proposal, including a reduction in the width of the road shoulder. Fire trails and access tracks into the Cataract Dam catchment and the nearby power line easements and substation would also be affected during construction. However, alternative access arrangements would be provided to ensure that access is available at all times.

Emergency and other services would be consulted during preparation of the TMP and would be advised of all construction areas and reduced speed zones, access restrictions and potential night closures of lanes in order for planning of appropriate routes during the construction period.

Operation

Table 6-14 below shows traffic forecasts on the M1 Princes Motorway between Bulli Tops and Picton Road for the opening year in 2018, 2028 (10 years after opening) and 2038 (20 years after opening). At opening year in 2018, traffic on the M1 Princes Motorway would be about 40,000 vehicles per day. In 2038 (20 years after opening), traffic on the M1 Princes Motorway would be about 55,000

vehicles per day. The future heavy vehicle proportion would be similar to current proportion, which is about 13 per cent heavy vehicles.

Table 6-14: Traffic forecasts

	2018 – opening year	2028 – 10 years after opening	2038 – 20 years after opening
Forecast average daily volumes	40,000	47,000	55,000
AM peak hour volumes:			
Light vehicles	NB:1,800 / SB:1,200	NB:2,000 / SB:1,300	NB:2,300 / SB:1,600
Heavy vehicles	NB:140 / SB:140	NB:190 / SB:190	NB:240 / SB:240
All vehicles	NB:1,900 / SB:1,300	NB:2,200 / SB:1,500	NB:2,500 / SB:1,800

(Note: NB = northbound SB=southbound)

To assess whether the proposal would result in improvements in traffic performance, the performance of the base case (do nothing) was compared against the proposal using traffic numbers from 2038.

One measure of traffic performance was assessed by calculating the “Level of Service” (LoS) for sections of the proposal based upon average traffic speed. Figure 6-5 graphically shows the LoS in the proposal area for 2038 in the AM peak with and without the proposal. Without the proposal, the LoS on the M1 Princes Motorway would be low with the LoS typically E or F (coloured in red) for the majority of the proposal area. The proposal would substantially improve the LoS to typically A or B (coloured in green). Other traffic performance measures such as vehicle travel times are also improved substantially by the proposal (refer to Table 6-16). Improvements include:

- Improved travel time on the M1 Princes Motorway between Bulli Tops and Picton Road (measured for the entire 8.3 kilometre section) - In 2038 (20 years after opening), the travel time saving on the M1 Princes Motorway would be up to 1.2 minutes (or 17 per cent) in the northbound direction and about two minutes (or 27 per cent) in the southbound direction
- Substantial improvements on the M1 Princes Motorway section between Bellambi Creek and Picton Road (3.5 km) due to the widening (three lanes in each direction) - In 2038, the speed improvement would be from about 63 to 72 kilometres per hour (base case) to 89 to 92 kilometres per hour with the proposal
- Improved heavy vehicles travel speed - In 2038 heavy speed would improve by up to 33 per cent from about 43 to 48 kilometres per hour (base case) to about 55 to 57 kilometres per hour with the proposal.

Table 6-15: Traffic performance measures – base case and with proposal (AM peak)

Traffic Criteria	Unit of measurement.	Vehicle Type	Base Case	With proposal	Improvement (Per cent)
Ability to improve travel time on the M1 northbound between Picton Road and Bulli Tops	Measured average travel time (minute)	All vehicles	7.1 mins	5.9 mins	1.2 mins (-17%)
Ability to improve travel time on the M1 southbound between Bulli Tops and Picton Road	Measured average travel time (minute)	All vehicles	7.4 mins	5.4 mins	2.0 mins (-27%)
Ability to improve northbound traffic flows on the M1 between Picton Road and Bellambi Creek	Measured average travel speed (km/h)	Light vehicle	72 km/h	92 km/h	20 km/h (+28%)
		Heavy vehicle	48 km/h	55 km/h	7 km/h (+15%)
Ability to improve southbound traffic flows on the M1 between Bellambi Creek and Picton	Measured average travel speed (km/h)	Light vehicle	63 km/h	89 km/h	26 km/h (+41%)
		Heavy vehicle	43 km/h	57 km/h	14 km/h (+33%)
VKT – section between Bellambi Creek and Picton (A to B).	Vehicle Kilometres Travelled	All vehicles	14321	13916	3%
VHT - section between Bellambi Creek and Picton (A to B).	Vehicle Hours Travelled	All vehicles	240	168	30%

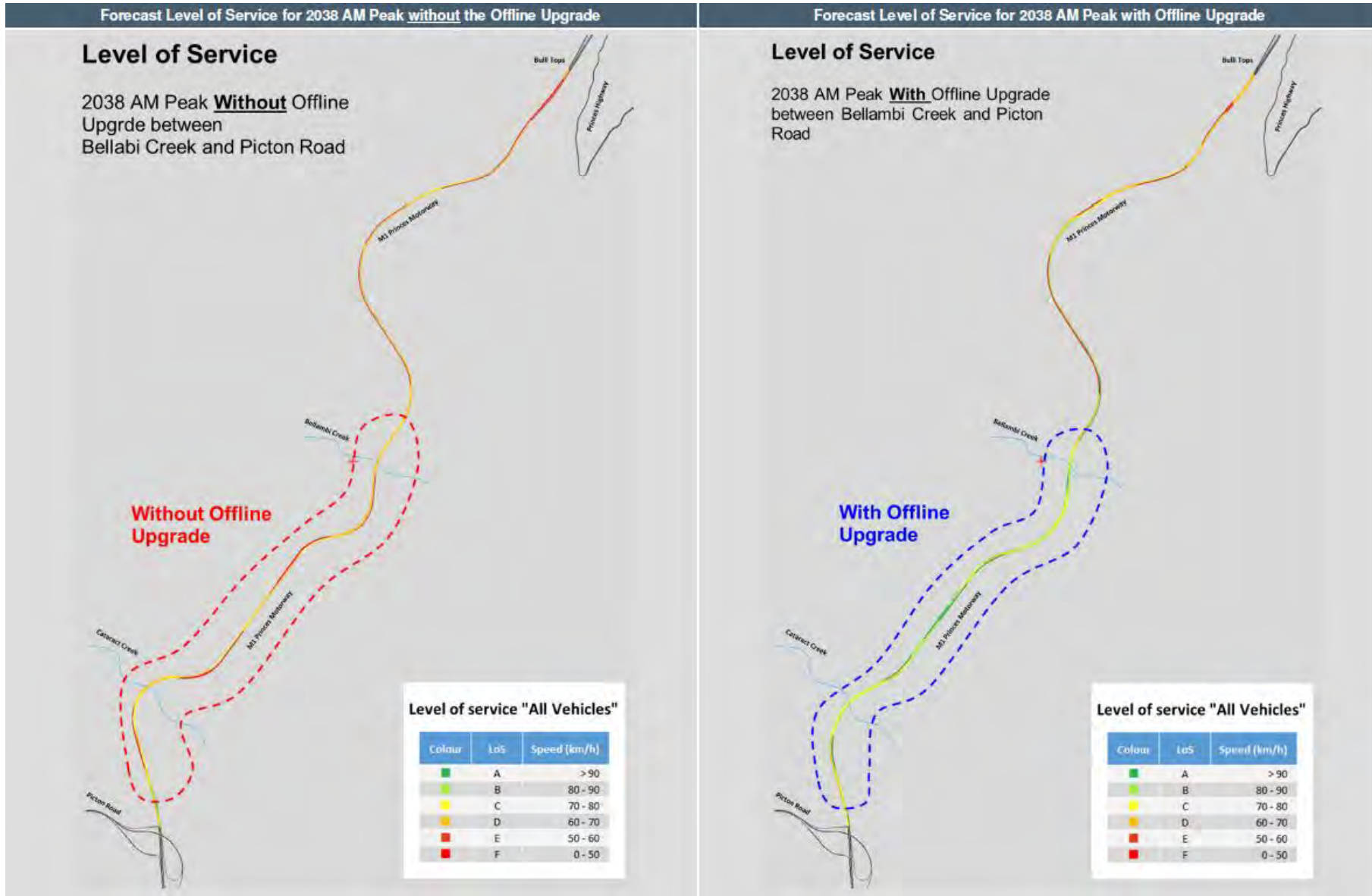


Figure 6-5: Traffic performance with and without the proposal in 2038

An improvement in road safety due to the proposal was estimated using Roads and Maritime's Crash Reduction Guide. The existing crash data in the study area was analysed to determine if any crashes could have been prevented, or consequences minimised as a result of the proposal.

The safety improvements estimated with the proposal predict that total number of crashes on the M1 Princes Motorway between Bellambi Creek and Picton Road would be reduced by 74 per cent. The annual crash rate would reduce from 22.5 (crashes per year) for the existing road to 5.8 with the proposal, with the potential to eliminate all fatal crashes. The crashes per 100 million vehicle kilometres would also be substantially reduced, falling from 31 to eight crashes per 100 million vehicle kilometres.

6.6.4 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential air quality impacts. These safeguards and management measures have been identified in Table 6-16 below.

Table 6-16: Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • confirmation of haulage routes • measures to maintain access to local roads • site specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain cyclist access and provision of alternative cyclist routes during construction • requirements and methods to consult and inform Busways and the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident 	Contractor	Pre-construction/ construction	<p>Core standard safeguard TT1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<ul style="list-style-type: none"> • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • processes to monitor and review the effectiveness of traffic control measures and to amend the TMP should this be necessary. 			
Property access	An access strategy for construction and operational phases will be developed and agreed with relevant agencies to maintain access to fire trails and other service roads	Design and construction contractors/ Roads and Maritime	Pre-construction, construction and operation	Additional safeguard

Noise and vibration

6.6.5 Existing environment

The proposal is located within a bushland environment between Bellambi Creek and Picton Road, Mount Ousley, on the Illawarra Escarpment. The protected catchment of Cataract Reservoir is located directly adjacent to the proposal on the eastern and western side of the road corridor. Other land uses within 600 metres of the proposal include an Endeavour Energy easement and environmental monitoring wells associated with project approvals for Wollongong Coals No 1. Colliery (Consolidated Coal Lease 745). These land uses are used intermittently for maintenance works and as such, are considered to have no permanent sensitive receivers.

A desktop assessment was undertaken in accordance with the *'Interim Construction Noise Guideline'* (ICNG) (DECC, 2009) to determine sensitive receivers within the study area. The closest sensitive receivers were found to be isolated residences located about 1,200 metres east of the proposal. The closest suburban residential areas are approximately 1,500 metres from the proposal. These closest receivers are located near the base of the Illawarra Escarpment at an elevation about 250 metres lower than that of the proposal.

The Road Noise Policy (DECCW, 2011) suggests that the study area for an operational noise assessment for new or redeveloped roads should be 600 metres either side of the road. As the nearest sensitive receiver is at least 1,200 metres away and about 250 metres below the proposal in elevation, no operational noise assessment or mitigation would be required. Consequently no background noise monitoring has been undertaken for the proposal.

6.6.6 Criteria

Noise criteria

To assess the potential impacts arising from construction and operation of the proposal, the following guidelines and policies were considered:

- *'Interim Construction Noise Guideline'* to assess construction noise impacts where construction is for scheduled development work under the POEO Act
- The *'Construction Noise and Vibration Guideline'* (CNVG) (RMS, 2016),
- Technical Basis for *Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990), which provides criteria designated to minimise annoyance and discomfort at sensitive receivers as a result of blasting works.

As no background noise monitoring for the proposal was undertaken, there is no site specific information on background noise levels at the nearest sensitive receivers. Instead the Roads and Maritime Construction Noise Estimator Tool (RMS, 2016) was used to derive typical background noise levels and to undertake an assessment of worst case construction noise impacts. Based upon the type of land use and sensitive receiver, noise management levels (NML) for different periods of the day are presented in Table 6-17.

Table 6-17: Potential pre-construction and construction activities

	L_{Aeq}(15minute) Noise management level (dB(A))
Day	50
Day (OOHW)	45
Evening	40
Night	35

Sources of construction noise

Sources of construction noise and vibration would comprise a range of heavy vehicles, plant and equipment and hand tools. A noise source may exhibit a range of particular characteristics that

increase annoyance, such as tones, impulses, low frequency noise and intermittent noise. Where this is the case, an adjustment was applied in Table 6-18 (plus 5 dB penalty) to the source noise level to account for the additional annoyance caused by the particular characteristics.

Noise generating activities and equipment expected to be used and the respective sound power levels associated with construction of the proposal are provided in Table 6-18.

Table 6-18 Construction scenarios and equipment sound power level (SWL)

Typical equipment used	SWL dB(A)	Construction noise generating activity		
		Site establishment and landscaping	Earthworks	Paving and tie in works
Mulching plant and chipper	113	✓		
Asphalt paving plant	112			✓
Rock crushing			✓	
Concrete saw	111			✓
Chainsaw	110	✓		
Milling machine				✓
Compressor	109	✓	✓	✓
Profiler	108			✓
Jackhammer				✓
Powered hand tools		✓		✓
Concrete truck	105		✓	✓
Crane	104	✓		
Bobcat		✓		
Compactor			✓	✓
Sweeper			✓	✓
Backhoe	103		✓	✓
Grader			✓	
Line marking truck	102			✓
Generator	101	✓	✓	✓
Excavator	99	✓		
Trenching machine				✓
Multi-tyred and vibratory roller	97		✓	✓
Concrete vibrator			✓	✓
Dump truck	95			✓
Spoil truck		✓		
Material truck		✓		
Road truck			✓	✓
Light vehicle	90			✓

Based on previous road construction projects, it is considered unlikely that all plant items would operate concurrently, at the same site, or as part of the same construction activity.

As shown in Table 6-18, the noisiest activities expected to be related to earthworks and this has been assessed as the worst case scenario.

No blasting would be undertaken for construction of the proposal.

Traffic noise

As there are no sensitive receivers within 1,200 metres of the proposal and there would be no projected increase in operational traffic specifically resulting from the proposal (apart from natural growth), an operational traffic noise assessment was not undertaken. Traffic noise would be largely inaudible at the nearest sensitive receivers.

6.6.7 Potential impacts

Construction

The worst case construction noise assessment was undertaken for the earthworks stage when multiple items of heavy machinery would be undertaking noisy activities in close proximity to each other. For the purposes of the assessment it was assumed the following plant were operating simultaneously in a location on the proposal alignment that that was closest to the nearest sensitive receiver.

- Four dump trucks
- Two 45 tonne excavators
- Two 45 tonne excavators with rock hammers
- One rock crusher
- Two graders.

The noise level at the nearest sensitive receiver was estimated to be 37 dBA (See Appendix K) – which is substantially below the daytime NML of 50 dBA and below the evening NML of 40 dBA. It would marginally exceed the night time NML by two dBA, however the scale of works assessed above is substantial and would not occur during the night. Night time works would be managed to ensure that the night time NML is achieved at the nearest sensitive receiver.

As detailed in Section 3.3.2, construction of the proposal would be undertaken both during and outside of standard working hours. Construction outside of standard working hours is considered best for project for three primary reasons:

- The works can be managed to ensure that no sensitive receivers experience noise levels above night time NMLs
- Construction activities and materials delivery could be programmed to minimise potential impacts on traffic flows or to maintain full traffic capacity during peak demand periods
- Benefits would be experienced by motorists as the duration of the construction program and subsequent disruption to traffic flow would be minimised.

It is anticipated that construction noise generating activities would vary in intensity and duration according to construction staging for the duration of works, being 24 months from 2016.

Vibration

Vibration intensive works may occur throughout each phase of the proposal. This has the potential to cause human discomfort by continuous, intermittent and impulsive vibration generated by general construction activities. Ground-borne noise impacts may also be generated by vibration-generating activities, such as compacting and drilling. Safe working distances that relate to cosmetic/structural damage and human discomfort for the proposal are presented in Table 6-19.

Table 6-19: Recommended safe working distances for vibration intensive plant

Plant	Rating/description	Safe working distance – Human response (metres)
Vibratory roller	< 50 kN (Typically 1-2t)	15-20
	< 100 kN (Typically 2-4t)	20

	< 200 kN (Typically 4-6t)	40
	< 300 kN (Typically 7-13t)	100
	> 300 kN (Typically 13-18t)	100
	> 300 kN (> 18t)	100
Small hydraulic hammer	300 kg – 5-12t excavator	7
Medium hydraulic hammer	900 kg – 12-18t excavator	23
Large hydraulic hammer	1600 kg – 18-34t excavator	73

The only items potentially affected by vibration from the construction works would be services and other associated infrastructure immediately adjacent to the proposal. Service providers and other infrastructure managers would be consulted where works need to be undertaken within the safe working distances. In these instances, the safeguards and management measures provided below would need to be implemented.

6.6.8 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential noise and vibration impacts. These safeguards and management measures have been identified in Table 6-20 below.

Table 6-20: Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Noise and vibration	<p>Noise and vibration will be considered in the preparation of the CEMP. The CEMP will generally follow the approach in the <i>Interim Construction Noise Guideline (ICNG)</i> (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • all potential significant noise and vibration generating activities associated with the activity • feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014). • a 24-hour contact telephone number for community enquiries and complaints • a complaints handling procedure detailing the complaints records, responses, correspondence and any relevant monitoring results in accordance with <i>Construction Noise and</i> 	Contractor	Detailed design / pre-construction	<p>Core standard safeguard NV1</p> <p>Section 4.6 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<i>Vibration Guidelines</i> (RMS, 2016)			

6.7 Aboriginal heritage

Artefact Heritage was engaged by Roads and Maritime to conduct an Aboriginal archaeological survey and assessment for the entire proposal (Stage 1 and Stage 2) in accordance with the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). A copy of the Stage 2 PACHCI Archaeological Survey Report is provided in Appendix F and a summary of the findings is presented below.

6.7.1 Existing environment

The wider region of the study area would have provided a range of food and manufacturing resources for the local Aboriginal population. It is also located within close proximity to perennial fresh water. The region provides access to coastal and estuarine resources to the east. Open sites are not likely to be located across the steep slopes that border the study area, with sites more likely associated with overhang shelter formations. Any areas that have not been disturbed and modified may present outcropping sandstone which may have archaeological significance.

The study area has been highly disturbed and modified throughout historic and contemporary times, predominately by the construction of the existing road easement. Areas within the study area that may have retained archaeological materials are generally highly disturbed and modified.

Aboriginal objects are considered unlikely to be present throughout most of the study area. Where natural landforms and sandstone outcrops remain it is possible that these areas may have some archaeological potential.

6.7.2 Aboriginal stakeholder consultation

Aboriginal consultation has been conducted in accordance with Stage 2 of the Roads and Maritime PACHCI.

A Native Title search, requested on 17 October 2016, indicated that there were no Native Title claims granted or registered for consideration within the study area.

The study area is within the boundary of Illawarra Local Aboriginal Land Council (ILALC). A representative of the ILALC was present throughout the survey, and the draft version of Appendix F was forwarded to ILALC for review and comment.

Initial consultation was carried out with the ILALC in accordance with Stage 1 of the PACHCI.

A representative of the ILALC participated in the field survey in accordance with Stage 2 of the PACHCI. The fieldwork methodology and details of the proposal were discussed with the participants, and topographic maps and aerial photographs were made available to guide the survey.

The results of the survey and the proposed recommendations were discussed with Mr. Tungai in the field, and no objections were raised. ILALC was invited by Roads and Maritime to prepare a cultural heritage survey report advising on Aboriginal cultural heritage issues that may arise as a result of the proposal, in accordance with Stage 2 of the PACHCI. ILALC did not provide a report.

6.7.3 Methodology

Assumptions about Aboriginal land use patterns are made on the basis of archaeological information gained from the local area, from observations made by Europeans after settlement of the area, and from information known about available natural resources.

A predictive model was developed for the assessment which comprised a series of statements about the nature and distribution of evidence of Aboriginal land use that is expected in the study area. Predictive statements for the study area are as follows:

- Shelter sites, possibly containing combinations of art/engravings/grinding grooves/deposit, will occur where suitable sandstone overhang formations occur
- Stone artefacts/artefact scatters, generally the most common Aboriginal site type, visibility can occur in varying densities across the landscape. Geomorphological factors such as steep eroding slopes and shallow soils may preclude the survivability of intact deposits in those contexts

- Artefact densities are likely to be low
- In-situ artefacts will be located in areas of least ground disturbance.

It was considered possible that previously unrecorded rock shelters, grinding grooves and art may exist within the study area, in light of the numerous previously recorded sites of these types. Overall, the narrow extent of the construction impact area, and the high levels of disturbance and modification throughout the proposal area, would lessen the chance of identifying Aboriginal objects.

Archaeological field survey methodology

The survey was conducted on foot over two and a half days (28 March, 31 March and 1 April 2014). The survey was undertaken by Josh Symons and Alyce Howard (Artefact Heritage). Troy Tungai represented ILALC throughout the survey. Julian Watson (Roads and Maritime) was present on the first morning.

The study area is a long, linear strip of land that crosses multiple landform units. The study area was divided into four survey units, each containing several landform units (Survey Units 2 and 3 are relevant to Stage 1 of the project). In several small areas, steep slopes and dense vegetation inhibited full survey coverage. These sections were highly disturbed and immediately adjacent to the existing M1 Princes Motorway. Where access to these areas could not be found through alternative routes, photos of these sections were taken. The survey canvassed the majority of the study area and is deemed to have accurately characterised the study area.

The survey was undertaken in accordance with relevant OEH standards and guidelines, as part of Stage 2 of the Roads and Maritime PACHCI. A handheld GPS was used to track the path of the surveyors, and to record the co-ordinates of sites, features and location of landform units within the study area. An aerial map of the study area was also carried by members of the survey team in the field.

All ground exposures were examined for stone artefacts, shell, or other traces of Aboriginal occupation. Old growth trees were examined for signs of cultural scarring or marking.

A photographic record was kept of all sections of the study area. Photographs were taken to record different aspects of the landform units within the study area, vegetation, levels of disturbance, Aboriginal sites and potential archaeological deposits (PADs). Scales were used for photographs where appropriate.

6.7.4 Potential impacts

Archaeological field survey results

The majority of the study area has been impacted from construction of the M1 Princes Motorway. These disturbances include large artificial embankments, large sandstone cuttings, extensive drainage work adjacent the current road alignment, and previous road alignments.

Where intact areas were identified within the construction impact area of the proposal, slope characteristics and distance from water sources suggest that those areas represent limited archaeological potential. Intact sandstone outcrops were observed, but were generally found to be largely fragmented, with no overhang formations or engravings identified.

The crests and slopes of Survey Units 2 and 3 were extremely modified and disturbed and found to have low archaeological potential (Artefact, 2016a).

Dense vegetation prohibited survey in several small areas. However, these areas were predominately steep, heavily modified slopes and as such, present low archaeological potential. Overall, the survey is deemed to have accurately characterised the study area.

No previously recorded Aboriginal sites were identified within the study area. No Aboriginal objects or areas of potential were identified during this survey (Artefact, 2016a).

Potential for impact

In accordance with Roads and Maritime Stage 2 PACHCI guidelines, the assessment established that the entire study area has low archaeological significance and no previously recorded Aboriginal

sites and/or places are located within the boundaries of the construction impact area or the wider field survey area. No areas of archaeological potential were identified during the field survey. The impact assessment has therefore found that there would be no impact to known Aboriginal sites and/or places or identified areas of potential under the proposal.

No further Aboriginal archaeological investigation is required for the proposed works.

6.7.5 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential Aboriginal heritage impacts. These safeguards and management measures have been identified below in Table 6-21.

Table 6-21: Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Aboriginal heritage	<p>The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place.</p> <p>Work will only re-commence once the requirements of that Procedure have been satisfied.</p>	Contractor	Pre-construction/ construction	<p>Core standard safeguard AH2</p> <p>Section 4.9 of QA G36 <i>Environment Protection</i></p>

6.8 Non-Aboriginal heritage

Artefact Heritage was engaged by Roads and Maritime to prepare a SOHI for the entire proposal (Stage 1 and Stage 2). A copy of the SOHI is provided in Appendix G and a summary of the findings are presented below.

6.8.1 Methodology

Determining the significance of archaeological items or items of heritage significance is carried out using the system of assessment informed by the Burra Charter of Australia's International Council on Monuments and Sites (ICOMOS). The principles of the charter are relevant to the assessment, conservation and management of sites and relics. The assessment of significance is outlined through legislation in the Heritage Guidelines (NSW Heritage Office 1196:25-27).

If an item meets one of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have significance. The significance of an item or potential archaeological site can be assessed as being of state or local significance, based on a series of criteria that have been developed for assessing significance relating to archaeological sites and their associated relics. The criteria identify a series of questions that could be asked in relation to the item to assist in the identification of the appropriate level of significance to be applied. Heritage significance assessment criteria are outlined in Table 6-22 below.

Table 6-22: NSW heritage assessment criteria

Criteria	Description
A – Historical significance	An item is important in the course or pattern of the local area's cultural or natural history
B – Associative significance	An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area's cultural or natural history
C – Aesthetic or technical significance	An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area
D – Social significance	An item has strong or special association with a particular community or cultural group in the local area for social, cultural or spiritual reasons
E – Research potential	An item has potential to yield information that will contribute to an understanding of the local area's cultural or natural history
F – Rarity	An item possesses uncommon, rare or endangered aspects of the local area's cultural or natural history
G – Representative	An item is important in demonstrating the principal characteristic of a class of the State's (or local area's): <ul style="list-style-type: none"> • Cultural or natural places • Cultural or natural environments.

Archaeological field survey

A site inspection was conducted on 8 and 10 September to identify and assess any areas of archaeological potential, unlisted heritage items or heritage views and vistas within the study area. The inspection was undertaken on foot and photographic records were made.

6.8.2 Existing environment

Existing heritage items were identified through desktop searches of relevant state and local government heritage registers, along with a site survey. Local heritage items and conservation areas, as well as a number of unlisted heritage items are described below.

Local heritage items

Three items of local heritage significance (refer to Figure 6-6), occurring in or adjacent to the Stage 1 study area include:

- **Old Mountain Road** road reserve - Item Number 6517, landscape heritage item. Old Mountain Road is located north of Rixons Pass Road, Bulli Tops. This item is located 250 metres west of the study area at the northern end of Stage 1. Old Mountain Road is currently used as a vehicle access track (unsealed) for nearby electricity transmission line infrastructure. It was assessed as having local significance satisfying criteria A and B of the NSW heritage assessment criteria. This item is not expected to be impacted by the proposal and as such is not discussed further.
- **Rixons Pass Road** landscape and walls - Item Number 6518, landscape heritage item. Rixons Pass Road extends from the M1 Princes Motorway in the west for about 860 metres before it reaches the Illawarra escarpment and joins with Old Mountain Road from the north. The western portion of Rixons Pass Road within the study is currently used as a vehicle access track (unsealed). This item was assessed as having local significance only, satisfying criteria A, B and C of the NSW heritage assessment criteria. Rixons Pass Road crosses the study area in the north east portion of the study area.
- Cataract Site of former **Biddulph Farm** Lot 30, DP 751301 - Item Number 6164 archaeological site. The site is located on both sides of the road corridor at the Mt Ousley Road intersection with Rixons Pass Road. The original farm site was established in 1855 by Edmund Biddulph Henning. The history of this property has been well documented due to the residence of Rachel Biddulph Henning, who's collection of letters describing early colonial life were published in the 1950s (Artefact, 2016c). The original farm consisted of a cottage cleared land supporting cattle pasture. No standing structures associated with the former farm and cottage are located within the study area. This item was assessed as having local significance only, satisfying criteria A and B of the NSW heritage assessment criteria. The north eastern portion of the study area intersects the curtilage of the former Biddulph Farm.

Heritage conservation areas

The **Illawarra Escarpment Landscape Area** (IELA) is listed as a heritage conservation area (landscape) of local significance in Schedule 5 Part 2 of the Wollongong LEP (2009). The heritage conservation area runs to the east of the existing road corridor for about one kilometre from the Appin Road Interchange (southbound). The escarpment has influenced the settlement patterns and development of the Illawarra by creating a physical boundary to urban growth. It dominates the coastal plain and provides a backdrop that is a significant part of the local identity. The escarpment has been popular with artists since the 1800's and is popular with Wollongong's residents who enjoy views of the escarpment. The extensive vegetative cover and the limited development enhance the escarpment's aesthetic values and create unique opportunities for tourism, recreation, and spiritual pursuits. Historic places and objects on the escarpment are mainly associated with mining and early European settlement (NPWS, 2003). This item was assessed as having local significance satisfying criteria A, C, F and G of the NSW heritage assessment criteria.

The study area does not intersect with the IELA curtilage area and is 300 metres away at its nearest point. Therefore, impacts associated with this area are not discussed further.

Mount Ousley Road and associated unlisted heritage items

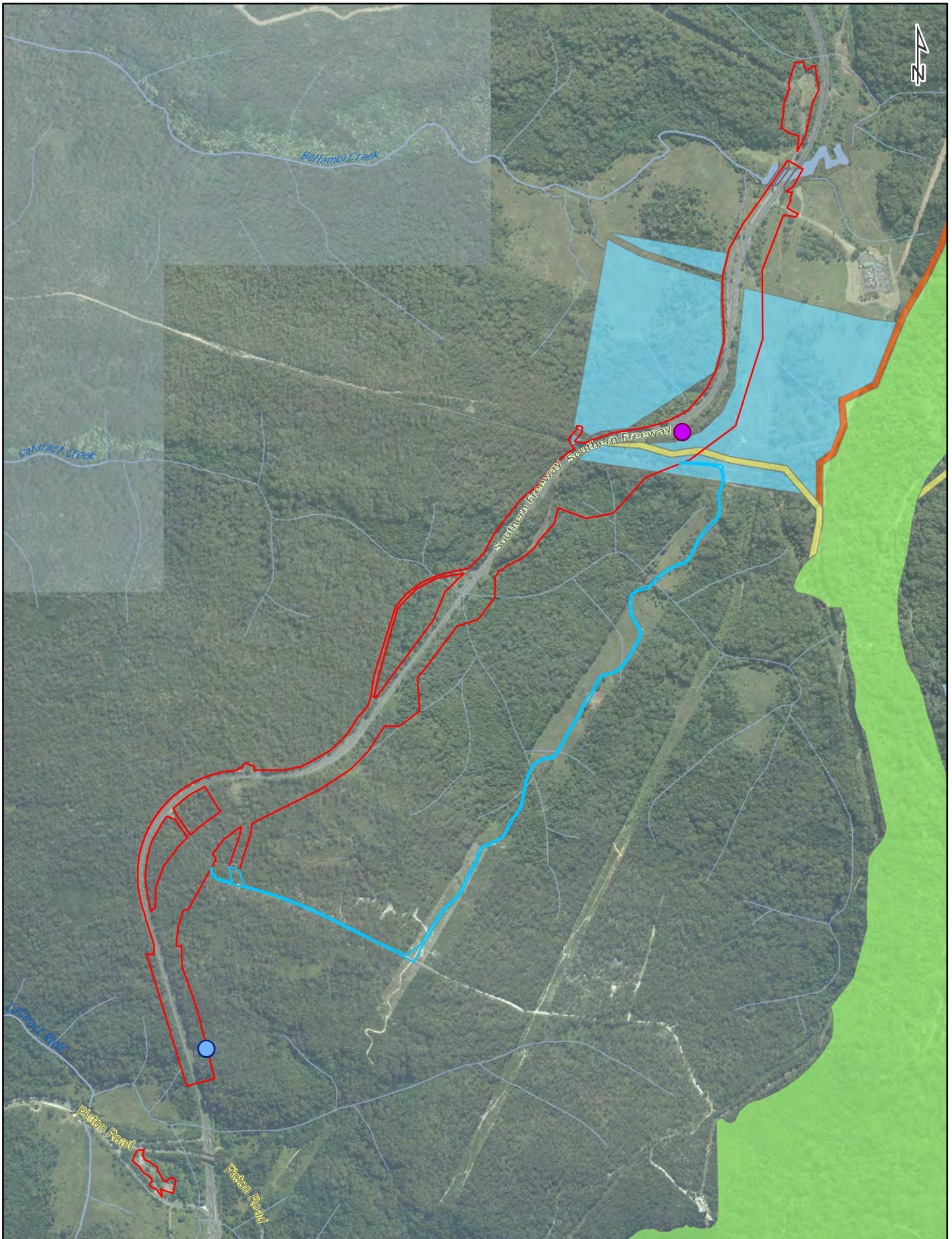
Mount Ousley Road was built to support war-time efforts to increase the volume and quality of road infrastructure in Australia. Completed in 1942, the road linked with the Princes Highway at Bulli Tops and descended via Mount Pleasant and Mount Ousley onto the coastal plain. The original road was a single carriageway, with a steep climbing gradient with several sharp curves. The single

carriageway was upgraded multiple times between the 1960's to the 1990's with several sharp curves removed. Three sections of the former road alignment have been identified, and although bitumen-sealed, considerable degradation has occurred as a result of revegetation. Numerous rock cuttings into the sandstone escarpment remain along the former alignments.

During the site survey undertaken by Artefact in September 2015 a number of heritage structures not previously listed were identified. These items are discussed below.

- A sandstone culvert and an associated retaining wall were identified 35 metres south east of the northern section of the alignment (refer to
- Figure 6-6). The culvert consists of medium sized sandstone blocks, varying in size from 150 millimetres to 300 millimetres in length. The neatly cut blocks form an arched roof and are bonded with a course of grey mortar. The sandstone retaining wall is located a metre north of the culvert. The wall is heavily degraded and has been extensively covered in encroaching vegetation.
- A chiselled sandstone drain was identified 10 metres east of the southern section of the alignment (refer to
- Figure 6-6). The drain runs parallel to the road alignment down a gentle slope for approximately 4.6 metres in two discontinuous segments.

Mount Ousley Road and its remaining residual structures (sandstone culvert and retaining wall and sandstone drain), were assessed as having local significance only, satisfying criteria A and C of the NSW heritage assessment criteria.



- Sandstone culvert and retaining wall
- Sandstone drain
- Biddulph Farm
- Escarpment Core Area
- Old Mountain Road
- Rixons Pass Road Landscape And Walls
- Construction footprint
- Construction light vehicle access track

M1 Princes Motorway Improvements - Picton Road to Bulli Tops (Stage 1)

Non-Aboriginal heritage items in or adjacent to the proposal

Source: Imagery from RMS

Fig. 6-6

0 100 200 m

Archaeological potential

Non-Aboriginal archaeological potential is defined as the potential of a site to contain historical relics, as classified under the NSW *Heritage Act 1977*. Non-Aboriginal archaeological potential is assessed by identifying former land uses and associated features through historical research, and evaluating whether subsequent actions (natural or human) may have impacted on evidence for these former land uses.

A summary of the archaeological potential of all the listed and unlisted heritage items in the study area is provided in Table 6-23 below.

Table 6-23: Archaeological potential for heritage items in the study area

Item	Listing	Description	Disturbance	Archaeological potential
Old Mountain Road	Wollongong LEP	Unsealed walking track through vegetated, undulating terrain	High	Not within Stage 1 study area
Rixons Pass Road	Wollongong LEP	Unsealed road from Mount Ousley Road down escarpment to Illawarra	High	No archaeological potential
Biddulph Farm	Wollongong LEP	Site of former cottage and farm property on the edge of the Illawarra escarpment	High	No archaeological potential, for the portion of the curtilage within the study area.
Illawarra Escarpment Landscape Area	Wollongong LEP/Wollongong DCP	Conservation area on the Illawarra escarpment	High	Not classified as an archaeological site and not within Stage 1 study area.
Mount Ousley Road	Unlisted	Motorway within obsolete road alignments and two small residual structures (sandstone culvert and chiselled sandstone drain)	Moderate	No archaeological potential

(Source: Artefact, 2016c)

6.8.3 Potential impacts

Overall, the proposal would have minor impacts on two locally listed heritage items within the study area and would have direct impacts on two items associated with the unlisted former alignment of Mount Ousley Road. There are unlikely to be impacts to archaeological remains as a result of the proposal. A heritage impact assessment for each heritage item is summarised below.

Rixons Pass Road

The area of Rixons Pass Road within the proposal area has been extensively disturbed as a result of use of the road as a fire-trail and vehicle access track. The curtilage of this heritage item is likely to be reduced by 3,626 square metres or 5.54 per cent (Artefact, 2016c). The proposal would not impact the physical fabric of Rixons Pass Road within the existing heritage curtilage.

The proposal would not impact any known archaeological remains associated with Rixons Pass Road.

As the road is in use as a functioning access track and fire trail, its visual amenity does not contribute to its heritage significance. Furthermore, the proposal would not impact any views or vistas relating to this item.

Biddulph Farm

The section of Biddulph Farm within the proposal area is heavily vegetated with regrowth over the cleared pasture of the original farm. The site of the former cottage is located outside of the study area. The proposal is not expected to impact any elements of built heritage significance or unearth any archaeological remains within the study area.

There are currently no visual characteristics of the former farm site that contribute towards its heritage value within the study area. Furthermore, the proposal would not impact any views or vistas relating to this item.

The curtilage of this heritage item is likely to be reduced by 32,550 square metres or 6.24 per cent (Artefact, 2016c).

Mount Ousley Road

Disused road alignments of Mount Ousley Road would be subject to minor impacts by the proposed works. These road alignments are likely to be used for vehicle access during construction. Some portions immediately adjacent to the M1 Princes Motorway would be physically removed in order to construct the proposed climbing lanes. Minor visual and physical impacts would occur as a result of the removal of sections of disused road alignment.

Two unlisted sandstone structures (sandstone culvert and retaining wall and sandstone drain) associated with the early construction of Mount Ousley Road would be impacted by construction of the proposal. These items were assessed as having local heritage significance, but are not classified as relics (Artefact, 2016c). The unlisted sandstone structures would all be removed during construction.

6.8.4 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential Non-Aboriginal heritage impacts. These safeguards and management measures have been identified below in Table 6-24 and incorporated in the Environmental Management measures in Section 7.

Table 6-24: Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Contractor	Pre-construction/ construction	Core standard safeguard H1 Section 4.10 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Non-Aboriginal heritage	<ul style="list-style-type: none"> The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied. 	Contractor	Detailed design/pre-construction/construction	Core standard safeguard H2 Section 4.10 of QA G36 <i>Environment Protection</i>
Rixons Pass Road	Wollongong City Council will be consulted regarding possible curtilage reduction	Roads and Maritime	Detailed design/pre-construction/construction	
Biddulph Farm	Wollongong City Council will be consulted regarding possible curtilage reduction	Roads and Maritime	Detailed design/pre-construction/construction	
Mount Ousley Road: Sandstone culvert and retaining wall Sandstone drain	The sandstone culvert and associated retaining wall and the drain structure would be archivally recorded according to NSW Heritage Division standards (1998), prior to the commencement of works.	Roads and Maritime	Pre-construction, construction	

6.9 Landscape character and visual impacts

The existing landscape character and the visual impacts of the proposal were assessed and measures to minimise any impacts have been identified. The detailed Urban Design and Visual Impact Assessment (UDVIA) is attached in Appendix D and is summarised below.

6.9.1 Methodology

The Roads and Maritime guideline *Visual Impact and Environmental Impact Assessment Guidance Note: Guidelines for landscape character and visual impact assessment* (RMS, 2013) was used as the basis for the assessment.

Landscape Character and Impact Assessment

To assess the landscape character, the context and the implications of the proposal need to be determined. This included defining character zones (zones of similar spatial or character properties) and their sensitivity to change - and then analysing the magnitude of changes to these character zones as a result of the proposal.

Landscape character is defined as: "The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place." (EIA No.4 Guidelines, 2013).

This assessment differs from a visual assessment in that it assesses the overall impact of a project on an area's character and sense of place, rather than specific viewpoints.

Visual Impact Assessment

A visual impact assessment focuses on the receptors (or viewers) who experience a change in visual impacts due to the proposal. Receptors are composed of static receptors i.e. those that adjoin the corridor and mobile receptors such as those that travel along the corridor. The impacts of the two groups are unique in that the time and frequency of the exposure differ.

The potential visual impact assessment of the proposal was assessed using five key viewpoints and group of viewpoints. It was based on the existing landuse pattern and development adjoining the motorway corridor. The assessment method involved:

- Defining the scale of the proposed works
- Identification of key visual envelopes, viewpoints and groups of viewpoints from which the proposal is visible
- Assessment of the level of impact on the proposed viewpoints from the proposal.

Landscape Character and Visual Assessment Matrix

Landscape character and visual assessment are equally important. Landscape character assessment helps determine the overall impact of a project on an area's character and sense of place including all built, natural and cultural aspects. Visual impact assessment helps define the day to day visual effects of a project on people's views. To quantify these impacts two qualities in relation to landscape character or view point were assessed, namely sensitivity and magnitude

Sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example a pristine natural environment will be more sensitive to change than a built up industrial area. Magnitude refers to the nature of the project. For example a large interchange would have a very different impact on landscape character than a localised road widening in the same area." (EIA No.4 Guidelines, 2013).

Roads and Maritime has adopted a matrix which combines rankings of sensitivity with magnitude of change in order to determine the overall impact of the proposal. This has been used in Landscape Character and Visual Assessment and is presented in Table 6-25.

Table 6-25: Landscape and visual impact assessment matrix

Sensitivity	Magnitude				
		High	Moderate	Low	Negligible
High	High	High-Moderate	Moderate	Negligible	Negligible
Moderate	High-Moderate	Moderate	Moderate-Low	Negligible	Negligible
Low	Moderate	Moderate-Low	Low	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

6.9.2 Existing environment

Landscape character

The proposal would traverse a section of the Illawarra Escarpment which consists of mostly native vegetation. The alignment's character is defined by the topography and the way in which the alignment has responded to it. The alignment is sinuous and undulating, and generally defined by a native tree canopy. Despite the relative consistency of the alignment, three character zones, Figure 6-7, have been identified. These character zones primarily relate to the adjacent vegetation communities and are as follows:

- **Character Zone 1 - Northern Section** (outside proposal area)
- **Character Zone 2 - Bellambi Creek Valley** (partially inside proposal area) - This character zone is consistent and is characterised by the valley of Bellambi Creek. The valley has been cleared in the past and now provides a sense of openness which contrasts with the sense of enclosure of the zones to either side
- **Character Zone 3 - Southern Section** (inside proposal area) - This character zone has two subzones defined by the topography and its subsequent impact on vegetation communities along the alignment. Zone 3A is defined by the valley of Cataract Creek and a forest community dominated by a mix of Tall Open Blackbutt Forest and moist Blue Gum Blackbutt forest, occurring in the lower section associated with the creekline. Zone 3B is located on the southern ridge top defined by exposed sandstone Scribbly Gum Woodland. The crest of this southern ridge to the Cataract Creek valley clearly defines this community. This community also coincides with the realignment of the corridor to the east at its southern most limits.

For the proposal which consists of the Stage 1 works, relevant character zones would be Zone 2 and Zone 3.

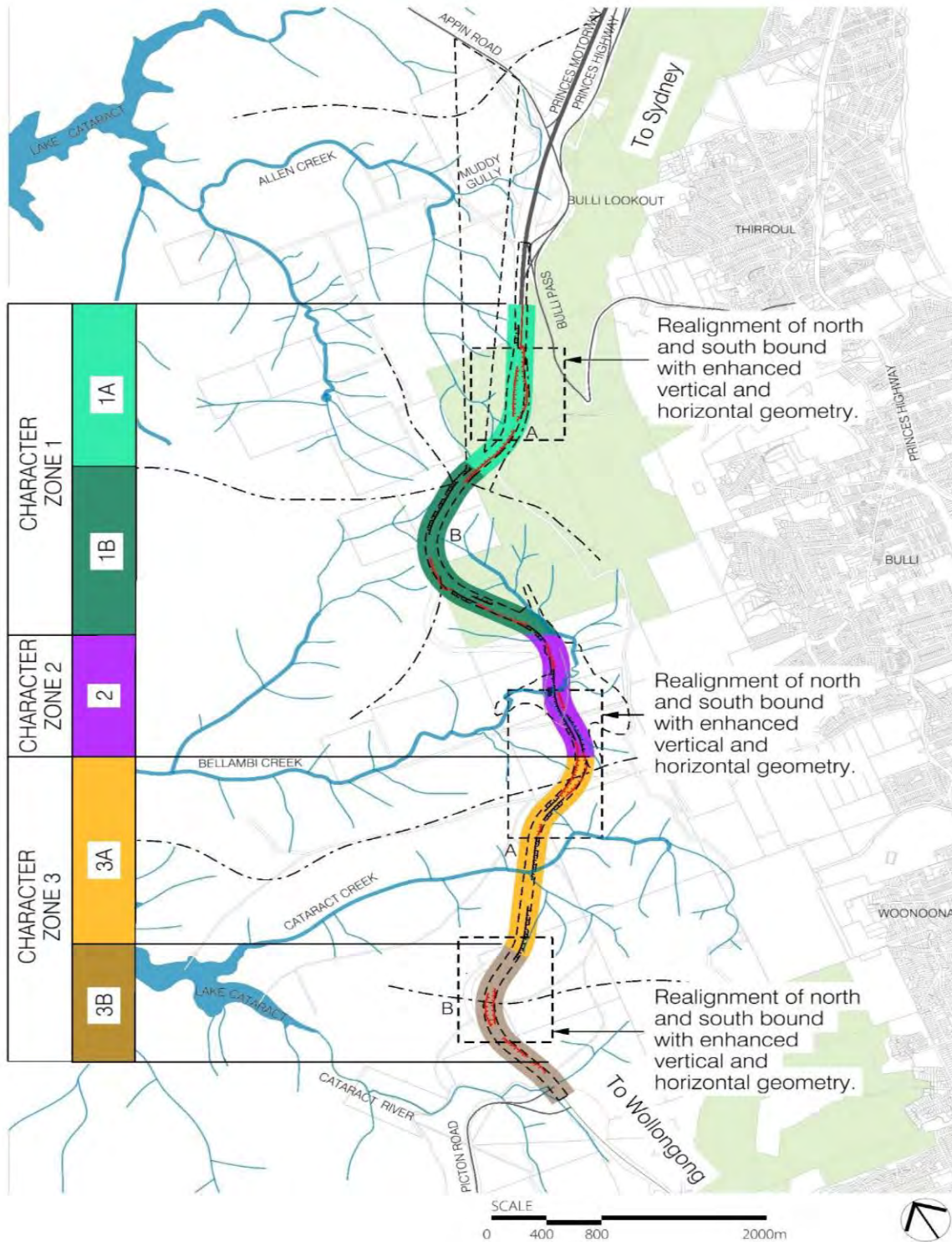







Figure 6-7: Landscape character zones (Source: Tract, 2015)

Visual (viewpoints)

A detailed field and desktop assessment of the proposal alignment was undertaken to determine the area from where the proposal would be visible (See Figure 6-8). The visibility of the proposal is primarily from the corridor itself. The land to the west of the alignment and most of the land to the east of the alignment is protected as part of Cataract Dam’s catchment – and consequently the land is undeveloped and heavily vegetated. Apart from potentially bushwalkers, there are very limited external viewpoints of the proposal. Of the eleven viewpoints assessed for the Stage 1 and Stage 2 project, five viewpoints were in the proposal (Stage 1) area. These are listed with a photo from the view point in Table 6-26.

Table 6-26: Viewpoints 6 to 10

Viewpoint	Photo
Viewpoint 6 - Bellambi Creek Valley	
Viewpoint 7 - View approaching the Cataract Creek Valley	
Viewpoint 8 - View from the southern ridge as the road descends towards Cataract Creek	
Viewpoint 9 - Northbound approach to Bellambi Creek	
Viewpoint 10 - View west of Bellambi Creek Bridge	

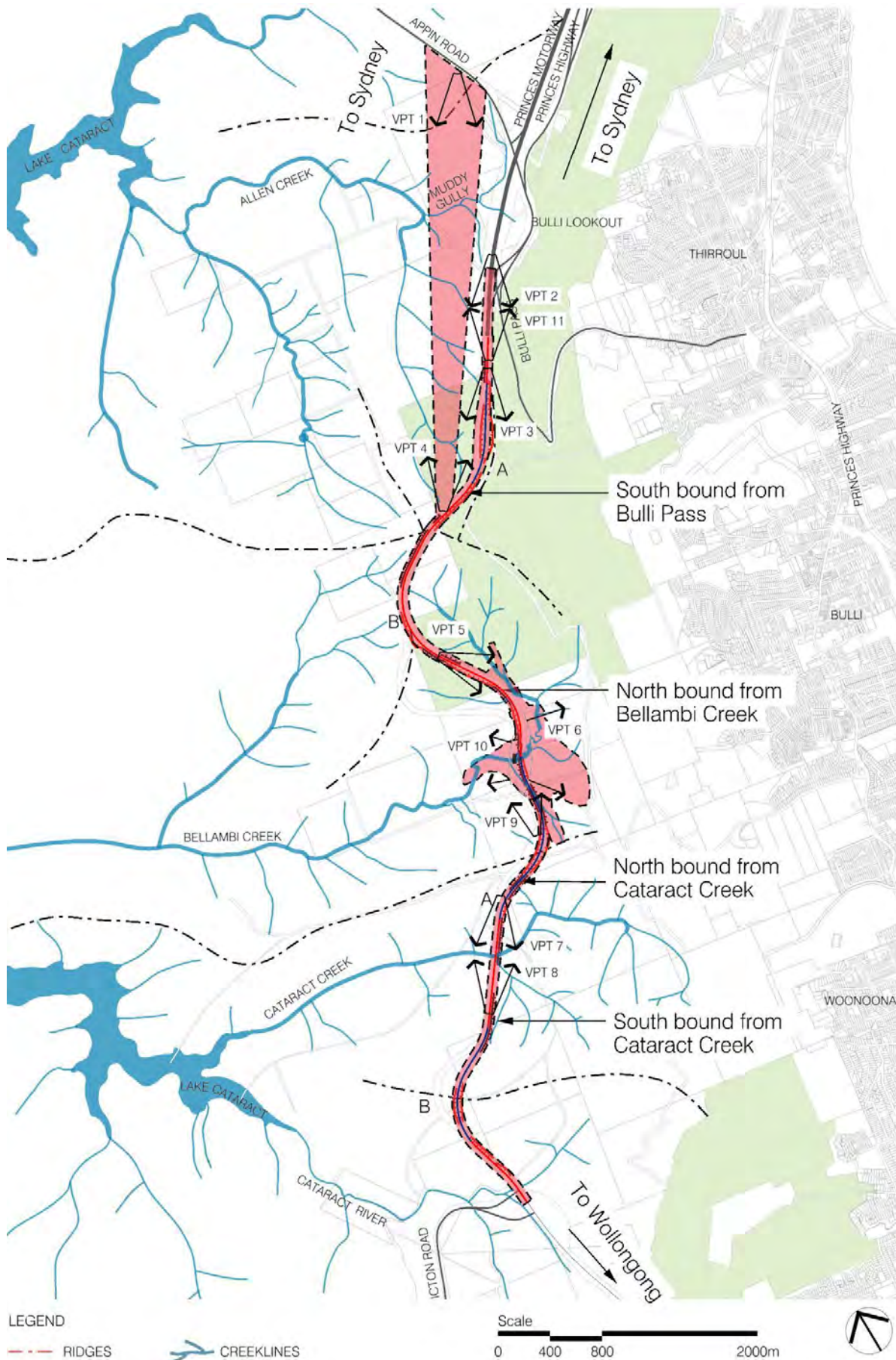


Figure 6-8: Viewpoints 6-10

6.9.3 Potential impacts

Construction

Visual impacts during the construction stage of the proposal would be associated with construction activities, including vegetation removal, the generation of wastes, areas of earthworks, stockpiling of spoil and materials, and the presence of large-scale construction plant and equipment. The location of construction compounds are presented in Figure 3-13.

The presence of construction activities would have the potential to reduce the visual amenity of any views that include the existing M1 Motorway. As noted in the UDVIA, this section of the M1 Motorway is visible from very few external viewpoints and consequently visual impacts during construction would be largely confined to road users. These impacts would not be significant as they would be transitory as the vehicle passes the construction areas and temporary during the construction period.

Mitigation measures to reduce the visual impacts of the proposal during construction are summarised in Section 6.10.4.

Operation

Landscape character impact assessment

For each of the character zones, key landscape attributes were identified and the proposal's impact assessed against these key attributes. These assessments were then used to determine the sensitivity of the landscape and the magnitude of impact using the matrix in Table 6-25. The assessments for character zone 2 (see Table 6-27) and character zone 3 (see Table 6-28) are presented in the following tables.

Table 6-27: Character Zone 2 - Bellambi Creek Valley

Attribute	Description	Impact
Landform	The Bellambi Valley is a relatively flat valley within the alignment. It is approximately 1.25 kilometres wide and at an elevation of 330 metres or below.	Alignment shifts to the east, at the southern end, introducing new fill embankments.
Vegetation	Vegetation has largely been cleared as part of previous landuse. It is dominated by grasses and annual weeds with sporadic native trees.	Minor clearance works due to the change in alignment opens up views to the valley due to clearance of vegetation that defines the corridor.
Hydrology	Dominated by the Bellambi Creek it also incorporates Charlesworth Dam to the west of the alignment.	Limited impact as bridge is widened to accommodate the additional lanes.
Land-use	Alignment is defined SP2 west of the alignment is Sydney Water catchment	No change.
Built form	Electricity stanchions and switching yard are the dominant element beyond the road form which is characterised by pavement, median barrier.	Increase in pavement area, as alignment shifts east expanding disturbed corridor and views to switching yard.
Spatial Quality	Alignment contrasts with that of much of this section of the corridor providing opportunities for views across the valley and along transmission easements beyond.	Views expanded as alignment shifts to the east, removing roadside vegetation and opening up views.

The overall assessment of the proposal's impact on landscape character in Zone 2 was assessed and is summarised below:

- **Sensitivity** - The landscape character is defined by the alignment and vegetation; in this instance a slightly more open character with cleared areas and ridges and trees set beyond

the alignment. The viewers of the alignment are essentially the occupants of the vehicle and consequently transitory in nature. The expansion of the corridor to the east provides a slightly more open character than that which currently exists. The sensitivity of the alignment is consequently considered to be low

- **Magnitude** - The change in alignment at the southern end of this character zone changes both the definition of the road corridor but also its scale. The magnitude of impact has been assessed as moderate
- **Overall** - The works involve realignment of the motorways alignment in the southern half and minor widening in the north. The overall degree of impact experienced within this zone has been assessed as moderate to low.

Table 6-28: Character Zone 3 - Southern Section 3A and 3B

Attribute	Description	Impact
Landform	Traversing a small ridge which separates Bellambi Creek from the Cataract Creek catchment this section crosses the valley of Cataract Creek at RL 310 metres before rising to a high point of 390 metres and descending to the south where it joins into the Picton Road intersection works.	Realignment of the northern half as it rises out of the Bellambi valley introduces a large fill east of the alignment. In the southern half realignment introduces a new cutting east of the present alignment easing geometry and grades.
Vegetation	Cataract Creek valley is dominated by the Tall open blackbutt forest to the north of this section before the alignment moves up onto the ridge and transitions to exposed sandstone scribbly gum woodland.	Vegetation will continue to define the corridor with clearing to the edge of the corridor to meet the expanded or new footprint.
Hydrology	Cataract Creek is the dominant watercourse within this section	No change
Land-use	Alignment is defined SP2 east and west of the alignment is Sydney Water Catchment	The realignment moves the alignment into a section of the Sydney Water Catchment area beyond the defined corridor
Built form	The road form is characterised by pavement, median barrier, and sandstone cuttings	Increase in pavement area and construction of new cuttings and fill embankments to east of the existing.
Spatial Quality	Alignment is defined by the canopy of the vegetation, to the east this enclosure is reinforced by the presence of a cutting	For much of the alignment a slight increase in corridor width corresponds to a reduction in the sense of enclosure. The new cutting introduces a completely new element but retains a sense of enclosure.

The overall assessment of the proposal's impact on landscape character in Zone 3 was assessed and is summarised below:

- **Sensitivity** - The area is defined by the alignment and vegetation. The viewers of the alignment are essentially the occupants of the vehicle and consequently transitory in nature. The sensitivity of the alignment is consequently considered to be low
- **Magnitude** - The scale of change south of Cataract Creek consists of three elements - a change in alignment and construction of new fill at the approach to Cataract Creek, minor widening through the central section and a new alignment at the southern end. This latter element has the greatest impact magnitude of change is consequently considered moderate to high

- **Overall** - The proposed changes results in two new sections of road alignment elements and an expanded corridor width, which will impact the scale and character of the alignment. The overall impact on the landscape character is consequently considered to be moderate.

Visual impact assessment

For each viewpoint an assessment of the sensitivity of the viewpoint and the magnitude of the impact of the proposal was undertaken (See Table 6-29). Using the sensitivity and magnitude rankings and the assessment matrix in Table 6-25, an overall impact was calculated for each viewpoint.

Generally the visual impact of the proposal was assessed as low, with impacts at three viewpoints “low” or “negligible” and at the remaining two viewpoints was “low-moderate”.

Table 6-29: Visual impact assessment from viewpoints 6 to 10

Views	Sensitivity	Magnitude	Overall impact
<p>Viewpoint 6</p> <p>This is the only section of the corridor where there is a sense of openness and views of cleared lands. The view is interrupted by a series of power easements which crisscross the landscape converging on a switching yard which is relatively concealed within a fold within the valley. The view is defined as a basin type formation in which views beyond the valley are contained by a ridge on all sides.</p>	<p>The sensitivity of the alignment at this viewpoint has been assessed as low. The viewpoint provides views of a cultural landscape defined by ridges or vegetation. The modified nature of the landscape provides a level of robustness which keeps the sensitivity low.</p>	<p>The proposal sees an expansion of the road cross-section and to the south the realignment to the east of the present highway. This later realignment will increase the openness of views as vegetation defining the corridor is removed. Drainage basins may be installed but are unlikely to form a significant visual element within the landscape generally being located below the alignment. The magnitude of the proposal has consequently been assessed as moderate.</p>	<p>Low - moderate</p>
<p>Viewpoint 7</p> <p>The descent to Cataract Creek reinforces the sense of enclosure experienced for much of the route. Tall vegetation flanks the corridor and a vegetated ridge at the opposite side of the valley terminates the view. The straight nature of the corridor in this section emphasises the undulating nature of the alignment overall.</p>	<p>Vegetation dominates the edges and distant views, with the alignment a dominant element in the foreground to distant views. The sensitivity has consequently been assessed as low.</p>	<p>The scale of change is minimal in relation to the scale of landscape in which the road sits and the magnitude has therefore been assessed as low. The alignments use is already defined and so the widening will have limited long term impact.</p>	<p>Low</p>
<p>Viewpoint 8</p> <p>The view is dominated by vegetation both flanking the alignment and as part of the distant views.</p>	<p>The alignment is dominated by and enclosed by the landscape which surrounds it. The sensitivity of this landscape due to its scale and expansiveness has consequently been</p>	<p>The sense of vegetation extending as far as the eye can see is a strong influence on the visual composition. The widening of the alignment will have limited impact on changing the sense of this. The realignment however will reduce the tightness of the bend</p>	<p>Low</p>

Views	Sensitivity	Magnitude	Overall impact
	assessed as low.	and produce a more lineal experience. Despite this the vegetated nature of the adjoining landscape will remain the dominant visual experience. The magnitude of change is therefore considered to be low.	
<p>Viewpoint 9</p> <p>Views: Views begin to open up as you descend into the Bellambi Creek Valley. Vegetation on the eastern edge thins first before the valley flattens and opens up on both sides of the alignment. The view is terminated by the vegetated ridge to the north.</p>	The visibility of this area is limited to the road user or service authorities. Services cross the alignment and vegetation has been cleared. The sensitivity of this section has consequently been assessed as low.	The pavements footprint is already wider than required by the present alignment and/or site clearing has occurred, as a result of the history of the roads changing alignment and needs. The proposal will see a shift in the roads footprint to the east providing a more open view across the valley to the vegetated ridge beyond. This will change the sense of enclosure and provide a more panoramic view. Its impact is considered to be low-moderate.	Low - moderate
<p>Viewpoint 10</p> <p>Views: A view looking west down Bellambi Creek valley. Beyond the road edge the waters of Charlesworth Dam, occupy the mid-ground before the creekline narrows and is flanked by native vegetation. This vegetation terminates views as the adjoining ridge lines converge.</p>	The landscape has been altered by development of the road, the Charlesworth Dam and the clearing of native vegetation. The impact of the proposal is considered to be low.	The proposal sees limited change in the existing pavement footprint as excess pavement occurs in this zone due to the intersecting of old and new alignments. Any change in the alignment is to the east of this view and so the view will remain unchanged. The works proposed are consequently minimal and the impact has been assessed as negligible.	Negligible

6.9.4 Safeguards and management measures

Overall the impact of the proposal on the landscape character was generally assessed as moderate and on individual viewpoints was generally assessed as low. The UDVIA also recommended project specific urban design and landscaping strategies and treatments to minimise the visual impacts of major elements of the proposal. The key strategies recommended can be summarised as follows:

- Reinforce eucalypt forest communities to enhance screening and provide greater stability to landscape
- Planting and seeding works is to be responsive to and compliant with road safety requirements for clear zones
- Maintain views where they exist to provide a sense of progression and of the landscape through which the road passes
- Manage noxious weeds as part of the upgrade process by implementation of a focused lantana management plan
- Management and treatment of batter slopes needs to be responsive to the existing character and the constraints of the rock type. The use of shotcrete should be avoided and/or minimised
- Retaining walls needs to be responsive to context, reflecting adjacent materials where in cut or considering the need to blend with their surroundings where retaining fill
- Treatment of the median barrier needs to consider the need for openness, while providing a degree of headlight control and an appropriate level of safety
- Signage needs to be located with due consideration to existing and proposed planting.

The treatments and strategies developed in the UDVIA would be used in the Landscaping and Urban Design Plan developed during the detailed design.

Table 6-30 identifies safeguards and management measures that will be implemented to address potential impacts of the proposal on landscape character and visual amenity.

Table 6-30: Safeguards and management measures – landscape and visual

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Landscape character and visual impact	<p>A Landscape and Urban Design Plan (LUDP) will be prepared during the detailed design phase of the project and implemented as part of the CEMP.</p> <p>The LUDP will present an integrated landscape and urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> • location and identification of existing vegetation and proposed landscaped areas, including species to be used, density and size 	Roads and Maritime/ Design contractor	Detailed design	Landscape character and visual impact

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	<ul style="list-style-type: none"> • Areas of the redundant road pavement that will be removed and revegetated • Hydromulch seed mix designs and locations • built elements including any retaining walls and bridge walls • pedestrian and cyclist elements if necessary • fixtures such as lighting, fencing and signs • details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage • procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Landscape and Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> • <i>Beyond the Pavement urban design policy, process and principles</i> (Roads and Maritime, 2014) • <i>Landscape Guideline</i> (RTA, 2008) • <i>Bridge Aesthetics</i> (Roads and Maritime 2012) • <i>Shotcrete Design Guideline</i> (RTA, 2005). 			
Visual impacts of construction activities	<p>To reduce the potential visual impact of construction activities:</p> <ul style="list-style-type: none"> • Work sites will be left tidy at the end of each work day • Where appropriate, fencing with material attached (eg shade cloth) will be provided around the construction compound to screen views from adjoining properties <p>Lighting for night-time work will comply with relevant Australian Standards, including <i>AS4282-1997 (Control of the obtrusive effects of outdoor lighting)</i>.</p>	Construction contractor	Construction	Visual impacts of construction activities

6.10 Land use, utilities and property access

6.10.1 Existing environment

Land use and property

The proposal is located along a four kilometre section of the M1 Princes Motorway, on the Illawarra escarpment, in land zoned as SP2 Infrastructure and E2 Environmental Conservation as identified in the Wollongong LEP (2009) (Refer to Section 4.1.3). Land uses in the study area include bushland, water catchment, and a colliery.

Property owners include Wollongong Coal Limited, WaterNSW and Endeavour Energy within the study area

The objectives of the SP2 Infrastructure zone are to provide for infrastructure and related uses; prevent development that is not compatible with or that may detract from the provision of infrastructure; and provide for key transport corridors. The proposal has been identified in the Wollongong LEP as being permissible with consent within the sections of the SP2 Infrastructure zone.

Where the proposal extends into the E2 zone, the proposal is prohibited as it is not classified as an activity permitted with consent for Zone E2.

However, the proposal is permissible under Clause 94 of ISEPP and can be carried out by or on behalf of a public authority without consent.

Clause 7.2 of the LEP seeks to protect, maintain or improve biodiversity on lands that are identified as “Natural resource sensitivity—biodiversity” in the LEP. Clause 7.8 provides controls to protect, conserve and enhance the Illawarra escarpment. Safeguards and management measures provided in Section 7 of this REF would ensure the proposal is carried out in a manner that satisfies the objectives of these clauses.

Utilities

A Dial-Before-You-Dig search was undertaken in April 2012 to determine public utility providers with assets within the vicinity of the proposal. In the broader project area Endeavour Energy and TransGrid high voltage power transmission lines are present, but are not anticipated to be impacted.

A Wollongong Coal overhead power supply line crosses the alignment about 350 metres north of Fire Trail (Access 7).

No water utilities and road signage and infrastructure (such as permanent variable message signage) have been identified within the proposal area.

Property access

There are several private accesses along the length of the proposal. Direct access is provided from the motorway to lands owned and/or managed by WaterNSW, Endeavour Energy, National Parks and Wildlife and Wollongong Coal owned mining lease areas.

There are four existing access locations within the proposal area. All accesses are infrequently used fire trails or utility access points. The access points include:

- **Bulli track (Brokers Nose fire trail)** would be amended, as the current location would be impacted by a major cut
- **Fire trail (Access 7)** would be relocated due to the realignment of the road at its current location
- **Rixon Pass Road** would be relocated due to the realignment of the road at its current location
- **Endeavour Energy access track** be amended to improve sight distance and safety, particularly for vehicles exiting the substation lands.

6.10.2 Potential impacts

Land use and property

The proposal would require the acquisition of around 28.8 hectares of property, split between Wollongong Coal Limited (14 hectares), WaterNSW (13.5 hectares) and Endeavour Energy (1.3 hectares). It should be noted that the current estimates for property acquisition may be subject to amendments during detailed design. Any changes to property acquisition would be confirmed in consultation with the relevant landowners.

Utilities

An overhead power supply line supporting Wollongong Coal Limited infrastructure would require relocation and management. This would be worked out in agreement with Wollongong Coal Limited to ensure minimal disruption to services while maintaining construction safety.

Property access

The four existing access locations within the proposal area. All accesses are infrequently used fire trails or utility access points. The access points include:

- Bulli track (Brokers Nose fire trail) would be amended, as the current location would be impacted by a major cut
- Fire trail (Access 7) would be relocated due to the realignment of the road at its current location
- Rixon Pass Road would be relocated due to the realignment of the road at its current location
- Endeavour Energy access track be amended to improve sight distance and safety, particularly for vehicles exiting the substation lands.

To discuss and determine access needs, an Access Workshop was convened by the project team and held at Roads and Maritime offices in August 2015. From the access workshop Roads and Maritime has developed an access strategy to enable safe long term access for stakeholders, including appropriate sight distance and turn paths and access ways, access control (including gating and security), emergency management and incident safety (such as during an unplanned fire event), for the construction period.

Access to Endeavour Energy and WaterNSW lands would be maintained, with the exception of during the temporary road closures during construction. Emergency access would be provided on all roads if required.

6.10.3 Safeguards and management measures

Table 6-32 identifies safeguards and management measures that will be implemented to address potential impacts of the proposal on landuse, utilities and property access.

Table 6-31: Safeguards and management measures – landuse, utilities and property access

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Roads and Maritime project manager	Pre-construction/ construction	Core standard safeguard PL1

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Wollongong Coal Limited overhead power line	Roads and Maritime will work with Wollongong Coal to minimise impacts during potential power line relocation. Undergrounding the cable in this area or an amended overhead power supply would be further investigated in detailed design	Roads and Maritime	Design/ pre-construction,	Additional standard safeguard

Other safeguards and management measures that would address property access impacts are identified in section/s 6.6 and 6.13.

6.11 Resource and waste management

Proposed construction activities would create a number of waste streams generating volumes of waste that require a coordinated management process. This section provides a description of each waste stream, and where known the expected quantities of waste materials generated. Additionally, the section details the policy settings and provides management measures for water material applicable to the proposal. Strategies aimed at reducing waste quantities and enhancing recycling of waste are also outlined.

6.11.1 Policy setting

The POEO Act, the *POEO (Waste) Regulation 2005* and the hierarchy prescribed in the WARR Act are the key pieces of legislation that regulate waste in New South Wales (refer to Section 4). They contain the requirements for managing, storing, transporting, processing, recovering and disposing of waste.

In addition to managing waste in accordance with the relevant legislation as outlined in Section 4, Roads and Maritime Services manages waste according to the NSW Waste Avoidance and Resource Recovery Strategy 2007 and the NSW Waste Classification Guidelines (DECCW 2009) as summarised below.

Resource recovery exemptions

Applying waste to land in NSW or using it as a fuel may trigger various regulatory requirements such as the need to hold an environment protection licence or pay the waste and environment levy. However in certain cases, the OEH has the power to exempt a person from some of these requirements when waste is used for these purposes.

These 'resource recovery exemptions' are granted by OEH where the land application or use as fuel of a waste material is a genuine, fit for purpose, reuse of the waste rather than another path to waste disposal. An exemption facilitates the use of these waste materials outside of certain requirements of the waste regulatory framework.

OEH will issue a resource recovery exemption only where the intended use:

- Will be beneficial
- Will cause no harm to the environment or human health.

In order for an exemption to apply, all the conditions of the exemption must be met. These conditions include, but are not limited to, sampling and testing requirements, chemical thresholds, use restrictions and record-keeping requirements.

Exemptions issued by OEH:

- Do not release those using them from the requirement to obtain the necessary planning consents or approvals from the appropriate regulatory authority
- Do not alter or override the requirements or conditions of any other relevant legislation in relation to the waste being applied to land or used as fuel, such as the need to maintain a Material Safety Data Sheet
- Do not apply to any waste received at a licensed landfill
- Do not apply to waste received for processing at a recycling facility.

OEH issues both general and specific resource recovery exemptions. A general exemption can be issued for commonly recovered, high-volume and well-characterised waste materials. These exemptions may be used by anyone, without seeking approval from OEH, provided the generators, processors and consumers fully comply with the conditions they impose.

The following general resource recovery exemptions are of most relevance to road construction projects and would be sought for the M1 Princes Motorway:

- Excavated natural material

- Excavated public road material
- Raw mulch
- Reclaimed asphalt pavement
- Recovered aggregate.

NSW Waste Avoidance and Resource Recovery Strategy 2007

The *NSW Waste Avoidance and Resource Recovery Strategy 2007* (Waste Strategy 2007) aims to maximise conservation of natural resources and to minimise environmental harm from waste management and disposal of solid waste. To promote these objectives, the strategy identifies waste avoidance and resource recovery goals and targets in four key result areas:

- Preventing and avoiding waste
- Increasing recovery and use of secondary materials
- Reducing toxicity in products and materials
- Reducing litter and illegal dumping.

Broad state targets for each of these key result areas are specified in Waste Strategy 2007. Of particular relevance to Roads and Maritime Services is the target “by 2014, to increase recovery and use of materials from the construction and demolition sector, from 65% (in 2000) to 76%.”

The targets of Waste Strategy 2007 would form the basis of Roads and Maritime Services specific targets for waste generation and recycling of construction materials relative to this proposal.

NSW Waste Classification Guidelines (DECCW, 2009)

The Waste Classification Guidelines describe a number of pre-classified wastes and provide specific direction on the classification of waste, based on chemical composition and associated environmental impacts. Waste streams require different management, transportation and disposal depending on their classification. The six waste categories outlined in the guidelines are:

- Special waste (e.g. clinical and related, asbestos and tyres)
- Liquid waste (e.g. human waste)
- Hazardous waste (e.g. waste with pH \leq 2, coal tar, lead paint waste, etc.)
- Restricted solid waste
- General solid waste (putrescibles) (e.g. household waste, manure, food waste, etc.)
- General solid waste (non-putrescible) (e.g. glass, plastic, rubber, garden waste, etc.).

Potential wastes generated from the construction, operational and decommissioning stages of the proposal are described below.

6.11.2 Potential impacts

Waste generated during construction would primarily be from civil works associated with site preparation, relocation of utilities, construction of road infrastructure and landscaping as outlined in Section 3.3. Waste-generating activities would include:

- Vegetation clearance, generating green waste such as logs and mulched material
- Construction of temporary construction sites, construction roads and ancillary sites would require vegetation clearance, road surface grading, temporary drainage structure installation and the placement of gravel road base where required, generating general asphalt waste, pipe cuts and green waste
- Installation and decommissioning of environmental controls, fencing, silt fences and lockable gates, generating material off-cuts
- Construction of the ultimate proposal involving earthworks, placement of pavement layers,

drainage, utilities placement and protection, installation of lighting, fencing and road furniture

- Installation of prefabricated culvert units on site, generating general construction waste.

Waste streams would be generated during construction of the proposal, including the following:

- Waste from existing structures that require demolition, such as bricks/concrete from existing stormwater pits/pipes
- Excavated soil and rock which is unable to be reused within backfilling or restoration
- Surplus material from construction and general site reinstatement, such as fencing, sediment, concrete, steel, formwork, and sand bags
- Packaging materials from items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials
- Vegetative waste from clearance and grubbing
- Plant and vehicle maintenance waste, such as oil containers
- General office wastes generated by onsite personnel, such as paper, cardboard, beverage containers and food wastes
- Sewage waste generated through the use of personnel facilities.

Soils have the potential to contain contaminants of concern to human health, that is, to excavation workers and people occupying the land in the vicinity of excavation works. There are no registered sites on the contaminated sites register within the construction impact area, as such, there is a low potential to encounter areas of contamination during construction. Further information regarding potentially contaminated soils in the study area is outlined in the Soils, Topography and Geology summary assessment provided in Section 6.1.

Stockpiled materials can also cause impacts when materials are mixed. For example, mixing of topsoils with sub soils, mixing of suitable and unsuitable material or mixing contaminated material can lead to materials that would have ordinarily been reused being rendered as waste. Improper management and handling of stockpiled materials may lead to the need to dispose of materials rather than being able to reuse the materials during the project. Stockpiled materials should be kept separate where possible to maximise potential for re-use.

Waste in this proposal would be minimised through the implementation of the safeguards and management measures listed below.

6.11.3 Safeguards and management measures

Table 6-32 identifies safeguards and management measures that will be implemented to address the potential resource and waste management of the proposal.

Table 6-32: Resource and waste management safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Construction waste impacts to the local environment as a result of the proposal	<p>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> • measures to avoid and minimise waste associated with the project • classification of wastes and management options (re-use, recycle, stockpile, disposal) • statutory approvals required for managing both on and off-site waste, 	Contractor	Pre-construction and Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>or application of any relevant resource recovery exemptions</p> <ul style="list-style-type: none"> • procedures for storage, transport and disposal • monitoring, record keeping and reporting. • The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets. 		

6.12 Hazards and risks

Hazards and risks associated with the proposal are discussed in terms of construction and operational phases.

6.12.1 Potential impacts

Construction

Hazards and risks likely to be associated with construction include:

- Impacts on native flora and fauna due to inadvertent clearing, accidental injury or death
- Spills or leakages of contaminants such as fuels, chemicals and hazardous substances entering surface or groundwater or contaminating soils
- Discharge of turbid runoff, resulting in pollution of waterways and vegetation.
- Noise and air pollution
- Biosecurity risks from the spread of disease, weeds or other pathogens through materials brought on-site or by the movement of material round the site
- Changed traffic conditions leading to accidents
- Impacts from floods.

The extent of the potential impacts listed above have been discussed in Sections 6.1, 6.2, 6.3, 6.4, 6.5, 6.6 and 6.7.

Bushfire may also affect construction activities for the proposal, resulting in damage to construction equipment and plant, danger to workers and delays.

Operation

This includes hazards and risks associated with the use of the proposal, and those associated with the maintenance and management of the assets.

General hazards and risks associated with the operation of the existing road network in the vicinity of the proposal include:

- Vehicle accidents due to substandard road design and consequent safety impacts
- Damage to public and private property due to proximity of property in the event of an accident.

Operational hazards and risks for vehicles utilising the proposal would be minimised primarily through improvement of the alignment. The development of the proposal has considered operational hazards and risks that have been assessed (and mitigation measures provided) in earlier sections of this REF, including:

- Contamination of local soils and surface water due to fuel and oil spills during operation and maintenance activities (Sections 6.1 and 6.3).
- Permanent and temporary disturbance to vegetation and fauna habitats, and the aquatic habitat (Section 6.4)

Increase in noise production from construction traffic, construction noises and vibrations, and operation traffic (Section 6.7).

6.12.2 Safeguards and management measures

In addition to safeguards and measures identified in previous sections of this REF, particularly Sections 6.1, 6.2, 6.3, 6.4, 6.5, 6.6 and 6.7, the measures in Table 6-33 below would be implemented.

Table 6-33: Hazards and risks safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Bushfire	A Bushfire Management Plan would be prepared and include provisions to minimise the potential for ignition or spread of fire. Consultation with the local Rural Fire Service would be undertaken during the preparation of the Bushfire Management Plan.	Contractor	Pre-construction/construction
Traffic access	The TMP, would include measures to facilitate emergency vehicle access through the site (including appropriately spaced divides in the central median), as well as access into or from adjacent lands in the event of an incident (eg. vehicle crash).	Contractor	Pre-construction/construction

6.13 Climate change

6.13.1 Policy setting

The leading climate science body, the Intergovernmental Panel on Climate Change (IPCC), has defined climate change as “a statistically significant variation in the mean state of the climate or its variability, persisting for an extended period (typically decades or longer)” (IPCC, 2007). These altered climate conditions are primarily attributed to the impact of greenhouse gases, such as water vapour, carbon dioxide, methane, nitrous oxide and aerosols. To understand the potential effects climate change would have on the proposal, it is important to understand what climate change is, and the interactions these changes will have on existing and proposed infrastructure in the region. Further, it is important to understand the potential impacts the proposal could have on climate change through the release of greenhouse gases during construction and operation.

Changes to temperature, rainfall and evaporation between now and 2050 have been projected for the NSW Profile, as published in the NSW Climate Impact Profile (DECCW, 2010). The Profile is based on the IPCC A2 emission scenario and using the four most appropriate global climate models for the region. The Profile provides refined climate profiles for regions across the state. The proposal falls within the Illawarra region.

The projected regional climatic changes for the 2050 scenario for Illawarra show:

- Mean daily maximum and minimum temperature are anticipated to increase in all seasons, being greatest in spring, autumn and winter. The magnitude of projected increases ranges from 1.5 to three degrees Celsius.
- Summer rainfall is likely to increase substantially across the region, with smaller increases likely in autumn and spring.
- Evaporation is likely to increase moderately by up to 50 per cent in spring and summer. Slight to moderate increases in evaporation are likely in autumn and winter.

A summary of the NSW Climate Impact Profile (DECCW, 2010) projected temperature and rainfall changes in the Illawarra region to 2050 is provided in Table 6-34.

Table 6-34: Projected temperature and rainfall changes in the Illawarra region to 2050

Seasons	Minimum temperatures	Maximum temperatures	Precipitation	Evaporation
Spring	2.0-3.0°C warmer	2.0-3.0°C warmer	Up to 20% increase	10-50% increase
Summer	2.0-3.0°C warmer	1.5-2.0°C warmer	Up to 50% increase	20-50% increase
Autumn	2.0-3.0°C warmer	2.0-3.0°C warmer	Up to 20% increase	10-20% increase
Winter	2.0-3.0°C warmer	2.0-3.0°C warmer	No significant change	5-20% increase

The Transport Authorities Greenhouse Group (of which the Roads and Maritime Services is a member) has produced a Greenhouse Gas Assessment Workbook for Road Projects (TAGG, 2013) which provides a means of consistently estimating road greenhouse gas (GHG) emissions at the key stages of construction, operation and maintenance. GHG emissions are usually categorised into various scopes, these are:

- Scope 1 emissions: those that are produced by activities that are controlled by the proponent (e.g. clearing of vegetation).

- Scope 2 emissions: indirect GHG emissions as a result of activities associated with the road project across the whole of life, not controlled by the proponent. Indirect GHG emissions from the consumption of electricity, heating, cooling or steam that is produced offsite (e.g. consumption of electricity by street lights during operation).
- Scope 3 emissions: indirect GHG emissions resulting from activities not controlled by the proponent, that are not Scope 2 emissions. Embodied emissions are Scope 3 emissions (e.g. offsite mining and production of materials used in the construction).

A greenhouse gas assessment was undertaken for construction and operation of the proposal using Carbon Gauge in August 2016. Carbon Gauge is a software implementation of the GHG calculation methods described in the Greenhouse Gas Assessment Workbook for Road Projects (TAGG, 2013). Carbon Gauge provide a means of estimating the materially significant whole of life GHG emissions during the major road activities of construction, operation, and maintenance calculated over a 50 year life. The assessment identified the dominant sources of greenhouse gas emissions and the estimated volume of emissions that would be produced. A copy of the assessment is provided in Appendix J and the results are summarised below.

6.13.2 Potential impacts

Impacts of the proposal on climate change

The human expansion of the greenhouse effect is believed to be the primary cause of climate change (IPCC, 2007) and its associated impacts. The IPCC has a “global warming potential” classification system, in which the standardised effect each gas has in the atmosphere (by carbon dioxide equivalent) is represented.

Construction

Construction of the proposal would result in greenhouse gas emissions being produced, including:

- Carbon dioxide would be generated from land clearing (decomposition of cleared vegetation) (Scope 1)
- Carbon dioxide and nitrous oxide would be generated from liquid fuel use in plant and vehicles (diesel, petrol) during construction, disposal and transport of materials. (Scope 1 and Scope 3)
- Methane would be generated from landfilling any carbon based waste, and possible fugitive emissions from the use of natural gas
- Embodied energy in construction materials, including concrete
- Emissions associated with electricity use (Scope 2 and Scope 3).

The estimated greenhouse gas emissions associated with construction of the proposal are summarised in Table 6-35.

Table 6-35: Summary of construction greenhouse gas emissions

Activity	Scope 1	Scope 2	Scope 3	Total
Site offices/ General areas	461	-	35	496
Demolition and earthworks	13,957	-	97	14,054
Construction – Pavements	509	-	213,453	213,962
Construction – Structures	-	-	-	-
Construction – Drainage	81	-	4,377	4,458
Construction – Road furniture	13	-	1,042	1,055

Activity	Scope 1	Scope 2	Scope 3	Total
Total	15,021	-	219,004	234,024

Note: All emission values are in tonnes of carbon dioxide equivalent (tCO₂^e)

The most significant source of greenhouse gas emissions during construction would be related to construction of pavements, followed by demolition and earthworks.

Operation

The majority of the estimated greenhouse gas emissions that would be produced during operation would be associated with vehicle use 6,487 tCO₂^e. No other operational emissions are associated with the proposal.

Impacts of climate change on the proposal

Construction

As the construction period would be temporary, that is for the duration of the works, it is not anticipated that changes to temperature or rainfall patterns in the short term would have a significant impact on construction activities.

Operation

Long term impacts of climate change have the potential to impact the operational of the proposal by way of soil instability or changes to evaporation. Projected changes in precipitation and temperature may affect soil water content which could modify soil structure through shrink-swell (IPCC, 2007). The implications of these changes could impact the integrity of the pavement and other infrastructure associated with the proposal, and could eventually impact on the foundations of structures, softening of pavements and road rutting.

The potential impacts of climate change on the proposal would be managed by adapting design standards where considered necessary to reduce the vulnerability of infrastructure to predicted effects.

6.13.3 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential climate change impacts. These safeguards and management measures have been identified Table 6-36 below.

Table 6-36: Climate change safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Impacts to the proposal as a result of climate change	Opportunities to increase the resilience of the road to the impacts of climate change would be investigated during detailed design where possible, as new information about the impact of climate change on performance of materials (for road foundation, fill, asphalt, bitumen etc.) and drainage structures becomes available. The review would aim to identify materials that are less susceptible to degradation impacts of climate change.	Roads and Maritime Services	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
Impacts of the proposal on climate change	<p>Detailed design is to include consideration of the following as a minimum to minimise the potential for GHG emissions:</p> <ul style="list-style-type: none"> • Preferential use of local materials (where feasible and practicable) to reduce quantities of fuel consumption associated with material transportation. • Delivery of materials with full loads where feasible. • Ensure that all plant and vehicles are maintained regularly to maintain fuel efficiency. • Seek opportunities to reduce the quantity of construction materials used through innovative design and construction methodologies. • Where reasonable and feasible, procure recycled content road construction and maintenance materials such as recycled aggregates in road pavement and surfacing (including crushed concrete, granulated blast furnace slag, glass, slate waste and fly ash). This measure forms part of RMS' implementation of the NSW Government's 'Waste Reduction and Purchasing Policy' (WRAPP). 	Contractor	Pre-construction and Construction

6.14 Cumulative impacts

Cumulative impacts are the combined impacts of existing and/or future activities in a locality or region, and can be both positive and negative. Cumulative impact assessments are based on the premise that it is not adequate to simply assess the impacts of a single proposal in isolation. The effective evaluation of the significance of the impacts of a proposal needs to also consider the totality of impacts of a proposal and other existing and proposed development in the social, economic and environmental context in which they exist.

Roads and Maritime is required under clause 228(2) of the EP&A Act, to take into account potential cumulative impacts as a result of the proposal.

6.14.1 Study area

The proposal area is located in the protected 'special area' of Cataract Reservoir and consequently the opportunity for current and future development near the proposal area is extremely limited. The nearest sensitive receiver is at least 1,200 metres to the east and 250 metres lower in elevation than the proposal. The proposal would have minimal noise, air quality and other amenity impacts on sensitive receivers – and therefore it is unlikely to have substantial cumulative impacts with any other development for these environmental issues.

It is noted that there is predicted growth in regional residential development, port activity and coal mine development and to cater for increased traffic from these sources is one of the justifications for proposal. This growth is predicted to be gradual and there are no known major developments that would result in substantially increased traffic growth along this section of the M1 Princes Motorway while construction of the proposal is being undertaken.

The major potential for cumulative impacts would be from other road works that have overlapping construction periods with the proposal. As construction works would not generate substantial heavy vehicle movements, they could reduce travel times due to speed restrictions around active construction zones.

Potential road work projects in the road network have been identified and assessed in the following sections.

6.14.2 Broader program of work

The proposal is part of a broader program of work to widen and improve the Mount Ousley section of the M1 Princes Motorway. As discussed in Section 1 and 2, Stage 2 of the works involves widening and minor realignments of the M1 Princes Motorway immediately north of the proposal between Bellambi Creek and Bulli Tops. Currently, there is no funding for Stage 2 and more work needs to be undertaken on the design and potential impacts on the Illawarra Escarpment State Conservation Area (IESCA). An Act of NSW Parliament would also be required to modify the boundaries of the IESCA to allow construction to commence. Given these issues to be resolved it is unlikely that Stage 2 construction would be start before Stage 1 construction has been completed.

6.14.3 Other projects and developments

Other road projects which may have overlapping construction periods with the proposal are presented and assessed in Table 6-37.

Table 6-37: Other road projects

Project	Construction impacts	Operational impacts
<p>Safety upgrades - Picton Road</p> <p>Roads and Maritime is developing safety treatments for the five remaining untreated sections of Picton Road. These projects will be considered as additional funding becomes available. These include:</p> <ul style="list-style-type: none"> • Hume Motorway interchange. • Mount Ousley Road to Mount Keira Road - Design of a median barrier and curve improvements. • Cordeaux Colliery to Cordeaux Dam - Design of a median barrier and extending the existing overtaking lane is being finalised. • Cordeaux Dam to Macarthur Drive - Design for road widening, installing a median barrier and shoulder improvements is being finalised. • Macarthur Drive to Janderra Lane - Roads and Maritime is investigating options to separate the east and westbound traffic to improve road safety. 	<p>Depending on when funding becomes available, the construction period of the Picton Road safety improvement projects may overlap with the proposal's construction period. It is unlikely that more than one safety improvement project would overlap at any one time with proposal's construction period.</p> <p>While both construction projects would generate additional traffic, the increase in vehicle numbers would be minor and would not result in a substantial impact.</p> <p>However with speed zone restrictions adjacent to the construction areas, there would be a cumulative increase in travel time for vehicles using the two sections impacted by construction works. This impact is unavoidable, however would not affect many road users as the routes between Picton Road and north on the M1 Princes Highway are not well used.</p>	<p>These projects would complement the proposal as they would improve the road network safety and performance.</p>
<p>Safety upgrade - Picton Road/M1 intersection (northbound)</p> <p>Roads and Maritime Services has completed the safety upgrade at the intersection of the M1 Princes Motorway (Mt Ousley Road) and Picton Road. The upgrade has improved safety by adjusting the access to Sydney from Picton Road to remove the current T-intersection and building an acceleration lane on the M1.</p>	<p>Works completed so no cumulative construction impacts</p>	<p>Works improve safety at interchanges</p>

Project	Construction impacts	Operational impacts
<p>M1 interchange at the base of Mount Ousley Roads and Maritime has begun planning for an interchange on the M1 at the base of Mt Ousley and will also explore opportunities to install a third southbound lane from about 650m north of New Mt Pleasant Road to Mount Ousley Road, a total distance of about 2.5km. The interchange will look at future traffic growth and improve road safety at the base of Mt Ousley.</p>	<p>Project is only in planning development phase and design or construction would not start within proposal construction period.</p>	<p>Unknown – however likely to improve safety and performance of regional road network</p>
<p>Mount Ousley heavy vehicle rest area In March 2013, the Australian and NSW Governments announced \$8.09 million to construct a north bound heavy vehicle rest area at the intersection of the M1 Motorway and Clive Bissell Drive, Mount Ousley.</p>	<p>Project is planned for construction in late 2016. It is likely that construction of the rest areas would be completed before construction of the proposal commences. Even if there was some overlap in construction periods the cumulative impacts would be minor as the rest area construction impacts are minimal and there are no sensitive receivers nearby. The highest potential impact would be on traffic, however given the small scale of the rest area construction, cumulative traffic impacts would not be expected.</p>	<p>It would assist in providing a safer road environment near the proposal.</p>

6.14.4 Potential impacts

Overall the only potential cumulative impacts from other developments would be on traffic (See Table 6-38).

Table 6-38: Potential cumulative impacts

Environmental factor	Construction	Operation
Traffic	<p>With speed zone restrictions adjacent to the construction areas, there would be a cumulative increase in travel time for vehicles passing two or more construction areas.</p> <p>This impact is generally unavoidable due to safety requirements. However the most likely simultaneous construction works would occur on Picton Road - which would not affect many road users as the routes between Picton Road and north on the M1 Princes Highway are not well used</p>	<p>In the longer term any additional road works would be likely to result in improved safety and capacity of the regional road network</p>

6.14.5 Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential cumulative impacts. These safeguards and management measures have been identified in Table 6-39 below.

Table 6-39: Cumulative impacts safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Traffic	<p>If any other road works projects in the regional network have overlapping construction periods with the proposal, consultation between the construction contractors would be undertaken to identify any measures to minimise traffic impacts on road users</p>	<p>Roads and Maritime/ Construction contractor</p>	<p>Pre-construction/ construction</p>	<p>Additional safeguard</p>

7 Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these management measures would be incorporated into the detailed design and applied during the corresponding time period: pre-construction/during construction/post construction.

A Construction Environmental Management Plan (CEMP) and associated sub-plans will be prepared to describe safeguards and management measures identified. The plan would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The plan would be prepared prior to construction of the proposal and must be reviewed and approved by the Roads and Maritime Services Environmental Officer, Southern Region, prior to the commencement of any on-site works. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the Roads and Maritime QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan) and the QA Specification G40 – Clearing and Grubbing.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> • any requirements associated with statutory approvals • details of how the project will implement the identified safeguards outlined in the REF • issue-specific environmental management plans • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action 	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard GEN1

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<ul style="list-style-type: none"> reporting requirements and record-keeping procedures for emergency and incident management procedures for audit and review. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>			
GEN2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Roads and Maritime project manager	Pre-construction	Core standard safeguard GEN2
GEN3	General – environmental awareness	<p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> threatened species habitat (Coastal Upland Swamp areas) adjoining private properties and accesses (Endeavour Energy, Wollongong Coal Limited) 	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard GEN3

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Soils 1	Erosion and sedimentation	Work areas are to be stabilised progressively during the works.	Contractor	Pre-construction/construction	
Soils 2	Erosion and sedimentation	The maintenance of established stockpile sites during construction is to be in accordance with the <i>Roads and Maritime Services Stockpile Site Management Guideline</i> (EMS-TG-10).	Contractor	Pre-construction/construction	
Soils 3	Erosion and sedimentation	<p>A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.</p> <p>The SWMP will be reviewed by a soil conservationist on the Roads and Maritime list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services.</p> <p>The SWMP should contain at a minimum the following elements:</p> <ul style="list-style-type: none"> • Consideration of appropriate erosion and sediment control. • Consideration of appropriate erosion and sediment controls at ancillary sites with particular consideration of 	Contractor	Pre-construction/construction	<p>Core standard safeguard SW1</p> <p>Section 2.1 of QA G38 <i>Soil and Water Management</i></p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>sediment basins at sites where material processing or stockpiling would occur.</p> <ul style="list-style-type: none"> • Procedure to be developed for early warnings of imminent and severe weather approaching site and response required by site for preparation of the forecasted event • Identification of site conditions or construction activities that could potentially result in erosion and associated sediment runoff. • Methods to minimise potential adverse impacts of construction activities on the water quality within surrounding waterways. • Details of specific measures to protect sensitive areas including drinking water catchments and sensitive vegetation such as (EECs). • Details of measures to minimise any adverse impacts of sedimentation on the surrounding environment. • Details of measures to minimise soil erosion caused by all construction works including clearing, grubbing and earthworks. • Details of measures to provide spill management and basin discharge procedures 			

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<ul style="list-style-type: none"> • Details of measures to make site personnel aware of the requirements of the SWMP by providing information within induction, toolbox and training sessions. • Details of the roles and responsibilities of personnel responsible for implementing the SWMP. • Details of measures for the inspection and maintenance of construction phase water treatment devices and structures. 			
Soils 4	Erosion and sedimentation	<p>A site specific Erosion and Sediment Control Plan/s (ESCP) will be prepared and implemented as part of the SWMP</p> <p>The plan will include site specific erosion and sediment controls, size and locations of sedimentation basins (as well as detailed erosion and sedimentation control design), arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</p>	Contractor	Pre-construction/construction	<p>Core standard safeguard SW2</p> <p>Section 2.2 of QA G38 <i>Soil and Water Management</i></p>
Soils 5	Erosion and sedimentation	Roads and Maritime will develop an ESCP in parallel during the	Roads and Maritime/Design contractor	Detailed design	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		concept/detailed design phase in consultation with WaterNSW.			
Surface water 1	Operational water quality	<p>Detailed design will seek to minimise water quality impacts by incorporating the following design principles:</p> <ul style="list-style-type: none"> • Vegetated drainage lines should be used in preference to engineered structures wherever practicable • Operational water quality control measures will be developed to ensure that a neutral or beneficial effect on water quality is achieved. Water treatment structures should be designed to be accessible for structural and vegetation maintenance and for removal of sediment. • Appropriate energy dissipation and scour prevention measures will be incorporated downstream of culverts and other drainage structures to minimise soil erosion. 	Roads and Maritime	Pre-construction	
Surface water 2	Construction water quality impacts	A Surface Water Quality Monitoring Program will be designed and implemented to detect and respond to any changes in water quality in Bellambi Creek and Cataract Creek waterways downstream of the proposal during construction.	Contractor	Pre-construction/ construction	-

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		The Program will include monthly and post rainfall visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) to identify any potential spills or deficient erosion and sediment controls.			
Surface water 3	Local water quality impacts	<p>If an incident (eg spill) occurs, the Roads and Maritime Services <i>Environmental Incident Classification and Reporting Procedure</i> is to be followed and the Roads and Maritime Services Contract Manager notified as soon as practicable.</p> <p>Roads and Maritime would immediately advise WaterNSW on the WaterNSW incident number 1800 061 069.</p>	Contractor	Construction	
Surface water 4	Local water quality impacts	Spill kits, including hydrocarbon absorbent booms would be kept at the ancillary site compounds in clearly marked and accessible locations	Contractor	Construction	
Surface water 5	Local water quality impacts	The refuelling of plant and equipment would occur in designated impervious bunded areas. Bunded areas will be located as far as possible from drainage lines or waterways.	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Ground water 1	Pollution or reduction in stream base flows	Drainage systems and water management measures will be designed to reduce sediment-related pollution of stream/aquifers and any reduction in base flows.	Roads and Maritime/Contractor	Detailed design	Additional safeguard
Biodiversity 1	General biodiversity impacts	<p>A Flora and Fauna Management Plan (FFMP) will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas (a map showing the Coastal Upland Swamp EEC and other native vegetation to be retained) management strategies for pre-construction, construction activities including control measures for the pre-clearing process requirements set out in the <i>Landscape Guideline</i> (RTA, 2008) pre-clearing survey requirements including specific requirements for protected fauna (Ecological pre-clearing surveys to be undertaken prior to the commencement of the 	Contractor	Pre-construction	<p>Core standard safeguard B1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>clearing, comprising searches for nest sites, maternal roosting sites for microchiropteran bats, and breeding sites for large forest birds such as Owls and the Glossy Black-Cockatoo) by a suitably qualified ecologist in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (Pre-clearing process) (RTA, 2011)</p> <ul style="list-style-type: none"> • procedures for unexpected threatened species finds and fauna handling • protocols to manage weeds and pathogens • proposed strategies for re-use of coarse woody debris and bushrock • fauna rescue and release procedure. 			
Biodiversity 2	General biodiversity impacts	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	RMS/Contractor	Detailed construction design/pre-	Core standard safeguard B2
Biodiversity 3	Native vegetation	Detailed design will seek to minimise the construction footprint to the extent possible. A Clearing Limits Report (or similar) will be prepared which identifies reduced clearing limits achieved by detailed design, compared to the original planned clearing limits. The report will	Roads and Maritime/Contractor	Detailed construction design/pre-	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		clearly explain / justify the proposed clearing limits at any locations that a reduction cannot be achieved, or only minor reductions can be achieved. The report will be approved by the Roads and Maritime Environment Manager.			
Biodiversity 4	Native vegetation	<p>Ensure exclusion zones areas are established prior to vegetation clearing through fencing and signage and these Management of exclusion zones should address the following matters:</p> <ul style="list-style-type: none"> • Ensure that any trees to be felled to establish exclusion zones are felled away from the exclusion zone and not into retained bushland habitats • Signs should be clearly visible from a distance of at least 20 metres and be general in nature, such as 'Exclusion Zone' or 'Environmental Protection Zone' • No clearing, stockpiling of plant and material shall take place in the established exclusion zones • Regular inspections of exclusion zone boundaries, and repairs to fencing should be undertaken. Additional checks should be undertaken following storms where there is a higher risk of material falling on 	Contractor	Pre-construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>fencing. Where possible, inspections of exclusion zones should form part of regular site environmental checks</p> <ul style="list-style-type: none"> • Communication of the locations and purpose of the exclusion zones should be provided to all site staff (eg in toolbox talks and formal inductions). 			
Biodiversity 5	ROTAP species - <i>Darwinia grandiflora</i>	Investigate options for salvage of the <i>Darwinia grandiflora</i> plant. Consultation with the local botanic gardens and council would be undertaken to investigate opportunities to collect seed from the plant or accepting individual plants that can be salvaged.	Roads and Maritime/Contractor	Pre-construction/construction	
Biodiversity 6	Native vegetation	<p>Landscape and Urban Design Plan to be prepared following project approval. This is to include:</p> <ul style="list-style-type: none"> • Areas that are to be revegetated • Areas that are to be stabilised • Topsoil requirements for revegetation <p>Ensure plant species used for revegetation are suitable for the habitat and where practicable indigenous species may be used.</p>	Road and Maritime	Detailed design/construction/post-construction	
Biodiversity 7	Native vegetation	Management of access into the project area through gating/fencing of existing tracks to reduce the impacts of human	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		disturbance and dumping on the retained vegetation adjacent to the site.			
Biodiversity 8	Invasive species and pathogens	The Site Erosion and Sediment Control Plan will be implemented in accordance with the Blue Book (Landcom 2004) during construction to minimise the movement of the soil borne organism, <i>Phytophthora cinnamomi</i> and weed seeds.	Contractor	Construction	
Biodiversity 9	Invasive species and pathogens	<p>A Weed Management Plan (WMP) will be developed for the site as part of the CEMP and in accordance with the <i>Biodiversity Guidelines - Guide 6</i> (RTA 2001). It will include, but not be limited to:</p> <ul style="list-style-type: none"> • A procedure for stockpile management • Requirements for the use of pesticides • Wash down procedure for vehicles to prevent the spread of weeds <p>Undertake weed management and control in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011) during and post-construction.</p> <p>Stockpiling of topsoil from cleared areas for re-use in site revegetation is only to be sourced from areas classified as 'weed free' by a site ecologist.</p>	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Biodiversity 10	Invasive species and pathogens	Establish a protocol to prevent introduction or spread of <i>Phytophthora cinnamomi</i> and Myrtle Rust consistent with <i>Roads and Maritime Biodiversity Guidelines - Guide 7 (Pathogen Management)</i> (RTA, 2011) during construction. The protocols used should be either the <i>Sydney Region Pest Management Strategy</i> or Best Practice Guidelines for <i>Phytophthora cinnamomi</i> (DECC 2008) and the DPI handout prepared for Myrtle rust response 2010–11: <i>Preventing spread of Myrtle Rust in bushland</i> or the OEH Interim management plan for Myrtle rust in bushland (2011).	Contractor	Construction	
Biodiversity 11	Habitat corridor and wildlife connectivity fragmentation	Produce a fauna connectivity strategy in consultation with Roads and Maritime environmental staff and an experienced fauna consultant to investigate and determine what types of wildlife connectivity structures will be included in the detailed design and facilitate the movement of threatened species. Target species include forest owls, Glossy Black Cockatoo, Little Lorikeet, Gang-gang Cockatoo, microchiropteran bats, Greater Glider, Yellow-bellied Glider and Eastern Pygmy-possum.	Roads and Maritime/Contractor	Detailed design	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>The fauna connectivity strategy will consider:</p> <ul style="list-style-type: none"> • Enhancing the likelihood of culvert use with fauna exclusion fencing to funnel wildlife towards culvert openings and promote tree growth near entrances to encourage use of culverts as wildlife underpasses and reduce barrier effect of the motorway. • Retention of large glide trees adjacent to the road to facilitate Glider movement. • The location of the fauna exclusion fencing to be determined and shown on the detailed design. 			
Biodiversity 12	Habitat corridor and wildlife connectivity fragmentation	A monitoring program will be designed and implemented to assess the effectiveness of fauna connectivity measures installed (once determined).	Roads and Maritime	Detailed design/post-construction	
Biodiversity 13	Loss of fauna habitat areas	Undertake staged habitat removal of hollow-bearing trees in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011). All habitat trees proposed for removal shall be tagged in the field with surveyors flagging tape and spray paint and clearly mapped for clearing Contractors. Felled habitat trees should be relocated into suitable retained	Contractor	Pre-construction/construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>habitats, where practicable, under the supervision of the project ecologist.</p> <p>Lost hollows shall be replaced by the installation of nest boxes in suitable habitats at a 1:1 ratio prior to their felling in accordance with the Nest Box Management Plan.</p>			
Biodiversity 14	Loss of fauna habitat areas	<p>A Nest Box Management Plan would be prepared in accordance with the <i>Roads and Maritime Biodiversity Guidelines-Guide 8 (Nestboxes)</i> (RTA 2011) and in consultation with a suitably experienced Fauna ecologist, to ameliorate the reduction in habitat features and loss of tree hollows.</p> <p>Target species for nest boxes would include forest owls, Glossy Black Cockatoo, The Little Lorikeet and the Gang-gang Cockatoo, microchiropteran bats and Greater Glider, Yellow Bellied Glider and Eastern Pygmy-possum.</p> <p>The Nest Box Management Plan is to ensure no net loss of suitable Eastern Pygmy-possum habitat occurs as a result of hollow-bearing tree removal. Eastern Pygmy-possum nest boxes would be installed in suitable habitats at a frequency of one every 30-50 metres.</p>	Contractor	Pre-construction/during construction/post construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		Undertake post-construction nest box installation maintenance and monitoring checks in accordance with the prepared Nest Box Management Plan and Roads and Maritime Biodiversity Guidelines (RTA, 2011).			
Biodiversity 15	Protected fauna	In the unlikely event any nest sites of the larger sized birds such as the Square-tailed Kite and other raptors, Powerful Owl, and Masked Owl are located within the clearing area, the clearing contractor will move the nest from the construction site to the nearest suitable area outside of the construction site under direction of an ecologist.	Contractor	Construction	
Biodiversity 16	Coastal Upland Swamps	An Upland Swamp Management Plan will be developed that will incorporate measures to minimise the impacts on Upland Swamps. This will include: <ul style="list-style-type: none"> • Identification of impacts to upland swamps • Methods to minimise impacts on upland swamps • Undertake a monitoring program at upland swamp locations prior to, during and for 12 months following, construction. 	Contractor/Roads and Maritime	Pre-construction/construction/post construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Biodiversity 17	Coastal Upland Swamps	<p>As part of an Upland Swamp Management Plan, post construction checks in line with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA 2011), will be implemented as part of the plan and will consider but not be limited to:</p> <ul style="list-style-type: none"> Assessing the effectiveness of bunding revegetation and ensure no indirect impacts on surrounding Upland Swamps have occurred as a result of the works. Should indirect impacts be encountered, remedial actions will be investigated and if practicable implemented. 	Contractor/Roads and Maritime	Pre-construction/construction/post construction	
Biodiversity 18	Coastal Upland Swamps	Spill management policy / guidelines to be followed to protect the retained Coastal Upland Swamp vegetation from any spills during construction of batters.	Contractor/Roads and Maritime	Construction	
Biodiversity 19	Coastal Upland Swamps	Batters between the new road cuttings and remaining swamps will be established to minimise impacts to the remaining Coastal Upland Swamps by preventing draining of the dissected Coastal Upland Swamps	Contractor/Roads and Maritime	Construction	
Biodiversity 20	Coastal Upland Swamps	The Landscape and Urban Design Plan is to incorporate progressive construction revegetation and restoration of cleared	Roads and Maritime	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>areas of Coastal Upland Swamp EEC in accordance with <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011).</p> <p>In particular, revegetating the batters installed with species associated with that particular swamp to prevent drainage of the Coastal Upland Swamps Stockpiled topsoil and/or tubestock planting will be used where appropriate.</p>			
Biodiversity 21	Eastern Pygmy-possum	<p>The Fauna Connectivity Strategy plan within the Construction FFMP will incorporate all of the mitigation measures, monitoring and control measures specific to Eastern Pygmy-possum in line with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011). These are to include:</p> <ul style="list-style-type: none"> • Measures to mitigate habitat fragmentation: including removal of concrete barriers on the old road alignment at the southern end of the project to provide additional connectivity for the existing Eastern Pygmy-possum population to the wider locality. • Enhance likelihood of culvert use with fauna fencing to funnel wildlife towards culvert openings and promote tree growth near entrances to 	Contractor	Pre-construction/construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>encourage use of culverts as wildlife underpasses and reduce barrier effect of the motorway.</p> <p>The Nest Box Strategy will incorporate specific measures to ensure no net loss of suitable Eastern Pygmy-possum habitat as a result of hollow-bearing tree removal within their habitat in accordance with the <i>Roads and Maritime Biodiversity Guidelines - Guide 8 (nestboxes)</i> (RTA, 2011). And in consultation with a suitably experienced Fauna ecologist Twenty five EPP nestboxes are currently installed within the study area within suitable habitat and those not within the construction footprint can be retained.</p> <p>Undertake post-construction nest box installation maintenance and monitoring checks in accordance with the prepared nest box strategy and <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011).</p>			
Air quality 1	General air quality impacts	An Air Quality Management Plan (AQMP) will be prepared for construction of the Proposal and implemented as part of the CEMP. The plan would detail air quality control measures and procedures to be undertaken during construction.	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Air quality 2	Impacts on local air quality during construction.	<ul style="list-style-type: none"> • Areas of exposed surfaces are to be minimised through construction site planning and programming, to reduce the area of potential construction dust emission sources. • Control measures would be implemented in order to minimise dust from stockpile sites. • Dust suppression measures, such as the use of water carts or soil binders, would be used on any unsealed surfaces and other exposed areas. • All trucks would be covered when transporting materials to and from the site. • Construction activities that would generate dust would be avoided or modified during high wind periods. • Work activities would be reviewed if the dust suppression measures are not adequately restricting dust generation. • Rehabilitation of completed sections would be progressively undertaken. 	Contractor	Construction	
Traffic 1	Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10</i>	Contractor	Pre-construction/construction	Core standard safeguard TT1 Section 4.8 of QA G36

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p><i>Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • confirmation of haulage routes • measures to maintain access to local roads • site specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain cyclist access and provision of alternative cyclist routes during construction • requirements and methods to consult and inform Busways and the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • processes to monitor and review the effectiveness of traffic control measures and to amend the TMP should this be necessary. 			<p><i>Environment Protection</i></p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Traffic 2	Property access	An access strategy for construction and operational phases will be developed and agreed with relevant agencies to maintain access to fire trails and other service roads	Design and construction contractors/ Roads and Maritime	Pre-construction, construction and operation	Additional safeguard
Aboriginal 1	Aboriginal heritage	The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Pre-construction/construction	Core standard safeguard AH2 Section 4.9 of QA G36 <i>Environment Protection</i>
Landscape and visual 1	Landscape character and visual impact	A Landscape and Urban Design Plan (LUDP) will be prepared during the detailed design phase of the project and implemented as part of the CEMP. The LUDP will present an integrated landscape and urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental	Roads and Maritime/ Design contractor	Detailed design	Landscape character and visual impact

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> • location and identification of existing vegetation and proposed landscaped areas, including species to be used, density and size • Areas of the redundant road pavement that will be removed and revegetated • Hydromulch seed mix designs and locations • built elements including any retaining walls and bridge walls • pedestrian and cyclist elements if necessary • fixtures such as lighting, fencing and signs • details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage • procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Landscape and Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> • <i>Beyond the Pavement urban design policy, process and principles</i> (Roads and Maritime, 2014) 			

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<ul style="list-style-type: none"> • <i>Landscape Guideline</i> (RTA, 2008) • <i>Bridge Aesthetics</i> (Roads and Maritime 2012) • <i>Shotcrete Design Guideline</i> (RTA, 2005). 			
Landscape and visual 2	Visual impacts of construction activities	<p>To reduce the potential visual impact of construction activities:</p> <ul style="list-style-type: none"> • Work sites will be left tidy at the end of each work day • Where appropriate, fencing with material attached (eg shade cloth) will be provided around the construction compound to screen views from adjoining properties <p>Lighting for night-time work will comply with relevant Australian Standards, including <i>AS4282-1997 (Control of the obtrusive effects of outdoor lighting)</i>.</p>	Construction contractor	Construction	Visual impacts of construction activities
Access 1	Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Roads and Maritime project manager	Pre-construction/construction	Core standard safeguard PL1
Access 2	Wollongong Coal Limited overhead power line	Roads and Maritime will work with Wollongong Coal to minimise impacts during potential power line relocation. Undergrounding the cable in this area or an amended overhead power supply	Roads and Maritime	Detailed design/pre-construction,	Additional standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		would be further investigated in detailed design			
Waste 1	Construction waste impacts to the local environment as a result of the proposal	<p>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> • measures to avoid and minimise waste associated with the project • classification of wastes and management options (re-use, recycle, stockpile, disposal) • statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • procedures for storage, transport and disposal • monitoring, record keeping and reporting. • The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets. 	Contractor	Pre-construction/construction	
Hazards and risks 1	Bushfire	A Bushfire Management Plan would be prepared and include provisions to minimise the potential for ignition or	Contractor	Pre-construction/construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		spread of fire. Consultation with the local Rural Fire Service would be undertaken during the preparation of the Bushfire Management Plan.			
Hazards and risks 2	Traffic access	The TMP, would include measures to facilitate emergency vehicle access through the site (including appropriately spaced divides in the central median), as well as access into or from adjacent lands in the event of an incident (eg. vehicle crash).	Contractor	Pre-construction/construction	
Climate 1	Impacts to the proposal as a result of climate change	Opportunities to increase the resilience of the road to the impacts of climate change would be investigated during detailed design where possible, as new information about the impact of climate change on performance of materials (for road foundation, fill, asphalt, bitumen etc.) and drainage structures becomes available. The review would aim to identify materials that are less susceptible to degradation impacts of climate change.	Roads and Maritime Services	Detailed design	
Climate 2	Impacts of the proposal on climate change	Detailed design is to include consideration of the following as a minimum to minimise the potential for GHG emissions: <ul style="list-style-type: none"> • Preferential use of local materials (where feasible and practicable) to reduce quantities of fuel 	Contractor	Pre-construction/construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>consumption associated with material transportation.</p> <ul style="list-style-type: none"> • Delivery of materials with full loads where feasible. • Ensure that all plant and vehicles are maintained regularly to maintain fuel efficiency. • Seek opportunities to reduce the quantity of construction materials used through innovative design and construction methodologies. • Where reasonable and feasible, procure recycled content road construction and maintenance materials such as recycled aggregates in road pavement and surfacing (including crushed concrete, granulated blast furnace slag, glass, slate waste and fly ash). This measure forms part of RMS' implementation of the NSW Government's 'Waste Reduction and Purchasing Policy' (WRAPP). 			
Cumulative 1	Traffic	If any other road works projects in the regional network have overlapping construction periods with the proposal, consultation between the construction contractors would be undertaken to	Roads and Maritime/ Construction contractor	Pre-construction/construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		identify any measures to minimise traffic impacts on road users			

7.3 Licensing and approvals

In addition to project approval under Part 5 of the EP&A Act, the separate licenses, permits, notifications and/or approvals listed in Table 7-2 may be required to construct/operate the proposal.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
<p><i>Water NSW Act 2014</i> <i>Water NSW Regulation 2013</i></p>	<p>The proposed work would be undertaken within a WaterNSW 'special area', as identified in Schedule 1 of the Water NSW Regulation 2013. Roads and Maritime would continue to liaise with WaterNSW in regard to access and work for the proposal within the 'special area'.</p>	<p>Prior to start of the activity.</p>
<p><i>Protection of the Environment Operations Act 1997 (Schedule 1, Parts 1(35)(2a) and 1(19)(1))</i></p>	<p>The proposal is classified as a scheduled activity on two accounts; i) extraction of more than 30,000 tonnes of material and ii) a road greater than four lanes in width and for a distance of more than one kilometre in the metropolitan area. An EPL would be required for the proposal and would be applied for through OEH.</p>	<p>Prior to start of the activity.</p>

8 Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

8.1 Justification

8.1.1 Social factors

The proposal would promote the social welfare of the community and a better environment by improving the capacity, safety and services of the M1 Princes Motorway. In addition, the proposal is considered to be consistent with Commonwealth, NSW and regional strategic planning policies relevant to safer and improved road infrastructure, including:

- NSW State Infrastructure Strategy 2012-2032
- NSW Long Term Masterplan
- National Road Safety Strategy in Australia 2011-2020
- National Road Safety Action Plan 2015-2017
- NSW Road Safety Strategy.

8.1.2 Biophysical factors

The assessment of the proposal's impact on biophysical environment found that there is unlikely to be a significant impact on relevant MNES and nationally listed threatened species, populations, endangered ecological communities and migratory species. As the proposal is consistent with the strategic assessment approval (refer to Section 4.3.1) a referral to the Commonwealth Department of the Environment and Energy for these matters is not required. Chapter 6 of the REF describes the safeguards and management measures to be applied.

Environmental impacts may include vegetation clearance, impacts to Sydney's drinking water catchment, and minor air quality impacts during construction. The short duration and minor nature of the impacts as a whole would be offset by the safety and capacity the improved M1 Motorway would provide to the region.

8.1.3 Economic factors

The benefits of the proposal relate to savings in road user costs due to the reduction in vehicle hours and vehicle kilometres compared with the base case, as well as the residual value of assets remaining at the end of the analysis period. The benefits include:

- Road User cost savings:
- Savings in vehicle operating costs;
- Savings in travel time costs; and
- Savings in crash costs
- Residual Value of Assets.

8.1.4 Public interest

Impacts on the community include land acquisition (of around 29 hectares) and impacts to road users during construction.

There are several private accesses along the length of the proposal. Direct access is provided from the motorway to lands owned and/or managed by WaterNSW, National Parks and Wildlife and Wollongong Coal owned mining lease areas.

The visual impact of the proposal was assessed as low, with impacts at three viewpoints “low” or “negligible” and at the remaining two viewpoints was “low-moderate”.

8.2 Objects of the EP&A Act

Table 8-1: Objects of the *Environmental Planning and Assessment Act 1979*

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The proposal would promote the social and economic welfare of the community and a better environment by improving the capacity, safety and services of the M1 Princes Motorway. The proposal has considered the development and conservation of natural and artificial resources, been designed to benefit future generations by ensuring that the proposed upgrade does not give rise to long-term adverse impacts on the environment and potential impacts would be minimised by implementation of appropriate safeguards as detailed in Section 7.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	Coordination of the orderly economic use and development of land has been considered through the concept design and REF process. Consultation activities undertaken with this aim have occurred with Wollongong City Council, WaterNSW (formerly Sydney Catchment Authority), National Parks and Wildlife and service providers as outlined in Section 5.
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	Coordination of utility has been considered through the concept design and REF process. Consultation activities undertaken with this aim have occurred with utility and service providers as outlined in Section 5.
5(a)(iv) To encourage the provision of land for public purposes.	The proposal provides for a road upgrade for public purposes as detailed in Section 1 and Section 3.
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	Not relevant to the project.
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	A thorough assessment of the existing local environment has been undertaken in order to identify and manage potential impacts of the proposal with the objective to provide protection where required on the receiving environment. The REF includes an Ecological Impact Assessment which specifically assessed the potential impacts on native animals and plants, including threatened species, populations and ecological communities, and their habitats. Refer to Section 6.4 and Appendix H.

Object	Comment
5(a)(vii) To encourage ecologically sustainable development.	The principles of ecologically sustainable development have been incorporated into the proposal as outlined in Sections 8.2.1 to 8.2.4.
5(a)(viii) To encourage the provision and maintenance of affordable housing.	Not relevant to the project.
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	Not relevant to the project.
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	Roads and Maritime have undertaken consultation with relevant stakeholders and government agencies. Consultation undertaken to date is presented in Section 5 and Appendix B of the report.

8.2.1 The precautionary principle

This principle states that “if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

Alternative options have been considered and assessed with the aim of reducing the risk of serious and irreversible impacts on the environment. Consultation undertaken for the proposal considered issues raised by government agencies and other stakeholders. Specialist studies, including a NorBE assessment, were undertaken for issues of ecology, soils, and traffic to provide accurate and impartial information to assist in the evaluation of the proposals potential impact.

The detailed assessment of potential environmental impacts has sought to minimise impacts of the proposal on the environment. Where impacts were likely to occur a number of safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

8.2.2 Intergenerational equity

This principle states that “the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations”.

The proposal would benefit future generations by ensuring that the proposed upgrade does not give rise to long-term adverse impacts on the environment and potential impacts would be minimised by implementation of appropriate safeguards.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a lower level of service by the road transport network. Travel times and the number of accidents would both increase along this section of the motorway as the volume of traffic increases over time.

The proposal would benefit future generations by ensuring that road safety and efficiency is improved, with this being a positive benefit for all road users.

8.2.3 Conservation of biological diversity and ecological integrity

This principle states that “the diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival”.

A thorough assessment of the existing local environment has been undertaken in order to identify and manage potential impacts of the proposal on biodiversity. Specific efforts have been taken at the design stage of the proposal to minimise impacts upon the local biodiversity.

The assessment of the proposal’s impact on MNES and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment under the EPBC Act.

The assessment of the proposal’s impact on nationally listed threatened species, populations, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle requires that “costs to the environment should be factored into the economic costs of a project”.

This REF has examined the environmental consequences of the proposal and identified mitigation measures for areas which have the potential to experience adverse impacts. Requirements imposed in terms of implementation of these mitigation measures would result in an economic cost to Roads and Maritime Services. The implementation of mitigation measures would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

The concept design for the proposal has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the concept design for the proposal has been developed with an environmental objective in mind.

8.3 Conclusion

The proposed upgrade of the Stage 1 upgrade of the M1 Princes Motorway between Picton Road interchange and Bellambi Creek, Mount Ousley is subject to assessment under Part 5 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, joint management and biobanking agreements under the TSC Act, wilderness areas, critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Commonwealth EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on the local community in the form of impacts to road users during construction. Environmental impacts include vegetation clearance, potential impacts to Sydney’s drinking water catchment, and minor air quality impacts during construction. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve travel time and efficiency with an enhanced level of safety. The proposal would also result in a road that is responsive to and integrated with the landscape, providing for a more enjoyable and interesting journey.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

There would be no significant impact on any other aspect of the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

This REF addresses and considers potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the 'avoid, minimise, mitigate and offset' hierarchy. No significant impacts are expected as a result of the proposal. The REF is consistent with the strategic assessment approval and a referral to the Commonwealth Department of the Environment and Energy for these matters is not required.

9 Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.




Michael Drowley
Senior Environmental Scientist
SMEC
Date: 1/12/16



Amy Louis
Manager | Environment, Communications and
Stakeholder Engagement
SMEC
Date: 1/12/16

I have examined this review of environmental factors and accept it on behalf of Roads and Maritime Services.



Julian Watson
Project Development Manager
Roads and Maritime Services Southern Region
Date:

13/08/2016

10 References

- ANZECC & ARMCANZ (2001). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volume 1. The Guidelines.
- Australian Government (1998). National Environment Protection (Ambient Air Quality) Measure. June 1998.
- Artefact (2016a). M1 Mount Ousley Road Climbing Lanes. Stage 2 PACHCI Archaeological Survey Report. November 2016.
- Artefact (2016b). Addendum to the PACHCI Stage 2 Archaeological Survey Report for the M1 Princes Motorway Improvements Project. November 2016.
- Artefact (2016c). M1 Mount Ousley Road Climbing Lanes. Statement of Heritage Impacts. November 2016.
- Biosis (2013). NRE No. 1 Colliery – Underground Expansion Project: Preferred Project Report - Biodiversity. Report for Gujarat NRE Coking Coal Ltd. Authors: N.Garvey & K.Beyer, Biosis Pty Ltd, Wollongong. Project no. 16646
- Bladon, Dickman and Hume (2002) Effects of habitat fragmentation on the demography, movements and social organisation of the eastern pygmy-possum (*Cercartetus nanus*) in northern New South Wales. In Wildlife Research (2002) Vol. 29, pg 105-116.
- DECC (2007). Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region: Volume 1 Background Report, Department of Environment and Climate Change NSW, Hurstville.
- DECC (2008). NSW Department of Environment and Climate Change. Managing Urban Stormwater; 'Soils and Construction' Volume 2D Main road construction. June 2008.
- ERM (2013). Environmental Assessment Report for the Russell Vale Underground Expansion Project at NRE No. 1 Colliery in the Southern Coalfield. Environmental Resources Management Australia.
- DPI (2014). Department of Primary Industry, NSW. Agriculture: Noxious weeds declarations for. Wollongong City Council, Available from <http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed>
- GeoTerra Pty Ltd (2012). NRE No.1 Colliery Major Expansion groundwater assessment Bellambi, NSW.
- GeoTerra Pty Ltd (2016). M1 Princes Motorway Stream, Swamp and Groundwater Assessment Bellambi, NSW. Draft Report for Roads and Maritime Services. 2 June, 2016.
- Hazelton et al. (1990). Wollongong – Port Hacking Soil Landscape Series, Geological Sheet 9029-9129 (1:100,000). Department of Mineral Resources, Sydney.
- Hyder (2015). M1 Princes Motorway - Offline Upgrade from Bellambi Creek and Picton Road. Traffic Modelling and Economic Appraisal. December 2014.
- Landcom (2004). Managing Urban Stormwater; 'Soils and Construction' Volume 1 4th Edition. March 2004.

- Laurance W.F. (1991) 'Predicting the impacts of edge effects in fragmented habitats' *biological Conservation* 55(1): 77-92
- Lesryk Environmental Consultants (2010). Flora and fauna assessment Mt Ousley Climbing Lanes. Prepared for the RTA. Lesryk Environmental Consultants, Bundeena.
- Murcia C. (1995) 'Edge effects in fragmented forests: implications for conservation' *Trends in Ecology and Evolution* 10 (2), 58-62.
- NPWS (2002). Wollongong LGA Bioregional Assessment (Part I): Native Vegetation of the Illawarra Escarpment and Coastal Plain. Report for the Commission of Inquiry into Planning and Development on the Illawarra Escarpment. NSW National Parks and Wildlife Service, Sydney.
- NPWS (2003). The Native Vegetation of the Woronora, O'Hare's and Metropolitan Catchments, NSW National Parks and Wildlife Service, Sydney.
- OEH (2013). New South Wales Office of Environment and Heritage. Atlas of NSW Wildlife, available from: <http://www.bionet.nsw.gov.au>.
- OEH (2016). VIS Classification database. Available from <http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx>
- OEH (2012). Upland Swamp Environmental Assessment Guidelines - Guidance for the underground mining industry operating in the southern coalfield. Draft. NSW Office of Environment and Heritage, August 2012
- OEH (2014). NSW Office of Environment and Heritage. Biobank Assessment Methodology. September 2014.
- RMS (2015). Roads and Maritime Services. NSW Government. Traffic Management – Specification D&C G10. June 2015.
- RTA (2010). Roads and Transport Authority. NSW Government. Traffic Control at Worksites (Version 4). June 2010.
- SMEC (2014). Biodiversity Technical Study M1 Princes Motorway Climbing Lanes. Report prepared for RMS, December 2014.
- SMEC (2016). Mount Ousley Road Stage 1 Biodiversity Assessment. Draft. July 2016.
- Tract Consultants (2016). M1 Princes Motorway improvements. Picton Road to Bulli Tops. Urban design and Visual Impact Assessment. Draft
- WorkCover (2005). NSW Government. Storage and Handling of Dangerous Goods – Code of Practice.

Terms and acronyms used in this REF

Term / Acronym	Description
µm	micrometres
PM ₁₀	Particles with diameters less than or equal to 10 micrometres
AADT	Average annual daily traffic
AAQ	Ambient air quality
ANZECC	Australia and New Zealand Environment Conservation Council
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ASL	Above sea level
BBAM	BioBanking Assessment Methodology
CBD	Central business district
CCTV	Close circuit television
CEMP	Construction environmental management plan
DLWC	NSW Department of Land and Water Conservation
DP&I	Department of Planning and Infrastructure
EEC	Endangered ecological communities
EIA	Environmental impact assessment
ENMM	Environmental Noise Management Manual
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPP	Eastern Pygmy-possum
EIS	Environmental impact statement
EPL	Environment Protection Licence

Term / Acronym	Description
ESCP	Erosion and sediment control plan
ESMR	Erosion and sedimentation management report
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
GHG	Greenhouse gas
GPS	Global positioning system
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
ICNG	<i>Interim Construction Noise Guideline</i>
ICOMOS	Burra Charter of Australia's International Council on Monuments and Sites
IELA	Illawarra Escarpment Landscape Area
IESCA	Illawarra Escarpment State Conservation Area
ILALC	Illawarra Local Aboriginal Land Council
IPCC	Intergovernmental Panel on Climate Change
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
ITS	Intelligent transport systems
kV	Kilo volts
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
LTTMP	NSW Long Term Transport Master Plan
LUDP	Landscape and Urban Design Plan
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
NAHMP	Non-Aboriginal heritage management plan
NEPM	National Environment Protection Council

Term / Acronym	Description
NML	Noise management level
NorBE	Neutral or Beneficial Effect on Water Quality
NOW	NSW Office of Water
Noxious Weeds Act	<i>Noxious Weeds Act 1993 (NSW)</i>
NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
NPWS	National Parks and Wildlife Service
NRSS	National Road Safety Strategy 2011–2020
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PAD	Potential archaeological deposits
PHA	Preliminary hazard analysis
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
REF	Review of environmental factors
RFS	NSW Rural Fire Service
Roads and Maritime	NSW Roads and Maritime Services
ROTAP	Rare or threatened Australian plants
SEPP	State Environmental Planning Policy. A planning instrument made under Part 3 of the EP&A Act.
SHR	State Heritage Register
SMEC	SMEC Australia Pty Ltd
SOHI	Statement of Heritage Impact
SIS	Species impact statement
TMP	Traffic Management Plan
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>
TSP	Total suspended solids
UDVIA	Urban Design and Visual Impact Assessment
VIS	Vegetation Information System
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2007</i>

Term / Acronym	Description
Wollongong LEP	Wollongong Local Environment Plan 2009

Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance

Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000*, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
<p>a. Any environmental impact on a community?</p> <p>Construction of the proposal would result in short term negative impacts on the local community, as discussed in Section 6. Potential impacts include traffic and transport delays, local traffic changes, and changes to accessibility. As a substantial proportion of the proposal would consist of a new alignment, the proposal would largely be constructed off-line which would minimise construction traffic impacts. Alternative access arrangements (detailed in the CTMP) would be provided to ensure that access is available at all times.</p> <p>Long term positive impacts would include increased road capacity for all road users and improved safety.</p>	<p>Short term negative</p> <p>Long term positive</p>
<p>b. Any transformation of a locality?</p> <p>The proposal would result in the removal of native vegetation recorded within the construction footprint, deemed to be a direct impact. The proposal would result in the removal of 28.29 hectares of remnant native vegetation and 20.01 hectares of highly modified vegetation (including roadside plantings, cleared areas and exotic dominated vegetation). A revegetation sub-plan will be prepared as part of the Construction Flora and Fauna Management Plan, following project approval. Batters, embankments, verges and redundant areas would be planted out, where practicable, with indigenous species.</p> <p>Visual impacts of the proposal on the locality would be reduced through the implementation of safeguards and management measures outlined in Section 7.2. Generally the visual impact of the proposal was assessed as low, with impacts at three viewpoints “low” or “negligible” and at the remaining two viewpoints was “low-moderate”.</p> <p>The transformation is justified by the improvement to traffic flow and improved road safety that would be achieved by the proposal.</p>	<p>Short term moderate negative</p> <p>Short term minor negative</p>
<p>c. Any environmental impact on the ecosystems of the locality?</p> <p>The proposal would involve clearing of native vegetation to facilitate construction activities. The seven-part tests prepared concluded that the proposal is unlikely to have a significant impact. Impacts on protected fauna would be minimised through the implementation of the safeguards and management measures in Section 7.2.</p>	<p>Long term minor negative</p>

Factor	Impact
<p>d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</p> <p>The proposal would result in the M1 Princes Motorway having an increased footprint in the locality. The proposal would alter the aesthetic of the Motorway in the current location (through sections of cuttings, fills and cleared vegetation). A Landscape and Urban Design Plan (LUDP) will be prepared to support the final detailed project design and implemented as part of the CEMP to provide for an improved Motorway appearance. A revegetation sub-plan will be prepared as part of the Construction Flora and Fauna Management Plan, following project approval. The revegetation plan will detail the vegetation to be planted throughout the study area.</p> <p>The short-term reduction in aesthetic and environmental quality is justified by the improvement to traffic flow and improved road safety that would be achieved by the proposal.</p>	<p>Short term minor negative</p>
<p>e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?</p> <p>In accordance with Roads and Maritime Stage 2 PACHCI guidelines, the assessment established that the entire study area has low archaeological significance and no previously recorded Aboriginal sites and/or places are located within the boundaries of the construction impact area or the wider field survey area. No areas of archaeological potential were identified during the field survey. The impact assessment has therefore found that there would be no impact to known Aboriginal sites and/or places or identified areas of potential under the proposal.</p> <p>Overall, the Stage 1 proposal would have minor impacts on two locally listed Non-Aboriginal heritage items within the study area and would have direct impacts on two items associated with the unlisted former alignment of Mount Ousley Road. There are unlikely to be impacts to archaeological remains as a result of the proposal.</p>	<p>Short term nil</p> <p>Short term nil</p>
<p>f. Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?</p> <p>The proposal would result in the removal of 28.29 hectares of remnant native vegetation and 20.01 hectares of highly modified vegetation (including roadside plantings, cleared areas and exotic dominated vegetation). Of the 28.29 hectares of remnant native vegetation 2.27 hectares is EEC (Coastal Upland Swamp Habitat) and the remaining 26.02 hectares is moderate to good condition native vegetation. The seven-part tests prepared concluded that the proposal is unlikely to have a significant impact. Impacts on protected fauna would be minimised through the implementation of the safeguards and management measures in Section 7.2.</p>	<p>Long term negative</p>

Factor	Impact
<p>g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</p> <p>The proposal is unlikely to endanger any species or plant or animal. The seven-part tests prepared concluded that the proposal is unlikely to have a significant impact. Impacts on protected fauna would be minimised through the implementation of the safeguards and management measures in Section 7.2.</p>	<p>Long term neutral</p>
<p>h. Any long-term effects on the environment?</p> <p>Long term positive impacts would include increased road capacity for all road users and improved safety.</p> <p>The proposal would result in the removal of 28.29 hectares of remnant native vegetation.</p>	<p>Long term positive</p> <p>Long term negative</p>
<p>i. Any degradation of the quality of the environment?</p> <p>The proposal would be constructed primarily within the highway road corridor. However, the proposal would result in the removal of 28.29 hectares of remnant native vegetation</p> <p>Water quality during construction could be reduced as a result of pollutants such as sediment, soil nutrients and waste entering drainage lines and waterways particularly during high rain events. Construction in and around Bellambi and Cataract Creeks may also have the potential to impact on water quality. Spillage of fuel during refuelling and leakage of hydraulic and lubricating oil from plant and equipment or rinse water from plant washing and concrete slurries would also have the potential to enter waterways. During construction, temporary mitigation measures would be implemented to reduce the potential impacts to water quality (refer Section 6.3.4).</p> <p>Air quality, noise and traffic impacts would result from the construction and operation phases of the proposal. These impacts would be minimised through the implementation of safeguards outlined in Section 7.2.</p>	<p>Long term negative</p> <p>Short term negative</p> <p>Short term negative</p>
<p>j. Any risk to the safety of the environment?</p> <p>There is potential for road safety to be decreased during construction due to the need for works to be undertaken adjacent to live traffic. Traffic and access management safeguards outlined in Section 7.2 and include the preparation of a TMP which would address safety risks during construction.</p> <p>Other potential risks during construction include the accidental releases or improper transporting, handling and storage of hazardous substances within the construction impact area. Potential rupture or interference with underground services may also occur during construction. Proposal specific management measures for hazards and risks are detailed in Section 7.2. A site specific Hazard and Risk Management plan will also be incorporated within the CEMP</p> <p>The proposal would improve road safety during operation as the proposal would provide additional capacity and improved alignment and line of sight.</p>	<p>Short term negative</p> <p>Short term negative</p> <p>Long term positive</p>

Factor	Impact
<p>k. Any reduction in the range of beneficial uses of the environment?</p> <p>The proposal would result in the acquisition of around 29 hectares on land currently owned by Wollongong Coal, WaterNSW and Energy Australia (Refer to Section 3.7).</p> <p>No commercial businesses would be impacted as a result of the proposal.</p>	<p>Short term minor negative Nil</p>
<p>l. Any pollution of the environment?</p> <p>The proposal would result in minor short term air pollution from plant and machinery and the generation of dust during construction. The proposal would have the potential to generate pollution in adjacent Bellambi and Cataract Creeks as a result of construction activities.</p> <p>There is potential for chemical and fuel spills to occur during construction. Pollution risks associated with construction of the proposal would be managed through the implementation of the safeguards and management measures outlined in Section 7.2.</p>	<p>Short term negative Short term negative</p>
<p>m. Any environmental problems associated with the disposal of waste?</p> <p>Waste generated during construction would primarily be from civil works associated with site preparation, relocation of utilities, construction of road infrastructure and landscaping as outlined in Section 3.3. 340,000 cubic metres of material (soil and rock) would be excavated during the proposal.</p> <p>A site-specific Materials Management Plan is to be prepared by the construction contractor prior to the commencement of relevant site works. The materials management plan is to ensure that wastes are properly managed during construction in a way that it is consistent with the principles of avoidance, reduction, reuse and recycling.</p>	<p>Short term negative</p>
<p>n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</p> <p>The proposal would make use of standard building materials and all resources required for the proposal are readily available and are not in short supply.</p>	<p>Neutral</p>
<p>o. Any cumulative environmental effect with other existing or likely future activities?</p> <p>The proposal is likely to generate some cumulative effects as a result of multiple construction activities underway at a similar time or in quick succession. Impacts would generally be limited to traffic and transport. Once completed, the cumulative impact of the multiple road upgrades in the area would result in reduced congestion and improved accessibility in the immediate region.</p>	<p>Short term negative</p>
<p>p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</p> <p>The proposal would not impact on coastal processes and coastal hazards.</p>	<p>Nil</p>

Matters of National Environmental Significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
a. Any impact on a World Heritage property?	Nil
b. Any impact on a National Heritage place?	Nil
c. Any impact on a wetland of international importance?	Nil

<p>d. Any impact on a listed threatened species or communities? Significance assessments for all species listed under the EPBC Act which were found to occur, or have potential to occur, in the study area are provided in the Biodiversity Technical Study in Appendix H. Communities and species listed under the EPBC Act which were found to occur, or have potential to occur, in the study area are:</p> <ul style="list-style-type: none"> • Coastal Upland Swamp Endangered Ecological Community • <i>Heleioporus australiacus</i> (Giant Burrowing Frog) • <i>Litoria littlejohni</i> (Littlejohn's Tree Frog) • <i>Pseudophryne australis</i> (Red-crowned Toadlet) • <i>Calyptorhynchus lathamii</i> (Glossy Black-Cockatoo) • <i>Callocephalon fimbriatum</i> (Gang Gang Cockatoo) • <i>Petroica boodang</i> (Scarlet Robin) • <i>Petroica phoenicea</i> (Flame Robin) • <i>Daphoenositta chrysoptera</i> (Varied Sittella) • <i>Glossopsitta pusilla</i> (Little Lorrikeet) • <i>Hieraaetus morphnoides</i> (Little Eagle) • <i>Ninox strenua</i> (Powerful Owl) • <i>Tyto tenebricosa</i> (Sooty Owl) • <i>Tyto novaehollandiae</i> (Masked Owl) • <i>Myotis macropus</i> (Southern Myotis) • <i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle) • <i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing Bat) • <i>Mormopterus norfolkensis</i> (Eastern Freetail Bat) • <i>Platyrrhinus vittatus</i> (Greater Broad-nosed Bat) • <i>Cercartetus nanus</i> (Eastern Pygmy-possum) • <i>Petaurus australis</i> (Yellow-Bellied Glider) • <i>Petauroides volans</i> (Greater Glider) • <i>Pteropus poliocephalus</i> (Grey-headed Flying-fox) • <i>Hoplocephalus bungaroides</i> (Broad-headed Snake) • <i>Varanus rosenbergi</i> (Rosenberg's Goanna) • <i>Monarcha melanopsis</i> (Black-faced Monarch) • <i>Rhipidura rufifrons</i> (Rufous Fantail) <p>These assessments were undertaken with consideration of the extent and nature of the proposal, the likely loss of 28.29 hectares of vegetation and under the assumption that the identified safeguards and mitigation measures would be implemented. The assessments concluded that EPBC listed communities and species would not be significantly impacted by the proposal if the adopted safeguards and mitigation measures are implemented.</p>	<p>Nil</p>
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Factor	Impact
e. Any impacts on listed migratory species?	Nil
f. Any impact on a Commonwealth marine area?	Nil
g. Does the proposal involve a nuclear action (including uranium mining)?	Nil
Additionally, any impact (direct or indirect) on Commonwealth land?	Nil

Appendix B

Statutory consultation checklists

Infrastructure SEPP

Council related infrastructure or services

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Stormwater	Are the works likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No	Wollongong City Council Refer to Table 5.2	ISEPP cl.13(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will <i>strain</i> the existing road system in a local government area?	No	Refer to Table 5.2	ISEPP cl.13(1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No	Refer to Table 5.2	ISEPP cl.13(1)(c)
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a <i>substantial</i> volume of water?	No	Refer to Table 5.2	ISEPP cl.13(1)(d)
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	No	Refer to Table 5.2	ISEPP cl.13(1)(e)
Road & footpath excavation	Will the works involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Refer to Table 5.2	ISEPP cl.13(1)(f)

Local heritage items

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the item/area are more than <i>minor</i> or <i>inconsequential</i> ?	Yes	Wollongong City Council	ISEPP cl.14

Flood liable land

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a <i>minor</i> extent?	No	Wollongong City Council	ISEPP cl.15

Public authorities other than councils

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> ?	Yes	Office of Environment and Heritage	ISEPP cl.16(2)(a)
Marine parks	Are the works adjacent to a declared marine park under the <i>Marine Parks Act 1997</i> ?	No	Department of Planning and Environment	ISEPP cl.16(2)(b)
Aquatic reserves	Are the works adjacent to a declared aquatic reserve under the <i>Fisheries Management Act 1994</i> ?	No	Office of Environment and Heritage	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the <i>Sydney Harbour Foreshore Authority Act 1998</i> ?	No	Department of Planning and Environment	ISEPP cl.16(2)(d)
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	ISEPP cl.16(2)(f)

Project benefits

- Increase safety by separating slow and fast moving vehicles
- Remove low standard curves along the road
- Improve travel time and efficiency through additional lane capacity
- Make the road straighter
- Increase reliability of access into and out of the Illawarra region and Port Kembla for general freight and large vehicles.

Features of the new road

- Three metre shoulders next to the new lanes
- Reduced steepness compared with the current road
- Improved drainage
- Three lanes in each direction between Bulli Tops and Picton Road.

Next steps

A concept design and review of environmental factors (REF) for the project are being prepared. The REF will include investigations on biodiversity, visual impact, Aboriginal heritage and non-Aboriginal heritage.

Roads and Maritime will continue to keep the community updated as the project progresses.

Further information and feedback

For more information about the project, please contact the Roads and Maritime project team:

Post: M1 improvements, Bulli Tops to Picton Road
Project Manager
PO Box 477
Wollongong NSW 2520

Email: SouthernProjects@rms.nsw.gov.au

Phone: 02 4221 2515

Web: rms.nsw.gov.au/projects



This document contains important information about road projects in your area. If you require the services of an interpreter, please contact the Translating and Interpreting Service on 131 450 and ask them to call the project team on 02 4221 2515. The interpreter will then assist you with translation.

Existing M1 Princes Motorway looking north



Australian Government

BUILDING OUR FUTURE



M1 Princes Motorway improvements

Bulli Tops to Picton Road

October 2015

The Australian and NSW Governments have jointly committed \$84 million for improvements to the M1 Princes Motorway between Bulli Tops and Picton Road.

Background

The M1 Princes Motorway between Picton Road and Bulli Tops is currently two lanes in each direction.

This section of road carries about 37,000 vehicles a day, 15 percent of which are heavy vehicles. Traffic numbers will continue to increase along this route.

Due to the steepness of the road and the tight turns, heavy vehicles have a slow uphill travel speed, which can lead to a large difference in speeds between light vehicles and heavy vehicles.

The project

The project will provide additional lanes and straighten out the road to improve safety, capacity and efficiency.

Stage one

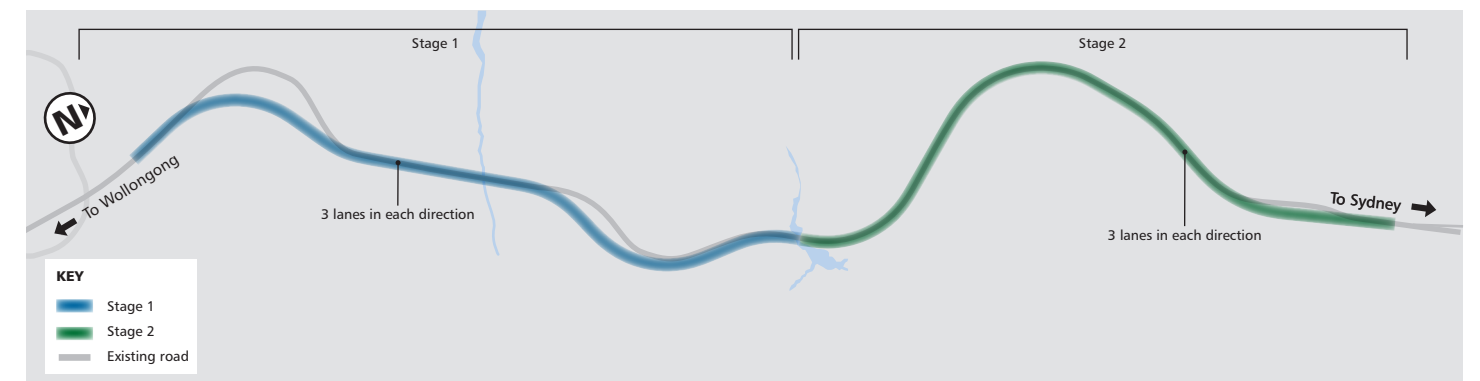
The first stage of the project will provide an additional lane in each direction of the M1 between Picton Road and Bellambi Creek. The tight curves on the existing M1 north of Picton Road and south of Bellambi Creek will be improved to increase safety and efficiency.

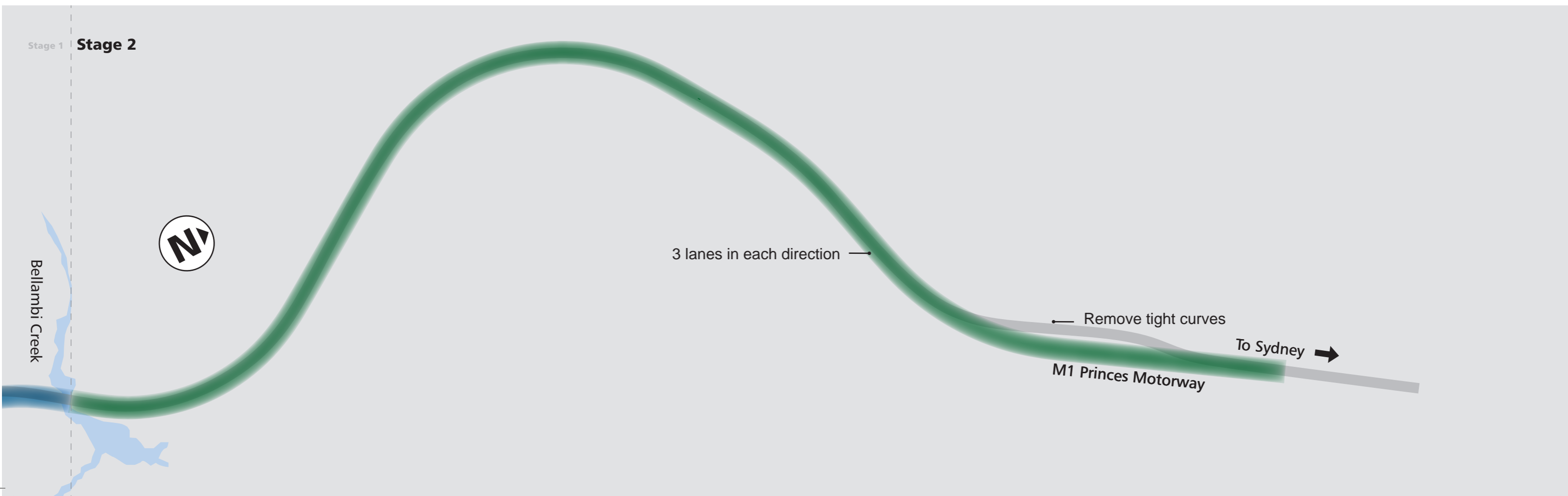
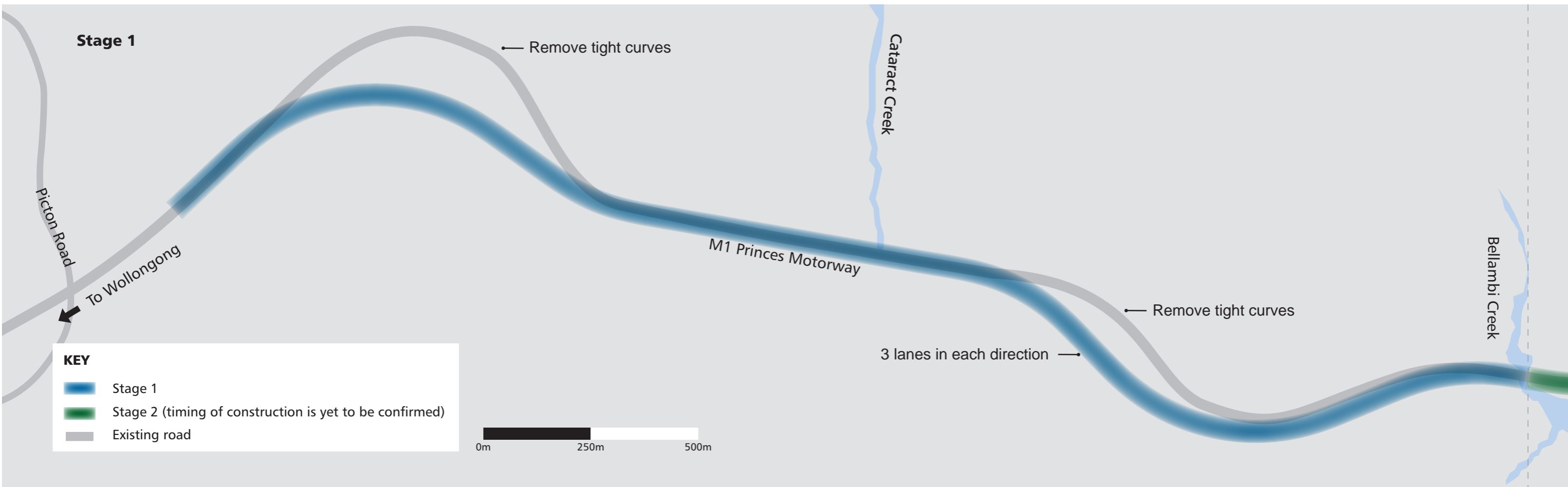
We are currently in the planning and design stages of this project and plan to start construction of stage one in mid 2017.

Stage two

The second stage of the project will link directly into stage one and will provide an additional lane in each direction between Bellambi Creek and Bulli Tops.

The planning and design for stage two will be carried out with stage one. The timing of construction of stage two is yet to be confirmed.





M1 Princes Motorway Survey

Project background

The Australian and NSW Governments have jointly committed \$84 million for improvements to the M1 Princes Motorway between Bulli Tops and Picton Road.

The first stage of the project will provide an additional lane in each direction of the M1 between Picton Road and Bellambi Creek.

The tight curves on the existing M1 north of Picton Road and south of Bellambi Creek will be improved to increase safety and travel times.

We are currently in the planning and design stages of this project and plan to start construction of stage one in mid-2017.

Survey

Roads and Maritime Services carried out a survey to help gauge sentiment for the project from heavy vehicle drivers who regularly travel this stretch.

The survey was carried out at the informal rest area located at the intersection of Clive Bissel Drive and the M1 Princes Motorway, Mount Ousley.

Heavy Vehicle drivers regularly frequent this rest area to utilise the coffee van located here.

The survey was carried out on four separate occasions throughout April and May at differing times of the day.

It was found that the best time to frequent the rest area was early morning when far more heavy vehicle drivers were likely to stop for a break.

A total of forty people were surveyed across this period with 36 respondents driving a heavy vehicle and a further four respondents driving a car.

The survey helped the project team –

- Measure support for the project from heavy vehicle drivers
- Gather information on any concerns regarding the project
- Measure perception of safety and traffic flow on this stretch of the M1 Princes Highway
- Allow interested commuters an opportunity to receive further information regarding the project.

Results

The survey demonstrated clear support for the project with 100 percent of respondents being in favour of the works.

Over 50 percent of respondents felt safety on the Princes Highway between Bulli Tops and Picton Road was 'fair' while over 20 percent rated safety on this stretch as poor.

Sixty two percent of respondents rated traffic flow as 'fair' in this area with 23 percent of those surveyed rating flow as 'good'.

Seven respondents said they had concerns regarding the project with three of these people highlighting the potential for traffic delays during construction.

Other concerns included the fact that heavy vehicles would still be required to merge at some point and the gradient of the hill.

It is important to note that those that all of the respondents that highlighted a concern still demonstrated strong support for the project.

Only two respondents wished to be kept informed of future news regarding the project with the vast majority of participants expressing a wish for works to commence immediately.

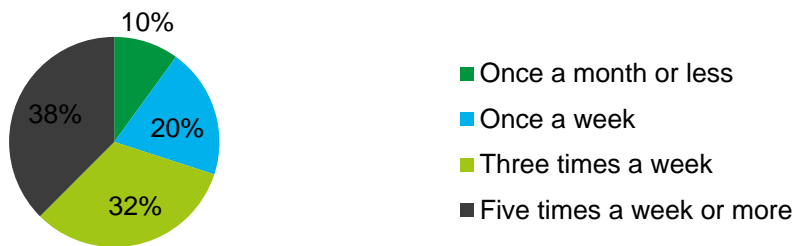


Survey

How often do you travel on the M1 Princes Motorway between Bulli Tops and Picton Road?

- Once a month or less - Four
- Once a week – Eight
- Three times a week - 13
- Five times a week or more – 15

How often do you travel the M1 Princes Motorway



What type of vehicle do you drive?

- Motorbike
- Car - Four
- Heavy Vehicle – 36

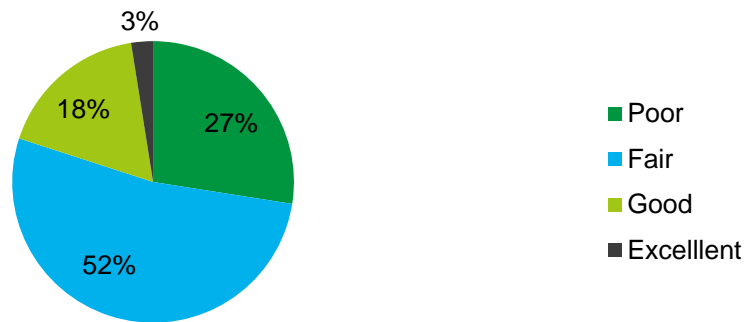
What type of vehicle do you drive



How would you rate safety on this stretch of road?

- Poor - 11
- Fair - 21
- Good - Seven
- Excellent – One

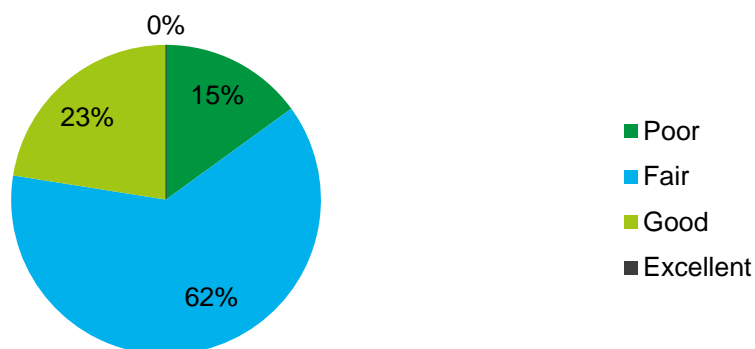
How would you rate safety on this stretch of road



How would you rate traffic flow on this stretch of road?

- Poor - Six
- Fair - 25
- Good - Nine
- Excellent

How would you rate traffic on this stretch of road



Do you support the upcoming upgrade works providing an additional lane in each direction of the M1 Motorway between Picton Road and Bellambi Creek?

- Yes - 40
- No - 0

Do you support the upcoming works...



Do you have any concerns about the upcoming upgrade works?

- Yes - Seven
- No – Zero

Do you have any concerns about the upcoming works



If you selected yes, please outline any issues or concerns below

- Still have to merge at some point
- Need to remove the gradient of the hills
- Need to improve section just past Picton Road – goes from three lanes to two and then back to two in a short time
- Eventual merging
- Need to fix just south of Picton Road
- Worse traffic during road works
- Mild inconvenience during roadworks
- Traffic delays during construction



27 November 2015

Contact person: Ted Collins

The General Manager
Wollongong City Council
41 Burelli Street
Wollongong NSW 2500

Dear Mr Farmer,

Invitation to comment – proposed M1 Princes Motorway Improvements, Picton Road to Bulli Tops

Roads and Maritime Services proposes to undertake improvements to sections of the M1 Princes Motorway between Picton Road and Bulli Tops, including improvements to alignment and the addition of a third travel lane in each direction. It is proposed to undertake the works in two stages. Stage 1, between Picton Road and Bellambi Creek, is currently jointly funded by the NSW Government and Australian Government for development and construction. Stage 2, between Bellambi Creek and Bulli Tops, is currently funded for planning and environmental approval. The planning, design and environmental assessment for Stages 1 and 2 is being undertaken together.

Previous discussion on this section of the M1 Princes Motorway between Roads and Maritime and Wollongong City Council includes concerns raised by Council regarding potential safety issues related to the interaction between faster moving vehicles and slower moving (typically heavy) vehicles (see attached letter). Roads and Maritime considers that the proposed M1 Improvements project will substantially address these concerns through improvements to alignment and additional travel lanes.

Under the State Environmental Planning Policy (Infrastructure) 2007, Roads and Maritime Services is required to consult with Wollongong City Council under clause 14 due to the potential impacts on the Illawarra Escarpment State Conservation Area, as part of Stage 2. In addition, Roads and Maritime seeks feedback on regarding the project so as to be able to inform the project's design and development phase, and to offer a briefing to staff and Councillors.

A review of environmental factors (REF) is currently being prepared to assess the likely impacts of the proposal under Part 5 of the *Environmental Planning and Assessment Act, 1979*. Roads and Maritime invites Council's comment and advise of any interests, concerns or statutory requirements relating to the proposal. Comments received will be considered in the REF.

This section of the M1 Princes Motorway has an average annual daily traffic (AADT) of around 37,000 vehicles is a four lane road with a central median divide, and has a posted vehicle speed limit of 100 kilometres per hour for the majority of its length. The proposal is located north of the Picton Road interchange and is used by a high proportion of heavy vehicles (around 15 to 20 per cent of AADT) due to its access and transport function for freight between Port Kembla, Sydney (including South West Sydney) and northern Illawarra collieries. The improvement works would involve the addition of travel lanes in each direction as well as improved road alignment.

The methods used to construct the proposal would be conventional techniques employed on road projects, adapted to account for project-specific environmental and social constraints, and would involve the following construction activities:

- Site establishment and site preparation
- Relocation/protection of services
- Earthworks
- Temporary and permanent drainage provision
- Construction of pavement layers
- Installation of safety barriers, lighting, fencing and roadside furniture, line marking and raised pavement markers and sign posting
- Rehabilitation of disturbed areas

Site compounds would be required for the proposal acting as a centre for construction coordination and communication, employee and visitor amenities and car parking. Site compounds would also accommodate stockpiles and provide storage areas for plant and equipment, construction materials, and pre-cast components. Existing hardstand areas are likely to be utilised wherever possible, such as at the Picton Road interchange or remnant road alignments at Bellambi Creek.

It is anticipated that construction of the proposal would be undertaken both during and outside of standard working hours. Standard hours adopted by RMS are as follows:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and Public Holidays: no work.

It should be noted that in an effort to minimise impacts to the travelling public, and noting the lack of residences in the project extent, these hours may vary depending on the construction methods and staging procedures undertaken.

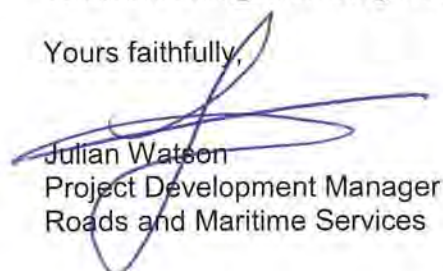
Owing to the high levels of traffic on this section of the road network, construction would also be undertaken outside normal working hours to minimise traffic impacts. Due to the location of the proposal, out of hours works are not anticipated to impact on sensitive noise receivers.

The works would be undertaken adjacent to WaterNSW scheduled lands and Illawarra Escarpment State Conservation Area, and partially located on land reserved under the *National Parks and Wildlife Act 1974* (Stage 2 only). A Neutral or Beneficial Effect (NorBE) assessment will also be undertaken in accordance with the requirements of the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 and the 'Neutral or Beneficial Effect on Water Quality Assessment Guidelines' (SCA, 2011). The REF will provide an assessment of key potential impacts of the proposal, and establish safeguards and mitigation measures to manage any potential for impact on the adjoining lands. In particular, mitigation for biodiversity, sediment and erosion control and traffic impacts would be established.

To assist in your response, please find attached a community update showing the location of the proposal and preliminary alignment. Further information on the project can also be found on the project website, <http://www.rms.nsw.gov.au/projects/illawarra/m1-princes-motorway-picton-rd-bullitops/index.html>

To enable consideration of your comments in the REF, a written response would be appreciated by January 11 2016. RMS would be pleased to provide further information if required, including briefing or meetings with Council. Julian Watson may be contacted on 02 4221 2515 or by email Julian.Watson@rms.nsw.gov.au.

Yours faithfully,


Julian Watson
Project Development Manager
Roads and Maritime Services

27/Nov/2015

Drowley, Michael

From: WATSON Julian R <Julian.WATSON@rms.nsw.gov.au>
Sent: Thursday, 13 October 2016 1:44 PM
To: Drowley, Michael
Subject: FW: WOLLONGONG CITY COUNCIL COMMENTS - PROPOSED M1 PRINCES MOTORWAY IMPROVEMENTS - PICTON ROAD TO BULLI TOPS.

Importance: High

From: Ted Collins [mailto:TCollins@wollongong.nsw.gov.au]
Sent: Monday, 11 January 2016 4:52 PM
To: WATSON Julian R
Cc: Peter Nunn; Walter Galvan; Naomi Reid; Mark Grimson
Subject: WOLLONGONG CITY COUNCIL COMMENTS - PROPOSED M1 PRINCES MOTORWAY IMPROVEMENTS - PICTON ROAD TO BULLI TOPS.
Importance: High

The Regional Manager
Roads & Maritime Services
PO Box 477
WOLLONGONG EAST 2520

11 January 2016
Our Ref: File: IW-910.30.01

Attention: Julian Watson.

Dear Sir.

WOLLONGONG CITY COUNCIL COMMENTS - PROPOSED M1 PRINCES MOTORWAY IMPROVEMENTS - PICTON ROAD TO BULLI TOPS.

I refer to your letter to Council dated 27 November 2015 with an invitation to comment on the proposed M1 upgrade. Council appreciates this opportunity given.

Council is pleased to support this NSW State government and RMS initiative that has obvious road safety and regional economic benefits. In particular, the existing heavy/light vehicle potential conflicts just north of Picton Road as raised in Council's letter to RMS dated 2 March 2010 now appear to be adequately addressed by this subject project. Whilst there appears to be a commitment for Stage One of the project, Council looks forward to confirmation of a commitment to Stage Two.

However, in addition to the above comments, Council wishes to raise with RMS the urgent need for a third downhill lane on Mount Ousley. The downhill road capacity and poor safety record on this section of arterial road appears exacerbated by the steep grades and sharp horizontal alignment that "hide" slow moving heavy vehicles in the kerbside lane. Largely due to this poor road geometry, many cars are trapped behind the heavy vehicles and pull out into the "fast" lane with a high level of risk. Light vehicles aquaplaning on this downhill section of Mount Ousley is also a concern. As I understand, the "Third Downhill Lane" on Mount Ousley is associated with the Interchange project at the base of Mount Ousley, however, Council is taking this opportunity to raise the need for urgent priority to be given for the advancement of planning, design and commitment to construction of a third lane at this location also.

Again, thank you for the opportunity to comment on this project and your offer to brief Council at a future date. I will contact you in due course should Council Executive request a briefing.

Yours Sincerely,

Ted Collins | WOLLONGONG CITY COUNCIL

Transport & Stormwater Services Manager (*Acting*)

Infrastructure Strategy & Planning Division

41 Burelli Street | Locked Bag 8821 | Wollongong DC NSW 2500 | Australia

Ph: (02) 4227 7106

Email: tcollins@wollongong.nsw.gov.au

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