

# Barton Highway Upgrade: Duplication of the Barton Highway from the ACT border towards Murrumbateman

Review of Environmental Factors

Roads and Maritime | November 2019





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Prepared by AECOM Australia Pty Ltd and Roads and Maritime  
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# Executive summary

The Barton Highway is a rural highway linking the southern and western areas of New South Wales (NSW) to the Australian Capital Territory (ACT). It connects the Hume Highway to the Federal Highway providing a key road link between Canberra, southern and western areas of NSW and Melbourne, Victoria.

## The proposal

Roads and Maritime Services proposes to duplicate around eight kilometres of the Barton Highway from about 700 metres south of the NSW/ACT border towards Murrumbateman. The upgrade would be from a two lane two way carriageway (one lane in each direction) to a four lane dual carriageway (two lanes in each direction) with a central median.

The proposal is subject to assessment under two planning pathways, a review of environmental factors (REF) under Division 5.1 of Environmental Planning and Assessment Act 1979 (EP&A Act) and a Works Approval under Part 12 of the Australian Capital Territory (Planning and Land Management) Act 1988 (P&LM Act). The majority of the proposal is subject to this REF. However, from the NSW/ACT border south to the existing dual carriageway in Hall, ACT, it is located within Designated Land. As such, that part of the proposal (known as the ACT proposal) is subject to the requirements of the National Capital Plan.

Key features of the proposal include:

- Providing a new two lane northbound carriageway from south of the NSW/ACT border towards Murrumbateman on the western side of the existing Barton Highway
- Modifying the existing Barton Highway to provide a two lane southbound carriageway from south of the NSW/ACT border towards Murrumbateman
- Providing a central median separating the two carriageways
- Modifying impacted intersections and property access roads to provide safe access to the highway
- Providing dedicated U-turn facilities at about one kilometre intervals to manage right turn movements
- Improving existing bus stops with accessible shelters and safe parking areas at Spring Range Road and Nanima Road
- Demolishing a residential property and all farm infrastructure in the construction boundary
- Modify the heavy vehicle enforcement bay south of Nanima Road by providing new deceleration and acceleration lanes
- Removing the rest area at the NSW/ACT border
- Providing safety barriers where required
- Providing drainage line crossings including creek crossings at Gooromon Ponds and Little Bedulluck Creek
- Relocating and protecting utilities within the construction boundary
- Establishing temporary compound areas and stockpile sites throughout construction
- Additional work including earthworks, improving street lighting, new street furniture, replacing signage, resealing, line marking, and upgrades to kerbs.

The proposal forms a significant part of the Barton Highway Improvement Strategy 2017, which was prepared in partnership with the Australian and NSW governments and aims to provide an efficient and safe highway to cater for the increasing traffic volume between Yass, Murrumbateman and Canberra.



Benefits to all road users include:

- Safer travel for all modes of transport
- Reduced travel times
- Transport efficiency
- More consistent and reliable travel
- Safer conditions for local communities.

The proposal forms part of a series of proposed upgrades of the Barton Highway between the NSW/ACT border and the existing dual carriageway south of Yass.

The proposal is jointly funded by the Australian and NSW governments and is to be developed in stages. Subject to planning approval, construction is expected to start late 2020 and be completed in 2023.

## Need for the proposal

The Barton Highway is part of the National Land Transport Network as well as the national Key Freight Route Network and is important for freight movements between Canberra, Melbourne, and southern and western NSW. The Barton Highway is also an essential commuter link between Canberra, Murrumbateman, Yass and the broader Yass Valley/Riverina area. More than 13,000 vehicles per day currently use the Barton Highway, and traffic numbers are forecast to rise with the expected population growth of the Yass Valley local government area (LGA).

The posted speed limit within the construction boundary is 100 km/h. The average travel speed within the construction boundary is between 89 km/h and 93 km/h, except during the morning southbound peak when the travel speed can fall to 86 km/h.

The level of service of roads is classified from levels A to F, with level of service 'A' representing the best operating conditions and 'F' the worst. The level of service along the Barton Highway currently varies from C to E during the day, depending on the location and the number of vehicles using the highway. Barton Highway is a 4R road and should operate at level of service C.

There are no viable alternative routes for planned or unplanned closures of the highway. This limits the opportunities for road maintenance and leads to significant disruption in the event of incidents.

The Barton Highway Improvement Strategy highlights a number of design deficiencies which impact highway safety. Between 2013 and 2017 within the construction boundary, the highway had a casualty crash rate of about 0.3 crashes per kilometre per year, which is higher than the national crash rate of 0.2 crashes per kilometre per year for comparable roads in NSW. During this period there were 17 crashes along the eight kilometre stretch.

The proposal will:

- Increase capacity of this key transport route to cater for current and future freight movements
- Improve road efficiency to support commuter growth from Murrumbateman, Yass Valley and Canberra
- Improve road safety by upgrading intersections, reducing traffic conflicts, relocating bus stops to safer locations, providing safer U-turn facilities and allowing for future upgrades
- Allow continued service during planned or unplanned closures.

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<sup>1</sup> Two-lane two-way undivided road with overtaking lanes which caters for an average annual daily traffic of 10,000 vehicles and average daily heavy vehicles of 1000 vehicles as set out in the Roads and Maritime Network and Corridor Practice Notes, 2008.

## Proposal objectives

The proposal's key objectives are to:

- Reduce travel times and improve travel time reliability for all road users and freight movement between Yass, the ACT, and southern and western NSW
- Reduce crash rates along the highway to provide a safer and more reliable journey for road users.

These proposal objectives support the following secondary objectives:

- Reduce impact to travel times and freight efficiency from detours resulting from traffic incidents on the Barton Highway
- Improve workplace health and safety for road maintenance activities by reducing conflicts between high speed traffic and road maintenance teams.

## Options considered

The *Preferred Road Corridor Boundaries Report* (Roads and Maritime, 2011a) set out the proposed road corridor boundaries for future duplication of the highway and determined which side of the existing highway the proposal should be built. The road corridor is included in the *Yass Valley Local Environmental Plan 2013*.

The proposal's design concentrated on the development of specific options within the published road corridor. The design involved repeated investigation, identification, evaluation and refinement of individual road network improvements. Providing a new Barton Highway alignment outside of the existing road corridor was not adopted, as this would not be consistent with relevant strategic plans and would introduce several new impacts to areas not currently affected by a road corridor.

Eight road design options and a 'do nothing' option were considered at the feasibility stage. The preferred option for the overall upgrade of Barton Highway was selected by evaluating options against the proposal objectives, traffic modelling and the environmental constraints identified within and adjacent to the road corridor.

Design refinements were considered in response to specialist investigations and community feedback. These refinements further reduced the environmental impact, particularly by narrowing the design through the Hall Travelling Stock Reserve (TSR) to minimise biodiversity impacts.

Various intersection designs were considered and land acquisition was carried out for future intersection upgrades.

Assessed impacts within this REF are based on reference designs for the proposal. These impacts will be further refined during the detailed design phase. Property impacts, access options and potential adjustments would be confirmed during detailed design in consultation with property owners and be subject to further environmental assessment.

## Statutory and planning framework

The proponent and determining authority for the proposal is Roads and Maritime Services under Clause 94 and Clause 68(4) of the *State Environmental Planning Policy (Infrastructure) 2007* which states the proposal may be carried out without the need for development consent. The proposal is therefore subject to assessment and determination under Division 5.1 of the *EP&A Act*.

This REF fulfils Roads and Maritime's obligation under Section 5.5 of the *EP&A Act* to examine and consider to the fullest extent possible all matters affecting, or likely to affect, the environment by reason of the activity. This REF also addresses the relevant considerations of the *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act), *Heritage Act 1977*, *National Parks and Wildlife Act 1974*, and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proposal is a scheduled activity under the *Protection of the Environment Operations Act 1997 (POEO Act)* and requires an environment protection licence (EPL).

## Community and stakeholder consultation

Roads and Maritime, in conjunction with AECOM, developed a communications and stakeholder engagement plan for the proposal.

A project website, email address and 1800 phone number were created to inform and consult with stakeholders and the community.

Other methods of communication included letters, phone calls, meetings, information kiosks in Murrumbateman and Yass, industry briefings, email updates, social media posts, newspaper articles and advertising, community newsletters and radio advertising.

There has been consultation with a range of stakeholders such as government agencies, Aboriginal knowledge holders, non-government organisations and other stakeholders including:

- Affected landowners
- Yass Valley Council
- Environment Protection Authority (EPA)
- NSW Department of Planning, Industry and Environment (DPIE) (includes former Department of Primary Industries and Office of Environment and Heritage)
  - DPIE - Fisheries
  - DPIE - Crown Lands
- Utility companies: Essential Energy, NBN Co, Nextgen Networks Pty Ltd, Optus and Telstra
- QCity Transborder Express
- Registered Aboriginal Parties (RAPs) within NSW
- Registered Aboriginal Organisations (RAOs) within ACT.

### Display

Roads and Maritime will continue to engage with the community and key stakeholders during the proposal's development. This REF would be placed on public display and submissions received would be addressed in a formal submissions report. The REF documents would be available on at [rms.nsw.gov.au/barton](https://rms.nsw.gov.au/barton).

The REF documents would be on display for comment over a five week period from 24 February to 27 March 2020 at the following locations:

- Murrumbateman Library (Saturday 10am to 1pm)
- Yass Valley Council (Monday to Friday 8.30am to 5pm)
- Yass Roads and Maritime Services depot, 1401 Yass Valley Way, (Monday to Friday 9am to 4pm)

Staff would host information kiosks at Yass and Murrumbateman to advise community about the REF and gather feedback on the following dates:

- Yass (Thursday 5 March 2020)
- Murrumbateman (Saturday 14 March 2020)

Suggestions and feedback obtained from the REF public display would be considered where appropriate in the detailed design process.

# Environmental impacts

## **Traffic and access**

Under the construction staging strategy developed by Roads and Maritime, access to existing properties along the Barton Highway would be maintained during construction.

Potential traffic impacts during construction would include increased travel times, temporary traffic diversions, temporary realignment of local roads accessing the Barton Highway and temporary relocation of bus stops. Considering the new northbound carriageway would be built first, the bulk of construction would be carried out off-line while the existing highway remains open to traffic. A temporary haul road (for construction vehicles only) may be built along the western side of the northbound dual carriageway footprint within the construction boundary allowing vehicles to move between temporary compound areas, stockpile locations and work areas without needing to access the highway.

A Traffic Management Plan (TMP) would be developed to ensure safe traffic conditions are maintained during construction. The TMP would minimise road closures and disruptions, maintain continuous access to local roads and properties, ensure road occupancy licences are obtained and maintain suitable road network safety and performance.

Once open, the proposal would provide a positive impact on traffic in the region, including reducing crash frequency and severity, improving road user safety and travel time, and providing greater regional connectivity. It would achieve the objectives set out in the *Barton Highway Design Guidelines* (Roads and Maritime, 2018b).

Property access would be maintained, but some properties would experience modified access to and from the Barton Highway.

At a number of intersections within the construction boundary, road users wishing to turn right from intersections along the highway would need to turn left onto the highway and perform a U-turn at the nearest U-turn facility.

## **Noise and vibration**

It was identified that during construction activities, noise management levels at some receivers close to the Barton Highway would be exceeded. Measures have been recommended to mitigate construction noise impacts upon nearby sensitive receivers. Specific noise management and mitigation measures would be detailed in the contractor's Construction Environmental Management Plan (CEMP).

To reduce potential for vibration impacts, minimum safe working distances for vibration intensive construction equipment (eg vibratory rollers) have been identified. Additional mitigation measures would be implemented if work is required within these safe working distances. Potential vibration impacts to heritage listed and other sensitive structures would be considered on a case-by-case basis. Controlled blasting, where required, would be carried out in line with regulatory requirements and each blast would be monitored to ensure compliance to stipulated noise standards.

Current operational noise conditions exceed the cumulative noise limit at Wattle Park Uniting Church and associated Sunday School due to their close proximity to the existing highway. Noise modelling predicts these receivers will still be affected by noise after construction, however it will be reduced in comparison to the existing situation. As such, these receivers are eligible for consideration of noise mitigation measures.

Operational traffic noise would be monitored at sensitive receivers after construction is complete. If traffic noise levels are above those predicted during detailed design, additional feasible and reasonable mitigation measures would be considered.

## **Biodiversity**

The proposal would require removing about 19.29 hectares of native vegetation. This includes about 16.85 hectares of NSW *BC Act* listed threatened ecological communities (TEC), 0.21 hectares of ACT *Nature Conservation Act 2014 (NC Act)* listed TECs and 2.24 hectares of nationally listed TECs. In many

instances, the same patches of vegetation are part of both a state and Commonwealth listed TEC. An assessment of significance was carried out for each of the threatened species and ecological communities that are known or likely to occur within the construction boundary. The assessments concluded the proposal would not have a significant impact on any species, population or TEC listed under the federal *EPBC Act*, *NSW BC Act* or *ACT NC Act*.

Key measures to protect biodiversity include minimising impact to any areas of Box-Gum Woodland next to the boundary during the construction period, particularly near the Hall TSR. This would include defining clearing limits, managing potential weed invasion, sedimentation and erosion.

The proposal would impact on 0.6 hectares of low quality, unoccupied habitat for the Golden Sun Moth. Areas of other habitat within the construction boundary will be protected with exclusion fencing.

### **Aboriginal heritage**

Based on results of the survey and test excavation program, as well as the findings of the Cultural Values Report (CVR), eleven Aboriginal archaeological/cultural sites have been recognised within the construction boundary. Of these 11 sites, two have been identified as having moderate scientific significance and seven as being of low scientific significance. Two cultural ring tree sites have been identified as having high cultural significance to the Aboriginal community. Further design refinements during detailed design will be investigated to retain these cultural trees in consultation with RAP's.

In order to mitigate the proposal's impact on the above sites, an archaeological salvage program is recommended. The program would incorporate surface collection of all surface open artefact sites assessed as of low scientific significance, as well as surface collection, manual open area excavation and mechanical soil sampling of sites assessed as moderate scientific significance.

### **Non-Aboriginal heritage**

The Wattle Park Uniting Church located north of the NSW/ACT border is an item of local heritage significance listed on the *Yass Valley Local Environmental Plan 2013* (#1124). The proposal has been aligned to best avoid impacting the church within the site constraints. A Non-Aboriginal Heritage Impact Assessment concluded the impact on the church's heritage values was not significant. Further mitigation measures have been recommended.

'Dellwood' homestead would be demolished as part of the proposal. It is considered likely that the subfloor space at this property could contain archaeological deposits of heritage significance which may be revealed during demolition activities. The archaeological potential of the homestead would be managed through archaeological assessment of the area in line with a Section 140 permit under the *Heritage Act 1977*. An Archaeological Research Design and Methodology would be prepared and submitted to the Heritage Council of NSW for approval under Section 140.

### **Soil**

Construction of the proposal requires significant earthworks, stockpiling of materials and movement of heavy machinery which could result in erosion and sedimentation. The proposal includes cross drainage and new creek crossings where there would be an increased risk of erosion and sedimentation. A site specific Soil and Water Management Plan (SWMP), which includes an Erosion and Sedimentation Control Plan (ESCP), would be developed to minimise potential erosion and sedimentation during construction.

A contamination assessment was carried out within the construction boundary which identified potential concerns that could be disturbed by the proposal. The assessment concluded the potential for contamination was low for agricultural areas but medium for stockpiles north of Nanima Road, filled areas of the existing Barton Highway and in the location of past fuel/chemical spills along the verge of the highway due to crashes. Additional ground investigation would be carried out to confirm potential contamination risks prior to significant ground disturbance.



## Water

The proposal may impact on surface water and aquatic ecology if erosion and sedimentation is not adequately controlled during construction. Temporary sediment basins are proposed, together with a range of mitigation measures to safeguard water quality during construction. The proposal is not anticipated to adversely impact groundwater. Four groundwater wells would be directly impacted by the proposal and sealed in line with a Groundwater Well Decommissioning Plan.

Flood modelling for the reference design determined the new northbound carriageway would achieve a 100 year average recurrence interval (ARI) flood immunity for all crossings and that the current flood immunity on the existing carriageway would not be compromised by the proposal.

## Landscape character and visual impact

The visual impact on sensitive receptors was rated as moderate or moderate-high for all locations except from the Wattle Park Uniting Church which was rated as high.

To mitigate potential landscape character and visual impacts, the proposal has been designed in line with the *Barton Highway Urban Design Framework* (Roads and Maritime, 2018) which provides strategic design guidance and direction for developing and achieving a well-integrated design outcome of consistent quality. In addition, site specific mitigation measures have been proposed to minimise the proposal's long term landscape character and visual impacts. These impacts would be considered in further detailed design.

## Property and land use

The proposal is located within the road corridor boundary identified in the *Yass Valley Local Environmental Plan 2013*, however about 85.68 hectares of property (a total of 33 lots) is needed. This includes the full acquisition of one property ('Dellwood' homestead) which would be demolished as part of the proposal.

Land acquisition is needed largely along the western side of the existing highway for the proposal. Roads and Maritime has adopted a land acquisition strategy taking into account future upgrades of intersections as traffic demand requires. Land acquisition would be carried out in line with the *Land Acquisition Information Guide* (Roads and Maritime, 2014a) and the *Land Acquisition (Just Terms Compensation) Act 1991*. Property impacts and potential adjustments would be confirmed during detailed design in consultation with property owners.

## Socio-economic

The proposal would cause temporary socio-economic impacts to the local area due to minor increases in noise and air emissions, additional traffic on local roads and visual disruptions. The change would be minor, short-term and highly localised.

Overall the operation of the proposal would provide permanent positive socio-economic growth for the local community, regional freight transport, road users and businesses by reducing congestion, travel times and improved road safety.

## Justification and conclusion

The proposal is subject to assessment under Division 5.1 of the *EP&A Act*. The REF has examined and taken into account to the fullest extent possible all environmental matters affecting or likely to be affected by the proposal. A number of potential environmental impacts from the proposal have been avoided or reduced during the design development and options assessment process.

The upgrade of the Barton Highway as described best meets the proposal's objectives, however, would still result in some potential impacts including:

- Construction and operational noise
- Construction vibration
- Habitat loss

- Access changes
- Traffic delays during construction

Mitigation measures would minimise these potential impacts. The proposal's environmental impacts are not considered significant and as such an environmental impact statement is not required. Therefore, approval is not required from the Minister for Planning under Division 5.2 of the *EP&A Act*.

The proposal would not significantly impact threatened species or ecological communities or their habitats, within the meaning of the *BC Act* or *FM Act*. The proposal would also not result in a significant impact on threatened species, ecological communities or migratory species, within the meaning of the *EPBC Act*. A referral to the Australian Department of the Environment and Energy is not required.

The proposal would reduce traffic congestion and improve road user safety along Barton Highway by increasing lane numbers, dividing the carriageway and formalising intersection access arrangements. The proposal would also provide a number of upgraded bus stops and improve safety for cyclists. On balance, the proposal is considered justified.

## Display of the review of environmental factors

The REF documents would be on display for comment over a five-week period from 24 February 2020 to 27 March 2020 through the following means:

### **Internet**

The documents will be available as Portable Document Format (PDF) files on the Roads and Maritime website at [rms.nsw.gov.au/roadprojects](http://rms.nsw.gov.au/roadprojects).

### **Display**

The review documents can be viewed at the following locations:

- Murrumbateman Library (Saturday 10am to 1pm)
- Yass Valley Council (Monday to Friday 8.30am to 5pm)
- Yass Roads and Maritime Services depot, 1401 Yass Valley Way, (Monday to Friday 9am to 4pm)

Staff would host information kiosks at Yass and Murrumbateman to advise community about the REF and gather feedback on the following dates:

- Yass (Thursday 5 March 2020)
- Murrumbateman (Saturday 14 March 2020)

Suggestions and feedback obtained from the REF public display would be considered where appropriate in the detailed design process.

## How can I make a submission?

To make a submission on the proposal, please send your written comments to:

- Go online to [www.rms.nsw.gov.au/barton](http://www.rms.nsw.gov.au/barton)
- Write to Barton Highway Upgrade  
Project Manager, Anthony Perera  
Roads and Maritime  
PO Box 484, Wagga Wagga  
NSW 2650
- Email [barton.highway@rms.nsw.gov.au](mailto:barton.highway@rms.nsw.gov.au)
- Call 1800 931 250 (toll free)

Submissions must be received by 5pm on 27 March 2020.

## What happens next?

Roads and Maritime will collect feedback from the REF display period and prepare a submissions report. All submissions made during the display period will be responded to by Roads and Maritime and addressed in the submissions report.

Feedback from this display period will help to further refine the design of the proposal. The community will be kept informed during this process. Following this, Roads and Maritime would proceed with detailed design and tenders would be called for construction.



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# 1. Introduction

Roads and Maritime Services (Roads and Maritime) is carrying out an assessment under Division 5.1 of the *Environmental Planning and Assessment Act 1979 (EP&A Act)* for the duplication of about eight km of the Barton Highway from about 700 m south of the NSW/ACT border towards Murrumbateman, about 300 m north of Kaveney's Road (the proposal). The proposal is located within the Yass Valley local government area (LGA) and is within the Roads and Maritime South West Region.

## 1.1 Proposal identification

Barton Highway (HW15) is a rural highway linking the southern and western areas of NSW to the ACT. It connects the Hume Highway to the Federal Highway providing a key road link between Canberra, southern and western areas of NSW and Melbourne, Victoria. A large volume of traffic uses the Barton Highway with over 13,000 vehicles using the highway each day mainly for commuting to Yass and Canberra, regional freight and passenger movements, and local trips.

About 33 km of the Barton Highway including Murrumbateman consists of a single carriageway with limited overtaking lanes. Traffic growth rates along the Barton Highway have been relatively consistent for the past 25 years, reflecting the steady transformation of the areas surrounding the highway from a rural farming catchment to a commuter area of Canberra. There are distinct weekday morning and afternoon peak periods with the largest peak leaving the ACT on Friday afternoons. There is an additional peak heading into the ACT on Sunday afternoons.

The highways safety record is poor with 105 recorded crashes between July 2012 to June 2017, which included three fatalities and 89 injury crashes. Only 13 of these crashes were on the dual carriageway section, leaving 83 crashes on the single carriageway section. More than half (59 per cent) of crashes were casualty crashes, or around 0.3 casualty crashes per kilometre per year. This is 50 per cent higher than an average rate for class 4R roads across the NSW road network which is close to 0.2 casualty crashes per kilometre per year. The proposal would improve safety, reduce travel times and support future traffic growth projections from planned development in Yass and Murrumbateman.

It is one of a series of proposed upgrades to sections of the Barton Highway which would provide a four lane (two lanes in each direction) dual carriageway with a median between the NSW/ACT border and the existing dual carriageway south of Yass.

## 1.2 Barton Highway Upgrade

The proposal forms part of the *Barton Highway Improvement Strategy 2017* (Australian and NSW governments, 2017) which aims to provide an efficient and safe highway to cater for the increasing traffic volume between Yass, Murrumbateman and Canberra. Benefits to all road users include:

- Safer travel for all modes of transport
- Reduced travel times
- Transport efficiency
- More consistent and reliable travel

Safer conditions for local communities.

The proposal would be jointly funded by the Australian and NSW governments and developed in stages. Current funding allocation provides for concurrent implementation of the following packages:

- Duplication of the Barton Highway from the ACT border towards Murrumbateman, ie providing a new northbound carriageway and modification of the existing highway to provide a southbound

carriageway for about eight km from about 700 m south of the NSW/ ACT border to about 300 m north of Kaveney's Road with a central median (the subject of this assessment)

- Concept design and environmental assessment for future duplication of the Barton Highway from completed duplication to Murrumbateman
- Strategic business case for future duplication of the whole length of the Barton Highway. The business case involves a series of technical investigations, including strategic duplication design, traffic data and modelling, and cost benefit analysis to develop a prioritised approach to future duplication
- Safety work including:
  - Improving clear zones (including installing safety barriers)
  - Improving bus stop locations
  - Installing Intelligent Transport Systems
  - Improving delineation and signage (upgrading linemarking)
  - Improving access for vulnerable road users (cyclists, pedestrians) in Murrumbateman village
  - Upgrading intersections
  - Road safety behavioural campaigns
  - Monitoring and maintaining bridges and culverts
  - Reviewing incident management plans.

## 1.3 Key features of the proposal

Key features of the proposal include:

- Providing a new two lane northbound carriageway from south of the NSW/ACT border towards Murrumbateman on the western side of the existing Barton Highway
- Modifying the existing Barton Highway to provide a two lane southbound carriageway from south of the NSW/ACT border towards Murrumbateman
- Providing a central median separating the two carriageways
- Modifying impacted intersections and property access roads to provide safe access to the highway
- Providing dedicated U-turn facilities at about one kilometre intervals to manage right turn movements
- Improving existing bus stops with accessible shelters and safe parking areas at Spring Range Road and Nanima Road
- Demolishing a residential property and all farm infrastructure in the construction boundary
- Modifying the heavy vehicle enforcement bay south of Nanima Road by providing new deceleration and acceleration lanes
- Removing the rest area at the NSW/ACT border
- Providing safety barriers where required
- Providing drainage line crossings including creek crossings at Gooromon Ponds and Little Bedulluck Creek
- Relocating and protecting utilities within the construction boundary
- Establishing temporary compound areas and stockpile sites throughout construction
- Additional work including earthwork, improving street lighting, new street furniture, replacing signage, resealing, line marking, and upgrades to kerbs.

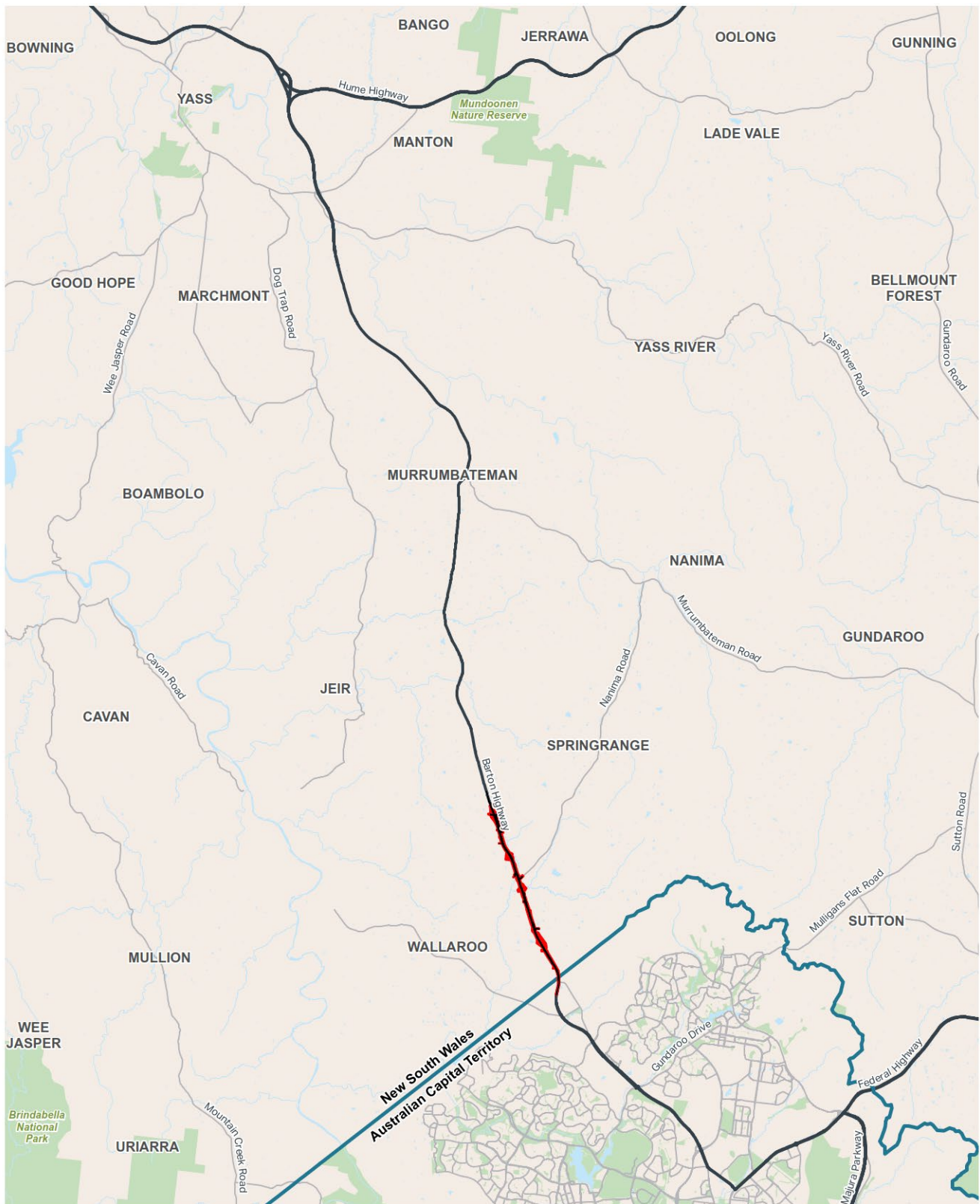
Subject to planning approval, construction is expected to start in late 2020 and be completed in 2023. Figure 1-1 shows the regional context of the proposal. A detailed description of the proposal is provided in Chapter 3 of this Review of Environmental Factors (REF).

## 1.4 Location of the proposal

The proposal extends from about 700 m south of the NSW/ACT border towards Murrumbateman, about 300 m north of Kaveney's Road and is shown in Figure 1-2. As part of the Barton Highway Upgrade, but subject to a separate planning and approvals process, the 700 m tie-in section would be provided from the NSW/ACT border south to the existing dual carriageway in Hall, ACT (see Section 1.6). The ACT section of the proposal is therefore not part of the construction boundary identified in this assessment.

The proposal is located within the Yass Valley LGA, part of the Southern Tablelands region of NSW. Yass is the main town in the Yass Valley LGA. Other settlements include the villages of Binalong, Bookham, Bowning, Gundaroo, Murrumbateman, Sutton and Wee Jasper. The highway crosses land used mostly for agriculture and low density residential purposes.





REGIONAL CONTEXT OF THE PROPOSAL

#### KEY

- Study area
- NSW/ACT boundary
- Primary road
- Secondary road
- Watercourse



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Figure 1-1 Regional context of the proposal



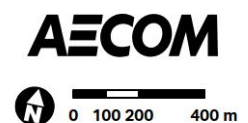
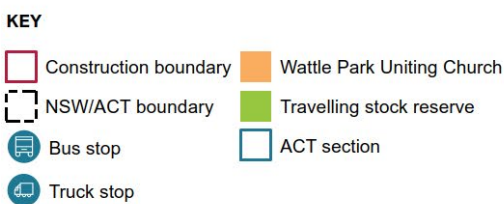
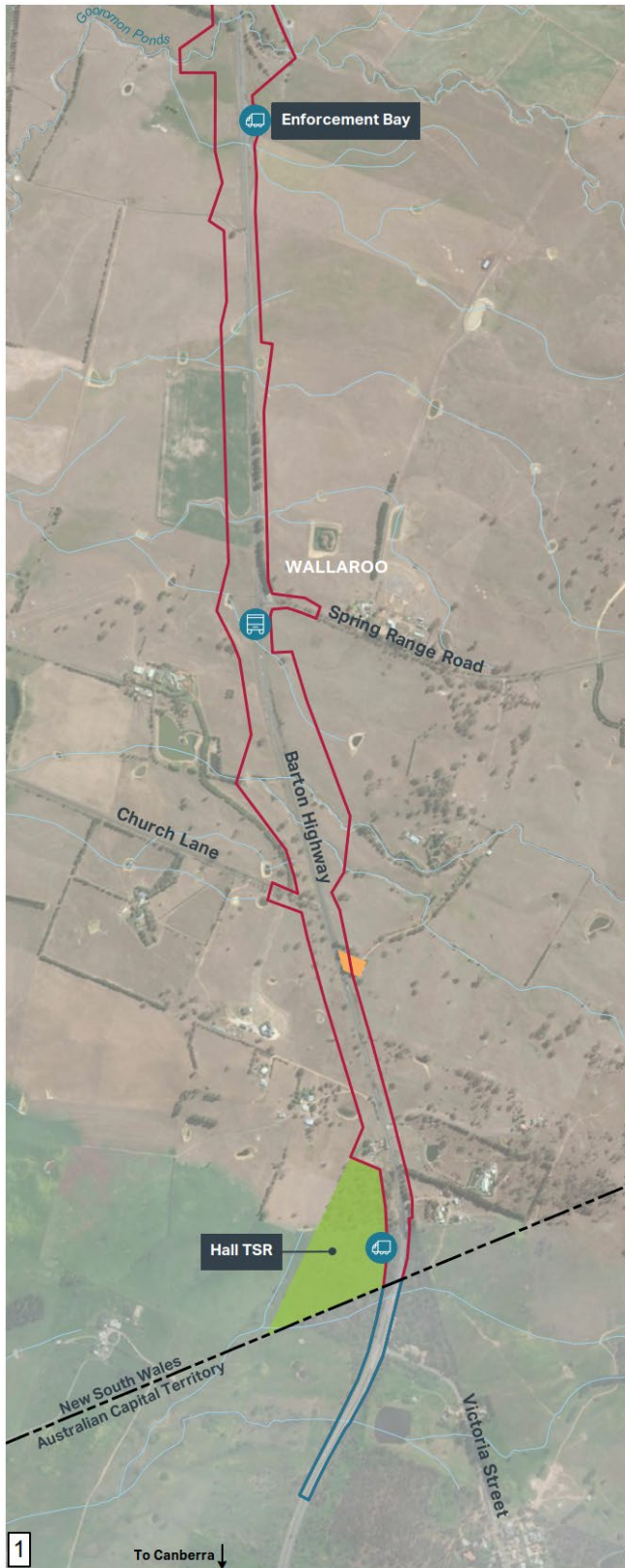


Figure 1-2 Construction boundary

## 1.5 Purpose of the report

This REF has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of Roads and Maritime South West Region. For the purposes of these work, Roads and Maritime is the proponent and the determining authority under Division 5.1 of the *EP&A Act*.

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

The description of the proposed work and assessment of associated environmental impact has been carried out 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), *Roads and Related Facilities EIS Guideline* (DUAP 1996), the *Biodiversity Conservation Act 2016 (BC Act)*, *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 5.5 of the *EP&A Act* including that Roads and Maritime examines 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 Division 5.2 of the *EP&A Act*
- The significance of any impact on threatened species as defined by the *BC Act*, in section 1.7 of the *EP&A Act* and therefore the requirement for a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR)
- 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 to make a referral to the Australian Government Department of the Environment and Energy for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the *EPBC Act*.

## 1.6 Other planning approvals

As part of the Barton Highway Upgrade, but subject to a separate planning and approvals process, a 700 m tie-in section would be provided from the NSW/ACT border south to the existing dual carriageway in Hall, ACT. The impact assessment for this section of modification is documented separately.

The tie-in section of highway lies within the ACT in land categorised as a 'Designated Area' under the National Capital Plan (NCP). The NCP is set under the Commonwealth's *Australian Capital Territory (Planning and Land Management) Act 1988 (P&LM Act)* as managed by the National Capital Authority (NCA). Further details on the legislative requirements for this section is provided in Section 4.3.2. The cumulative impact of the proposal including the ACT section is provided in Section 6.13.

## 2. Need and options considered

This chapter describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

### 2.1 Strategic need for the proposal

#### 2.1.1 Overview

The Barton Highway provides a key connection between Canberra, southern and western NSW and Melbourne, Victoria. The highway is part of the National Land Transport Network which is funded by Federal and State governments and nominated as part of the Commonwealth *National Land Transport Act 2014*. This network of road and rail transport links is made up of national and inter-regional transport corridors which are important to national and regional economic growth and connectivity.

Barton Highway is also part of the national Key Freight Route Network and is an important route for freight movements between Melbourne, the NSW Riverina and south-east NSW. It carries an increasing volume of traffic from warehousing and distribution centres in Albury-Wodonga and Wagga Wagga.

The highway has growing importance as a commuter link between Canberra and the satellite towns to the north around Murrumbateman and Yass. More than 13,000 vehicles per day currently use the Barton Highway, and traffic numbers are forecast to rise with the expected population growth of the Yass Valley LGA. The *Yass Valley Settlement Strategy 2036* (Yass Valley Council, 2017) forecasts the population of the Yass Valley LGA to grow by 58 per cent to about 25,000 people by 2036 and to about 43,900 people by 2056. The majority of this future growth is expected to occur within the existing settlements of Yass and Murrumbateman in the short to medium term (to 2036).

Overall the *Barton Highway Improvement Strategy 2017* (NSW and Australian governments, 2017) found that current travel speed and levels of service for the highway are acceptable. However, given the importance of the transport link the Barton Highway provides for state and regional freight transport, as well as to and from Canberra, traffic growth should be considered when assessing the future level of service the highway is able to maintain.

Between 2013 and 2017 within the construction boundary, the Barton Highway had a casualty crash rate of about 0.3 crashes per kilometre per year, which is higher than the national crash rate of 0.2 crashes per kilometre per year for comparable roads in NSW. During this period there were 17 crashes along the eight kilometre stretch. Improving safety is a key factor that justifies the need for the proposal which aims to improve safety for current road users as well as to cater for projected future traffic volumes.

#### 2.1.2 Strategic planning and policy context

The following plans and strategies are relevant to the strategic planning context of the proposal:

- National Road Safety Strategy for Australia 2011 - 2020
- Future Transport Strategy 2056
- NSW: Making It Happen
- Sydney-Canberra Corridor Regional Strategy 2006-2031
- South East and Tablelands Regional Plan 2036
- Barton Highway Improvement Strategy 2017
- Yass Valley Community Strategic Plan 2011-2030
- Yass Valley LEP 2013



- Yass Valley Settlement Strategy 2036
- Murrumbateman Masterplan 2031.

### ***National Road Safety Strategy for Australia 2011 - 2020***

The *National Road Safety Strategy for Australia 2011 – 2020* released in 2011 by the former Australian Transport Council and is now overseen by the Transport and Infrastructure Council. The strategy is firmly based on Safe System principles and is framed by the guiding vision that no person should be killed or seriously injured on Australia's roads. As a step towards this long term vision, the strategy presents a 10 year plan to reduce the number of serious injuries and fatalities on Australian roads by 30 per cent. To achieve this target, four key road safety actions or interventions have been identified, supported by immediate and future steps. Of the four actions, 'safe roads' and 'safe speeds' are relevant to the proposal.

The 'safe roads' action aims to adopt improved standards for road design, construction and operation to reflect the Safe System principles, and to improve the manner in which road safety benefits are identified and implemented in road investment programs.

The 'safe speeds' action aims to achieve a better balance between safety and mobility objectives, and to improve compliance with speed limits.

The Safe System principles include a holistic view of the road transport system and the interactions among roads and roadsides, travel speeds, vehicles and road users. This is an inclusive approach that caters for all groups using the road system, including drivers, motorcyclists, passengers, pedestrians, cyclists, and commercial and heavy vehicle drivers. The Safe System approach recognises that people will always make mistakes and may have road crashes, but that the system should be forgiving and those crashes should not result in death or serious injury.

The proposal has been designed in accordance with current Roads and Maritime road design guidelines, safety and traffic efficiency requirements to address the existing high crash history, and aims to deliver immediate safety benefits through introducing design features such as: dividing the highway to instantly reduce the risk of both head on collisions, and collisions resulting from turns made across the highway; and providing improved pedestrian and cyclist facilities.

The proposal is considered to be consistent with the guiding vision of the Safe System approach, and would contribute towards achieving, the aims of the *National Road Safety Strategy for Australia 2011 – 2020*. The detailed design of the proposal would continue to consider road safety requirements.

### ***Future Transport Strategy 2056***

The *Future Transport Strategy 2056* (NSW government, 2018) provides an update of the NSW Long Term Transport Master Plan. The strategy focuses on customer experience and providing initiatives and programs that plan for an expected increase in customer travel in the future. It also identifies Canberra as a Global Gateway City in regional NSW.

The strategy has a vision for the growth and vibrancy of regional cities and centres. Growth is facilitated by road upgrades and bypasses to improve liveability and road safety and by also growing regional public transport operations.

The proposal aligns with the aims of growing regional cities through improvements to liveability and in providing improved road safety for residents of regional NSW and beyond travelling to and from Canberra. The proposal would improve journey reliability, ease congestion, improve driver safety and boost freight productivity.

## ***NSW: Making It Happen***

In September 2015, the NSW government announced a series of State Priorities as part of *NSW: Making It Happen* (NSW government, 2015). The State Priorities are intended to guide the ongoing actions of the NSW government across the state, and guide resource allocation and investment in conjunction with the *NSW Budget*. *NSW: Making it Happen* focuses on 12 key priorities to achieve the NSW government's commitments, including infrastructure, the environment, education, health, wellbeing and safety in addition to government services.

Three of the key priorities identified in *NSW: Making It Happen* are supported by the proposal. The proposal fulfils the aim to provide increased investment in building transport infrastructure and also supporting the creation of new jobs by investing in infrastructure to support the construction industry. The proposal would also seek to improve the reliability of public transport services through providing improved transport infrastructure and reducing traffic delays.

## ***Sydney - Canberra Corridor Regional Strategy 2006 - 2031***

The *Sydney - Canberra Corridor Regional Strategy 2006 - 2031* (NSW government Department of Planning, 2006) is the pre-eminent planning document for the Sydney–Canberra Corridor Region. The strategy identifies the Barton Highway as a key road link to enable development within the corridor particularly between Canberra and Yass.

The proposal supports the strategy by improving the transport link between Canberra to Yass. The proposal would also support safer and improved access along the Barton Highway from Canberra to Yass.

## ***South East and Tablelands Regional Plan 2036***

The *South East and Tablelands Regional Plan 2036* (NSW Department of Planning, 2017) is a framework to guide land use planning and decisions for the next 20 years, with a large consideration given to road access to and economic development of Canberra. Direction 11 is to: 'enhance strategic transport links to support economic growth'.

The plan identifies the development of the Barton Highway as a major opportunity for the improvement of the freight network which is directly supported by the proposal.

## ***Barton Highway Improvement Strategy 2017***

The *Barton Highway Improvement Strategy 2017* (NSW and Australian governments, 2017) was prepared to guide the upgrades to the Barton Highway for the next 20 years. Funded by both the Australian and NSW governments, the strategy takes a staged approach to improving the safety and traffic efficiency along the Barton Highway. The strategy sets out a vision for the section of the Barton Highway between the NSW/ACT border and the Hume Highway, to:

- Provide safe and reliable commuter access to Canberra
- Improve safety and amenity for Murrumbateman
- Provide an alternative access route to Canberra
- Support key freight movements between western and southern NSW and the ACT
- Cater for the mix of through, local and tourist traffic along the corridor.

The *Barton Highway Improvement Strategy 2017* identifies a number of key short, medium and long term actions to address poor road safety performance, provide improved travel reliability and address community feedback. The proposal is a key component of the delivery of the priorities and is the first

major package of its implementation through the duplication of the highway from NSW/ACT border towards Murrumbateman.

### ***Yass Valley Community Strategic Plan 2011-2030***

The *Yass Valley Community Strategic Plan 2011-2030* (Yass Valley Council, 2011) is Council's 'peak plan' providing Council, community and other stakeholders with priority issues to address and goals for achievement in the longer term. The plan identifies the key challenge facing Yass Valley Council as the need to balance competing demands in an environment of high projected growth, increasing community expectations and limited resources.

The proposal supports the plan by providing improved and safer access along the Barton Highway supporting the forecast growth within the Yass Valley LGA.

### ***Yass Valley Local Environmental Plan 2013***

The *Yass Valley LEP 2013* (Yass Valley Council, 2013) is the governing plan for the Yass Valley LGA. The plan delineates a corridor reserve for the Barton Highway duplication and provides specific development criteria for the Barton Highway Upgrade.

The proposal meets the aims and development requirements of the *Yass Valley LEP 2013*. The highway duplication would support safer and improved access along the Barton Highway between Yass and Canberra.

### ***Yass Valley Settlement Strategy 2036***

The *Yass Valley Settlement Strategy 2036* (Yass Valley Council, 2017) provides a direction for long term regional growth of settlements within the Yass Valley LGA and has been prepared to address the projected population growth. The strategy identifies Yass as growing into a regional centre and Murrumbateman as growing into a major township. The strategy also addresses the increasing pressure for NSW/ACT border development.

A key principle of the strategy is that future development should strengthen the efficient use of infrastructure, services and transport network and not overburden existing services elsewhere. The strategy highlights the Barton Highway duplication as an opportunity to support the development of Yass and Murrumbateman through improved connectivity to the ACT.

The strategy makes provision for the proposal and supports its business case. It identifies the proposal as one of the key drivers for change in the Yass Valley LGA. Development goals are specified in the strategy which would manage the development in the area surrounding the proposal to minimise future conflict.

The proposal forms part of the regional highway network that also supports regional traffic and freight to and from Canberra Airport from the Riverina, western and central west NSW, highlighted in the strategy.

### ***Murrumbateman Masterplan 2031***

The *Murrumbateman Masterplan 2031* (Yass Valley Council, 2012) is the key document that guides the growth of Murrumbateman up to 2031. A specific objective of the masterplan is to maximise opportunities created by the duplication of the Barton Highway and bypass of Murrumbateman.

The proposal supports the objectives of the *Murrumbateman Masterplan 2031* as it improves connectivity to Murrumbateman as part of the overall highway strategy.

### 2.1.3 Improved safety

The Barton Highway has a traffic volume of over 13,000 vehicles per day and has experienced relatively consistent traffic growth for the past 25 years which has resulted in safety issues. The *Barton Highway Improvement Strategy 2017* highlighted the poor safety record of the Barton Highway as a key factor to justify the need for the proposal. Key matters related to safety that supports the proposal include:

- There were 17 crashes along the highway within the construction boundary
- Of these, 10 (or 59 per cent) were casualty crashes, those which resulted in at least one (but possibly more) injury or fatality
- There was one fatal crash recorded between 2013 and 2017 which saw two fatalities and six injured in a multi vehicle event
- Of the crashes identified in the *Barton Highway Improvement Strategy 2017*, most recorded crashes were between Murrumbateman and the NSW/ACT border, ie the section of highway within the construction boundary
- The casualty crash rate of 0.3 crashes per kilometre per year within the construction boundary is higher than the national average casualty crash rate for other roads with similar general traffic and heavy vehicle volumes of about 0.2 casualty crashes per kilometre per year.

At the time of preparing this REF, a head-on collision occurred between two vehicles on the highway within the construction boundary, which resulted in two fatalities and multiple injuries (ABC News, 25 May 2018).

As projected traffic volumes increase, the potential for crashes is also likely to rise. An increase in demand on the single carriageway section of highway would result in lower travel speeds, and more time spent following other vehicles. This typically results in vehicles travelling closer together and increases the likelihood of rear-end crashes. Motorists may also take greater risk to turn on or off the highway as gaps in the flow of traffic become less frequent. It may also raise the likelihood of motorists making dangerous overtaking manoeuvres.

Road safety improvements would be delivered as part of the proposal by upgrading with enhanced road design and travel efficiencies. Road safety would also increase by providing acceleration and deceleration lanes and reducing the frequency of conflicting turning movements by restricting direct access to properties be mostly left-in left-out, with a few key right hand turns to minimise traffic disruptions.

The proposal would also be designed to meet the vertical curve design criteria set specified in the *Barton Highway Design Guideline* (Roads and Maritime, 2018b) providing adequate sight distances and safety improvements. Detailed design requirements are discussed in Section 3.2.

Should traffic volumes grow at a much greater rate than currently forecast, future highway improvements may be considered to separate traffic completely at intersections providing grade separation and removing any occurrence of conflicting traffic. Current and forecast traffic estimates do not currently justify this level of expenditure, however property acquisition at part of this proposal has made allowances for these future modifications to minimise future community disruption.

### 2.1.4 Travel speed and level of service

Within the construction boundary the highway has a posted speed limit of 100 km per hour. The average travel speeds during the morning and afternoon periods (6am to 9am and 4pm to 7pm) are between 89 and 93 km per hour. Route performance declines for a short period during the morning peak hour (7.15am to 8.15am) when average travel speeds for southbound vehicles travelling towards Canberra falls to 86 km per hour.



The level of service of roads is classified from levels A to F, with level of service 'A' representing the best operating conditions and level of service 'F' the worst. According to the *Network Performance Measures and Network Planning Targets* (Roads and Maritime, 2010), Barton Highway is a 4R road which should operate at level of service C. The level of service along the Barton Highway currently varies from C to E during the day, depending on the location and the number of vehicles using the highway. Roads and Maritime (2010) recommends that an overtaking lane should be provided at locations where the level of service is worse than C. Traffic modelling results show that additional overtaking lanes would improve the level of service for peak hour road users within the construction boundary.

There are no viable alternative routes for planned or unplanned closures of the Barton Highway. This limits opportunities for road maintenance and leads to significant disruption in the event of incidents occurring. Between 2009 and 2013 the Barton Highway (including outside of the construction boundary) was closed for about 60 hours due to planned closures and unplanned incidents, causing significant delays and inconvenience to road users. This also has implications for the highway as it is a key road freight route.

Overall, proposed upgrades are needed to provide additional road capacity to maintain an acceptable level of service and to minimise issues with road closures by providing an alternative route in the event of planned maintenance or road incidents. Longer travel times and delays are likely in the absence of the proposal. Increased commuting times would hinder employment growth in the region and the desirability of the area for people who travel to Canberra and Yass for work. Recreational road users would also become less inclined to accept the time and cost associated with travelling through the area.

### 2.1.5 Flood immunity

The existing highway within the construction boundary currently has low flood immunity and is susceptible to minor flooding for events as frequent as five year average recurrence interval (ARI). Major flooding involving overtopping of the highway that would likely make the highway impassable for short periods would occur for flood events of about 20 year ARI and greater. The highway is also susceptible to partial blockage of drainage structures as a result of debris and sediment, which could increase the frequency of flooding. Flooding of the highway would restrict local and regional traffic movement and greatly limit access between Canberra and Yass.

Providing a new northbound carriageway that achieves flood immunity for the 100 year ARI flood event and considers the risk of blockage would be consistent with contemporary standards and minimise the obstacles to regional traffic flows, enhance road safety and provide for improved access during major flood events.

## 2.2 Existing infrastructure and land uses

### 2.2.1 Barton Highway

After being proclaimed a state highway in 1935, the Barton Highway was officially named in 1954 in honour of Edmund Barton, the first Prime Minister of Australia (1901-1903). It was later identified as National Route 25 signifying its importance but was not fully sealed until 1960. In 1974, it was designated as a national highway. The relevant statutory authorities (now Roads and Maritime) have continued to maintain and upgrade the Barton Highway, but there have been no significant alterations to the route within the proposal since the 1950s.

The stretch of highway within the construction boundary is about eight km and is configured with one lane (3.5 m wide) in each direction and a posted speed limit of 100 km per hour. The highway has been upgraded over the years including providing overtaking lanes at various stretches and several intersection

upgrades, which has resulted in the highway surface being of variable width throughout the construction boundary. There are two existing overtaking lanes within the construction boundary:

- CH20900 to CH22000 on the northbound lane (totalling 1.1 km, starting 60 m north of Rolfe Road)
- CH22500 to CH23250 on the southbound lane (totalling 750 m, starting 130 m south of Kaveney's Road)

Road signage and safety barriers are located along selected stretches and street lighting can be found at key intersections. Additional safety barriers have recently been installed on the highway within the construction boundary as part of the Barton Highway Upgrade safety works), see Section 1.2.

There are a number of at grade T-intersections and private access roads which connect to the highway within the construction boundary, some of which have been modified and are not standardised. The intersections within the construction boundary are shown in Figure 1-2 and are as follows:

- At grade T-intersections at Church Lane, Spring Range Road, Nanima Road, Rolfe Road, Boundary Lane, Briarwood Lane, Tallawong Close, Kaveney's Road and Anchow Hill Lane
- Private access roads at CH16450, CH16700, CH17200, CH2280, CH22920 and CH23200 to the east and CH16820, CH19580, CH21830 and CH22750 to the west.

Currently traffic accessing the Barton Highway from/to local roads and private access routes are able to make left turn and right turn movements onto and from the highway except where solid white lines are present. Right turn movements require road users to cross the path of oncoming traffic.

Private access routes within the construction boundary are not of a standard design, and in some cases are not sealed and do not have the appropriate line marking or signage.

Surveys carried out as part of the *Barton Highway Improvement Strategy 2017* found that around 35 to 45 per cent of trips using Barton Highway are through traffic and 55 to 65 per cent are local trips.

## 2.2.2 Drainage

There are a total of 31 existing drainage structures which cross the highway within the construction boundary. These range in size from a minimum diameter of 375 mm up to close to 10 m in total width.

## 2.2.3 Public transport

There is low public transport use within the construction boundary (accounts for less than one per cent of commuter traffic). A limited number of commuter bus services run between Yass and Canberra on weekdays including the 981 and 982 QCity Transborder Express bus routes that provide a service between Yass to Canberra City and Canberra Hospital via Murrumbateman and Hall. The 981 route departs Yass at 6.40am and 7.05am and 3.35pm in the afternoon. The 6.40am service operates all year including between Christmas and New Year. From Canberra, the 982 services departs the City Bus Station at 2.05pm and the 981 service departs Canberra Hospital at 4.28pm and 5.08pm. The 5.08pm service operates all year round including the Christmas and New Year period.

There are eight school bus services that operate on weekdays during school terms, all interchanging at Hall in ACT in the morning and afternoon peaks. These are the Koala, Eagle and Emu services, which depart Yass and Hall at 7.24am and 8.05am respectively. The Emu and Koala services depart from Canberra from the City Bus Station and Community Bus Station at 3.55pm and 4.05pm respectively.

Six existing bus stops within the construction boundary, located at Rolfe Road, Kaveney's Road, Briarwood Lane, Nanima Road and two near Spring Range Road are used by commuters and school children.

There are safety issues at bus stops due to the poor visibility and limited safe stopping areas for vehicles to drop off/collect passengers, especially those located on the Barton Highway. Bus stops located along the Barton Highway are positioned on narrow shoulders, exposing waiting bus passengers to high speed traffic conditions.

## 2.2.4 Pedestrian and cyclist facilities

There are no formal cycling lanes along the highway within the construction boundary. Provision for cyclists is currently along the existing road shoulder of the highway. Conditions for cyclists vary significantly along the highway causing safety issues due to the narrow road shoulders, poor road surface texture and high speed traffic.

There is currently limited provision for pedestrians along the Barton Highway within the construction boundary with most pedestrian activity occurring at bus stops.

## 2.2.5 Rest area and enforcement bay

A rest area and an enforcement bay (which is used as a rest area) are located along the northbound lane at CH16450 (450 m north of Victoria Street) and southbound lane at CH19900 (640 m south of Nanima Street) respectively. These are both located next to the highway and have limited facilities or amenities.

## 2.2.6 Utilities

There are a range of above ground and underground utilities within the construction boundary which include:

- Essential Energy - overhead 22 kV power transmission lines run along the western side of the highway
- Essential Energy - overhead 66 kV, 132 kV and 330 kV power lines that cross over the highway at a major easement at CH17000 (400 m south of Church Lane)
- Optus and Telstra - underground telecommunication fibre optic cables that run along the western side of the highway with underground transverse crossings at various points.

There are no main water supply pipes within the construction boundary. Further information on the existing utilities is provided in Section 3.5.

## 2.2.7 Road safety audits

Various road safety audits of the Barton Highway have been carried out over the past decade. A road safety audit carried out in 2013 concluded that all of the horizontal curves (ie a bend in the highway which veers to the left or right) meet *Austrorads Guide to Road Design* minimum radius for the relevant speed zone, however a number of vertical curves (ie a change in grade moving either up or down a hill) along the highway were considered to be medium or high risk due to sight distance constraints. Key locations with vertical curves issues within the construction boundary are:

- Northbound lane between the NSW/ACT border and Spring Range Road
- Southbound lane between Mundays Lane and Kavenneys Road.

More recent road safety audits (Roads and Maritime 2018c) have highlighted a number of other safety deficiencies along the Barton Highway within the construction boundary. Between the NSW/ACT border and Briarwood Lane, the predominant road safety risks are unprotected headwalls within the five metre

clear zone, fill batters with steep slopes and roadside drains. Generally, the risk ratings are low due to the uncomplicated road geometry.

The Barton Highway within the construction boundary consists of flexible road surface with bituminous spray sealing which has undergone some patching and resurfacing work along certain stretches in the past. The highway's surface displays structural serviceability, acceptable roughness, acceptable limit of cracking and only 10 per cent of the single carriageway road surface sections shows moderate rutting.

## 2.3 Proposal objectives and development criteria

### 2.3.1 Proposal objectives

The key proposal objectives of the Barton Highway Upgrade are to:

- Reduce travel times and improve travel time reliability for all road users and freight movement between Yass, ACT, and southern and western NSW
- Reduce crash rates along the highway to provide a safer and more reliable journey for road users.

These proposal objectives also support the following secondary objectives:

- Reduce impact to travel times and freight efficiency from detours resulting from traffic incidents on the Barton Highway
- Improve workplace health and safety for road maintenance activities by reducing conflicts between high speed traffic and road maintenance teams.

### 2.3.2 Urban design objectives

The urban design principles and objectives for the proposal address the requirements '*Beyond the Pavement*' (Roads and Maritime, 2014b) urban design policy and are set out in the *Barton Highway Urban Design Framework* (Roads and Maritime, 2018d). See Section 3.2.3 for the urban design objectives.

### 2.3.3 Road corridor boundary

In 2009 to 2010, Roads and Maritime carried out a preliminary environmental investigation (PEI) of the Barton Highway road corridor from the NSW/ACT border to the existing dual carriageway south of Yass. The investigation included a number of preliminary specialist studies including:

- Aboriginal and Non-Aboriginal heritage assessments
- Road traffic noise investigation
- Soil and water assessment
- Preliminary flora and fauna assessment
- Preliminary landscape character assessment
- Planning, land use and socio-economic assessment
- Contaminated land assessment (phase one).

Information gained from the PEI was used to identify key environmental and community constraints within the road corridor. The recommendations within the PEI, in combination with community consultation, consideration of environmental and engineering restrictions, consideration of design standards,

maximising safety and minimising construction costs were used to inform the identification of new road boundaries which would accommodate future improvements while minimising impact.

The *Preferred Road Corridor Boundaries Report* (Roads and Maritime, 2011a) sets out the proposed road corridor boundaries for a future duplication of the highway. In doing so, the assessment determined which side of the existing highway the proposal should be built. The road corridor boundary was included in the *Yass Valley LEP 2013*. The proposal would be designed to fit within this road corridor boundary.

## 2.4 Assessment of alternatives

### 2.4.1 Overview

Development of the Barton Highway Upgrade has been ongoing for over two decades with various design development stages as shown in Figure 2-1. Various options to increase road capacity and improve safety on the Barton Highway have been considered at different stages of development of the proposal. The options considered with the methodology for selection of the preferred option that best meets proposal objectives while also considering engineering, environmental, social and financial constraints are discussed in Sections 2.4.2 to 2.6.1.

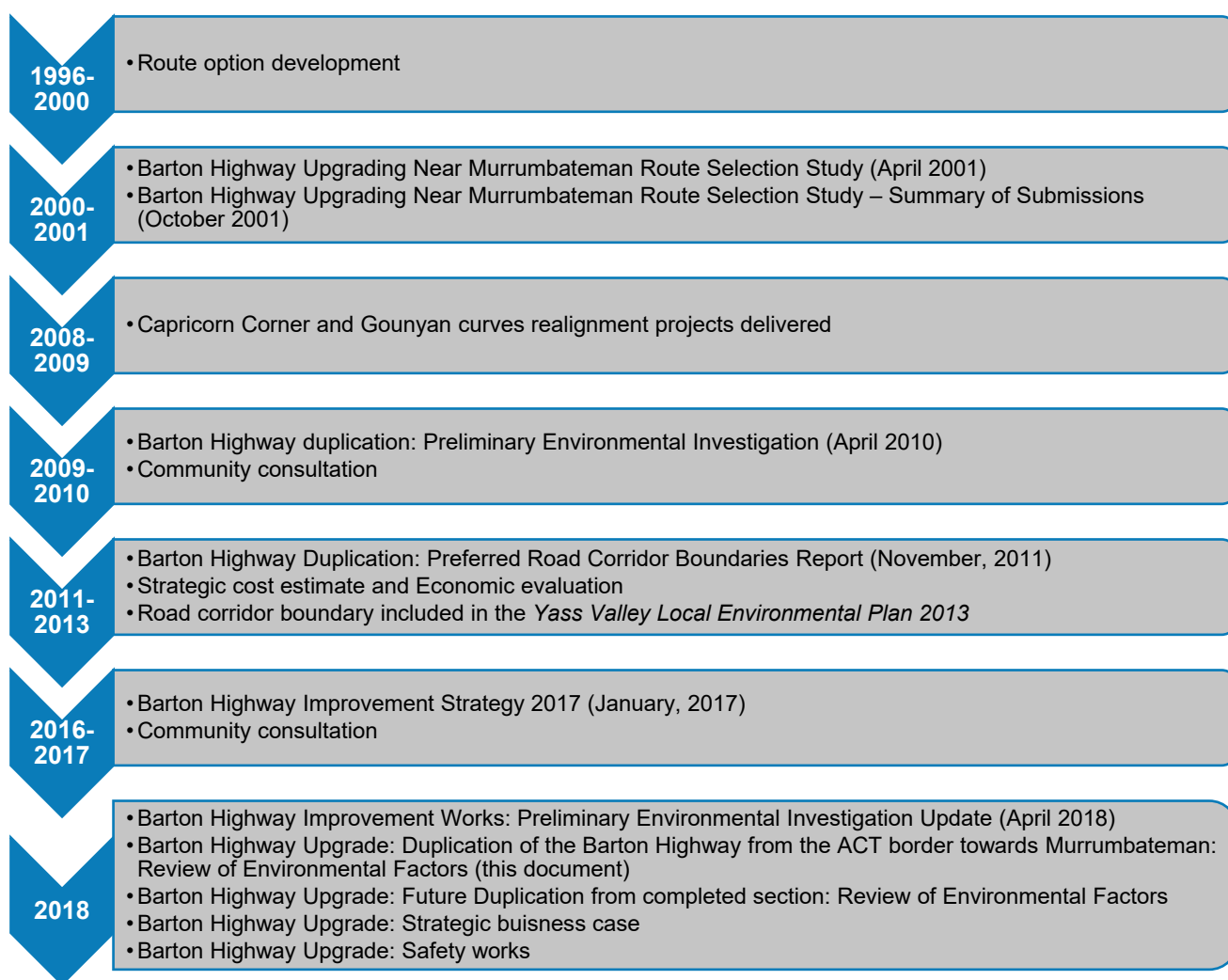


Figure 2-1 Barton Highway Upgrade – development to date



## 2.4.2 Do nothing option

The do nothing option would result in the Barton Highway continuing to function in its current state. There would be no improvement to road safety or reduction in the crash rate along this section of the highway, which is higher than the national average (see Section 2.1.3). The level of service would continue to decline due to the projected increase in traffic volume as a result of population growth in Murrumbateman and Yass, which would contribute to increase risk of crashes occurring. Over time the safety performance and travel times of the Barton Highway would continue to deteriorate and the proposal objectives (see Section 2.3.1) would not be achieved. The do nothing option was therefore not considered to be feasible.

## 2.4.3 Alternative options considered

Options for increasing road capacity and improving safety on the highway were developed following a feasibility study and succession of workshops with key stakeholders and the project design team. Three high level concepts were considered viable to achieve the proposal objectives:

- Providing new overtaking lanes on the existing highway with safety improvements
- Providing a new northbound carriageway with safety improvements to the existing highway
- Full reconstruction of the highway (new northbound and southbound carriageways).

Eight initial design options were developed to provide the necessary improvements. There were design elements which were common to all options including development predominately on the western side of the existing highway (to avoid the Wattle Park Uniting Church and Bedulluck TSR), providing safety improvements to the existing highway, being located within the road corridor boundary where practical and being able to tie in with the existing highway at the northern and southern extents of the proposal. Schematic diagrams of the options are shown in Figure 2-2. The initial design options were:

### ***New overtaking lanes***

- Option 1 – Provide new overtaking lanes on the existing highway with improvements to the road surface to increase its design life. The existing highway would be widened along its length and generally remain in its current vertical and horizontal geometry. Intersection upgrades would be required with new safety barriers and line marking. Construction of this option would be carried out online requiring multiple periods of partial and full closures of the highway causing significant traffic disruption
- Option 2 – Provide new overtaking lanes on the existing highway with modifications to the vertical geometry to improve safety and meet the requirements of the *Barton Highway Design Guidelines*. The existing highway would be widened along its length and generally remain in its current horizontal geometry. Intersection upgrades would be required with new safety barriers and line marking. Construction of this option would be carried out online requiring multiple periods of partial and full closures of the highway causing significant traffic disruption
- Option 3 – Provide a new single carriageway with overtaking lanes. A new single carriageway would be constructed to the west of the existing highway meeting the design and geometry requirements of *Barton Highway Design Guidelines* with overtaking lanes to provide additional capacity. Construction of the new single carriageway would be carried out offline minimising traffic disruption. The existing highway would be closed and landscaped following the opening of the new carriageway.

### ***New northbound carriageway***

- Option 4 – Provide a new northbound carriageway to the west of the existing highway with safety improvements to the existing carriageway. The existing carriageway would be modified to become the southbound carriageway providing a dual carriageway within the construction boundary. Construction of the new northbound carriageway would be carried out offline minimising traffic disruption

- Option 5 – Provide a new northbound carriageway to the west of the existing highway with improvements to the surface of the existing highway to increase its design life. The existing carriageway would be widened and modified to become the southbound carriageway providing a dual carriageway within the construction boundary. Construction of the new northbound carriageway would be carried out offline minimising traffic disruption
- Option 6 – Provide a new northbound carriageway to the west of the existing highway with modifications to the vertical geometry of the existing highway to improve safety and meet the requirements of the *Barton Highway Design Guidelines*. The existing carriageway would be widened and modified to become the southbound carriageway providing a dual carriageway within the construction boundary. Construction of the new northbound carriageway would be carried out offline minimising traffic disruption
- Option 7 – Provide a new northbound carriageway to the west of the existing highway with a narrow median. The existing highway would be widened to the west to provide a new northbound carriageway and the existing carriageway would be modified to become the southbound carriageway providing a dual carriageway within the construction boundary. Construction of the proposal would be carried out online requiring multiple periods of partial and full closures of the highway causing significant traffic disruption.

#### ***Full reconstruction (new northbound and southbound carriageways)***

- Option 8 – Provide a new dual carriageway with a new northbound and southbound carriageways and a narrow median. The new dual carriageway would be built offline minimising traffic disruption and designed to meet the *Barton Highway Design Guidelines*. On opening of the new dual carriageway the existing highway would be converted into a service road with one lane closed and landscaped.

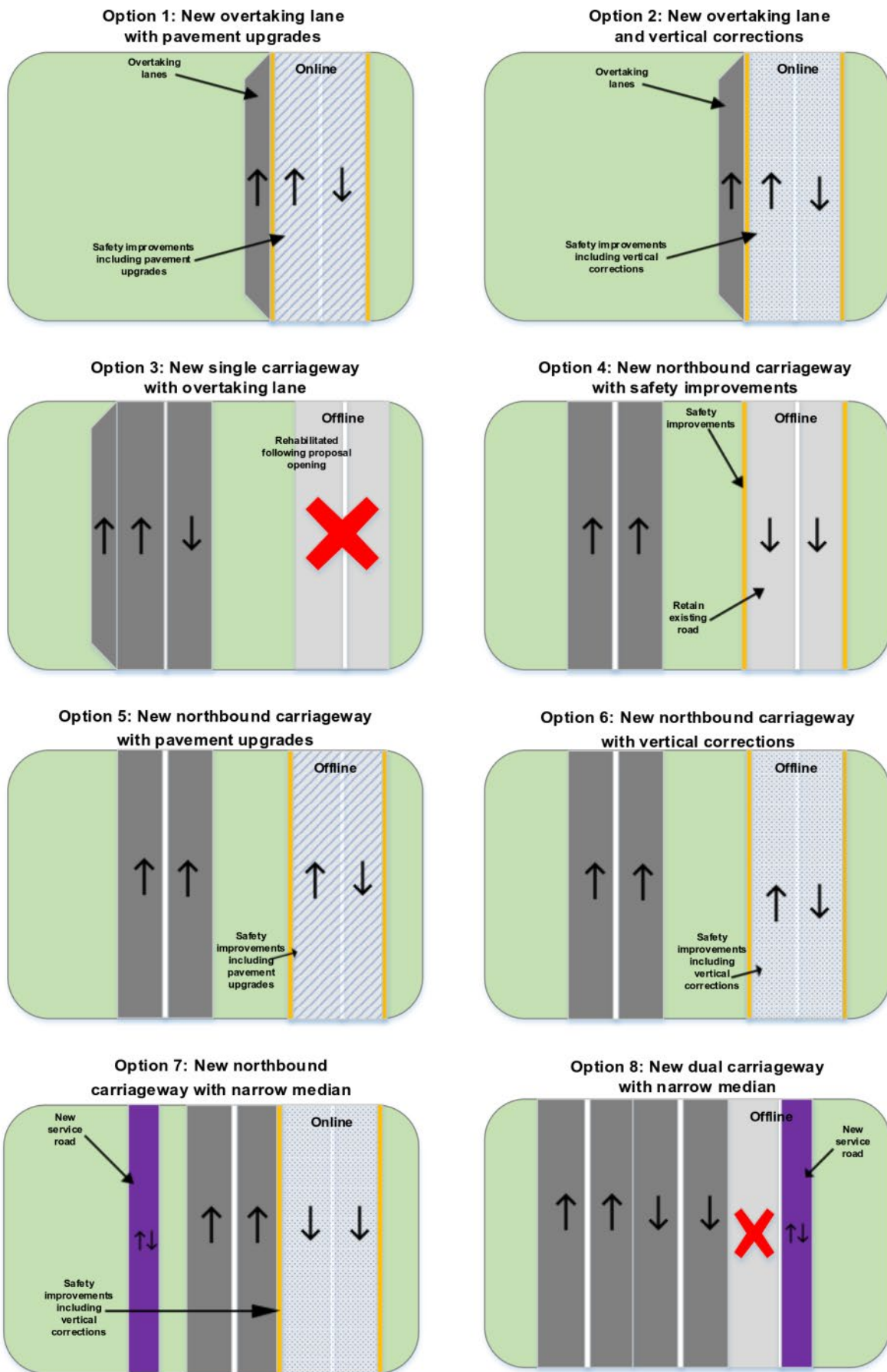


Figure 2-2 Schematic diagrams showing the layouts of the initial design options

The initial design options were assessed against the proposal objectives as part of the feasibility study with consideration to a number of economic, design and environmental factors, including:

- Total estimated cost
- Amount of additional vehicle capacity provided
- Impact to road users during construction (online or offline)
- Earthwork (cut and fill) volumes
- Design life of road pavement following construction
- Drainage improvements as a result of the proposal
- Utilities relocation requirements
- Road safety improvements
- Environmental and socio-economic impact
- Property acquisition requirements.

Options 1 and 2 which provide new overtaking lanes on the existing highway would require the least amount of property acquisition, utilities relocation and loss of existing land uses/vegetation. However, these options would be built 'online' requiring multiple periods of partial and full closures of the highway causing significant traffic disruption.

Option 3 which provides a new single carriageway with overtaking lanes would require high quantities of earthwork in comparison to the other options increasing estimated costs.

Options 1, 2 and 3 would provide short terms benefits to increasing capacity and improving safety, however in time, the highway would require further modification as the predicted increases to traffic demand would start to impact functionality and safety; and ultimately not meet proposal objectives. These options were therefore not taken forward.

Options 4, 5 and 6 provide a new northbound carriageway offline to the existing highway to minimise traffic disruption during construction. All three options provide a new dual carriageway within the construction boundary increasing capacity. These options require high quantities of earthwork in comparison to the other options increasing estimated costs. These options would require a comparable amount of property acquisition, utilities modification and environmental impact. They would provide different treatments to the existing highway at varying costs but would each meet the proposal objectives. These options were therefore taken forward for future assessment.

Option 7 which provides a new northbound carriageway next to the existing highway with a median built online causing temporary traffic disruption during construction. The design of the new northbound carriageway would be constrained by the geometry of the existing highway. This option was therefore not taken forward.

Option 8 which would provide a new dual carriageways offline would require significant property acquisition and would have a proportionate impact on existing land uses and vegetation. This option requires the largest quantity of earthwork in comparison to the other options increasing estimated costs. While this option met the proposal objectives it also had the highest cost and impact. This option was therefore not taken forward.

Option 4, 5 and 6 meet the proposal objectives while being the most cost effective and minimising impact to traffic during construction and to existing land uses. These options were therefore taken forward as the preferred options for further refinement and assessment.

## 2.4.4 Concept design options

Following the strategic cost analysis and assessment of the initial design options at the feasibility stage, the three concept design options for the proposal (Options 4, 5 and 6) were considered for further refinement and analysis at the concept design stage. In addition one new option (Option 4a) was considered which is similar to Option 4 but includes additional linkages and adjustment to local roads. All four options involved construction of a new northbound carriageway to the west of the existing Barton Highway which would be built offline. The main differences between the options was the treatments to the existing highway with Option 4a providing similar benefits of Option 4 but with additional safety improvements through additional adjustment to local roads.

A Value Management Workshop was held in March 2018 to identify key performance criteria for the proposal and to help determine the preferred option for development. The workshop involved the project team and technical specialists and included an assessment of:

- Functional/technical/utilities/constructability/maintenance risks
- Environmental/land use planning/flooding/regulatory risks
- Social/community/stakeholder/safety risks
- Corporate/project management/delivery/approval risks.

Using the performance criteria set at the workshop and through the development of the *Barton Highway Design Guidelines* (Roads and Maritime, 2018b) the concept design options were assessed. Option 5 and 6 were considered to be more costly than Option 4 and 4a, thereby reducing the length of duplication that could be provided within the proposal budget constraints. The highways surface was considered to be performing well and could be sufficiently improved by road surface upgrades provided in Option 4 and 4a.

The options were also assessed against their relative safety improvements and the occurrences of potential traffic conflicts and the ability to 'design out' safety issues. Option 4a had reduced traffic conflicts than Option 4 as it had fewer intersections which directly access the highway requiring local traffic to merge before joining the highway.

Option 4a had minimal environmental impact, best fulfilled the proposal objectives and met stakeholder requirements, and was therefore taken forward as the preferred option.

## 2.5 Justification for the preferred option

The do nothing option would mean that the objectives of the proposal would not be achieved, which would not support NSW government policies and strategies for providing safe and efficient road transport to support development in the state. This option would lead to reduced levels of service and increased crash rates within the proposal as traffic volumes increase over time. The do nothing option was therefore not considered a feasible option.

The preferred option selected for development (Option 4a) would provide a new northbound carriageway offline from the existing highway. This would allow construction to be carried out while the existing highway remained open to traffic minimising traffic disruption. Once the new northbound carriageway is complete both lanes of traffic would be temporarily switched to the new carriageway to allow the modification of the existing highway. The current safety issues with the existing highway would be significantly reduced through the provision of an additional lane of traffic in each direction and removing the need for dangerous overtaking manoeuvres.

Option 4a includes modifications of the existing highway to improve safety (such as minor road surfacing work, intersection upgrades and providing acceleration and deceleration lanes) while minimising modifications that are not justified from a cost benefit perspective (allowing a greater distance of the new



northbound carriageway to be provided within budget provisions). While the road surface of the existing highway is reaching the end of its design life, a condition assessment carried out in 2017 found that it is performing well and displays structural serviceability, acceptable roughness, acceptable limit of cracking and only 10 per cent of the single carriageway road surface sections show moderate rutting (Australian and NSW governments, 2017).

## 2.6 Design refinements

### 2.6.1 Intersection design

Intersection design is a key component of the proposal with respect to improving the level of service as well as for safety performance of the Barton Highway. There are two key types of intersections:

- At-grade intersections – where two or more road lanes meet or cross at the same height (grade) so that traffic must cross other road lanes
- Grade separated interchanges – where road lanes cross each other at different heights (grades) so that they do not disrupt the traffic flow on other road lanes when they cross each other.

Grade separated interchanges are generally considered safer than at-grade intersections as there is no requirement to cross oncoming traffic to cross road lanes. To achieve the different grades of road lanes, significant (generally concrete) structures are used in combination with major earthwork and the use of piers to separate the lanes. The capital cost of grade separated interchanges is very high and therefore they are generally only used in busy urban areas and on highways with significant traffic.

At-grade intersections do not typically require significant structures and are therefore much more cost effective to construct, however there are potential safety implications as road users must cross over lanes with oncoming traffic to continue their journeys.

In the development of the proposal, grade separated interchanges have been considered for the various intersections along the highway. Figure 2-3 shows an example of the differing intersection options considered at the Barton Highway/Kaveney's Road/ Anchow Hill Lane intersection.

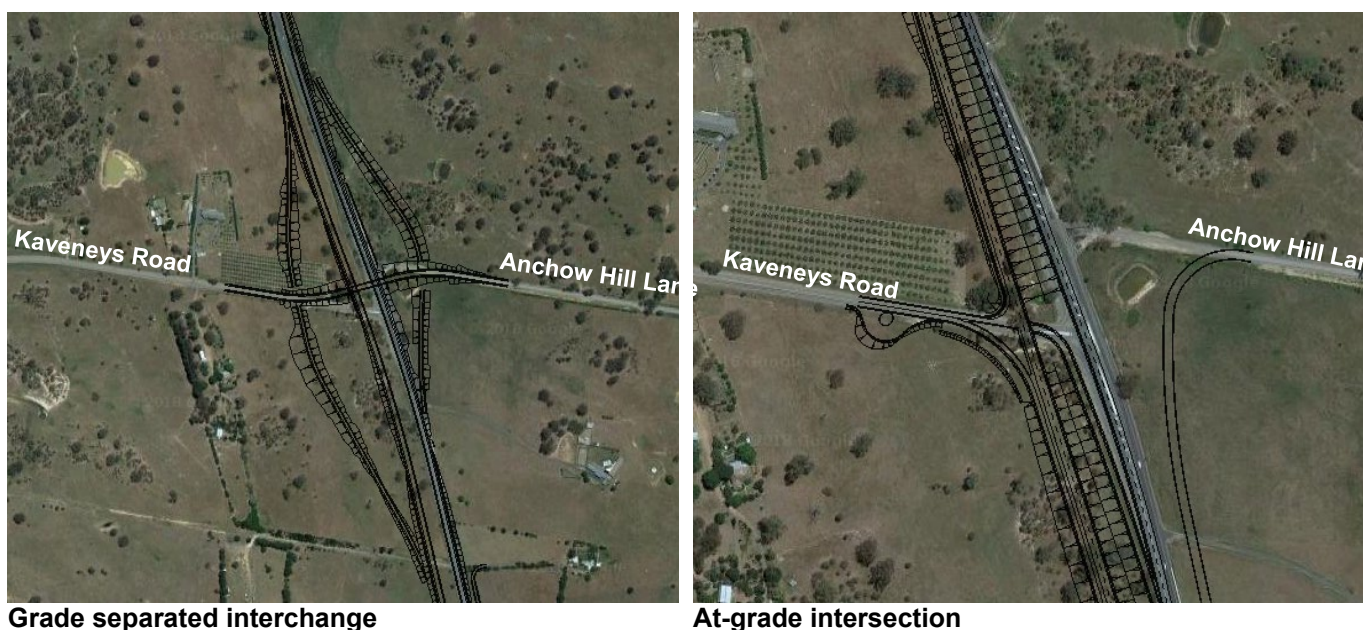


Figure 2-3 Intersection design options at Kaveney's Road – Anchow Hill Lane intersection

The current traffic demand on the Barton Highway and adjoining local roads are such that the capital expenditure required for grade separated interchanges is not considered justifiable. Design refinements for the proposal have therefore used at-grade intersections throughout the construction boundary with necessary modifications such as acceleration and deceleration lanes and a review of sight distances.

As traffic demand increases on the Barton Highway, cost benefit assessments may justify the need for providing grade separated intersections within the construction boundary. The proposal has therefore been designed to enable conversion to grade separated interchanges in the future based on traffic generation requirements (eg future conversion should not require alterations to the alignment of the Barton Highway). Property acquisition carried out as part of the proposal has also considered future property acquisition requirements to minimise the disruption to nearby landowners from continual acquisition of land.

## 2.6.2 Median width

The strategic design carried out by Roads and Maritime in 2011 adopted a wide median to allow for storage of a B-Triple design vehicle, as sought by Yass Valley Council. However during the Value Management Workshop the median design requirement was revised to cater for a B-Double trailer with an allowance for B-Triple check vehicle, which would allow narrowing of the median. The resulting intersection configuration allows for acceleration and deceleration lanes to reduce impact with through traffic on the Barton Highway.

## 2.6.3 U-turn facilities

The proposal would remove right-turn movements from most access points within the construction boundary. Design options were considered to minimise the distances that local road users would be required to travel before turning round. Considering the options, u-turn facilities were designed to provide the required operational performance while minimising cost and environmental impact.

The u-turn facilities cater for right-turn movements from left-in left-out access points. U-turn facilities would be provided at the following locations:

- Church Lane
- Spring Range Road
- Rolfe Road
- Nanima Road
- Kaveney's Road.

The u-turn facilities also allow for off-alignment bus stops to be located at Spring Range Road, Nanima Road and Kaveney's Road with provision of off-alignment safe parking at these locations.

## 2.6.4 High voltage relocation

The existing high voltage (22 kV) distribution line running parallel with the Barton Highway on the western side is impacted by the proposed northbound carriageway. Two options were considered for the relocation of this utility:

- Relocation of distribution line within approved road corridor as identified in the *Yass Valley LEP Plan 2013*
- Relocation of distribution line to private property.

It was determined in the Value Management Workshop that relocation of the distribution line is to be carried out within the approved road corridor to minimise impact to local residents and property acquisition. This relocation would be advanced during detailed design consultation with the utility provider and property owners.

## 2.6.5 Horizontal geometry at Hall

The existing Barton Highway alignment at Hall near the NSW/ACT border includes a 'broken back curve' (see Figure 2-4). Broken back curves are nearby curves of the same direction which are separated by a short length of straight or in some cases by a large radius curve (Austroads, 2018). Broken back curves are typically avoided for safety reasons unless absolutely necessary.



Figure 2-4 Barton highway - Broken back curve at the NSW/ACT border

The broken back curve on the existing highway would be improved and realigned in the future when funding is available. For the new northbound carriageway alternate options were assessed to achieve design objectives and minimise impact to Box-Gum Woodland at the Hall TSR. These options included:

- Match alignment of existing highway (ie using a broken back curve)
- Single radius horizontal curve (with allowances for future upgrades to the existing highway)
- Single radius horizontal curve (with narrowed median)
- Relocate both carriageways east.

Designing the new northbound carriageway to follow the existing highway would require the use of a broken back curve providing a design which is not preferred for safety reasons. This option was not taken forward as it would not meet the project objectives of improving safety for road users of the Barton Highway.

Using a single radius horizontal curve for the new northbound carriageway provides a safer alternative and best meets the project objectives of providing improving safety for road users. This option provides adequate space for the future reconstruction of the existing highway at this location to replace the existing

broken back curve with a new single radius horizontal curve (when funding is available) without needing to upgrade the new northbound carriageway. This option has the greatest impact on the nearby area of Box-Gum Woodland on the western side of the existing highway.

Providing a single radius horizontal curve for the new northbound carriageway with a narrowed median would minimise impact to Box-Gum Woodland on the western side of the existing highway however would not allow for the future upgrade of the existing highway to remove the broken back curve. Future work to improve the experience and safety for road users by removing the broken back curve would require reconstruction of the new northbound carriageway and/or impact to the Box-Gum Woodland on the eastern side of the highway. This option would have greater traffic issues during construction than the option without the narrowed median.

An option was considered which would relocate the alignment of the new northbound carriageway and the existing highway to the east to minimise impact to Box-Gum Woodland to the west. This option would require reconstruction of the existing highway, which would have implications for managing traffic impact during construction. This option would also impact the Box-Gum Woodland to the east of the existing highway. The impact to Box-Gum Woodland would be relatively comparable but would impact the trees on both sides of the highway.

Overall the option which best meets the project objectives to provide a safer Barton Highway for road users is the option to provide a single radius horizontal curve. While this option has the greatest impact to Box-Gum Woodland on the western side of the existing highway it provides adequate space for future proposals to upgrade the existing highway to remove the broken back curve without needing to reconstruct the new northbound carriageway. This option minimises impact to traffic during construction and would provide a safer design for road users.



## 3. Description of the proposal

Chapter 3 describes the proposal and summarises key design parameters, construction method and associated infrastructure and activities. The description of the proposal is based on the reference design, and is subject to detailed design.

### 3.1 The proposal

The proposal involves duplicating around eight km of the Barton Highway from about 700 m south of the NSW/ACT border towards Murrumbateman, about 300 m north of Kaveney's Road. The upgrade would be from a two lane two way carriageway (one in each direction) to a four lane dual carriageway (two lanes in each direction) with a central median.

Key features of the proposal include:

- Providing a new two lane northbound carriageway from about 700 m south of the NSW/ACT border towards Murrumbateman, about 300 m north of Kaveney's Road on the western side of the existing Barton Highway
- Modifying the existing Barton Highway to provide a two lane southbound carriageway from about 700 m south of the NSW/ACT border towards Murrumbateman, about 300 m north of Kaveney's Road
- Providing a central median separating the two carriageways
- Modifying impacted intersections and property access roads to provide safe access to the highway
- Providing dedicated U-turn facilities at about one kilometre intervals to manage right turn movements
- Improving existing bus stops with accessible shelters and safe parking areas at Spring Range Road and Nanima Road
- Demolishing a residential property and all farm infrastructure in the construction boundary
- Modifying the heavy vehicle enforcement bay south of Nanima Road by providing new deceleration and acceleration lanes
- Removing the rest area at the NSW/ACT border
- Providing safety barriers where required
- Providing drainage line crossings including creek crossings at Gooromon Ponds and Little Bedulluck Creek
- Relocating and protecting utilities within the construction boundary
- Establishing temporary compound areas and stockpile sites throughout construction
- Additional work including earthwork, improving street lighting, new street furniture, replacing signage, resealing, line marking, and upgrades to kerbs.

As part of the Barton Highway Upgrade, but subject to a separate planning and approvals process, a 700 m tie-in section would be provided from the NSW/ACT border south to the existing dual carriageway in Hall, ACT. The impact assessment for this section of the proposal is documented separately (see Section 1.6).

The key features of the proposal are shown in Figure 3-1 to Figure 3-3. Typical cross sections of the proposal are shown in Figure 3-4.



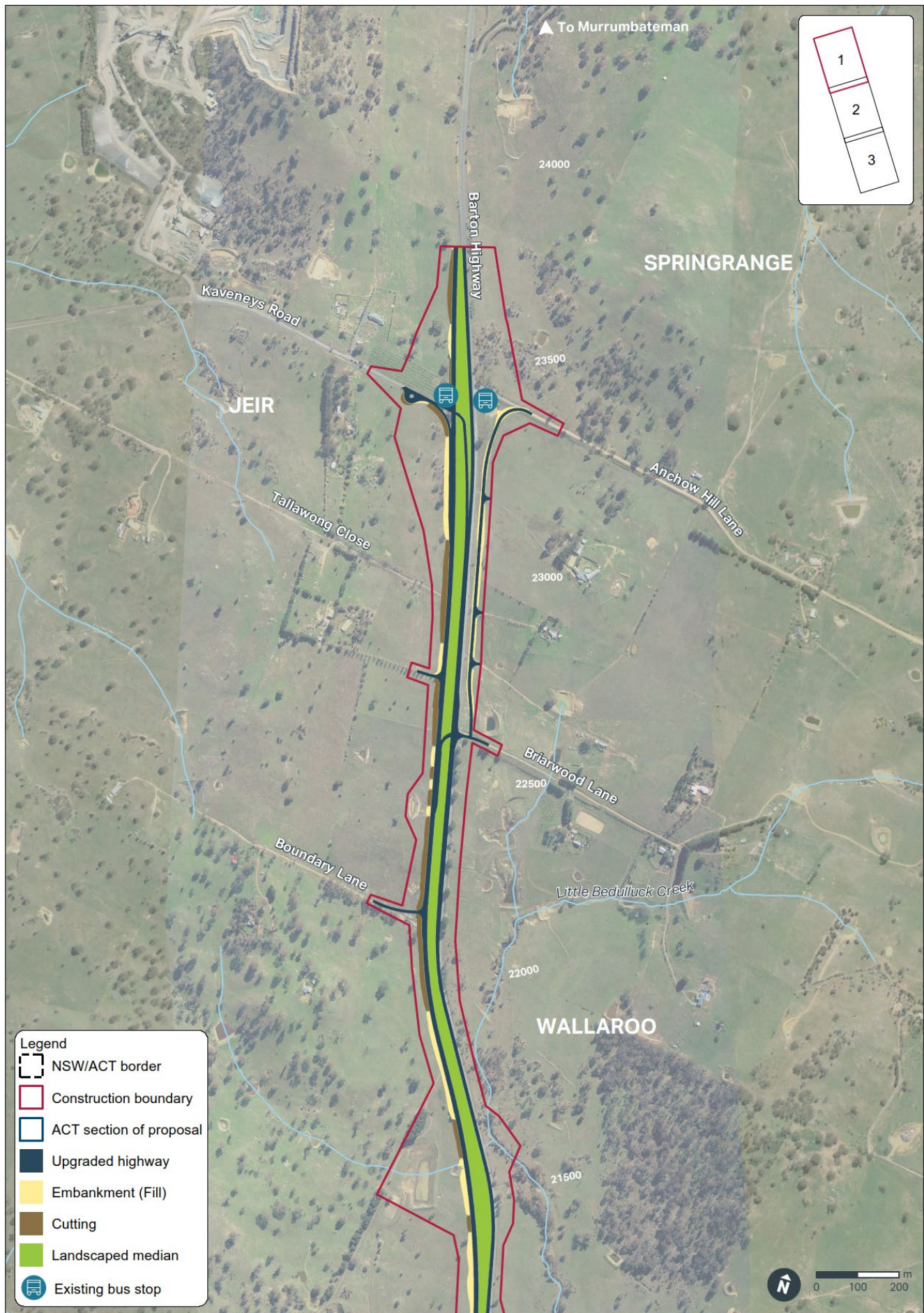


Figure 3-1 Key features of the proposal – map 1 of 3



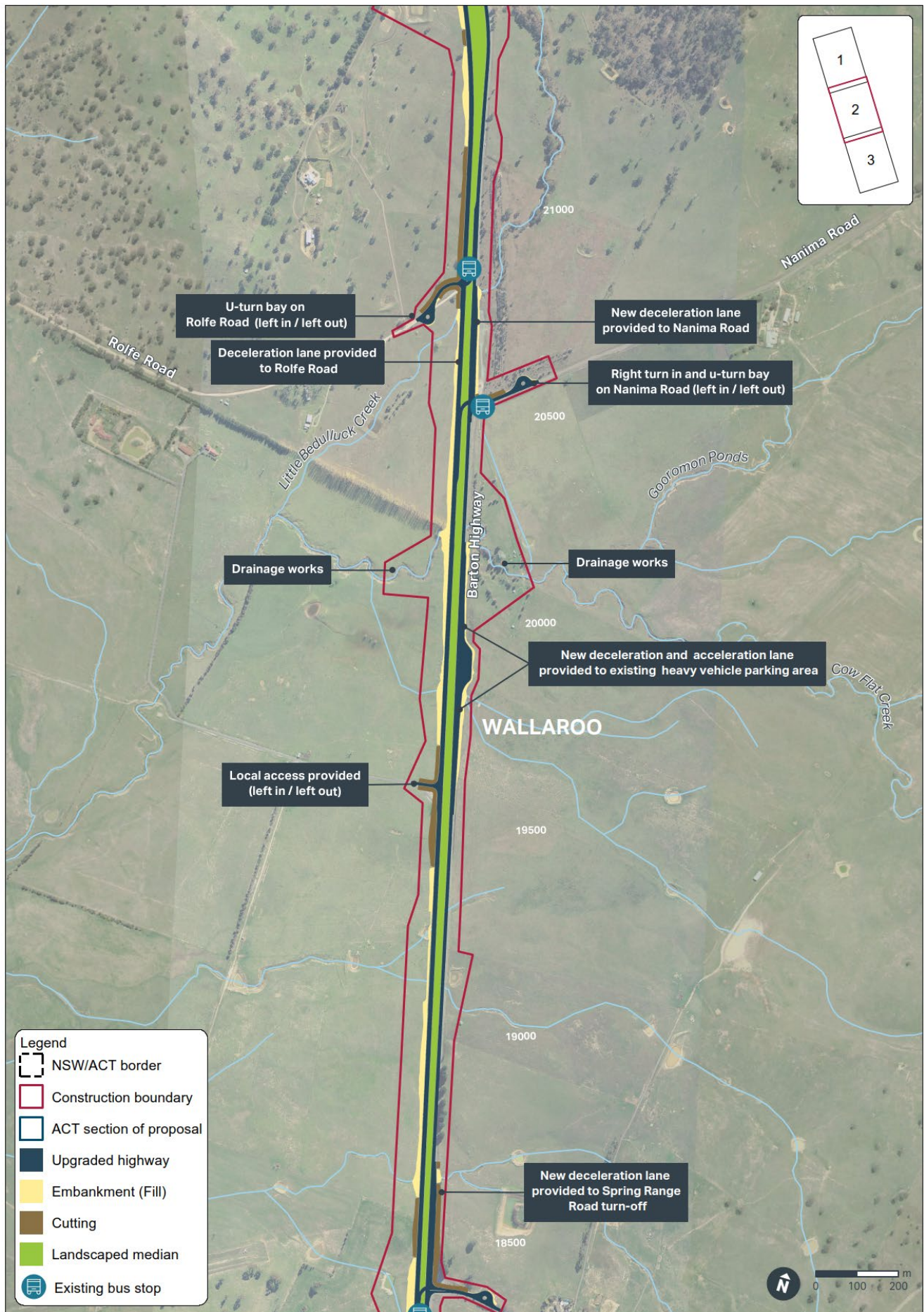


Figure 3-2 Key features of the proposal – map 2 of 3



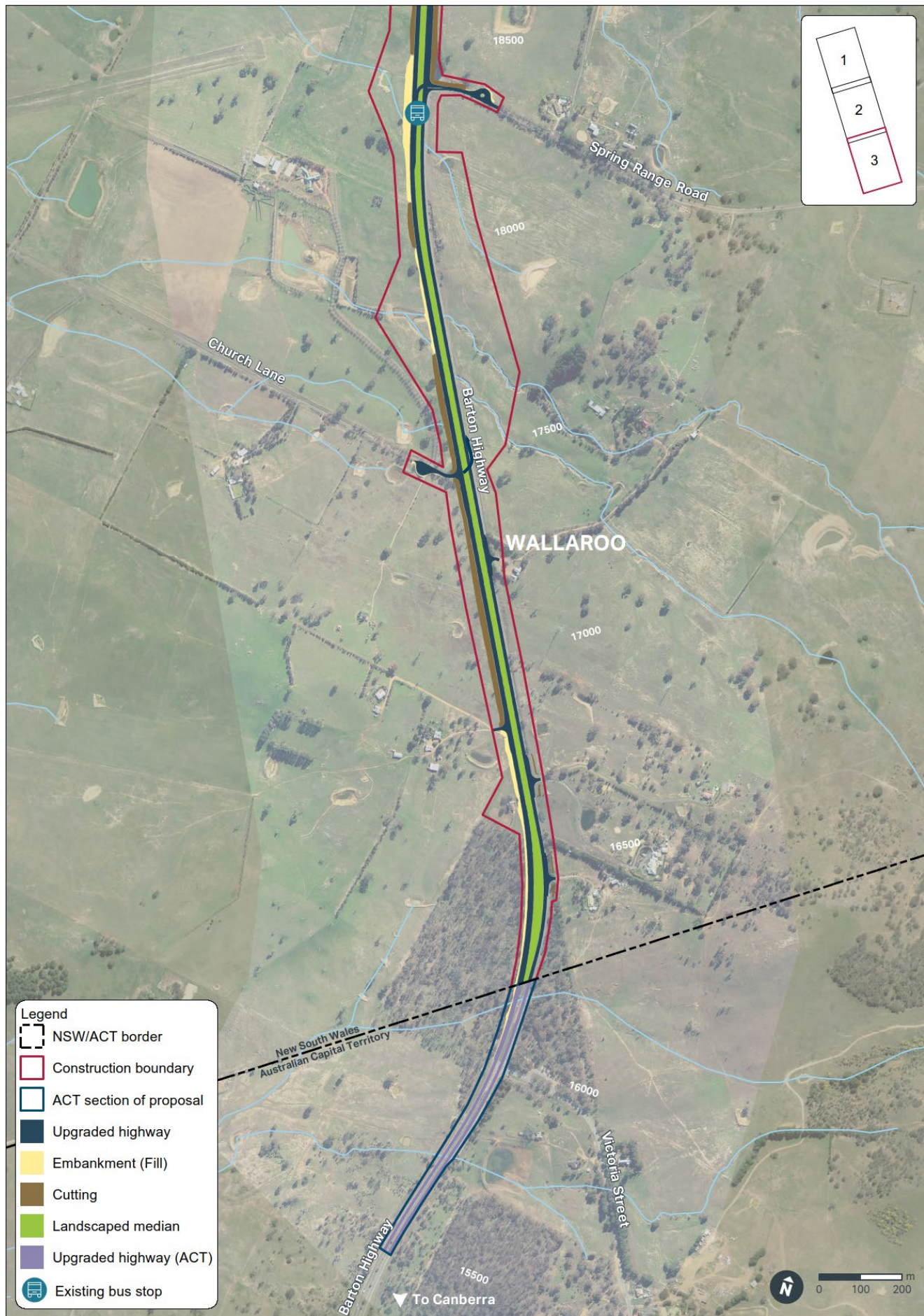
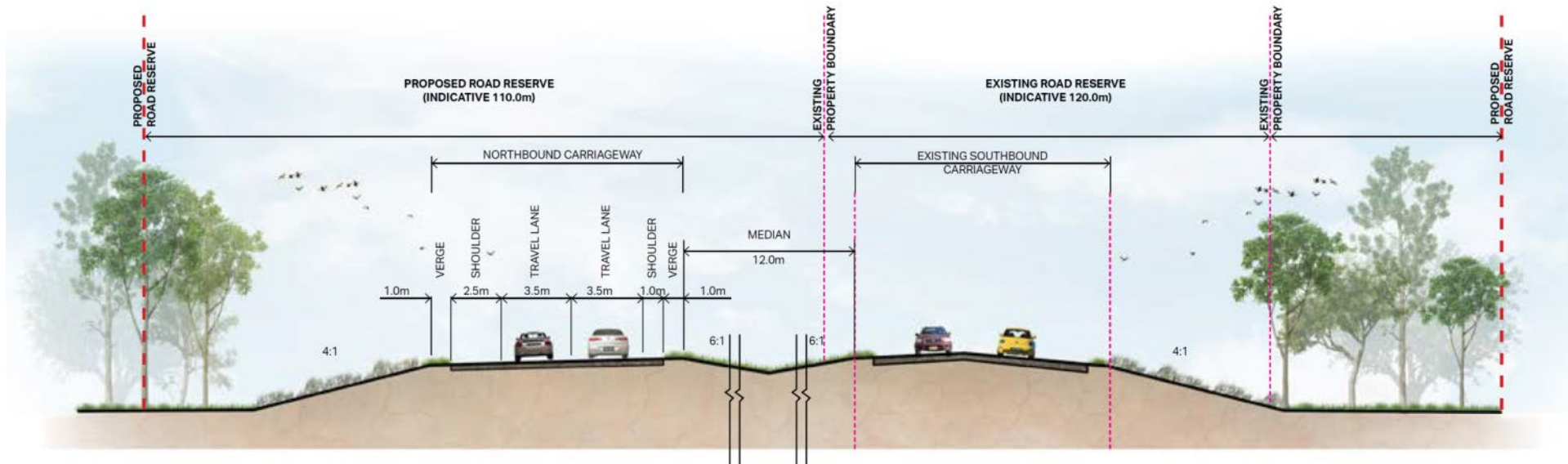
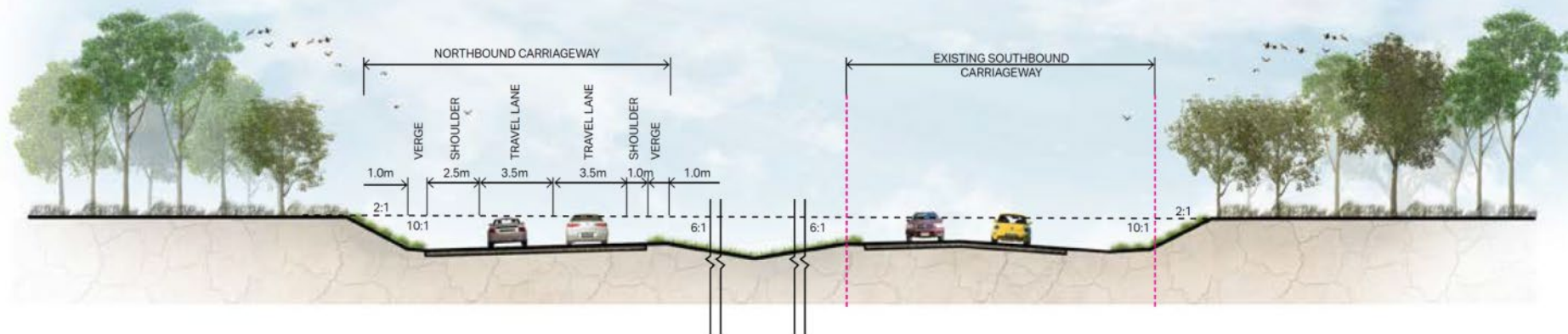


Figure 3-3 Key features of the proposal – map 3 of 3





**TYPICAL SECTION- BARTON HIGHWAY: REFERENCE DESIGN (FILL SECTIONS)**  
SCALE: 1:200



**TYPICAL SECTION- BARTON HIGHWAY: REFERENCE DESIGN (CUT SECTIONS)**  
SCALE: 1:200

Figure 3-4 Typical cross section of Barton Highway for fill and cut sections

## 3.2 Design

### 3.2.1 Design criteria

The proposal has been designed to be consistent with Roads and Maritime's *Barton Highway Design Guideline* (Roads and Maritime, 2018b), which provides design requirements for the proposal in conjunction with the *Guide to Road Design* (Austroads, 2009). The design criteria for the proposal include those identified in Table 3-1.

Table 3-1 Design Criteria

Criteria	Requirement
<b>Main carriageway</b>	
Design speed	110 km/h
Posted speed	100 km/h
Number of lanes	Two in each direction
Crossfall	Less than three per cent (four per cent where vertical grade is less than one per cent)
Superelevation	Greater than three per cent
Grade	Desirable minimum: 4.5 per cent. Absolute maximum: six per cent (alternative slopes can be used pending geotechnical advice and approval. Sight distance requirements must also be achieved)
Lane width (including auxiliary lanes)	3.5 m
Shoulder width	Nearside (outside): 2.5 m (3 m next to barrier) Offside (median): 1 m (2 m next to barrier)
Verge width	Nearside: 2 m Offside: 2 m
Kerb and gutter	Outside shoulder (kerb to be outside of shoulder to ensure consistent paving width)
Median width	12 m (minimum) (safety barrier to be provided where median width is less than 14 m)
Clearance (eg underside of power lines)	5.6 m (minimum)
Design vehicle	Five m car 26.0 m B-Double trailer (design) 36.5 m B-Triple trailer (design check)
Hazard free zone	12 m
Property access	Left in / Left out
Flood immunity	Existing highway: No change New northbound carriageway: 1 in 100 year ARI flood event

### 3.2.2 Engineering constraints

A number of existing constraints have influenced the design of the proposal. These are discussed below.

**Existing structures and configuration:** the location and configuration of existing structures needed to be considered during the development of the design – these structures included the existing Barton Highway, drainage structures, intersections and utility infrastructure. The existing intersections would be used to tie in with the road network where available.

**Roads and Maritime requirements:** as per Section 3.2.1, the proposal was designed to be consistent with Roads and Maritime's *Barton Highway Design Guideline* (Roads and Maritime, 2018b), which provides design requirements for the proposal in conjunction with the *Guide to Road Design* (Austroads, 2009).

**Utilities:** A Dial Before You Dig search and site inspections with utility providers has identified a number of utilities in the vicinity of the proposal including:

- High voltage electrical services (aboveground) running along the length of and across the proposal
- Telecommunication services (underground)
- Stormwater
- Water and sewer.

These existing utilities have been located using environmentally sensitive potholing techniques and relocations have been incorporated into the proposal (subject to detailed design).

#### Other considerations:

- The construction boundary contains Matters of National Environmental Significance (MNES), namely Box-Gum Woodland and Golden Sun Moth which are protected under the *EPBC Act*, and other species and habitats protected under the *BC Act*. Disturbance of these areas, particularly during site establishment, is to be minimised to the greatest extent practical
- The Barton Highway is a key traffic access route and so access is to be maintained throughout the duration of the construction program to the greatest extents practical
- Wattle Park Uniting Church, located to the east of the existing highway, is a community facility and is listed in the *Yass Valley LEP 2013* for its heritage values and should be avoided
- Areas of Aboriginal heritage potential have been identified within the construction boundary should be avoided as feasible and reasonable
- Mature trees, including large pine tree stands which act as wind breaks, should be avoided where feasible and reasonable as these trees provide screening of the highway, have amenity value and may provide habitat for protected fauna
- It is desirable to achieve an earthwork balance (ie the same amount of cutting and filling)
- The proposal would be designed to make the flood immunity of the area no worse than the existing situation.

### 3.2.3 Urban design and landscape

Roads and Maritime has developed a *Barton Highway Urban Design Framework* (Roads and Maritime, 2018d) for the *Barton Highway Upgrade* to provide strategic design guidance and direction for developing each part of the program (which includes the proposal) to achieve a well-integrated design outcome of consistent quality throughout.

The aim of the *Barton Highway Urban Design Framework* is also to ensure successful highway duplication in line with the *Barton Highway Upgrade* objectives by:

- Providing a consistent Urban Design Framework along the length of the highway duplication



- Providing the key Urban Design Principles for effective communication between design packages
- Establishing design bench-marks against which to measure the Barton Highway Upgrade.

The *Barton Highway Urban Design Framework* provides specific urban design guidance for the development and delivery of the *Barton Highway Upgrade*. Seven key design objectives are provided which have evolved from the nine urban design principles of *Beyond the Pavement* (Roads and Maritime, 2014b) and are supplemented by a number of Roads and Maritime Guidelines.

The urban design objectives are:

- Objective 1: Contribute to urban structure and revitalisation of Murrumbateman
- Objective 2: Fit the highway lightly within its landscape setting
- Objective 3: Design the highway alignment to maximise legibility and user navigation
- Objective 4: Respond to natural vegetation patterns, threatened flora and cultural plantings
- Objective 5: Connect road, public transport and active transport modes (pedestrian, cycling, equestrian) and communities
- Objective 6: Achieve integrated and minimal maintenance design
- Objective 7: Provide a simple, coordinated composition of road elements along the corridor.

In addition to the above urban design objectives which have been considered during the development of the design, a landscape character and visual impact assessment has been carried out and a landscape strategy developed for the proposal, see Section 6.8.

### 3.2.4 New northbound carriageway

The new two lane northbound carriageway to the west of the existing Barton Highway would be designed to meet the design criteria outlined in Table 3-1 and start about 700 m south of the NSW/ACT border north towards Murrumbateman, ending about 300 m north of Kaveney's Road. The new northbound carriageway would generally follow the alignment of the existing highway with curves modified (generally straightened) to meet design requirements for a design speed of 110 km per hour (and a posted speed limit of 100 km per hour).

Construction of the new northbound carriageway would incorporate a series of cut and fill elements to respond to the undulating terrain within the construction boundary and to achieve the required vertical alignment. A new median separating the northbound carriageway and the modified existing highway (southbound carriageway) would be built to improve the safety of the highway during operation and to provide for the management of surface water flows.

Eight existing intersections would be modified to provide safe access to the new northbound carriageway, including five named roads and three property access roads. See Section 3.2.6 for further details on intersection modifications.

Safety barriers would be installed where required along the length of the proposal. The type of barrier to be installed would be dependent on safety requirements.

### 3.2.5 Modification of the existing highway (southbound carriageway)

The existing two lane two way carriageway (one in each direction) would be modified to provide a new two lane southbound carriageway. Modification of the existing highway would be carried out from about 700 m south of the NSW/ACT border towards Murrumbateman, about 300 m north of Kaveney's Road. Minimal work would be carried out to facilitate the conversion and would likely include:

- Road resurfacing at limited locations, including modifying road crossfall
- Upgrading of drainage as required including extensions of culverts
- Providing new deceleration lanes at the Spring Range Road and Nanima Road intersections
- Providing new u-turn facilities on Spring Range Road and Nanima Road
- Modifying the heavy vehicle enforcement bay south of Nanima Road by providing new deceleration and acceleration lanes
- Improving street lighting, providing new street furniture, replacing signage, new line marking and upgrading to kerbs.

The modifications to the existing highway are likely to be carried out following the completion of the new northbound carriageway to minimise traffic disruption. Section 3.2.6 provides further details on proposed intersection modifications.

## 3.2.6 Intersections

The proposal would include the following intersections:

- Thirteen at-grade intersections with the Barton Highway
- Five protected right turn bays
- Five u-turn facilities.

Intersections would be designed to provide a minimum Level of Service “C”, in accordance with *Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis*. At-grade intersections provided as part of the proposal have been designed to allow for future upgrades to grade separated interchanges if required based on traffic growth. Table 3-2 details the intersection upgrades provided as part of the proposal.

Table 3-2 Intersection upgrades

Road name	Location	Description	Nearest right turn access point
Property access CH16450	East	Direct property access would be maintained but would be restricted to left-in left-out movements for improved road safety	Victoria Street about 450 m south
Property access CH16700	East	Direct property access would be maintained but would be restricted to left-in left-out movements for improved road safety	Victoria Street about 700 m south
Property access CH16820	West	Direct property access would be maintained but would be restricted to left-in left-out movements for improved road safety	Spring Range Road u-turn facility about 1.6 km north
Church Lane	West	The existing at-grade intersection would be modified to include a right turn from the southbound carriageway with a dedicated u-turn facility. A deceleration lane would be provided for traffic turning off the northbound carriageway. Movements from Church Lane would be restricted to left-out only for improved road safety	Spring Range Road u-turn facility about 1 km north

Road name	Location	Description	Nearest right turn access point
Spring Range Road	East	The existing at-grade intersection would be modified to include a right turn from the northbound carriageway with a dedicated u-turn facility. A deceleration lane would be provided for traffic turning off the southbound carriageway. Movements from Spring Range Road would be restricted to left-out only for improved road safety	Church Lane u-turn facility about 1 km south
Property access CH19600	West	Direct property access would be maintained but would be restricted to left-in left-out movements for improved road safety	Nanima Road u-turn facility about 1 km north
Nanima Road	East	The existing at-grade intersection would be modified to include a right turn from the northbound carriageway with a dedicated u-turn facility. A deceleration lane would be provided for traffic turning off the southbound carriageway. Movements from Nanima Road would be restricted to left-out only for improved road safety	Church Lane u-turn facility about 3 km south
Rolfe Road	West	The existing at-grade intersection would be modified to include a right turn from the southbound carriageway with a dedicated u-turn facility. A deceleration lane would be provided for traffic turning off the northbound carriageway. Movements from Rolfe Road would be restricted to left-out only for improved road safety	Kaveney's Road u-turn facility about 2.5 km north
Property access CH21850	West	The existing at-grade intersection would be removed as part of the proposal. Access to the Barton Highway from this property is provided through the existing local access road connections to Rolfe Road	N/A
Boundary Lane	West	The existing at-grade intersection would be modified with movements restricted to left-in left-out only for improved road safety	Kaveney's Road u-turn facility about 1.2 km north
Briarwood Lane	East	The existing at-grade intersection would be modified to include right turn from the northbound carriageway. A deceleration lane would be provided for traffic turning off the southbound carriageway. Movements from Briarwood Lane would be restricted to left-out only for improved road safety	Rolfe Road u-turn facility about 1.8 km south
Property access CH22750	West	Direct property access would be maintained but would be restricted to left-in left-out movements for improved road safety	Kaveney's Road u-turn facility about 650 m north
Tallawong Close	West	The existing at-grade intersection would be removed. Access to the Barton Highway from Tallawong Close would be provided through the existing local access road connections to Kaveney's Road	N/A
Property access CH22810	East	The existing at-grade intersection would be removed as part of the proposal. Access to the Barton Highway from this property would be provided through the construction of a new local access road connecting to Briarwood Lane	N/A

Road name	Location	Description	Nearest right turn access point
Property access CH22920	East	The existing at-grade intersection would be removed as part of the proposal. Access to the Barton Highway from this property would be provided through the construction of a new local access road connecting to Briarwood Lane	N/A
Property access CH23200	East	The existing at-grade intersection would be removed as part of the proposal. Access to the Barton Highway from this property would be provided through the construction of a new local access road connecting to Briarwood Lane	N/A
Kaveney's Road	West	The existing at-grade intersection would be modified and restricted to left-in movements only with the provision of a deceleration lane for traffic turning off the northbound carriageway. Movements from Kaveney's Road include left-out and right-out with acceleration lanes provided	Kaveney's Road includes a right turn lane
Anchow Hill Lane	East	The existing at-grade intersection would be removed. Access to the Barton Highway from Anchow Hill Lane would be provided through a new local access road connecting to Briarwood Lane	Rolfe Road u-turn facility about 2.6 km south

Existing accesses would be maintained for all properties, although some properties would experience modified access to and from the Barton Highway following the completion of construction. All intersections have been designed to improve the safety of the highway for road users in line with the proposal objectives. This has included changes to vehicle movements to reduce traffic crossing the road corridor (eg to make a right turn). The number of intersections with the highway has also been reduced to minimise slow moving traffic joining the highway.

Anchow Hill Lane has been modified to include a new local access road connecting to Briarwood Lane to the south, with three property accesses connecting to the new local access road. This reduces the number of intersections with the highway and removes the interaction with traffic turning right from Kaveney's Road opposite this section of the highway.

Except in the case of Kaveney's Road, road users wishing to turn right from intersections along the highway would be required to turn left onto the highway and then perform a u-turn at the nearest u-turn facility. The proposal includes u-turn facilities at the following locations:

- Church Lane
- Spring Range Road
- Nanima Road
- Rolfe Road
- Kaveney's Road.

At Kaveney's Road a right turn is provided with an associated acceleration lane.

Figure 3-5 and Figure 3-6 shows the property access arrangements and expected traffic movements required to access the upgraded highway. Further detail on changes to property access are provided in Section 6.1 and Appendix D (Traffic and Access Impact Assessment).



RIGHT TURN OUT OF CHURCH LANE	RIGHT TURN OUT OF SPRING RANGE ROAD	RIGHT TUR OUT OF NANIMA ROAD	RIGHT TURN OUT OF ROLFE ROAD	RIGHT TURN OUT OF BOUNDARY LANE
<b>FROM:</b> Church Lane to ACT via Spring Range Road	<b>FROM:</b> Spring Range Road to Yass via Church Lane	<b>FROM:</b> Nanima Road to Yass via Church Lane	<b>FROM:</b> Rolfe Road to ACT via Briarwood Lane	<b>FROM:</b> Boundary Lane to ACT via Kavenys Road
<b>DISTANCE / TIME:</b> 2.30 km / 1 minute 40 seconds	<b>DISTANCE / TIME:</b> 1.60 km / 1 minute 10 seconds	<b>DISTANCE / TIME:</b> 5.90 km / 3 minute 40 sec	<b>DISTANCE / TIME:</b> 3.70 km / 2 minutes 20 seconds	<b>DISTANCE / TIME:</b> 3.1 km / 1 minute 50 seconds

Figure 3-5 Property access arrangements – map 1 of 2




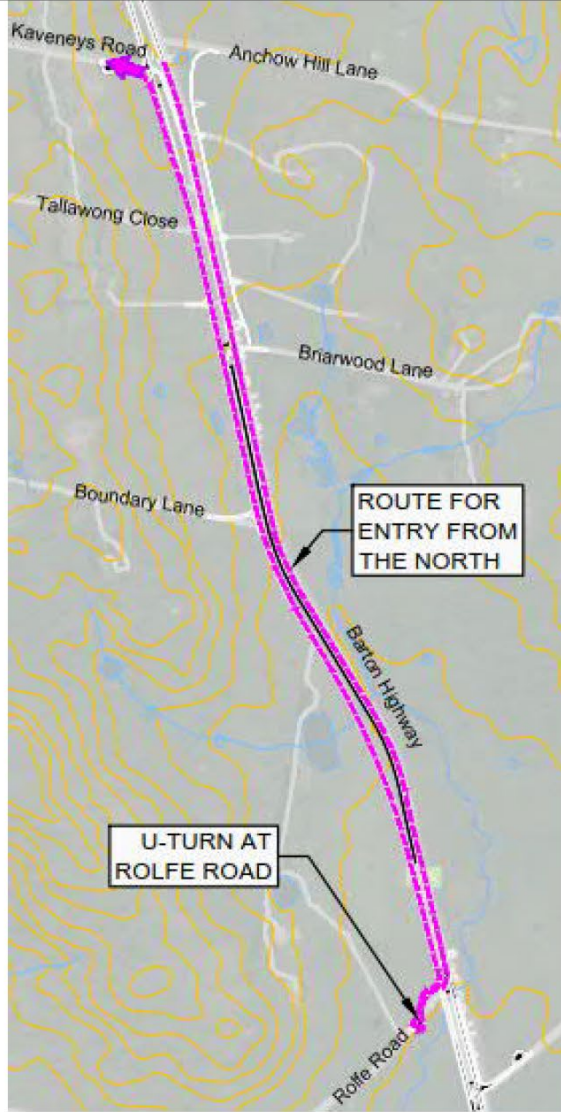

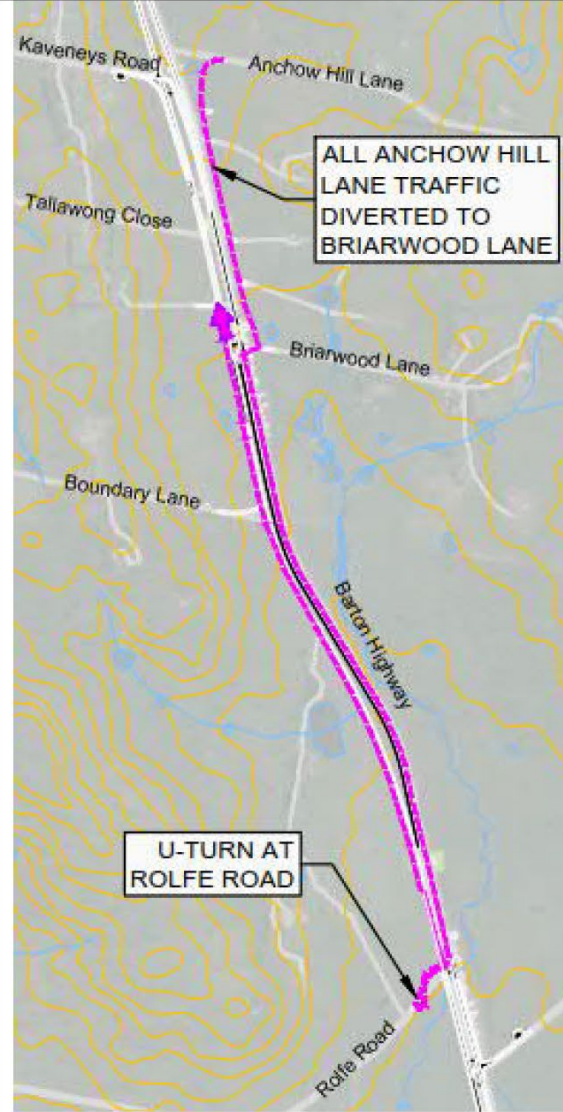
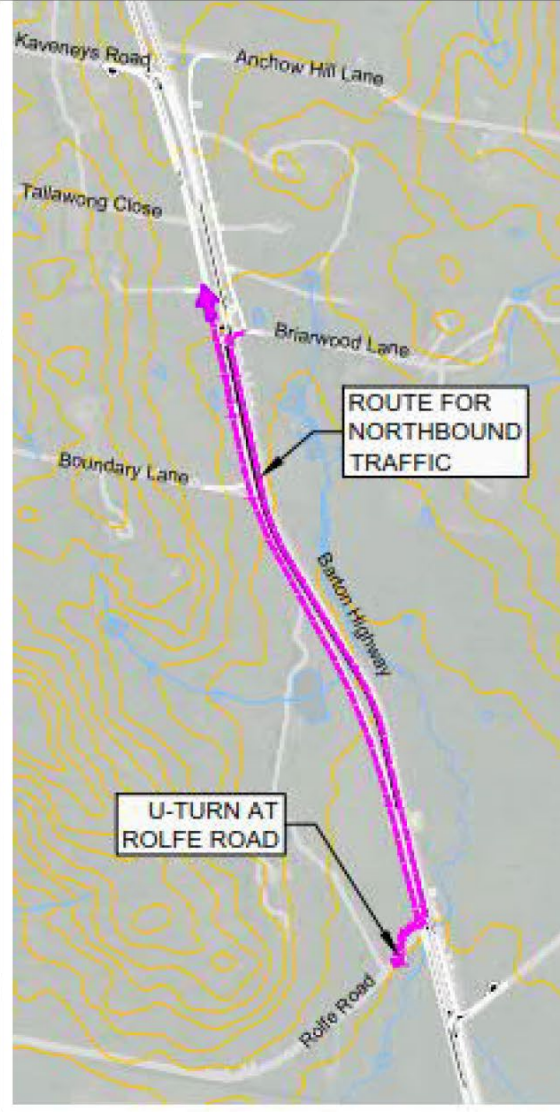
RIGHT TURN INTO BOUNDARY LANE	RIGHT TURN INTO KAVENEYS ROAD	RIGHT TURN INTO ANCHOW HILL LANE	RIGHT TURN OUT OF ANCHOW HILL LANE	RIGHT TURN OUT OF BRIARWOOD LANE
				
<b>FROM:</b> Yass to Boundary Lane via Rolfe Road	<b>FROM:</b> Yass to Kaveney's Road via Rolfe Road	<b>FROM:</b> ACT to Anchow Hill Lane via Briarwood Lane	<b>FROM:</b> Anchow Hill Lane to Yass via Rolfe Road	<b>FROM:</b> Briarwood Lane to Yass via Rolfe Road
<b>DISTANCE / TIME:</b> 2.4 km / 1 minute 30 seconds	<b>DISTANCE / TIME:</b> 4.8 km / 3 minutes 10 seconds	<b>DISTANCE / TIME:</b> 1.7 km / 1 minute	<b>DISTANCE / TIME:</b> 5.0 km / 3 minutes 30 seconds	<b>DISTANCE / TIME:</b> 3.3 km / 2 minutes 10 seconds

Figure 3-6 Property access arrangements – map 2 of 2



### 3.2.7 Bus stops

The existing bus stops at Spring Range Road, Nanima Road, Rolfe Road, Kaveney's Road and Anchow Hill Lane would be removed. New upgraded bus stops would be provided as part of the new u-turn facilities at:

- Spring Range Road (southbound carriageway)
- Nanima Road (southbound carriageway)
- Kaveney's Road (northbound carriageway).

The u-turn facilities provide safe off-road stopping areas with five spaces for vehicles to wait for buses off the highway improving the safety for road users. The new bus stops avoid bus passengers waiting in locations directly next to the highway.

### 3.2.8 Drainage structures

The proposal would include a number of transverse drainage structures, including reinforced concrete pipe and reinforced concrete box culverts provided on the northbound carriageway and designed to meet the one in 100 year ARI flood event. Two larger drainage structures would be provided at Little Bedulluck Creek and Gooromon Ponds. No permanent sediment basins are proposed.

Most of the drainage structures on the existing highway (southbound carriageway) would be retained where possible, however extension or replacement may be required to reduce potential impact for the current flood immunity during the one in 100 year ARI flood event.

All new drainage structures would be designed in accordance with the requirements specified in *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). The final design and configuration of the culverts, scour protection measures and drainage systems would be confirmed during detailed design of the proposal.

A median would be provided for the length of the proposal to capture surface runoff between the two carriageways and to direct surface water flows to the new drainage structures. Cuttings, embankments and pavements would each have drainage systems to collect surface water runoff. These would comprise gutters, pits, berms, catch drains, swales and pipes.

The likely area required for the construction of drainage infrastructure, including scour protection measures and channel work, has been included in the construction boundary for the proposal. Flooding constraints, impact and mitigation measures are discussed in further detail in Section 1.1.

### 3.2.9 Street furniture and landscaping

Street furniture elements (described in Table 3-3) would be provided along the length of the proposal improving safety for road users, providing directional guidance, and for security purposes. The location and design of these elements would be further refined during detailed design. All street furniture would be designed in accordance with the *Barton Highway Urban Design Framework* and its objectives described in Section 3.2.3.

The entranceway to the ACT would continue to mark the boundary between NSW and ACT and would ensure the structure, detail and signage is consistent along the Barton Highway route into the National Capital. Signs along the length of the proposal would be designed clearly to allow road users to transition from the highway onto nearby roads in a safe manner.

Table 3-3 Street furniture

Item	Indicative details
Safety barriers	A range of safety barriers (with the appropriate transitions) would be provided to protect vehicles from potential hazards and would be tailored depending on safety requirements. This would include wire rope barriers, concrete barriers and steel beam barriers where appropriate
Line marking	Line marking would be in accordance with Roads and Maritime standards and would include reflective lines and raised road surface markers. Additional delineation would be provided by way of standard reflectors on safety barriers and guideposts
Traffic signs	Traffic signs would be provided to ensure the clear, consistent and compatible design between the proposal and the State road network, and would satisfy regulatory requirements. The signposting scheme would be developed in accordance with Roads and Maritime guidelines and in consultation with relevant stakeholders
Lighting	Highway lighting would be limited to grade-separated intersections in accordance with <i>AS/NZS 1158 Set:2010 Lighting for Roads and Public Spaces Set</i>
Fencing	Fencing would be provided along the boundary of the road reserve and private land to define land ownership. Temporary security fencing may be utilised during construction, however it would not be required for operation and would be removed on completion of construction

### 3.2.10 Noise attenuation

Noise criteria exceedances have been identified at the Wattle Park Uniting Church and associated Sunday School building, due to the existing location of these buildings (see Section 6.2). Noise modelling has found that the proposal would reduce the noise at these receivers (in comparison to the existing situation), however due to the identified exceedances, these receivers are eligible for the consideration of noise mitigation measures.

Appropriate noise mitigation to minimise noise impact on the Wattle Park Uniting Church and associated Sunday School building would be determined during detailed design. Noise mitigation would be determined in consultation with Roads and Maritime, a qualified heritage specialist, a qualified landscape specialist, Yass Valley Council and the church organisation to identify the most suitable mitigation option.

## 3.3 Construction activities

### 3.3.1 Construction boundary

Figure 3-7 to Figure 3-9 show the construction features for the proposal. The figures illustrate the proposed construction boundary including road duplication, drainage infrastructure, utilities relocations, potential haulage roads, temporary work and four proposed ancillary facilities and/or stockpile sites. This is the construction boundary that is expected to be disturbed by vegetation removal, general road construction, operation of machinery and provision of construction access which has been assessed by this REF. The construction boundary would be reinstated when work is complete.



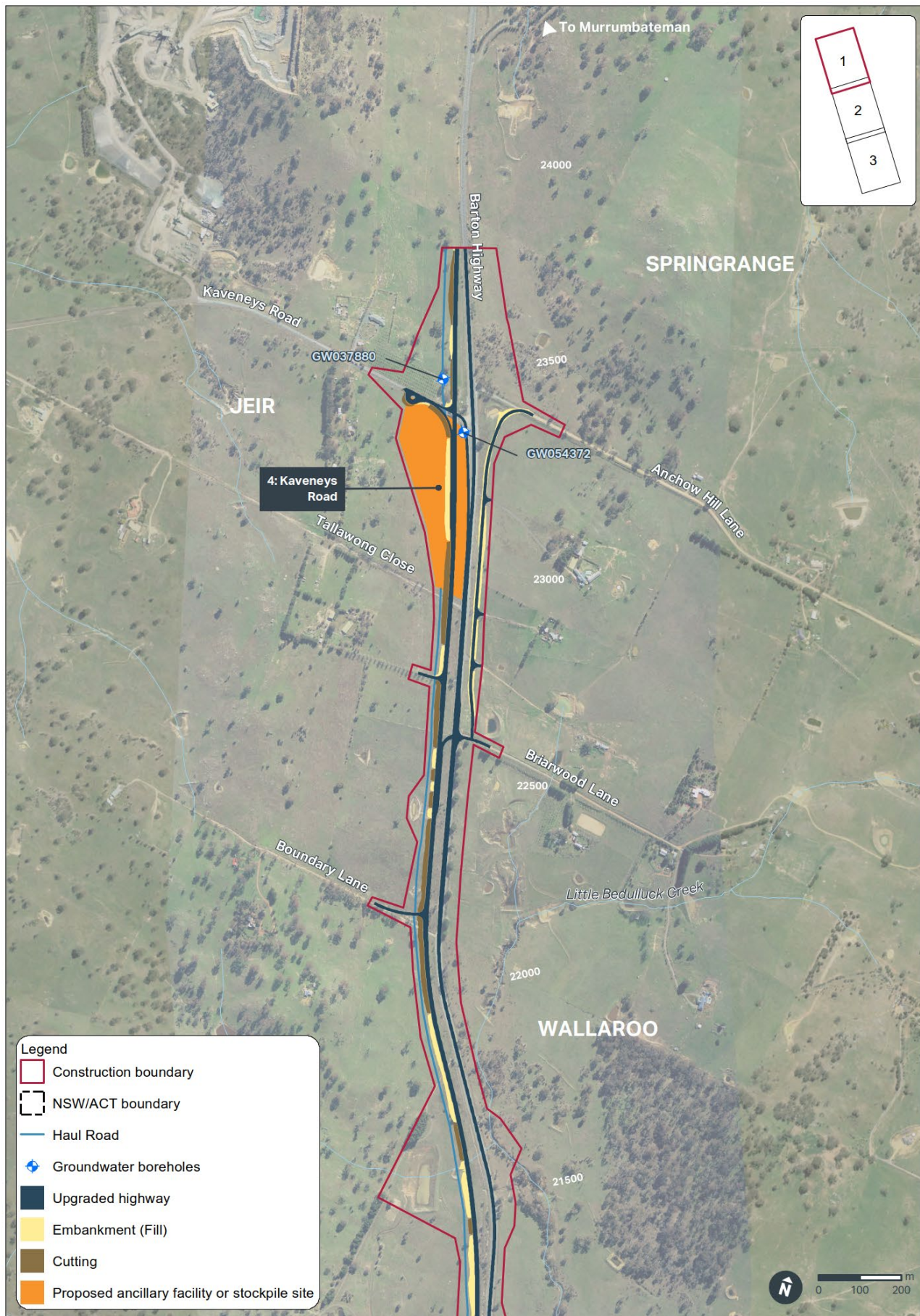


Figure 3-7 Construction features – map 1 of 3



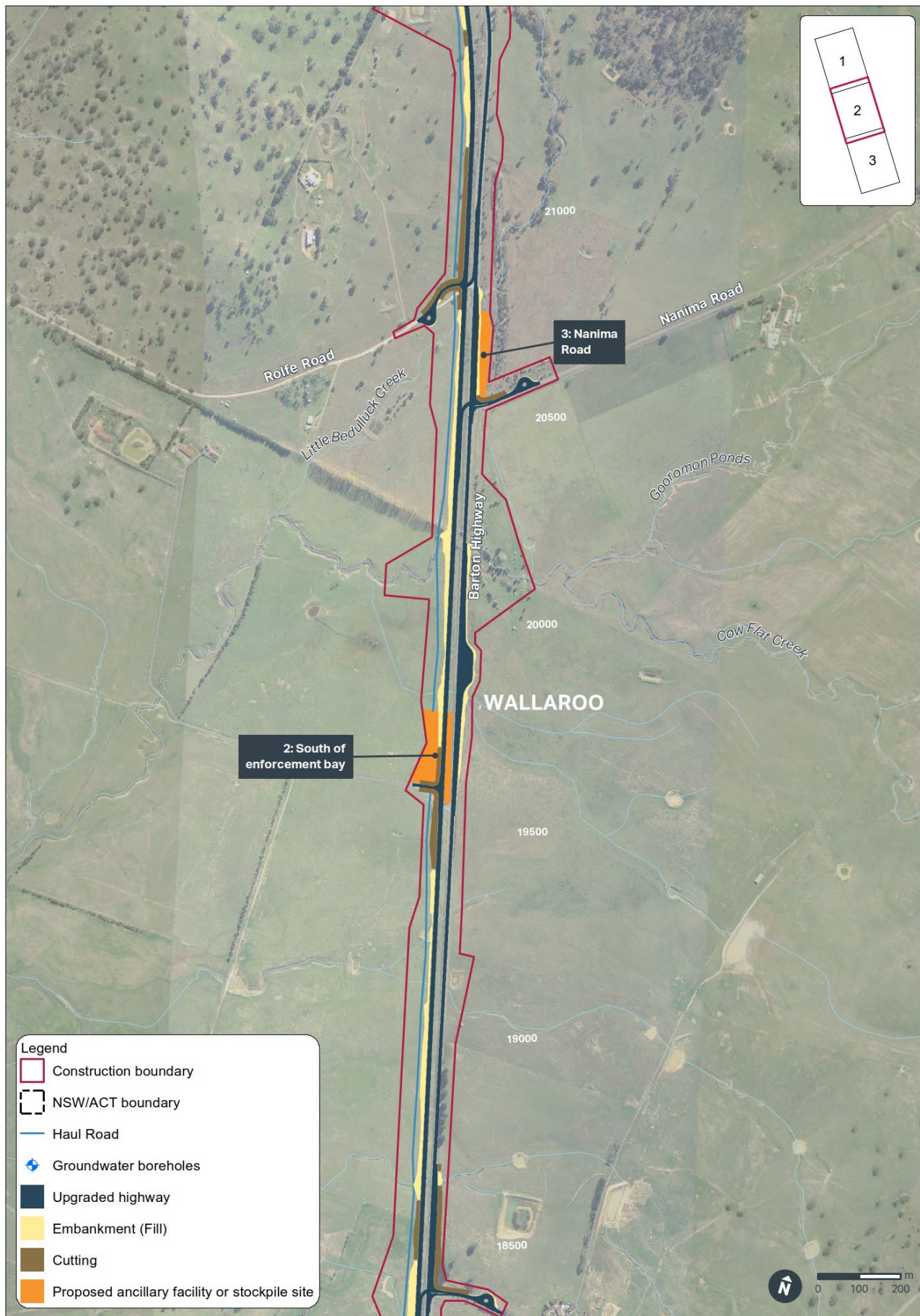


Figure 3-8 Construction features – map 2 of 3



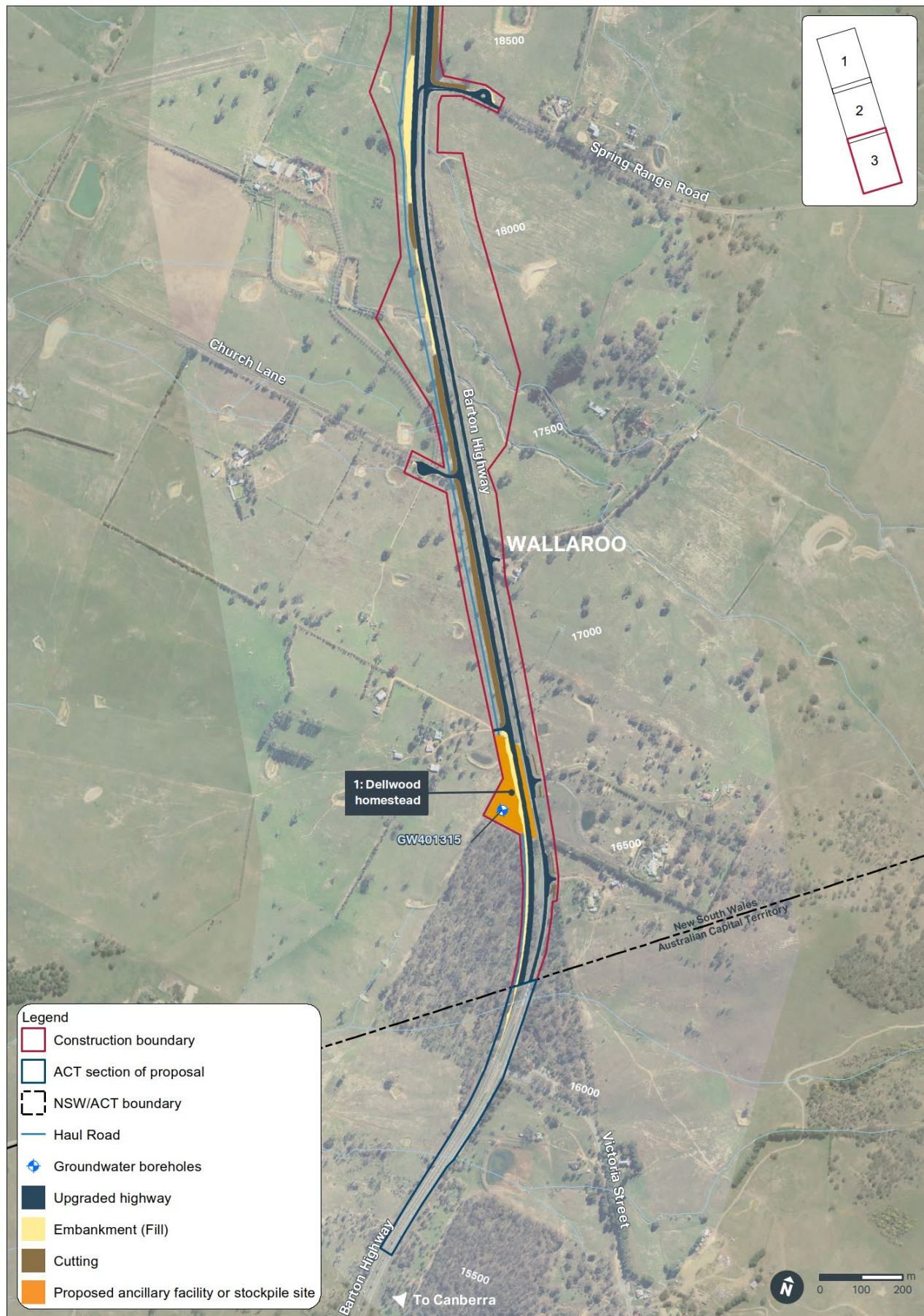


Figure 3-9 Construction features – map 3 of 3



### 3.3.2 Work methodology

Subject to approval, construction is expected to start in late 2020 and be completed in 2023. The construction methodology would be further developed during the detailed design of the proposal and is dependent on the contractor's preferred methodology, program and sequencing of work.

The typical work sequence for road construction activities and stages are presented in Table 3-4. The methods used to construct the proposal would be conventional techniques employed on major road projects, adapted to account for the project-specific environmental and social constraints. Local access requirements and the geotechnical conditions would influence the final choice of construction techniques to ensure the proposal is constructed in a safe, operationally functional, and efficient manner.

The proposed construction staging would be based on ensuring that the existing Barton Highway is open to traffic throughout the construction phase (as far as practicable) to minimise traffic disruptions. Temporary tie-in work would be required to enable work on the existing Barton Highway to be carried out while maintaining access to traffic.

Table 3-4 Indicative construction activities and staging

Construction Stage	Indicative scope of work
Site establishment	<ul style="list-style-type: none"> <li>Fencing of construction boundary/clearing limits/exclusion zones</li> <li>Installing temporary environmental protection measures in accordance with the CEMP</li> <li>Establishing temporary compound areas, laydown areas and temporary amenities</li> <li>Additional survey and geotechnical investigation, as required</li> <li>Progressive implementation of TMP (eg temporary line marking, installation of temporary signage, safety barriers and lighting, etc)</li> <li>Delivery of construction machinery and equipment</li> <li>Haulage and delivery of construction materials</li> </ul>
Relocation/ protection of utilities	<ul style="list-style-type: none"> <li>Consulting relevant service providers on service relocation</li> <li>Relocating, protecting and reconnecting utilities and services</li> </ul>
Site preparation	<ul style="list-style-type: none"> <li>Site clearing, tree and vegetation removal, mulching for reuse during construction or landscaping</li> <li>Constructing temporary drainage and installation of erosion and sedimentation control measures in accordance with the Soil and Water Management Plan (SWMP) and Erosion and Sedimentation Control Plan (ESCP)</li> <li>Constructing an internal haulage and access route</li> <li>Demolishing structures and disposing of debris at licensed disposal sites</li> </ul>
Earthwork	<ul style="list-style-type: none"> <li>Removing and stockpiling top soil and unsuitable material</li> <li>Bulk earthwork</li> <li>Blasting and crushing of excavated rock</li> <li>Importing, stockpiling and placement of earth and rock fill material</li> <li>Batter treatments for stabilisation</li> </ul>
Drainage work	<ul style="list-style-type: none"> <li>Installing drainage structures, including foundations, abutments and delivery/installation of pre-cast elements</li> <li>Instream works</li> </ul>
Road and surfacing work	<ul style="list-style-type: none"> <li>Constructing road layers including select material, sub-surface drainage, sub-base and base layers and surfacing</li> <li>Sealing and line marking of road surface</li> </ul>

Construction Stage	Indicative scope of work
Modifying existing highway	<ul style="list-style-type: none"> <li>Switching traffic to new alignment to allow work to be carried out</li> <li>Resurfacing and modification of crossfall (as required)</li> <li>Upgrading of drainage infrastructure (eg extension or replacement of existing culverts)</li> <li>Installing deceleration lanes and u-turn facilities at Spring Range Road and Nanima Road</li> <li>Modifying of heavy vehicle parking area including deceleration and acceleration lanes</li> <li>Modifying street furniture, signage, safety barriers, lighting and kerbs</li> </ul>
Finishing work	<ul style="list-style-type: none"> <li>Progressive revegetation, stabilisation and reinstatement of exposed areas</li> <li>Installing street furniture, signage, safety barriers and lighting</li> <li>Removing temporary work and temporary environmental protection measures</li> <li>Site clean-up and transporting any construction waste to licensed disposal facilities</li> <li>Demobilising plant and equipment from the construction boundary</li> </ul>

### 3.3.3 Working hours

The majority of work required for the proposal would be carried out during standard construction hours as recommended in the *Interim Construction Noise Guideline* (DECC, 2009) as follows:

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturdays
- No work on Sundays or public holidays.

Certain work may need to occur outside standard hours and would include night work. Out of hours work would be required in some cases to minimise disruptions to pedestrians, motorists and nearby sensitive receivers; and to ensure the safety of construction workers.

All work outside standard working hours (ie extended working hours and out of hours work) would be carried out in accordance with the *Roads and Maritime Out-of-hours Work and Assessment Procedure* (Roads and Maritime, 2016a) and *Construction Noise and Vibration Guideline* (Roads and Maritime, 2016b). Work would be carried out in accordance with the Construction Noise and Vibration Management Plan (CNVMP) (see Section 6.2.5), TMP (see Section 6.1) and Communication Plan (CP) (see Section 6.10.4) which would provide the framework for managing the potential environmental impact of the work. All work outside standard working hours would be carried out in accordance with requirements specified in the EPL for the proposal with appropriate notification periods used. Potential activities which require extended working hours or out of hours work are discussed in the following sections.

#### **Extended work hours**

Where required, certain construction activities may be carried out outside of the standard construction hours from 6am to 7pm, i.e. by extending additional hours before and after standard working hours.

Activities likely to be carried out during these extended construction periods include:

- Compound operation and general office duties
- Maintenance activities
- Deliveries of materials, such as large pre-cast concrete components
- Haulage of material
- Concreting work including pouring, curing and concrete cutting where required

- Completing tie-ins at intersections, temporary traffic facilities and traffic switches to maintain highway traffic flows
- Utility adjustments where required
- Finishing work.

Extended construction hours at the start and finish of each working day are considered to be in the public interest as they would:

- Shorten the overall construction period thereby minimising disruption on the Barton Highway and improve the level of service in a shorter period
- Reduce the public's exposure to a substandard and inefficient road, reducing potential for crashes
- Potentially reduce the overall cost of construction.

Extended work hours can only be carried out once the contractor seeks and receives approval from Roads and Maritime and/or other authorities (as appropriate).

### ***Out of hours work***

Some construction work would be carried out outside the standard and extended construction working hours in the following circumstances:

- Work that does not cause construction noise to exceed the noise management levels
- Delivery of materials or oversized structural elements such as pre-cast concrete elements, required outside these hours by the police or other authorities for safety reasons
- Where it is required in an emergency to avoid loss of lives or injury, damage to property and/or to prevent environmental harm
- As agreed through negotiations between Roads and Maritime and potentially affected sensitive receivers. Any such agreement shall be documented, a copy kept on-site and made readily available for inspection throughout the duration of the work
- As agreed by the NSW Environment Protection Authority (EPA) for a specific activity, determined on a case-by-case basis.

Out of hours work can only be carried out once the contractor seeks and receives approval from Roads and Maritime and/or other authorities (as appropriate).

Expected activities that would need to be carried out outside of normal and extended construction hours are described in Table 3-5. The activities listed are not comprehensive and may include other activities on a case-by-case basis after obtaining approval from Roads and Maritime and/or other authorities. Carrying out these out-of-work hours would ensure road safety, minimise disruption to regional and local traffic flows and facilitate meeting technical requirements as well as the delivery schedule. All feasible and reasonable mitigation measures would be implemented to ensure that the potential for adverse impact on the local community is minimised.

Table 3-5 Possible out-of-hours construction work

Activity	Justification
Completing tie-ins with existing roads, temporary traffic diversions and traffic switches	Tie-ins with existing roads, or installing temporary traffic diversions and traffic switches at night when traffic flows are lower. This would minimise disruption traffic and minimise potential safety conflict between traffic and construction personnel
Delivering large pre-cast concrete components, such as box culverts	Minimise disruption to highway and local traffic flows

Activity	Justification
Concrete cutting	Concrete sampling for quality control purposes requires cutting of cores from the concrete pavement. Depending on the hardening rate of the concrete, core sampling may require cutting any time within four and 24 hours after the concrete pavement is laid. Roads and Maritime specifications state the timing requirements for concrete sampling after it has been laid and this may need to be carried out outside normal construction hours. Temporary compound areas would also need to be operational during this period to support these activities
Concrete pouring/curing	Roads and Maritime has specifications for concrete pouring and curing: <ul style="list-style-type: none"> <li>• Temperature: not to be carried out when below 5°C or above 38°C.</li> <li>• Rain: curing cannot be exposed to rain</li> </ul> Average temperatures for the region may fall below 5°C and the frequency of rain events may require more intensive concrete pour/curing activity during periods of good weather
Utility adjustment	Utility adjustments typically need to be carried out during out of hours work periods to minimise the impact on consumers, road traffic and ensure the safety of workers involved
Refuelling operations and maintenance	To maximise the plant and machinery operations during the recommended standard hours, and reduce the overall duration of the proposal, refuelling operations of plant and machinery are proposed at: <ul style="list-style-type: none"> <li>• Monday to Saturday: 5am to 7am</li> <li>• Monday to Friday: 6pm to 9pm</li> <li>• Saturday: 1pm to 9pm</li> </ul>

### 3.3.4 Plant and equipment

Construction of the proposal would be carried out using standard road project construction techniques. Plant and equipment that are typically required for road construction include items listed in Table 3-6.

Table 3-6 Plant and equipment

Construction Stage	Plant and equipment
Site establishment	Trucks, excavators, generators, light vehicles, water carts, cranes, hand tools, traffic management equipment, portable sheds, portable toilets, fuel storage tanks
Relocation/protection of utilities	Trucks, cranes, elevated work platform vehicle, backhoes and trenchers, directional drilling equipment, hand tools
Site preparation	Trucks, bulldozers, scrapers, excavators, backhoes, piling rigs, chainsaw, mulcher/chipper, hand tools
Earthwork	Bulldozer, excavator, backhoes, rock breakers, gravel crusher and screening plant, concrete vibrators, jack hammers, compressors, grader, trucks, vibratory rollers, water carts
Drainage work	Trucks, excavators, bulldozers, piling rig, concrete trucks, concrete pumps, compactors

Construction Stage	Plant and equipment
Road and surfacing work	Graders, asphalt plant, trucks, bitumen sprayer, asphalt paver, vibratory rollers, rubber tyre rollers, concrete saws, compactor, line marking equipment
Modifying existing highway	Graders, asphalt plant, trucks, bitumen sprayer, asphalt planer, asphalt paver, vibratory rollers, rubber tyre rollers, concrete saws, compactor, line marking equipment
Finishing work	Trucks, cranes, excavator, generators, light vehicles, road sweeper

### 3.3.5 Earthwork

The proposal would require cut (material removal) and fill (material deposit) activities along the length of the alignment. The current design estimates about 135,000 cubic metres of cut material would be generated, and about 155,000 cubic metres of fill would be required. This fill material would hopefully be sourced from suitable cut material from construction works. Other excavated materials would likely include milled asphalt, select material and topsoil.

There is expected to be a deficit in material of around 20,000 cubic metres though opportunities to achieve an 'earthwork balance' (ie no net gain or loss of material) would be refined during detailed design. Excavated material would be reused onsite where possible or disposed of in accordance with relevant legislative requirements. Waste management is discussed further in Section 6.11. Table 3-7 shows the estimated earthwork volumes for the proposal.

Table 3-7 Indicative earthwork balance (subject to detailed design)

Material	Quantity
Cut to fill	135,000 cubic metres (cut), includes 15,000 cubic metres topsoil stripping 155,000 cubic metres (fill), this is total to finished levels – includes imported material below
Imported material	Heavily bound base 18,500 cubic metres Verge material 17,700 cubic metres Upper zone of formation 26,400 cubic metres Bridging layer 31,700 cubic metres
Topsoil (stockpiled for reuse)	15,000 cubic metres

Excavations and earthwork would generally be required for the following:

- Removal and stockpiling of top soil
- Trenching activities for utility adjustments and relocations
- Cut and fill activities to meet vertical design requirements for the new northbound carriageway
- Cut and fill activities for installation of structures (eg drainage structures)
- Limited blasting work may be required
- Formation of road base and road shoulders
- Modification of the crossfall of the existing highway (as required).



### 3.3.6 Blasting

Blasting may be required at some cut areas that reach bedrock. Blasting work would typically be carried out at a rate of one blast per day. Simultaneous blasts would be carried out in accordance to regulatory requirements. Simultaneous blasts would reduce both the number of blasts and the duration of construction. Rock material from within the construction boundary would be crushed on site and reused for construction work as appropriate.

### 3.3.7 Source and quantity of materials

Materials required for construction of the proposal would include, but may not be limited to the following:

- Earth fill material (of varying quality) for use in earthwork
- Pavement materials, including verge material, 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 for asphalt production and seals
- Steel for use in reinforcement of structures
- Wood for use in formwork and other temporary structures
- Safety barriers, railing, signage and other street furniture
- Lighting poles and lamps
- Geotextiles and geofabrics
- Fencing
- Utility materials
- Topsoil from site stripping
- Mulch from chipping cleared vegetation (reused for construction erosion and sedimentation controls)
- Water for dust control
- Pre-cast concrete products: pits, pipes, culverts, grates, sumps and headwalls for drainage work
- Potential landscaping materials.

#### **Material sources**

Indicative sources of construction materials are provided in Table 3-8. Materials for select fill would preferably be sourced from the deeper cuttings throughout the construction boundary, where the material is of suitable quality. This would minimise the need for imported fill material. Cut or other material that is deemed unsuitable or is excess would be stockpiled and stabilised for potential reuse onsite. Further investigations would be carried out to determine the availability of quality fill and select material.

Additional construction materials would be sourced off site. This may include fill or select material to address shortfalls in required earthwork volumes in the event that material won by the proposal is found to be unsuitable.

The majority of raw and manufactured materials would be hauled from quarries and batch plants located close to the proposal. Materials should preferably be sourced closest to the proposal to minimise haulage distance and associated environmental impact. One potential option is to source materials from Boral Quarry which is located at Kaveney's Road less than one kilometre from Barton Highway. Pending contract

negotiations and the suitability of material this would offer an opportunity to minimise larger haulage distances.

Table 3-8 Indicative sources of construction materials

Material type	Source
Fill	From other Roads and Maritime projects in the vicinity or other sources within the Yass Valley
Base and sub-base	Various or from other Roads and Maritime projects in the vicinity
Bitumen	Various
Sand	Various
Aggregate	Various, possibly Boral Quarry (located near the proposal)
Cement	Various suppliers within the region
Steel	Various
Pre-cast concrete elements	Various suppliers within the region
Asphalt	Various suppliers within the region
Concrete	Various suppliers within the region

### ***Natural resource consumption***

Indicative quantities of raw materials required for construction are identified in Table 3-9.

Table 3-9 Indicative resource quantities required for construction

Resource	Amount
General fill (obtained from site, if suitable)	135,000 cubic metres
Steel	Traffic barriers only: about 10,000 m
Cement (for in situ components)	Minor quantities for signage and barriers
Asphaltic concrete	28,200 cubic metres
Road base	Heavily bound base: 18,500 cubic metres Other road surfacing material: 84,500 cubic metres

All materials would be purchased from Roads and Maritime registered suppliers located in the vicinity of the proposal where practical.

Water for construction would be sourced from on-site sediment basins or from groundwater and surface water. These sources would be assessed before use to ensure there are no detrimental impact to the environment. Potable water supplied from available hydrants in the area would be used where on-site resources are not available to provide adequate quantities or water quality needs. The required quantities of water are not yet known, however the use of material such as ready mix concrete (required for road surface and kerbs) would reduce the amount of onsite water required during construction. Water would also be required for compaction of road layers, such as select layers to adjust the moisture content, and for dust

suppression. Opportunities to minimise water consumption would be investigated during detailed design and implemented during construction.

### ***Spoil and waste***

Waste materials typically generated from road construction projects include the following:

- Excavated spoil material that is unsuitable for reuse for backfilling or revegetation works
- Surplus material from construction and general site activities
- Packaging materials from items delivered to site
- Biomass from site clearance and grubbing
- Waste and debris from demolition of existing structures
- Plant and vehicle maintenance waste, such as oil containers, used tyres or filters
- General office wastes from the site office, such as paper, cardboard, food and beverage wastes
- Sewage waste generated from staff amenities on site.

A Waste Management Plan (WMP) would be developed to manage all waste streams generated on site. Where practical spoil should be reused within the construction boundary for revegetation works. All waste generated would be recycled as best practical and disposed at appropriately licenced premises. See Section 6.11 for further assessment of waste and resource impact and proposed mitigation measures.

## **3.3.8 Traffic management and access**

### ***Vehicle movements***

The new north bound lane would be constructed while the Barton Highway remains open to traffic. It is therefore essential that the work be carried out while maintaining adequate levels of service on the Barton Highway and minimising disruption or delays to traffic throughout construction. Traffic management and access planning has been considered early in proposal design and planning.

The number of vehicle movements during construction would vary with the work stages. It is expected that a maximum of 100 construction vehicles per day would be required during peak construction periods. Vehicle movements of workers to and from the work site would likely be via Barton Highway from Murrumbateman/Yass to the north and from Canberra to the south.

Traffic and transport impact associated with the proposal are assessed in Section 6.1. The potential traffic and access impact expected during the construction of the proposal include:

- Increased travel times due to construction zone speed limits, truck and construction machinery movements, temporary lane closures (mostly at night) and stop/go traffic control. Work with the potential for traffic disruption, such as utility adjustments along the trafficked road surface, would be scheduled to take place outside of peak commuting periods in order to minimise road user delays
- Temporary realignment of local roads accessing the Barton Highway to maintain traffic flow during construction which would likely cause temporary traffic disruption, particularly during peak hours
- Increased traffic conflicts due to construction traffic movements, especially at construction access entrances. Temporary compound areas would be located within the construction boundary with direct access to internal haulage routes to avoid unnecessary truck movements and equipment on nearby local roads
- The Barton Highway would remain open to traffic during construction. There would be temporary traffic diversions from the existing highway to the new northbound carriageway (once complete) to allow the

modifications to the existing highway to be carried out safely. There would be minor delays at the time of traffic switching (when the temporary traffic diversions are implemented), with traffic control. Traffic switching would be scheduled to occur at off-peak periods

- Temporary relocation of existing bus stops.

### **Traffic management**

A TMP would be prepared in accordance with *Traffic Control at Work Sites Technical Manual* (Roads and Maritime, 2018e) and the Roads and Maritime *Specification G10 - Control of Traffic*. The TMP would provide details of traffic switches and traffic management measures to be implemented during construction to ensure traffic flow on the surrounding network is maintained where possible. The TMP would also ensure the safe separation of workers on site from vehicles on Barton Highway.

Parking for worker vehicles would be provided at temporary compound areas. Where possible the transport of heavy machinery to and from site would be avoided during peak hours to minimise road user delays. The TMP would also detail specific haulage routes that construction traffic would follow throughout the construction phase. To avoid major congestion, temporary lane closures would only occur during off-peak periods and in consultation with the NSW Transport Management Centre. Reduced speed limits may be introduced for long periods as required to ensure construction worker safety.

### **Haulage routes**

During site establishment, internal haulage routes would link compound areas, stockpile areas and work areas. The location of haulage routes would be limited to within the construction boundary and would likely span the length of the proposal. Temporary traffic management measures would be required for temporary haulage roads particularly at intersections with public roads. Detailed haulage road routes would be determined during detailed design stage and documented in the TMP.

### **Access**

The majority of construction related traffic would be contained within the construction boundary and would use internal haulage roads to access working areas. Construction vehicles and deliveries would require access to/from the highway to the construction boundary, predominately at compound areas. The entrances of the compound areas to the highway would be designed, signposted and managed during construction to ensure the safety of road users and construction workers.

All property accesses would be maintained throughout construction. Affected residents would be notified of changes to local accesses.

## **3.3.9 Drainage and water quality**

During construction, temporary sedimentation basins would be used in conjunction with erosion and sedimentation controls to manage surface water from the construction boundary in order to protect the water quality of receiving water bodies. Sediment basins would be constructed at low-lying areas next to the formation and close to natural watercourses. All temporary sedimentation basins would be designed in accordance with the requirements of *Managing Urban Stormwater; Soils and Construction Volume 1, 4th Edition* (Landcom, 2004). Erosion and sedimentation controls would be used to manage clean and dirty surface runoff to control water quality originating from the construction boundary.

The final number and locations of temporary sediment basins would be determined during detailed design and specified in the SWMP and ESCP prepared by the contractor.

Transverse waterways within the construction boundary may require temporary creek crossings during construction. The locations and design of the temporary creek crossing would be determined during



detailed design and construction and used to minimise potential impact to water quality, terrestrial ecology and aquatic ecology.

Dewatering may be required during construction to artificially lower the water table in order to maintain dry working conditions within excavations. Construction site dewatering would be managed in accordance with the *Technical Guidelines for the Environmental Management of Construction Site Dewatering* (RTA, 2011) and the EPL.

### 3.4 Ancillary facilities

A number of ancillary facilities would be required during construction, including temporary compound areas, stockpiling sites and temporary sedimentation basins. Temporary compound areas would contain site sheds, toilets, waste bins, material and equipment storage/laydown areas, material stores and light and heavy vehicle parking.

Indicative locations of temporary compound areas assessed in this REF include:

- North of the NSW/ACT border (west)
- Midpoint, CH19600 (west) (about 940 m south of Nanima Road)
- Existing Roads and Maritime stockpile area (east)
- Kaveney's Roads (west).

These temporary compounds areas are shown in Figure 3-7 to Figure 3-9. Temporary compound locations would be confirmed during detailed design and identified in the CEMP.

The locations of the ancillary facilities would be within the construction boundary where possible and selected taking into consideration the ecological, social, hydrological and heritage criteria described in Table 3-10.

Typical work carried out within ancillary facilities would include site establishment, stockpiling, earthwork, road construction, drainage construction, safety signage installation and site restoration. Typical equipment used during these stages has been presented Section 3.3.4.

Table 3-10 Selection criteria for ancillary facilities

Selection criteria
<b>Location</b>
Locate within the construction boundary or directly next to the proposal
Preferably located on land in Roads and Maritime ownership
If Roads and Maritime owned land is not available or suitable for use, ancillary construction facilities are to be located (in order of preference) on: <ul style="list-style-type: none"> <li>• Sites that can be leased from council</li> <li>• Sites that can be leased from private owners</li> </ul>
Locate other temporary compound areas on relatively level ground, ie with slope less than 10 per cent
Stockpiling sites: <ul style="list-style-type: none"> <li>• Not located on slopes with a gradient greater than 2:1 horizontal to vertical</li> <li>• Selected and managed in accordance to <i>Roads and Maritime Stockpile Management Protocol</i> (Roads and Maritime, 2014c)</li> </ul>

<b>Selection criteria</b>
Mulch stockpiles are to be located more than: <ul style="list-style-type: none"> <li>• 20 m from a watercourse including floodplains (if on site for less than one month)</li> <li>• 50 m from a watercourse including floodplains (if on site for more than one month)</li> </ul>
Provide a minimum one to two hectares to cater for the ancillary facility
<b>Services</b>
Locate temporary compound areas where they can be easily serviced with electricity and potable water
Locate stockpile sites where they can be easily serviced/supplied with the appropriate quality of water
All ancillary sites are to have direct and safe access to the road network
Access points are to be at a distance from residences (to avoid traffic conflicts) where practical
<b>Environmental</b>
Wherever possible, sites are to be located above the one in 100 year flood level. If sites cannot be located above the one in 100 year flood level, they should be located above the one in 20 year flood level subject to the implementation of appropriate mitigation measures to reduce flood risk and impact on the surrounding environment (such as provision of a sufficient freeboard for storage areas)
Locate facility more than 50 m from watercourses*
No clearing of Endangered Ecological Communities (EECs), threatened flora species or threatened fauna habitat beyond what is already required for the proposal
No substantial vegetation clearing. Ancillary sites are to be located on land of existing low conservation significance for flora and fauna
No exceedance in air quality targets for construction
Wherever possible, sites are to be located and designed to satisfy noise and vibration management levels, relevant to the noise catchment area, and vibration goals at the sensitive receiver (or building, in the case of vibration). If noise management levels or vibration goals cannot be met, feasible and reasonable mitigation measures, the restriction of hours of operation and/or negotiated agreements with affected parties would be considered
<b>Heritage</b>
Locate on sites that have a low likelihood of having Aboriginal or Non-Aboriginal heritage significance (including identified Aboriginal cultural value) and/or potential. Aboriginal due diligence walk-overs shall be carried out before confirmation of site selection and mobilisation
Sites or areas of moderate to high Aboriginal and/or Non-Aboriginal heritage significance and/or potential, including known sites, potential archaeologically sensitive areas and areas of Aboriginal cultural significance, are not to be used for ancillary facilities except where the impact is authorised and managed by a relevant approval or an approved Heritage Management Plan

*Note: Refers to the working footprint of the facility. The property on which the site is located may encompass or may extend within the 50 m buffer to the watercourse.*

### **Temporary compound areas**

Varying temporary compound areas would be required for the proposal:

- Administration compounds – these would be the centre for proposal coordination and communication, and provide employee and visitor amenities and car parking

- Construction compounds – these would vary in size and provide a supporting role to the administration compounds. They would be used to enclose work machinery and materials, including chemicals. Temporary compound areas may also be used to store pre-cast concrete components, aggregates, and mobile machinery for rock crushing and screening as well as for asphalt production.

Temporary compound areas may provide a mix of services, and provide both construction and administrative support as well as be co-located with stockpile sites.

The installation of temporary compound areas would form part of site establishment and would include:

- Erection of site fencing
- 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
- Construction of pre-fabricated or purpose built temporary offices, crib sheds and storage sheds
- Establishment of temporary utility connections, sewerage storage and pump out facility.

The location and layout of temporary compound areas would be designed with consideration of the natural and built environment, and the location of sensitive receivers. Environmental mitigation and management measures would be established, implemented and monitored throughout construction.

### **Stockpile sites**

Construction stockpile sites would temporarily store materials for construction, or materials generated from within the construction boundary. This could include road base constituents, stripped topsoil, pre-cast concrete components, rock crushing and screening machinery, crushed rock and excess spoil unsuitable for use.

Site establishment activities for all stockpile sites would include the erection of site fencing and establishment of erosion and sediment control measures. Stockpile sites would be managed in accordance with the *Roads and Maritime Stockpile Management Protocol* (Roads and Maritime, 2013d).

## **3.5 Public utility adjustment**

The main utilities located within the vicinity of Barton Highway are shown in Figure 3-10. Some of these utilities are within the construction boundary and would need to be relocated and/or protected before the main construction activities.

The main utilities located near the Barton Highway include:

- The 132 kV high voltage power lines that cross the highway at CH17000 (400 m south of Church Lane). The clearance would need to meet at least 5.6 m
- The 22 kV power lines that cross the alignment at CH17000 (400 m south of Church Lane) and run parallel along the western boundary of the northbound lane from CH18000 (380 m south of Spring Range Road) northwards. The clearance would need to be adjusted to meet at least 5.6 m and the power lines relocated to about 30 m to the west of the current alignment while remaining within the road corridor
- Optus underground fibre optic cables that run parallel along the western flank of the existing highway from CH15500 (460 m south of Victoria Street) to CH18700 (280 m north of Spring Range Road) which would need to be realigned
- Telstra fibre optic cables along the entire alignment which would also need to be realigned.

Consultation has started with the service providers and relocation or protection work would be carried out before construction in accordance with the environmental requirements of Roads and Maritime, the authorities and the respective service providers' industry specific environmental guidelines.

## 3.6 Property acquisition

The proposal would require partial acquisition of land from 33 public and privately held properties and full acquisition of one private property (ie Dellwood homestead). Properties impacted by acquisition are shown in Figure 3-10 and listed in Table 3-11 and. Of the 32 partial acquisitions, 28 are private properties, four are for social infrastructure (Uniting Church Australia) and four are Crown land used as TSRs. The extent of property impacts would be refined and confirmed during detailed design in consultation with property owners. Partial acquisitions would require the development of property adjustment plans, which would be prepared in consultation with the property owner. Property acquisition areas have been identified to allow for future development of the Barton Highway to accommodate additional modifications as traffic numbers grow in the region (such as grade separated interchanges).





Table 3-11 Proposed property acquisition

Area ID	Lot	DP	Total area (Hectare)	Acquisition type	Current owner	LEP land use zone
01	1	554163	2.03	Partial	Private	Primary production zone
02	1	555341	5.32	Partial	Private	Primary production zone
03	3	537708	3.87	Partial	Private	Primary production zone
04	4	1042254	0.23	Partial	Private	Primary production zone
05	2	559993	1.62	Partial	Private	Primary production zone
06	6	264636	7.62	Partial	Private	Primary production zone
07	5	264636	1.64	Partial	Private	Primary production zone
08	6	702319	2.26	Partial	Private	Primary production zone
09	1	807398	0.35	Partial	Private	Primary production zone
10	8	702319	2.92	Partial	Private	Primary production zone
11	5	702319	1.99	Partial	Private	Primary production zone
12	7	702319	5.47	Partial	Private	Primary production zone
13	2	807398	0.05	Partial	Private	Primary production zone
14	1	621846	0.71	Partial	Private	Primary production zone
15	230-231	754880	0.07	Partial	Private	Primary production zone
17	238	754880	0.44	Partial	Private	Primary production zone
18	2	621846	0.70	Partial	Private	Primary production zone
19	129	754880	1.66	Partial	Crown	Primary production zone
20	230-231	754881	0.17	Partial	Private	Primary production zone
22	1	985079	0.22	Partial	Private	Primary production zone
23	7001	96224	0.83	Partial	Crown	Primary production zone
24	3	846623	0.30	Partial	Private	Primary production zone
25	2	846623	0.76	Partial	Private	Primary production zone
26	4	817135	8.61	Partial	Private	Primary production zone
27	1	846623	1.39	Full	Private	Primary production zone
28	128	754880	2.21	Partial	Crown	Primary production zone
29	127	754880	14.19	Partial	Private	Primary production zone
30	2	595807	3.21	Partial	Private	Primary production zone
31	5	1141235	6.17	Partial	Private	Primary production zone
32	6	1141235	7.77	Partial	Private	Primary production zone
33	123	1189195	0.46	Partial	Private	Primary production zone
<b>Total area</b>			<b>85.68</b>			

The proposal would affect existing access routes for properties along the northbound carriageway which currently have direct access to Barton Highway. The current access routes would be modified and new alternative access routes would be designed and constructed in consultation with affected residents.

In addition to permanent acquisition, land may be temporarily leased during construction for the ancillary facilities and other construction requirements. These requirements would be determined during the detailed design stage.

Roads and Maritime would carry out property acquisition and/or leasing arrangements in accordance with *Land Acquisition Information Guide* (Roads and Maritime, 2014a) and the *Land Acquisition (Just Terms Compensation) Act 1991*. Final property acquisitions would be confirmed through detailed design in consultation with landowners.



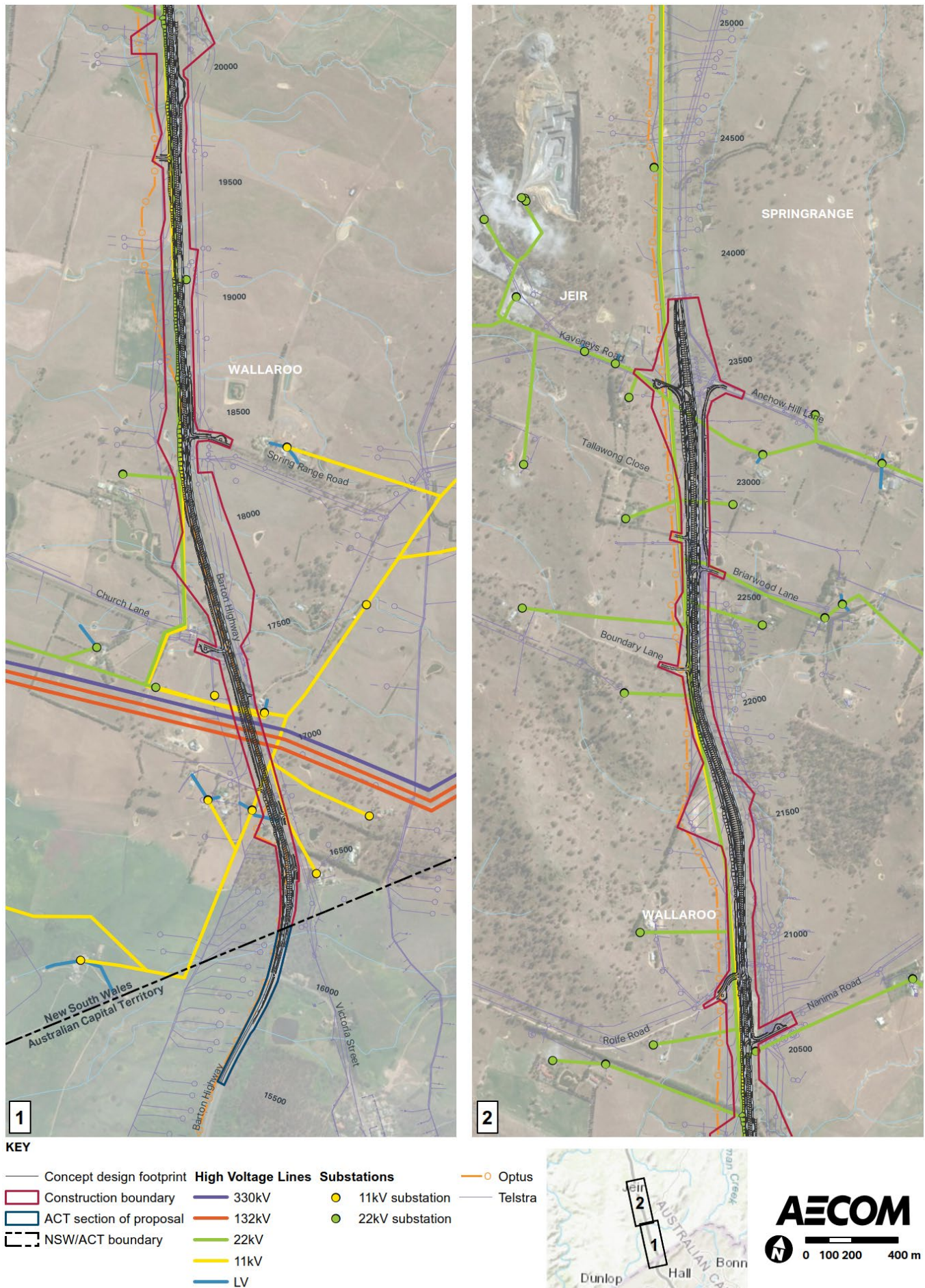


Figure 3-11 Major utilities within the construction boundary



## 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

The *EP&A Act*, *Environmental Planning and Assessment Regulation 2000* (*EP&A Regulation*) and associated environmental planning instruments such as State Environmental Planning Policies (SEPPs) and local environmental plans provide the framework for the assessment of environmental impact and approval of development in NSW.

Clause 228(2) of the *EP&A Regulation* sets out environmental factors that need to be considered to assess the likely impact of the proposal on the natural and built environment. This has been addressed in Appendix A.

#### 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.

As the proposal is for a road and road infrastructure facilities and is to be carried out by Roads and Maritime, it can be assessed under Division 5.1 of the *EP&A Act*. Development consent from council is not required.

The proposal is not located on land reserved under the *NPW Act* and 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 before the start of certain development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in Chapter 5 of this REF.

#### 4.1.2 Local Environmental Plans

##### ***Yass Valley Local Environmental Plan 2013***

The proposal is located within the Yass Valley LGA and the planning provisions of *Yass Valley LEP 2013* apply. The proposal is located partially within the SP2 Infrastructure (Classified Road) zone, but would also encroach onto land zoned as RU1 Primary Production. The proposal is consistent with the objectives of the SP2 Infrastructure Zone.

The objectives of the RU1 zone include:

- Encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- Encourage diversity in primary industry enterprises and systems appropriate for the area

- Minimise fragmentation and alienation of resource lands
- Minimise conflict between land uses within this zone and adjoining zones
- Protect and enhance the biodiversity of Yass Valley
- Protect geologically significant areas of Yass Valley
- Maintain the rural character of Yass Valley
- Encourage the use of rural land for agriculture and development that are associated with rural industry or that require an isolated or rural location
- Ensure that the location, type and intensity of development is appropriate, having regard to the characteristics of the land, the rural environment, and the need to protect significant natural resources, including prime crop and pasture land
- Prevent the subdivision of land on the fringe of urban areas into small lots that may prejudice the proper layout of future urban areas.

Construction of roads within this zone is permitted with consent. However, as noted in Section 4.1.1, Clause 94 of the ISEPP removes consent requirements. The proposal would improve transportation safety and efficiency and would generally support objectives of the RU1 zone.

## 4.2 Other relevant NSW legislation

### 4.2.1 Biodiversity Conservation Act 2016

The *BC Act* aims to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The *BC Act* commenced on 25 August 2017, repealing and replacing the *Threatened Species Conservation Act 1995* (NSW), the *Nature Conservation Trust Act 2001*, the *Native Vegetation Act 2003* and part of the *NPW Act*. The *BC Act* contains provisions for the assessment of impact on biodiversity values of a proposed development, providing measures to calculate offset for these impacts and establishing market-based conservation measures, including biodiversity credits.

A Biodiversity Assessment Report (BAR) has been prepared for the proposal and describes the biodiversity values present within the construction boundary and identifies impact from the proposal on these values. Further details of this assessment are outlined in Chapter 6.

### 4.2.2 Heritage Act 1977

The *Heritage Act 1977* provides for the protection and conservation of NSW's environmental heritage. State significant items are listed on the NSW State Heritage Register and are given automatic protection under the Act against any activities that may damage an item or affect heritage significance.

Section 139 specifies the requirements for an excavation permit to disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will 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.

If the proposal is likely to result in disturbance to an archaeological relic, approval is required from the Heritage Council under section 140 of the *Heritage Act 1977* in the form of an excavation permit. There are no formal registers available for archaeological relics and they are given automatic protection if they are of local significance or higher. As such, if an area may contain archaeological relics it would trigger the requirement to assess the likelihood that the relics remain and what their significance may be.

Based on the findings of the Non-Aboriginal Heritage Impact Assessment (AECOM, 2018a) (see Section 6.5 and Appendix H) a permit under Section 140 of the *Heritage Act 1977* would be required for conducting archaeological investigation of the Dellwood homestead which would be demolished as part of the proposal. It is considered likely that the subfloor space at the Dellwood homestead contains archaeological deposits of heritage significance which may be revealed during demolition activities. An Archaeological Research Design and Methodology should be prepared and submitted to the Heritage Council of NSW for approval under Section 140.

### 4.2.3 Native Title Act 1994

Section 103 of the *Native Title Act 1994* requires notification of any representative Aboriginal/Torres Straits Islander bodies for an area concerned where an act is to take place. There were no active registrations or determinations for Native Title Claims within the construction boundary.

### 4.2.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974 (NPW Act)* provides the basis for legal protection and management of Aboriginal sites within NSW, and for the management of National Parks Estate lands. The construction boundary is not located within or next to land reserved under the *NPW Act*.

All Aboriginal sites and objects, other than those made for sale, are protected under the *NPW Act*. Under the *NPW Act*, it is an offence to knowingly harm or desecrate an Aboriginal object, or to harm or desecrate an Aboriginal object or Aboriginal place. Section 87 of the *NPW Act* provides the following defences against prosecution of harm to Aboriginal objects:

- The harm or desecration concerned was authorised by an Aboriginal Heritage Impact Permit (AHIP) and the conditions to which that AHIP was subject were not contravened
- If due diligence was exercised to determine whether the proposal would harm an Aboriginal object and reasonably determined no Aboriginal object would be harmed.

An assessment of the potential for the proposal to impact on Aboriginal heritage objects or places identified that a number of Aboriginal heritage sites and potential Aboriginal heritage sites are likely to be impacted by the proposal (see Section 6.4 and Appendix G). An AHIP is required to allow the development of the proposal.

### 4.2.5 Fisheries Management Act 1994

The *Fisheries Management Act 1994 (FM Act)* sets out the legislative requirements to conserve, develop and share fishery resources of the State for the benefit of present and future generations which includes promoting ecologically sustainable development and the conservation of biological diversity.

Under Section 199 of the *FM Act*, written notification must be provided to the Minister for carrying out work (ie any excavation within, or filling or draining of, water land or the removal of woody debris, snags, rocks or freshwater native aquatic vegetation or the removal of any other material from water land that disturbs, moves or harms these in-stream habitats) on land that is permanently or intermittently submerged by water. As the proposal involves temporary work associated with construction of drainage structures, including larger crossings of Gooromon Ponds and Little Bedulluck Creek, notification to the Minister is required before start of the work.

Under Section 219, work within a waterway that may result in the temporary or permanent blockage of fish passage will require a permit from the NSW DPIE. Blockages to fish passage may include the construction of physical barriers such as road crossings, the presence of hydrological barriers (eg alteration of the

gradient of the stream bed or increases in water velocities), or the creation of behavioural barriers (eg where water quality or temperature is altered deterring fish passage for some or all native fish species).

The Yass Valley key fish habitat map (NSW DPI, 2018) identifies Gooromon Ponds, Little Bedulluck Creek and Cow Flat Creek as key fish habitat (Type 2/3 Class2/3) within the construction boundary. Therefore a permit would be required from the Minister before commencement of construction work in these waterways.

Waterway crossings should be designed and constructed in accordance with the national guidelines entitled *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings.*

## 4.2.6 Water Management Act 2000

The *Water Management Act 2000 (WM Act)* provides for the sustainable and integrated management of the water sources of the state for the benefit of present and future generations. It is also intended to provide formal means for both the protection and enhancement of the environmental qualities of waterways and in-stream uses as well as provide protection of catchment conditions.

The *WM Act* sets the legislative requirements to control the extraction, and use of water, construction of dams and weirs and carry out activities in or near water sources. Water sources' are defined broadly and include the whole or any part of a river, lake, estuary, place where water occurs naturally on or below the surface of the ground, and NSW coastal waters.

The proposal would require water supply for the temporary compound areas and for construction. The DPIE would be consulted in relation to the water requirements for the proposal should an approval be required under the *WM Act*.

Dewatering may be required during construction to artificially lower the water table in order to maintain dry working conditions within excavations in the vicinity of creek crossings as well as to empty full sediment basins as required. Dewatering work may require a permit under the *WM Act* before being carried out. Construction site dewatering would be managed in accordance with the *Technical Guidelines for the Environmental Management of Construction Site Dewatering* (RTA, 2011).

## 4.2.7 Crown Lands Act 1989

Parts of the construction boundary are located within Crown Land which is subject to the *Crown Lands Act 1989*, including:

- Travelling Stock Reserves:
  - Hall TSR at the NSW/ACT border
  - Bedulluck TSR north of Nanima Road to the east of Barton Highway
- Crown roads:
  - Boundary Lane
  - Rolfe Road
  - Church Lane
  - Anchow Hill Lane
  - Barton Highway from Spring Range Road southwards to the NSW/ACT border.

The Minister as empowered under Section 34(1), may: 'in such manner and subject to such terms and conditions as the Minister determines: (b) grant easements or rights-of-way over, or licences or permits in respect of, Crown land, on behalf of the Crown.' Therefore for the proposal to be carried out on Crown Land, a permit is required from the DPIE. Before work within the TSR, consultation with DPIE is required to provide notification of intended activities.



## 4.2.8 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997 (CLM Act)* sets out the legislative requirements for conducting site investigations and remediation of contaminated land as well as specifying the role of site auditors. The *CLM Act* is administered by the NSW EPA. Section 60 of the *CLM Act* stipulates the duty of landowners to notify EPA, carry out investigation and remediation of land if found to be contaminated above EPA guideline limits.

A contamination assessment was carried out for the REF and found the construction boundary to have a moderate risk of contamination with potential contaminants of concern (see Section 6.6 and Appendix I). Should contaminants be confirmed present on site, an assessment would need to be carried out in accordance with EPA guidelines in order to determine if notification under section 60 of the *CLM Act* is required to the EPA. Land remediation would be carried out in accordance with the *CLM Act* as necessary and contaminated material disposed at authorised premises before development of the proposal.

## 4.2.9 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997 (POEO Act)* aims to protect, restore and enhance the environments of NSW and reduce potential risks to human health and the environment. The *POEO Act* outlines pollution offences relating to land, water, air and noise pollution and includes a duty to report pollution incidents. The *POEO Act* is administered by the NSW EPA and establishes the State's environmental regulatory framework which includes licensing requirements for certain scheduled activities.

Under Section 48 of the *POEO Act*, an EPL is required for scheduled activities as defined in Schedule 1, which includes:

- Clause 35(3)(b)(iii) applies to road construction, which covers construction, widening or rerouting of roads and any related earthworks and cuttings if it results in the existence of four or more traffic lanes (other than bicycle lanes or lanes used for entry or exit) where the road is classified or proposed to be classified as a main road, freeway or tollway under the *Roads Act 1993 (Roads Act)* and is five km in length (in a non-metropolitan area).

The proposal is about eight km in length and involves duplication of an existing Barton Highway into a four lane highway (ie with a northbound and southbound dual carriageway respectively), as such an EPL is required for the proposal under the *POEO Act*.

Under Part 5.7 of the *POEO Act*, the contractor and Roads and Maritime are required to notify the EPA and each 'relevant authority' immediately if a pollution incident occurs that causes or threatens material harm to the environment.

## 4.2.10 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001 (WARR Act)* promotes waste avoidance and resource recovery to achieve a continual reduction in waste generation through the efficient use of resources and implementation of the waste management hierarchy principles:

- Avoidance of unnecessary resource consumption
- Resource recovery (including reuse, reprocessing, recycling and energy recovery)
- Disposal.

The *WARR Act* facilitates conformance to the *POEO Act* and associated regulations and promotes extended producer responsibility for the life-cycle of a product.

Roads and Maritime encourages the efficient use of resources and the minimisation of environmental harm in accordance with the principles of Ecologically Sustainable Development (ESD). Resource and waste management is discussed in Section 6.11.

#### 4.2.11 Biosecurity Act 2015

The *Biosecurity Act 2015* manages biosecurity risks in NSW in an integrated and streamlined manner. The provisions of this Act relevant to the proposal include those around the management of weeds, particularly those previously regulated by the (now repealed) *Noxious Weeds Act 1993*.

The *Biosecurity Act 2015* includes a general biosecurity duty for all individuals who deal with plants known or likely to pose a biosecurity risk. This includes a duty to prevent, eliminate or minimise the risk posed by a prohibited matter as outlined in Schedule 2 of the Act so far as is reasonably practicable. A biodiversity assessment was carried out as part of this REF which identified weeds declared as priority weeds in the Yass Valley LGA as occurring within the construction boundary (see Section 6.3 and Appendix F). A priority weed is one that should be prevented, managed, controlled or eradicated in the region. Noxious weeds removed during site clearing would be managed in accordance with the recommended mitigation and management measures in compliance to the requirements of the *Biosecurity Act 2015*.

#### 4.2.12 Land Acquisition (Just Terms Compensation) Act 1991

The *Land Acquisition (Just Terms Compensation) Act 1991* (Land Acquisition Act) specifies the legislative mechanism for the acquisition of land by a state authority by agreement or as authorised by compulsory process. Land acquisition that would be required for the proposal has been discussed in Section 3.6. The final details of property acquisition would be confirmed through detailed design and in consultation with landowners. All property valuations and acquisitions would be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime, 2014a) and the Land Acquisition Act.

#### 4.2.13 Roads Act 1993

The *Roads Act* sets out the legislative requirements for the use, development and maintenance of roads throughout NSW. The *Roads Act* also describes the functions of Road and Maritime as well as other local authorities in managing roads.

Under section 177 of the *Roads Act*, Roads and Maritime has the authority to acquire land for the purpose of opening, widening or constructing a road or road work either by negotiation and agreed sale or through a compulsory acquisition process. For the proposal, Roads and Maritime would need to acquire land that is directly impacted by a proposal as detailed in Section 3.6.

Section 143 of the *Roads Act* stipulates that a roads authority can use a public road in the exercise of a function conferred by the *Roads Act*, so long as the function is exercised in a way that will not unduly interfere with the rights of passage and access that exist with respect to the public road. The proposal would involve carrying out work on a number of local roads (see Section 6.1) which are under the jurisdiction of the Yass Valley Council. Work would involve temporary impact to traffic which would be managed as part of a TMP. Road occupancy license(s) would be required from Yass Valley Council before carrying out the work and activities would be managed in accordance with the conditions specified in the license throughout the work.

## 4.3 Commonwealth legislation

### 4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *EPBC Act* a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on MNES or the environment of Commonwealth land. These are considered in Appendix A and Chapter 6 of the REF and are summarised below.

#### ***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, endangered ecological communities and migratory species found that there would be a significant impact on relevant matters of national environmental significance. Generally a referral to the Australian Government Department of the Environment and Energy is not required for proposed road activities that may affect nationally listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impact to these biodiversity matters are the subject of a strategic assessment approval granted under the *EPBC Act* by the Australian Government in September 2015. However the strategic assessment approach is not available for this project as it involves potential impact in both NSW and the ACT.

Potential impact to Commonwealth biodiversity matters are considered as part of Section 6.3 of the REF and Appendix F. Chapter 7 of the REF describes the safeguards and management measures to be applied to minimise or mitigate impact.

### 4.3.2 Other relevant Commonwealth legislation

#### ***Native Title Act 1993***

The *Native Title Act 1993* provides a national system for the recognition of traditional rights and interests of Aboriginal and Torres Strait Islander people, the protection of native title to land and waters and for its co-existence with the national land management system.

There are no active registrations or determinations for Native Title Claims within the construction boundary.

#### ***ACT Planning and Land Management Act 1988***

The *Planning and Land Management Act 1988 (P&LM Act)* establishes the National Capital Authority (NCA) and the development of the National Capital Plan (NCP). The NCP provides a framework for development within the ACT to promote the national role of Canberra.

The NCP provides detailed planning policies and guidelines for areas which have the special characteristics of the National Capital, known as Designated Areas. Section 12 of the *P&LM Act* stipulates that work within Designated Areas shall be carried out in accordance with the NCP and Work Approval would be required from the National Capital Authority before commencement.

Work proposed in Designated Areas do not require development approval from the ACT's planning authority (Environment, Planning and Sustainable Development Directorate (EPSDD)) under the *ACT Planning and Development Act 2007*, however it still requires endorsement from the ACT agencies which administer ACT environmental regulations to be provided as part of the Work Approval process.

Under Section 12 of the *P&LM Act*, a Work Approval would be required for the 700 m tie in section of the Barton Highway Upgrade one which is located in the ACT. The Work Approval application would require submission of a 'planning report' that addresses the environmental requirements for Designated Areas specified in NCP and advises how obligations have been met under other legislation including the *EPBC Act*.

A separate environmental assessment for the ACT section of the proposal has been carried out concurrently with this REF in accordance with the applicable Commonwealth and ACT legislative requirements.

While separate environmental reports have been prepared for the NSW (this REF) and the ACT (Work Approval) sections of the Barton Highway Upgrade, an assessment of the cumulative impact of the proposal including the ACT section is provided in Section 6.13.

### ***Nature Conservation Act 2014 (NC Act)***

The *Nature Conservation Act 2014 (NC Act)* is the chief legislation for the protection of native plants and animals in the ACT and for the management of the conservation reserve network. The *NC Act* protects native plants and animals, and provides management authority for conservation lands and provides the legal underpinning of nature conservation policy, management and action across the Territory.

The *NC Act* empowers the Conservator of Flora and Fauna to act on issues that affect the conservation matters embodied in the *NC Act*. This relates, in particular, to protecting native plants and animals including the administration of a licensing system for the taking, keeping, selling, importing, exporting, disturbing, displaying and killing of native plants and animals; managing the nature reserve system; and protecting and conserving threatened species and ecological communities. Biodiversity assessments as part of development applications would be assessed by the Conservator of Flora and Fauna, who may produce an environmental significance opinion that a proposal may not have a significant adverse environmental impact and hence may be exempt from and Environmental Impact Statement (EIS).

The *Nature Conservation Amendment Act 2016* enables greater consistency across states, territories and the Commonwealth in listing of threatened species and ecosystems.

## **4.4 Confirmation of statutory position**

The proposal is categorised as development for the purpose of a road and road infrastructure facilities 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 Division 5.1 of the *EP&A Act*.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under section 5.5 of the *EP&A Act* including 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.

Under the *NPW Act*, an AHIP needs to be prepared for the proposal and approval obtained from DPIE before any ground disturbance work. All work carried out for the proposal must comply with the conditions of the AHIP.



Under Section 140 of the *Heritage Act 1977*, a permit would be required for archaeological investigation of Dellwood homestead, which would be demolished and which is considered likely to contain archaeological deposits of local heritage significance which may be revealed during demolition activities.

The list of approvals, licenses or permits required for the proposal are summarised in Section 7.3.

## 5. Consultation

This chapter discusses the consultation for the proposal.

### 5.1 Consultation strategy

Roads and Maritime has informed the community and consulted with stakeholders while developing the proposal. An overall community and stakeholder engagement strategy has been developed for the Barton Highway Upgrade as well as a strategy for the public consultation of this REF (Appendix C). Both strategies aim to:

- Keep the community and stakeholders regularly informed of the progress of the proposal, and inform of potential impact
- Encourage participation from communities and other stakeholders, where required
- Ensure community and stakeholder feedback is fed into the proposal, where possible
- Ensure that proposal information is distributed in an effective and timely manner, through various consultation methods that suit the community
- Build a database of stakeholders for ongoing consultation and engagement on the proposal.

### 5.2 Community involvement

The proposal was announced in December 2017 and included the following community engagement plan:

- Updates to the proposal webpage on the Roads and Maritime website and develop a project 1800 phone number and email
- Letters, phone calls and meetings with impacted property owners to discuss the proposal
- Distribution of two project update newsletters in May and October 2018 to more than 6,200 residences in Hall, Murrumbateman, Yass and surrounding areas.

To proactively inform the wider community and stakeholders about the proposal, from June 2018, community engagement tools and activities included:

- Three community information pop-ups at the Murrumbateman Village (Saturday 28 July 2018), Yass Community Markets (Saturday 18 August 2018), and the Murrumbateman Field Days (Saturday 20 and Sunday 21 October 2018) for the local community to discuss the proposal with the project team. In total, more than 740 community members visited the pop-ups
- Four email distributions (on Monday 23 July, Monday 13 August, Friday 12 October and Wednesday 17 October 2018) to more than 300 stakeholders and community members in the stakeholder database about the pop-ups and October newsletter
- Eight Facebook posts (in July, August and October 2018) informing stakeholders about the pop-ups and the October newsletter
- Newspaper advertising in the Yass Tribune (15 August 2018) and radio advertising on Yass FM 100.3 (from 13 August 2018) about the pop-ups
- Updates to the project webpage on the Roads and Maritime website about the proposal, pop-ups and the newsletters.

Stakeholders were encouraged to discuss the proposal and provide feedback to be considered, where possible, in the REF.

Sentiment for the proposal was supportive, with many stating 'just get on with it'. Key issues raised about the proposal included:

- poor driver behaviour
- duplication from the ACT instead of Yass or Murrumbateman
- impact of the proposal and construction timeframes.

Many were concerned about issues outside of the construction boundary including the Murrumbateman bypass and interchange (see Appendix C for topics raised outside of the construction boundary). A summary of stakeholder issues about the proposal is outlined in Table 5-1.

Table 5-1 Summary of issues raised by the stakeholders and the community

Topic	Comments and issue raised	Response / where addressed in REF
Poor driver behaviour impacting safety on the Barton Highway	There is poor driver behaviour on the Barton Highway including dangerous overtaking, inexperienced drivers using the highway, drivers making unsafe moves, drivers speeding and not enough police enforcement	Public education campaigns targeting road worker safety and speed were rolled out between April and June 2018 using outdoor billboards, radio and social media. The Animals on Country Roads radio campaign was broadcast during June 2018.  Roads and Maritime is investigating other opportunities to promote road safety messages that address specific issues on the Barton Highway, identified through crash data analysis
Proposal funding	Questions about how the proposal would be funded and if the funding would be enough	The Australian and NSW Governments are providing \$100 million (\$50 million each) over four years to upgrade the Barton Highway. The Australian Government has committed a further \$100 million in the 2019-20 Budget  If the proposal is approved, Roads and Maritime is focused on maximising the length of duplication from the NSW/ACT border towards Murrumbateman within this budget commitment
Duplication from the ACT	The duplication of Barton Highway should start from Yass or Murrumbateman and not the NSW/ACT border	Roads and Maritime is proposing the duplication from the NSW/ACT border as this section has higher traffic volumes, a higher crash rate and would meet the growing transport demands and ease congestion approaching the ACT  See Section 6.1 of the REF

Topic	Comments and issue raised	Response / where addressed in REF
Road alignment	Questions about why the duplication is happening on the western side of the Barton Highway, which would mean demolishing Dellwood homestead	To avoid impact to the Wattle Park Uniting Church and the woodland along Little Bedulluck Creek, the proposal would duplicate the western side of the Barton Highway  Roads and Maritime has been in contact with the property owner of Dellwood homestead as part of the property acquisition process  See Section 4.2.12 of the REF
U-turn facilities	Interest in the provision of u-turn facilities away from the Barton Highway	See Section 3.2.6 of the REF
Cycling pathway	Request for an 'off road' cycle pathway to align with the proposed 'cycling triangle' around Murrumbateman Road, Nanima Road and Murrumbateman village  Question on whether the proposal would have a wide sealed hard shoulder for cyclists similar to the Federal Highway	Current funding is focussed on providing as much duplicated carriageway as possible from the NSW/ACT border towards Murrumbateman. The provision of an off road cycle pathway along the whole route, including the construction boundary, would be considered as part of the strategic business case for the Barton Highway
Nanima Road	Concerns about Nanima Road including its road surface condition, use as an alternate route into Canberra by heavy vehicles and if it will be upgraded as part of the proposal	Nanima Road intersection with the Barton Highway would be upgraded as part of this proposal. Any upgrades or maintenance on Nanima Road is a matter for Yass Valley Council  See Sections 3.2.5 and 3.2.6 of the REF
Biodiversity	Concern about the impact to native flora and fauna including the Box-Gum Woodland and offset locations, legless lizards and bearded dragons  Concern about the loss of hollow bearing trees and suggestions to transplant trees, similar to the Gounyan Curves project  Suggestion to plant 'patchy shrubby undergrowth' with native species, early in the project to minimise impact	As part of the REF, Roads and Maritime has assessed the environmental impact, including flora and fauna impact within the construction boundary. The REF also considers mitigation strategies  See Section 6.3 of the REF
Noise impact	Concerns about noise impact along the Barton Highway when the proposal is open to traffic	As part of the REF, Roads and Maritime has assessed noise impact. The REF also considers noise mitigation measures  See Section 6.2 of the REF



Topic	Comments and issue raised	Response / where addressed in REF
Visual amenity	Suggestion to maintain 'open views' in the vicinity of Little Bedulluck Creek.	As part of the REF, Roads and Maritime has assessed impact to visual amenity. See Section 6.8 of the REF
Construction timeframes	Questions about proposal construction timeframes.	Once detailed design has been completed for the proposal in 2020, construction is likely to start in late 2020 and be completed in 2023. See Section 3.3.2 of the REF
Construction impact	Concern that during construction of the proposal, traffic would be diverted to Nanima Road.	The proposal is currently in the reference design phase and there are a number of steps to be completed before the proposal would be ready for construction.  The existing Barton Highway would remain open at all times during construction, but with likely speed limit reductions. No diversions are currently proposed.  Information and updates during construction would be available on the Roads and Maritime website. The project team would keep the community informed throughout the construction of the proposal. See Section 5.6 of the REF
Property acquisition	Question on whether impacted property owners have been contacted.	Roads and Maritime has directly contacted property owners within the construction boundary to discuss property impact. Roads and Maritime would continue to liaise directly with affected property owners throughout the proposal. See Section 6.9 of the REF
Support for the proposal	Support that the proposal is going ahead	Roads and Maritime thanks stakeholders and the community for their support and interest in the proposal.  Stakeholders and the community will continue to be informed about the proposal as it progresses. See Section 5.6 of the REF

Topic	Comments and issue raised	Response / where addressed in REF
Community consultation	Community members wanted to be included on the email distribution list and noted that Facebook and community information pop-up sessions were a good way to keep the community informed about the proposal.	Roads and Maritime will continue to use a variety of community engagement tools and activities including Facebook and community information pop-up sessions, to inform the community about the proposal.  Community members can receive email updates on the proposal by emailing <b><i>barton.highway@rms.nsw.gov.au</i></b>

## 5.3 Aboriginal community involvement

Aboriginal community consultation acknowledges the right of Aboriginal people to be involved, through direct participation, on matters that directly affect their heritage. Involving Aboriginal people in all facets of the assessment process ensures adequate opportunity to share information about cultural values, and to actively participate in the development of appropriate management and/or mitigations measures. The successful identification, assessment and management of Aboriginal cultural heritage values are dependent on an inclusive and transparent consultation process.

Aboriginal community consultation for AECOM's Aboriginal Cultural Heritage Assessment Report (ACHAR) completed for this REF was carried out in accordance with DPIE's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a) and in accordance with ACT Heritage Council requirements as per the ACT *Heritage Act 2004* as outlined in Table 5-2. This includes a process where Aboriginal community members are given the opportunity to register for consultation, review and comment on the proposed assessment methodology, participate in a focus group meeting, and review and comment on the draft assessment report. The key issues raised by the Registered Aboriginal Parties (RAPs)/ Registered Aboriginal Organisations (RAOs) are summarised in Table 5-3.

Table 5-2 Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Roads and Maritime assessment
Stage 2	Site survey and further assessment
Stage 3	Formal consultation and preparation of a cultural heritage assessment report
Stage 4	Implement environmental impact assessment recommendations

Table 5-3 Issues raised through Aboriginal community consultation

Group	Issue	Response / where addressed in REF
All RAPs/RAOs	<ul style="list-style-type: none"> <li>Significant concerns were raised by RAP/RAOs over the potential impact on cultural Ring Trees at sites H and I</li> </ul>	<ul style="list-style-type: none"> <li>Roads and Maritime has committed to review designs to avoid the cultural Ring Trees (See Section 3.2.5 of the ACHAR in Appendix G)</li> </ul>

Group	Issue	Response / where addressed in REF
All RAPs/RAOs	<ul style="list-style-type: none"> <li>Disagreement by RAP/RAOs over the long-term storage of Aboriginal objects from test excavation and salvage programme</li> </ul>	<ul style="list-style-type: none"> <li>AECOM consulted with individual RAP/RAOs to obtain majority consensus (See Section 3.2.5 of the ACHAR in Appendix G)</li> </ul>

## 5.4 ISEPP consultation

The Yass Valley Council has been consulted about the proposal as per the requirements of clause 13-15 of the ISEPP. Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered. There were no comments received from Yass Valley Council.

## 5.5 Government agency and stakeholder involvement

A range of government agencies and stakeholders were sent a letter on 23 August 2018 to provide feedback on the proposal by 17 September 2018 while others were consulted via one-on-one stakeholder meetings. Below is the list of the government agencies and stakeholders:

- NSW EPA
- NSW DPIE (includes former Department of Primary Industries and Office of Environment and Heritage)
  - DPIE – Fisheries (Aquatic Habitat Protection Unit)
  - DPIE - Crown Land
- Essential Energy
- NBN Co
- Nextgen Network Pty Ltd
- Optus Administration Pty Ltd
- Telstra Network Integrity
- QCity Transborder Express.

Issues raised by these government agencies and stakeholders are outlined below in Table 5-4. Roads and Maritime will continue to consult with agencies and stakeholders throughout the proposal.

Table 5-4 Issues raised through stakeholder consultation

Agency	Issue raised	Response / where addressed in REF
NSW EPA	<ul style="list-style-type: none"> <li>No comments received</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
NSW DPIE	<ul style="list-style-type: none"> <li>Flood risk management requirements to address:               <ul style="list-style-type: none"> <li>Impact of flooding on the proposal</li> <li>Impact of the proposal on flood behaviour on and off site</li> <li>Implications of climate change and cumulative development impact</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Section 6.7</li> <li>Safeguards W4 in Table 7-1</li> </ul>

Agency	Issue raised	Response / where addressed in REF
	<ul style="list-style-type: none"> <li>• Flood compatibility of the design to ensure continued operation during a flood</li> <li>• Maps in accordance to the NSW <i>Floodplain Development Manual 2005</i> (NSW government 2005) including <ul style="list-style-type: none"> <li>• Flood prone land</li> <li>• Flood planning area</li> <li>• Hydraulic categorisation</li> <li>• Flood assessment and modelling covering: <ul style="list-style-type: none"> <li>• 1:10 year and 1:100 year ARI flood event</li> <li>• 1:200 and 1:500 year flood events to assess climate change</li> </ul> </li> </ul> </li> <li>• Assess the impact of the proposal on flood behaviour covering: <ul style="list-style-type: none"> <li>• Impact to other properties and infrastructure</li> <li>• Consistency with council floodplain risk management plans</li> <li>• Compatibility with flood hazard of the land, flow conveyance in floodways and flood storage areas</li> <li>• Impact of inundation on floodplains, erosion and sedimentation, riparian habitat and stability of river banks</li> <li>• Flood risk and emergency management requirements which have been discussed with Council and SES</li> <li>• Impact on social and economic costs due to flooding</li> </ul> </li> </ul>	
NSW DPIE	<ul style="list-style-type: none"> <li>• Biodiversity</li> <li>• Assessment to be conducted in accordance to standard options</li> <li>• The assessment shall include: <ul style="list-style-type: none"> <li>• Mapping of the study area</li> <li>• Description of methodologies used and qualification of personnel</li> <li>• Identification of national and state listed threatened biota</li> <li>• Impact assessment and mitigation measures including offset package</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The assessment of impact to state (<i>BC Act</i>) listed entities were found to be not significant according the assessment of significance carried out and therefore a Biodiversity Assessment Development Report/Species Impact Statement is not required</li> <li>• Section 6.3 Biodiversity</li> <li>• Safeguards B1 to B12 in Table 7-1</li> <li>• Threatened species and endangered ecological communities are assessed</li> </ul>



Agency	Issue raised	Response / where addressed in REF
		in the Biodiversity Assessment report provided in Appendix F
NSW DPIE	<ul style="list-style-type: none"> <li>Aboriginal cultural heritage assessment requirements: <ul style="list-style-type: none"> <li>Compliance to DPIE codes of practice and guidelines</li> <li>Cultural heritage values assessment and consultation in accordance to National Parks and Wildlife Regulation 2009</li> <li>Consideration of views of Aboriginal people about the impact of the proposal</li> <li>Assessment of impact and mitigation measures</li> <li>AHIP required if objects will be harmed</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Section 6.4 and Aboriginal Cultural Heritage Assessment Report in Appendix G</li> <li>Safeguards AH1 to AH4 in Table 7-1</li> <li>Requirement for AHIP specified in Section 7.3</li> </ul>
NSW DPIE – Fisheries	<ul style="list-style-type: none"> <li>The REF shall address the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Update 2013)</li> <li>Primary concern is the disturbance and/or destruction of aquatic habitats and any adverse impact on aquatic species, ie due to siltation from excessive sediment runoff, blockages to fish passage such as the construction of causeways, culverts and temporary crossings and direct impact on aquatic habitat such as the removal of aquatic vegetation</li> </ul>	<ul style="list-style-type: none"> <li>Safeguard B1 and B3 in Table 7-1 and Section 6.3.4</li> <li>Requirement for notification to the Minister before any dredging or reclamation work specified in Section 7.3</li> <li>Safeguard S2 and S2 in Table 7-1 addresses erosion and sedimentation</li> <li>Addressed in Appendix F Biodiversity Assessment Report which covers crossings at Gooromon Ponds and Little Bedulluck Creek</li> </ul>
NSW DPEI – Crown Land	<ul style="list-style-type: none"> <li>No comments received.</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Essential Energy	<ul style="list-style-type: none"> <li>Relocation work of 22 kV power lines running along the Barton Highway potentially impacting quality and reliability of connected customers</li> <li>New power lines to be kept within road reserve and avoid crossing Crown Land</li> <li>Relocation work to comply with:</li> </ul>	<ul style="list-style-type: none"> <li>Section 3.2.2, Table 3.5, Table 3.6, Section 3.3.7, Section 6.12.1 and Table 6.12.2</li> <li>Safeguards U1 and U2 in Table 7.1</li> <li>Section 3.5; Relocation of the 22 kV powerlines would</li> </ul>

Agency	Issue raised	Response / where addressed in REF
	<ul style="list-style-type: none"> <li>CEOM7097 Overhead Design Manual</li> <li>ISSC 20 Guideline for the Management of Activities within Electricity Easements and Close to Infrastructure</li> <li>Code of Practice – Work near Overhead Power Lines and Code of Practice – Work near Underground Assets</li> </ul>	be carried out in accordance to Essential Energy's Design Information Package which covers the specified requirements
NBN Co	<ul style="list-style-type: none"> <li>No comments received.</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Nextgen Network Pty Ltd	<ul style="list-style-type: none"> <li>No comments received.</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Optus Administration Pty Ltd	<ul style="list-style-type: none"> <li>No comments received</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Telstra Network Integrity	<ul style="list-style-type: none"> <li>No comments received</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>
QCity Transborder Express	<ul style="list-style-type: none"> <li>Provided information about bus routes and schedules</li> <li>Raised concerns about safety issues related to bus stops</li> </ul>	<ul style="list-style-type: none"> <li>Addressed in Appendix D Traffic and Access Impact Assessment</li> <li>Considered in reference design</li> </ul>

## 5.6 Ongoing or future consultation

Roads and Maritime will continue to keep stakeholders informed as the proposal progresses. A variety of engagement methods would be used including webpage updates, newsletters, stakeholder briefings, media releases, newspaper advertisements, facebook posts, community information pop-up sessions and other consultation tools.

This REF will be on public display until 24 January 2020 for feedback. The community will be notified about the display period through the engagement methods listed above.

Following public display, all comments received will be recorded and addressed in a submissions report, detailing how each issue raised has been considered in finalising the proposal. The submissions report will be made available to the public on the project webpage.

The community will be informed of changes to the proposal as a result of the submissions report or any future consultation.

## 6. Environmental assessment

This chapter provides a detailed description of the potential environmental impact 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 impact 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 impact.

### 6.1 Traffic and transport

A Traffic and Access Impact Assessment<sup>2</sup> was prepared by AECOM for the proposal (AECOM, 2018b) to identify current traffic conditions, transport patterns and access to the highway and to assess the potential impact during construction and operation of the proposal. The assessment is provided in Appendix D and the findings are summarised in this section.

#### 6.1.1 Methodology

The traffic and access assessment included:

- Analysis of existing traffic flows, travel times and access conditions
- Review of historic crash data within the study area
- Assessment of public transport performance
- Traffic modelling with and without the proposal
- Identification of traffic and access impact during construction and operation for all road users
- Development of mitigation and management measures to minimise identified impacts.

Traffic modelling for the reference design was carried out using the Aimsun 8.2.1 model. This was calibrated using traffic count and travel time data collected in late 2017. Scenarios with and without the proposal were modelled for the years 2027 and 2037 which provided potential travel time savings, as well as changes in intersection delays and levels of service.

An assessment of significance of potential traffic impacts was determined as a function of the magnitude and sensitivity to affected stakeholders using the social impact methodology (NSW Department of Planning and Environment, 2017). Magnitude was determined from spatial extent, duration and severity, whereas sensitivity considered the susceptibility or vulnerability of stakeholders to adverse changes caused by the impact, or the importance placed on the affected issue.

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<sup>2</sup> The Traffic and Access Impact Assessment study area extended an additional 1.3 km north of the REF construction boundary which ends about 300 metres north of Kaveney's Road.

Further details of the assessment methodology and outcomes are provided the Traffic and Access Impact Assessment (see Appendix D).

## 6.1.2 Existing environment

The existing infrastructure within the construction boundary is described in Section 2.2. Key traffic and transport characteristics of the existing highway are summarised below.

### **Existing highway geometry**

Much of the Barton Highway within the construction boundary consists of one traffic lane in each direction with a southbound overtaking lane near Kaveney's Road. The posted speed limit is 100 km per hour. Key issues with the road geometry of the highway identified in the *Barton Highway Improvement Strategy 2017* are:

- Long continuous lengths of single lane carriageway limit the opportunity to overtake slower vehicles, which increases travel times and risk taking behaviour, and reduces travel time reliability
- Some crests limit stopping sight distance. This creates hazards associated with vehicles turning at intersections. Driveways affect vehicles overtaking in the opposite travel direction or overtaking stationary objects on the highway, can reduce road safety and affects travel speed and travel time reliability
- Mature vegetation, fences and roadside embankments at various locations limit horizontal stopping sight distances. This may reduce road safety and affect travel speed and travel time reliability
- Drainage culverts and mature trees within the clear zone and no safety barriers. This increases the likelihood of a run-off-road crash being a casualty crash. It may also have an impact on driver comfort, with a flow-on effect on travel times and reducing travel time reliability
- The majority of intersections do not have auxiliary lanes that offer protection and improved access to the main road for turning vehicles
- Road shoulders along the majority of the highway are under the two metre recommendation. This limits safety for motorists, cyclists and bus passengers
- Sight distances at some intersections are affected by bus stops locations
- There is a lack of heavy vehicle rest area facilities
- Exit from the Jeir Creek heavy vehicle rest area on the northbound carriageway conflicts with the merge of the overtaking lane
- There is insufficient signage and delineation in some areas.

### **Road surface**

While the road surface on parts of the Barton Highway has exceeded its design life, the majority of the road surface was found to be performing well as reported in the *Barton Highway Improvement Strategy 2017*. Road surface issues identified included:

- The highway displays structural serviceability and acceptable roughness
- It is within the acceptable limit of cracking for the sealed surface
- Sideway-force coefficient routine investigation machine data shows that minimal work is required to improve skid resistance
- Only about 10 per cent of the single carriageway section shows moderate rutting.



## Traffic volumes

Traffic counts by TCS Instruments Pty Ltd in October 2017 found that the highway within the construction boundary is carrying between 11,000 and 16,000 vehicles per day and that traffic volumes are higher closer to the NSW/ACT border.

The October 2017 traffic count surveys found that heavy vehicles make up about 8 to 15 per cent of daily traffic on the highway within the construction boundary. This represents about 900 to 2,300 heavy vehicles each day, which is noticeably higher than previous traffic counts carried out in 2014. Results of traffic count surveys at two monitoring sites within the construction boundary are summarised in Figure 6-1.

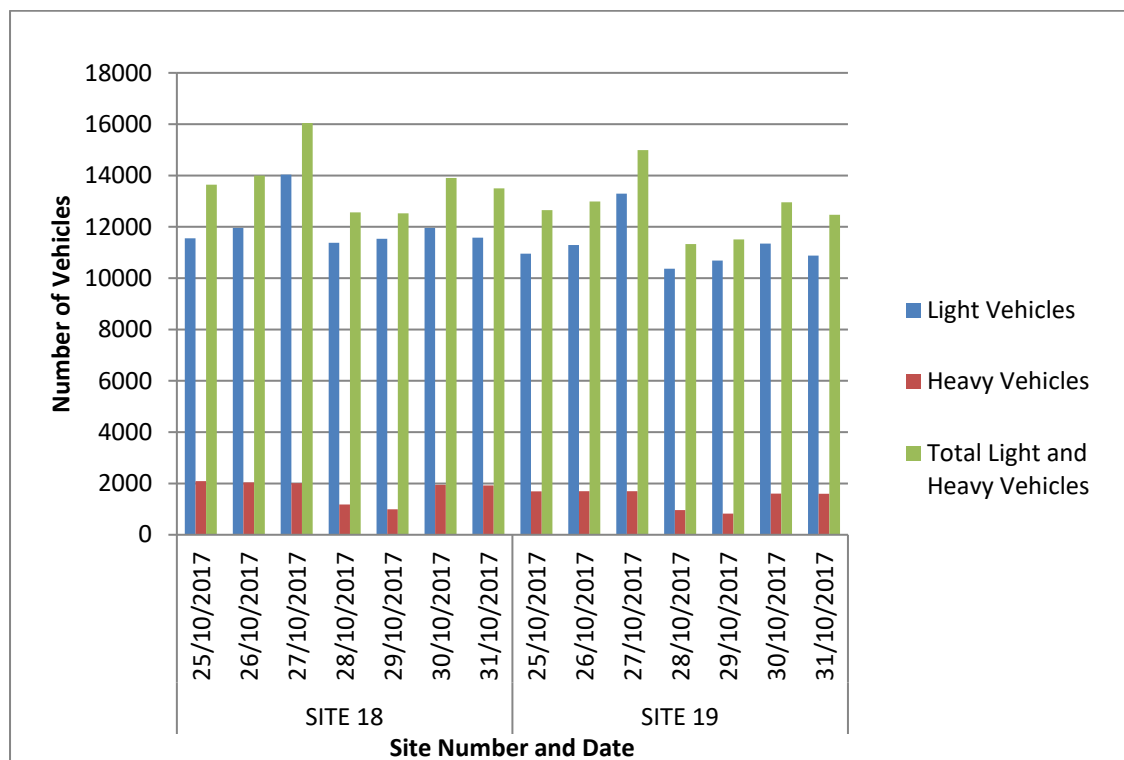


Figure 6-1 Daily traffic counts on the Barton Highway by heavy and light vehicles

*Note: Site 18 is located north of Spring Range Road while Site 19 is located north of Nanima Road*

The October 2017 traffic count data and Sydney coordinated adaptive traffic system signals volume data collected at the intersection of Barton Highway with Kuringa Drive and Clarrie Hermes Drive (within the ACT) for a 13 month period (1 May 2017 to 31 May 2018) was used to estimate traffic volumes within the construction boundary. The assumptions used and results of analyses of average weekday data for day of week, month of year, week of year, time of day and public holiday periods is provided in Appendix D. The key findings are summarised below:

- November had the highest variation in daily traffic (averaging 13,500 vehicles per day), while January is the quietest month (averaging 12,050 vehicles per day)
- Total two-way weekly volumes range between 90,000 and 95,000 vehicles per week. Traffic volumes peak at 95,000 vehicles per week just before Christmas, then drop to a low of 70,000 vehicles per week between Christmas and New Year
- The highest average recorded volumes are on Fridays at 14,500 vehicles per day where the southbound direction consistently has more traffic than northbound
- Morning peak hour occurs between 7am and 8am, averaging 1040 vehicles per hour (ranging from between 1000 to 1400 vehicles per hour) with about 78 per cent of these vehicles travelling southbound towards ACT.

- Afternoon peak hour occurs between 5pm and 6pm, averaging 1,070 vehicles per hour (ranging from between 1000 to 1200 vehicles per hour) with about 57 per cent travelling northbound towards Yass
- Traffic volumes on weekdays are highest in February/March and lowest in December/January
- The highest traffic volumes on weekends are around midday. There is an additional peak heading into the ACT on Sunday afternoons. The maximum average peak hour volume recorded on a weekend was 1100 vehicles per hour, with April/May having the highest volumes and January the lowest volumes
- Daily volumes on public holidays average 10,000 vehicles per day, while they average 13,500 vehicles per day on weekdays.

### **Level of service**

The level of service of roads is classified from levels A to F, with level of service 'A' representing the best operating conditions and level of service 'F' the worst. The average travel speed along the highway within the construction boundary is between 89 and 93 km per hour, except during the morning southbound peak when the travel speed can fall to 86 km per hour.

According to the *Network Performance Measures and Network Planning Targets* (Roads and Maritime, 2010), Barton Highway is a 4R road which should operate at level of service C. The level of service along the Barton Highway currently varies from C to E during the day, depending on the location and the number of vehicles using the highway. Roads and Maritime (2010) recommends that an overtaking lane should be provided at locations where the level of service is worse than C. Traffic modelling results show that additional overtaking lanes would improve the level of service for peak hour road users within the construction boundary.

Traffic modelling studies indicate that key intersections within the construction boundary operate at a satisfactory level under existing conditions, between level of service A and B.

### **Road safety**

Between July 2013 and April 2017, there were 19 crashes recorded within the study area which included two fatality and nine injury crashes. The most common crashes were rear end crashes and striking animals on the highway, followed by head-on collisions and veering left off the highway. The two fatal crashes were the result of a head on collision and an overtaking manoeuvre.

Of the 19 crashes, about 32 per cent occurred at or near intersections and about 60 per cent occurred on weekends or during peak periods. See Section 2.1.3 for more information on road safety.

Figure 6-2 shows the crash locations within the study area and severity.

The average crash rate within the study area was 1.2 crashes per kilometre between 2013 and 2017 which is significantly higher than the average crash rate of 0.195 crashes per kilometre on other comparable roads in NSW. The proposal aims to improve road user safety through the provision of a dual carriageway with consistent road conditions and design to reduce the crash rate and to cope with the predicted future traffic movements in the area.

Recent road safety audits (Roads and Maritime 2018b) highlighted that between the NSW/ACT border and Briarwood Lane, the predominant road safety risks are unprotected headwalls within the five metre clear zone, fill batters that have steep slopes and roadside drains. Safety risks identified as being medium to high included various deficiencies particularly at intersections and property accesses (see Section 2.2.7 and Appendix D for more details).



Figure 6-2 Crash plot data within construction boundary (2013-2017)

## **Public transport**

As described in Section 2.2.3, there is low public transport use in the construction boundary. Two commuter bus services (QCity Transborder Express) operate between Yass and Canberra and eight school bus services operate on weekdays during school terms.

There are six bus stops within the construction boundary used by commuters and school children, including the following:

- Rolfe Road
- Kaveney's Road
- Briarwood Lane
- Nanima Road
- two near Spring Range Road.

There are safety concerns at a number of the bus stops. These include:

- Spring Range Road intersection: inadequate space for deceleration and for waiting passengers (see Figure 6-3), turnaround located too close to highway (see Figure 6-4)
- Nanima Road intersection: possible hazardous northbound bus movements and stopping. Attracts hazardous u-turns close to the intersection
- Rolfe Road intersection: inadequate space for deceleration and stopping, no facility southbound
- Briarwood Lane intersection: attracts hazardous u-turns close to the intersection
- Kaveney's Road and Anchow Hill Lane intersections: inadequate space for waiting passengers and located in a high conflict area.



Figure 6-3 Bus bay near Spring Range Road – looking north



Figure 6-4 Bus stop facilities on Spring Range Road – looking west

The school bus services stop frequently along the highway but at less defined bus stops. Some school bus stops have signage for road users. Safety at bus stops is a concern due to limited bus stop facilities on the highway and the location of waiting passengers, including school children. Waiting bus passengers are exposed to vehicle run off as they wait at bus stops on narrow shoulders close to high speed traffic.

## **Pedestrian and cyclist facilities**

Pedestrian and cyclist use on the Barton Highway is very low within the construction boundary. This section of the Barton Highway is generally not safe for on-road cycling. Key deficiencies include:



- Changed shoulder conditions at NSW/ACT border; road surface texture is not conducive for cycling (see Figure 6-5)
- Narrow southbound shoulder north of NSW/ACT border not safe for on-road cycling (see Figure 6-6) – from about 200 m north of Victoria Street for 1.1 km (CH16200 to CH17300)
- Northbound shoulder narrows north of Church Lane
- Generally narrow shoulders both sides of road north of Spring Range Road not safe for on-road cycling.



Figure 6-5 Change in road surface texture at NSW/ACT border – looking south



Figure 6-6 Typical two-lane section about 400 m north of NSW/ACT border – looking south

Source: Google Maps (2018)

There is currently limited provision for pedestrians along the Barton Highway within the construction boundary with most pedestrian activity occurring at bus stops.

### Access and connectivity

Access to the highway within the construction boundary is via nine intersections and ten property accesses. There is also a stockpile site access, three bus stops, an enforcement bay and a rest area accessed directly off the highway.

The proposal would affect a number of existing property accesses along Barton Highway, especially to the west. Table 6-1 provides a list of property accesses and current issues with sight distances. Safe intersection sight distance (SISD) was measured from a 3D survey of the road and was compared with the requirements indicated in *Australian/ New Zealand Standard AS/NZS2890: Parking Facilities Parts 1-6* and *Austroads Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2010) for a design speed of 110 km per hour (SISD = 300 m).

Table 6-1 Property accesses and sight distance

Access	Side of road	Sight distance and access
Rest area – CH16400	West	300 m SISD achieved to the south. Double lines next to access make right turns unsafe if carried out
Property - CH16450	East	300 m SISD achieved to the north. Double lines next to access make right turns unsafe if carried out
Property – CH16610	West	Vegetation and road signage obstruct sight lines when looking to the south, with an achievable sight distance less than 300 m (about 240 m). Double lines next to access, making right turns unsafe if carried out

Access	Side of road	Sight distance and access
Property - CH16690	East	Satisfactory sight distance to the north. Double lines next to access, make right turns unsafe if carried out
Property - CH16780	West	300 m SISD achieved to the south. Double lines next to access, make right turns unsafe if carried out
Property - CH17230	East	300 m SISD achieved to the north. No storage provision for northbound right turns into access creating risk of collisions with high speed highway traffic
Church Lane - CH17410	West	300 m SISD achieved to the north and south. No storage provision for southbound right turning traffic, nor deceleration lane for northbound left turns, creating risk of collisions
Bus stop – CH18360	West	Adequate sight distance in both directions. The indented bus bay (bus stop) has inadequate space for deceleration and for waiting passengers
Spring Range Road - CH18400	East	300 m SISD achieved to the north and south. Storage provision for right turns
Property - CH19560	West	Adequate sight distance in both directions
Rest area – CH19910	East	Adequate sight distance in both directions. Double lines make right turns from northbound lane unsafe and dangerous if carried out
Nanima Road - CH20530	East	Adequate sight distance in both directions. No deceleration lane for southbound left turns creating risk of rear end collisions
Stockpile Site – CH20770	East	Adequate sight distance, but double lines next to access, making right turns unsafe and dangerous if carried out
Rolfe Road & bus stop - CH20830	West	Satisfactory sight distance to the south. Double lines next to access, making right turns unsafe if carried out. Inadequate space for deceleration and stopping, creating potential risks of conflicts with turning traffic and northbound highway traffic
Property - CH21830	West	300 m SISD achieved to the south. Access is located near the merge at the end of an overtaking lane, increasing inherent risks associated with no deceleration lane for northbound left turns. Double lines make right turns from southbound lane unsafe and dangerous if carried out
Boundary Lane - CH22130	East	Satisfactory sight distance to the north. No deceleration lane for northbound left turns creating risk of rear end collisions. Double lines next to access, make right turns unsafe if carried out
Briarwood Lane - CH22630	East	300 m SISD achieved to the north and south. No deceleration lane for southbound left turns creating risk of rear end collisions. Break in double lines make right turns legal here, but no storage for northbound right turns creates risks of high speed collisions with highway traffic
Property - CH22750	West	Satisfactory sight distance to the south. No deceleration lane for northbound left turns creating risk of rear end collisions. Double lines next to access, make right turns unsafe if carried out

Access	Side of road	Sight distance and access
Property - CH22810	East	Inadequate sight distance to the north due to crest in the vertical alignment of the road. 180 m SISD available to the north with a minimum set back of five metres. No deceleration lane for southbound left turns creating risk of rear end collisions. Double lines next to access, make right turns unsafe if carried out
Property - CH22930	East	Inadequate sight distance achieved to the north with only 150 m available SISD. Double lines next to intersection, make right turns unsafe if carried out
Tallawong Close - CH22940	West	Satisfactory sight distance to the south. No deceleration lane for northbound left turns creating risk of rear end collisions. Double lines next to intersection, make right turns unsafe if carried out
Property - CH23210	East	Satisfactory sight distance to the north. No deceleration lane for southbound left turns creating risk of rear end collisions. Double lines next to access, make right turns unsafe if carried out
Kaveney's Road - CH23370	West	300 m SISD achieved to the north and south. Seagull intersection allows for safe merging into southbound lanes
Bus stop – CH23420	West	Inadequate sight distance to the south. Has inadequate space for waiting passengers and located in a high conflict area
Anchow Hill Lane - CH23470	East	Vegetation obstructs sight lines when looking to the north, limiting SISD to less than 300 m. 300 m SISD is achieved to the south. Break in double lines make right turns legal here

*Note: Sub-rule 3-1 of Rule 134 of the NSW Road Rules 2014 allows traffic to turn to/from a property or intersection across continuous lines.*

### **Freight transport**

The Barton Highway provides important road connections from the Hume Highway and into the Riverina and Murray-Darling regions to Canberra and the eastern part of the Capital Region. The Hume Highway is the busiest freight corridor in Australia, from Sydney to Melbourne.

Boral Quarry is located close to the proposal and supplies a significant amount of aggregate material into southern NSW and ACT. Freight movements to and from the quarry occur on the Barton Highway via Kaveney's Road intersection.

Canberra Airport is a growing influence for freight transport in the region. The recently announced upgrade of Nerriga Road could increase freight movements on Barton Highway.

A rest area is located northbound just north of the NSW/ACT border (at CH16400) and a heavy vehicle enforcement bay located southbound at CH19910 within the construction boundary. Both facilities are sub-standard with limited separation from the highway and no deceleration or acceleration lanes, affecting the safety and amenity of these areas.

## **6.1.3 Potential impact**

### **Construction**

#### *Construction traffic volumes and impact to the local road network*

Traffic impact during construction would occur due to the movement of construction vehicles along the Barton Highway and along local roads, for hauling of construction materials and movement of construction

equipment and personnel. During construction there would be up to 100 additional heavy vehicle trips per day (peaking during earthwork and paving work) and about 100 light vehicle trips.

Potential impact caused by construction vehicle traffic would include:

- Increased travel times due to reduced speed limits around construction sites
- Increased travel times due to increased truck and construction machinery movements
- Temporary closure of parts of the highway and altered property accesses during construction.

A potential temporary haul road would be built along the western side of the construction boundary enabling construction traffic to move between the compound areas, stockpile locations and working areas without needing to access the highway. Separating construction vehicles and highway traffic, as far as practical, minimises disruption and the potential interaction between construction vehicles and road users.

Increased heavy vehicle traffic and localised speed restrictions on Barton Highway would not have a significant negative impact on level of service. The proposal is predominately being constructed offline so the existing highway would remain open to traffic and be largely unaffected. Once the new northbound carriageway has been completed, both lanes of traffic would be directed to the new carriageway to allow the modifications to the existing highway to be carried out without significantly impacting traffic.

Delays during construction would occur when work is being carried out next to the existing highway when it is open to traffic, such as during drainage work and also during tie-in work. This may require the narrowing of lanes with temporary speed reductions to ensure the safety of construction workers. This may also delay access to emergency services and existing public and school bus services. Work which impact traffic would be carried out outside of peak hours or during out of hours to minimise disruption to traffic (see Section 3.3.3). The impact of these activities on the level of service during construction range from negligible to low negative.

#### *Access for local roads and property*

Access to existing properties within the construction boundary would be maintained during all stages of construction. However, access routes to individual properties may be temporarily affected, either through the loss or alteration of existing access arrangements. Residents and property owners would be consulted about access changes if such impact cannot be avoided.

Where local roads on the western side of the Barton Highway cross through the construction site, temporary crossing points would be established to provide a safe crossing point to the highway and also access for construction vehicles to connecting parts of the temporary haulage road. Traffic management operations would be established at these crossing points to manage the conflict between construction and local traffic and would be described in the TMP to be prepared by the contractor.

#### *Public transport*

Most bus stops would continue to operate during construction, with minimal negative impact. However, there would be some increase in public transport travel times due to temporary speed restrictions during construction. Bus stops located near intersections would experience similar impact on level of service and traffic safety as that for general traffic. Bus stops may be temporarily relocated during construction which may cause an inconvenience to users. Provision of traffic control staff would be required to help school children cross construction interfaces to access bus stops. The impact of construction work on public transport would be of low negative significance.

#### *Pedestrian and cyclist facilities*

There would be minimal negative impact on pedestrian and cyclist facilities during construction. Pedestrian and cyclist access would be maintained or alternative routes provided throughout construction. The new northbound carriageway would benefit both pedestrians waiting at bus stops and cyclists using Barton Highway once operational. Overall impact of construction on active transport is of low negative significance.



### *Freight transport*

The main impact of construction activity on freight transport would be increased travel times due to construction zone speed limits, truck and construction machinery movements, lane closures and stop/go traffic control. Access to the Boral Quarry would be maintained throughout construction. The quarry operators would be consulted about upcoming access changes if such impact cannot be avoided. Overall, the impact of construction work on freight transport along the proposal section of highway would be of medium negative significance.

### *Operation*

The proposal would provide a positive impact to traffic operations in the region, including:

- Reduced crash frequency and severity and more broadly improved road user safety
- Travel time improvements from higher travel speeds and less congestion which would also lead to operational cost savings for business and individuals
- Economic benefits throughout the operation period
- Greater connectivity between existing and proposed population centres within the study corridor, depending on the interface with the local road network.

### *Traffic performance*

The proposal would improve the level of service and safety of the highway within the construction boundary. Once open to traffic the proposal would provide two lanes of traffic in each direction providing opportunities for road users to overtake slow moving vehicles without needing to cross into the path of oncoming traffic. The proposal would also provide an alternative route should one of the carriageways require planned or unplanned maintenance or in the event of a traffic incident.

There is likely to be a small increase in traffic on the Barton Highway due to some diversion of traffic from Murrumbateman Road and an increased rate of development in Murrumbateman and Yass which would be partially strengthened by the proposal. However, the increase in traffic volumes as a result of the proposal is likely to be minor in magnitude. The sensitivity of road users to the increase would be negligible within the construction boundary, but would be medium north of the proposal between Murrumbateman and Anchow Hill Lane. The impact of increased traffic volumes would be of low negative significance.

There would be reduced travel times for traffic travelling through the construction boundary, but some increased travel times for local traffic accessing properties due to changed property access arrangements (see *Access and connectivity* below). Table 6-2 shows the predicted savings in northbound and southbound travel time as a result of the proposal. Results presented are for average daily travel of all vehicles for two distinct travel routes:

- Vehicles travelling between Murrumbateman and ACT
- Vehicles travelling between the Hume Highway and ACT.

There would be small savings in travel times in each direction. The most noticeable changes would be for travel between Murrumbateman and ACT (almost ten per cent by 2037). Savings would be greater in peak periods. The magnitude of change in mid-block level of service would be of low positive significance.

Table 6-2 Travel time savings due to proposal

Route	Scenario	2022		2027		2037	
		Travel Time (min)	Time Saving	Travel Time (min)	Time Saving	Travel Time (min)	Time Saving
Northbound from the NSW/ACT border to the Hume Highway	Existing	21.7	-	21.9	-	22.2	-
	Proposal	21.4	1.2%	21.7	1.2%	21.7	2.0%
Northbound from the NSW/ACT border to Murrumbateman	Existing	14.2	-	14.3	-	14.5	-
	Proposal	14.0	1.4%	14.0	1.9%	14.1	2.5%
Southbound from the Hume Highway to NSW/ACT border	Existing	26.5	-	31.1	-	47.5	-
	Proposal	24.9	5.8%	29.6	4.6%	44.4	6.6%
Southbound from Murrumbateman to NSW/ACT border	Existing	18.4	-	22.7	-	38.0	-
	Proposal	17.0	7.8%	21.4	5.9%	34.7	8.8%

Source: AECOM (2018b)

Note: Travel time is measured from the start of the proposal at the NSW/ACT border (CH16000) to South Street in Murrumbateman (CH38000) and through to the Hume Highway (CH49340). The savings represent a percentage saving compared against the base case for each of the time horizons.

### Intersections

Traffic modelling of the key intersections within the construction boundary shows there would be noticeable improvements in intersection level of service in the morning peak as a result of the proposal (AECOM 2018b). Fewer changes would be evident in the afternoon peak, as shown in Table 6-3, as well as off-peak. Overall impact of intersection upgrades on level of service would be of low to medium positive significance.

Table 6-3 Intersection level of service with or without proposal

Intersection	Peak	2022		2027		2037	
		Existing	Proposal	Existing	Proposal	Existing	Proposal
Church Lane	Morning	F	A	F	A	F	A
	Afternoon	A	A	A	A	B	A
Spring Range Road	Morning	B	A	C	B	B	A
	Afternoon	A	B	A	A	A	A
Nanima Road	Morning	C	A	B	A	B	A
	Afternoon	A	A	A	A	A	A
Rolfe Road	Morning	A	A	B	A	A	A
	Afternoon	A	A	A	A	A	A
Boundary Lane	Morning	A	A	A	A	A	A
	Afternoon	A	A	A	A	A	A

Intersection	Peak	2022		2027		2037	
		Existing	Proposal	Existing	Proposal	Existing	Proposal
Kaveney's Road	Morning	D	-	F	-	E	-
	Afternoon	A	-	A	-	A	-
Anchow Hill Lane	Morning	F	A	F	A	F	A
	Afternoon	A	A	A	A	B	A

Source: AECOM (2018b)

### Safety

The proposal would result in a number of safety benefits within the construction boundary.

Constructing a new northbound carriageway and modification of the existing highway with an associated wide median would greatly reduce the occurrence of serious crashes, such as head-on collisions and run-off road collisions. Roads and Maritime (2018c) indicates that the duplication proposal could result in a 55 per cent reduction in fatalities and serious injuries, as well as a 40 per cent reduction in run-off road collisions with low to moderate injury. There would also be noticeable benefits to cyclists travelling northbound with the provision of wider and better quality shoulders for the full length of the proposal, however no southbound provisions have been made.

The proposal would provide a substantial reduction in intersection crashes, given the reduction of conflicts at intersections and the provision of deceleration and acceleration turning lanes. Crash data indicated that about 32 per cent of crashes occurred at intersections (see Section 6.1.2) and it is anticipated that the proposal would result in a notable reduction of these crashes.

Recent road safety audits and sight distance analyses highlighted safety concerns with almost all existing property accesses. The proposal would provide much safer accesses, including a sealed road surface for deceleration, acceleration and off-road storage of larger vehicles. It would also minimise the risks of collisions with drainage head walls at accesses.

The proposal would include upgrades to bus stops in the construction boundary which would be relocated away from the Barton Highway and on to side roads at the u-turn facilities. Parking spaces would be provided at u-turn bays for safe drop off and vehicle waiting.

The road safety audit highlighted a number of mid-block safety hazards from safety barriers, as well as established trees and steep embankments located close to the clear zone. These hazards would be addressed during construction of the proposal improving the safety for road users.

There may be a slight adverse impact on safety north of Kaveney's Road where the proposed northbound carriageway would merge into the existing southbound carriageway. This would be signposted as per *Road and Maritime Design Guidelines*.

Overall the proposal would greatly improve the safety for road users throughout the construction boundary and be of high positive significance.

### Enforcement bay and rest area

The heavy vehicle rest area at the NSW/ACT border would be removed as part of the proposal with the heavy vehicle enforcement bay located just south of Nanima Road being upgraded with improved amenities and safer access to and from this area. The removal of the rest area at the NSW/ACT border would have a minor negative impact as a result of the loss of this safe stopping area. However with the improvements to the heavy vehicle enforcement bay which is located about 3.5 km from this area the overall impact is considered to be negligible.

### *Public transport*

Bus stops within the construction boundary would be relocated away from the Barton Highway into the side roads (Spring Range Road, Nanima Road and Kaveney's Road). These relocated bus stops would provide a safer drop-off environment for public transport users. The impact of the proposal on public transport would be of high positive significance.

### *Pedestrians and cyclists*

The proposal would benefit pedestrians and cyclists by providing enhanced bus stop facilities and widened and high quality road shoulders on the new northbound lanes. The new northbound carriageway would have 2.5 metre wide shoulder and higher quality paving which would provide improved safety, ride comfort and level of service for cyclists travelling north from the NSW/ACT border towards Murrumbateman. However as the existing highway would be modified into a southbound dual carriageway with no modification to the existing road shoulder, there would be no benefit to cyclists travelling from Murrumbateman towards the NSW/ACT border. Much greater benefit would occur should the duplication extend to Murrumbateman, providing an important connection from the ACT. The impact of the proposal on cyclists would be of medium positive significance.

The benefits to pedestrians would be largely limited to the improvements to bus stops due to the low number of pedestrians which use the highway within the construction boundary.

### *Access and connectivity*

The proposal would facilitate increased accessibility to services, community facilities and employment through reduced travel times and in providing a safer road. The increased accessibility provided by the proposal would benefit many people and businesses both locally and in the region. The changes in accessibility from the proposal for the broader community, Murrumbateman residents and businesses would be of high positive significance.

The proposal incorporates a new median and closures of direct access to the highway from the following intersections and property accesses:

- Tallawong Close (west)
- Anchow Hill Lane (east)
- property access at CH21850 (west),
- property access at CH22810 (east)
- property access at CH22900 (east)
- property access at CH23200 (east).

By consolidating access points to the highway it improves road safety by increasing distances between intersections. Access to the affected properties would be maintained through existing and/or new local access routes. A new service road would link Anchow Hill Lane to Briarwood Lane and provide access to the properties at CH22810, CH22900 and CH23200.

All intersections have been designed to considerably improve the safety of the highway for road users in line with the proposal objectives. This includes changes to traffic movements to reduce the number of occasions where traffic is required to cross the road corridor (eg to make a right turn), reducing the potential for interactions with oncoming traffic.

Except in the case of Kaveney's Road, road users wishing to turn right from intersections along the highway would be required to turn left onto the highway and then perform a u-turn at the nearest u-turn facility. At Kaveney's Road a right turn is provided with an associated acceleration lane. See Section 3.2.6



Table 6-4 shows the local roads and property accesses affected by the proposal. The new routes are shown in Figure 3-5 and Figure 3-6. Other accesses would either close or not be impacted. Those most affected are:

- Right turns out of Nanima Road – 5.9 km or 3.7 minute detour
- Right turns out of Anchow Hill Lane – 5.0 km or 3.5 minute detour
- Right turns into Kavenneys Road – 4.8 km or 3.2 minute detour.

The magnitude of change to local road and property accesses would be of medium negative significance.

Table 6-4 Changed access to side-roads and properties

Intersection/ Access	CH	Affected Turn	Closest Right Turn Facility	CH	Detour Distance (km)	Detour Time (min)
Private access	17230	Right turn into access	Spring Range Road	18570	2.7	1.8
	17230	Right turn out of access (northbound)	Victoria Street	16120	2.2	1.6
Church Lane	17440	Right turn out of access (southbound)	Spring Range Road	18570	2.3	1.6
Spring Range Road	18400	Right turn out of access (northbound)	Church Lane	17580	1.6	1.2
Private access	19600	Right turn into access	Church Lane	17580	4.0	2.6
	19600	Right turn out of access (southbound)	Nanima Road	20710	2.2	1.6
Nanima Road	20530	Right turn out of access (northbound)	Church Lane	17580	5.9	3.7
Rolfe Road	20830	Right turn out of access (southbound)	Briarwood Lane	22670	3.7	2.3
Boundary Lane	21990	Right turn out of access (southbound)	Briarwood Lane	22670	3.1	1.8
Briarwood Lane	22630	Right turn out of access (northbound)	Rolfe Road	20990	3.3	2.2
Private access	22810	Left turn into access	Briarwood Lane	22670	0.3	0.5
Private access	22930	Left turn into access	Briarwood Lane	22670	0.5	0.6
Private access	23210	Left turn into access	Briarwood Lane	22670	1.1	1.0
Kavenneys Road/ Tallawong Close	23400	Right turn into access	Rolfe Road	20990	4.8	3.2
Anchow Hill Lane	23500	Right turn out of access (northbound)	Rolfe Road	20990	5.0	3.5
	23500	Right into access (northbound)	Briarwood Lane	22670	1.7	1.0

### Freight transport

The proposal would benefit freight transport by reducing travel times and improving road safety. There would also be safety and amenity enhancements at the heavy vehicle enforcement bay located south of Nanima Road including provision of a deceleration and acceleration lane, and new road surface. The magnitude of the change for freight transport would be of medium positive significance.

## 6.1.4 Safeguards and management measures

The recommended safeguards and management measures for traffic and access impact are provided in Table 6-5

Table 6-5 Traffic and access safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	<p>A TMP will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the <i>Roads and Maritime Traffic Control at Work Sites Manual</i> (Roads and Maritime, 2018e) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008).</p> <p>The TMP will include:</p> <ul style="list-style-type: none"> <li>• Confirmation of haulage routes</li> <li>• Measures to maintain access to local roads and properties</li> <li>• Site specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>• Measures to maintain pedestrian and cyclist access</li> <li>• Measures to maintain safe access to bus stops</li> <li>• Requirements and methods to consult and inform the local community of impact on the local road network in line with Roads and Maritime '<i>Community Engagement and Communication Manual</i>' (Roads and Maritime 2012)</li> <li>• Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads</li> <li>• A response plan for any construction traffic incident</li> <li>• Consideration of other developments that may be under construction to minimise traffic conflict and congestion</li> </ul>	Contractor	Detailed design/ Pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>that may occur due to the cumulative increase in construction vehicle traffic</p> <ul style="list-style-type: none"> <li>Monitoring, review and amendment mechanisms.</li> </ul>			
Construction traffic impact	A detailed construction staging plan will be developed to maintain existing peak flow capacity	Contractor	Pre-construction and construction	Additional safeguard
Traffic and transport	Where possible, the most disruptive work (such as work that requires lane closures) will be carried out at night to minimise potential impact on the regional road network. This, combined with temporary effective traffic management, will assist in minimising impact to traffic and transport using the Barton Highway	Contractor	Construction	Additional safeguard
Impact to emergency services	Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency and documented in the TMP	Contractor	Pre-construction and construction	Additional safeguard
Safe access to bus services	Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community	Contractor/ Roads and Maritime	Pre-construction and construction	Additional safeguard
Property access - pre-construction	Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners	Contractor/ Roads and Maritime	Pre-construction and detailed design	Additional safeguard

## 6.2 Noise and vibration

A Noise and Vibration Impact Assessment<sup>3</sup> was prepared by AECOM for the proposal (AECOM, 2018c) to identify the extent and magnitude of potential noise and vibration impact of the proposal on residential and other sensitive receivers such as places of worship. The assessment is provided in Appendix E and the findings are summarised in this section.

### 6.2.1 Methodology

The noise and vibration assessment was prepared in accordance with the following guidelines:

- *Interim Construction Noise Guideline* (ICNG), Department of Environment and Climate Change (DECC), 2009
- *Assessing Vibration: A Technical Guideline*, Department of Environment and Conservation (DEC), 2006
- *NSW Road Noise Policy* (Road Noise Policy), Department of Environment, Climate Change and Water (DECCW), 2011
- *Noise Policy for Industry* (NPfI), EPA, 2017
- German Standard DIN 4150: Part 3 1999 *Structural Vibration in Buildings - Effects on Structures*, 1999
- British Standard 6472: Part 1 2008 *Evaluation of Human Exposure to Vibration in Buildings*, 2008
- Australian Standard AS 2436-2010, *Guide to noise and vibration control on construction, demolition and maintenance sites*, 2010
- UK Department for Environment, Food and Rural Affairs *Update of noise database for prediction of noise on construction and open sites*, 2006.

#### Noise catchment areas

The assessment used the definition of a study area from the Road Noise Policy which defines the study area as '600 m from the centre line of the outermost traffic lane on each side of the subject road'.

To assist in determining noise criteria for noise sensitive receivers potentially impacted by the proposal, five noise catchment areas (NCAs) have been identified. The noise environment within each NCA is considered to be comparable for each receiver. The NCA locations are shown in Figure 6-7.

#### Noise monitoring

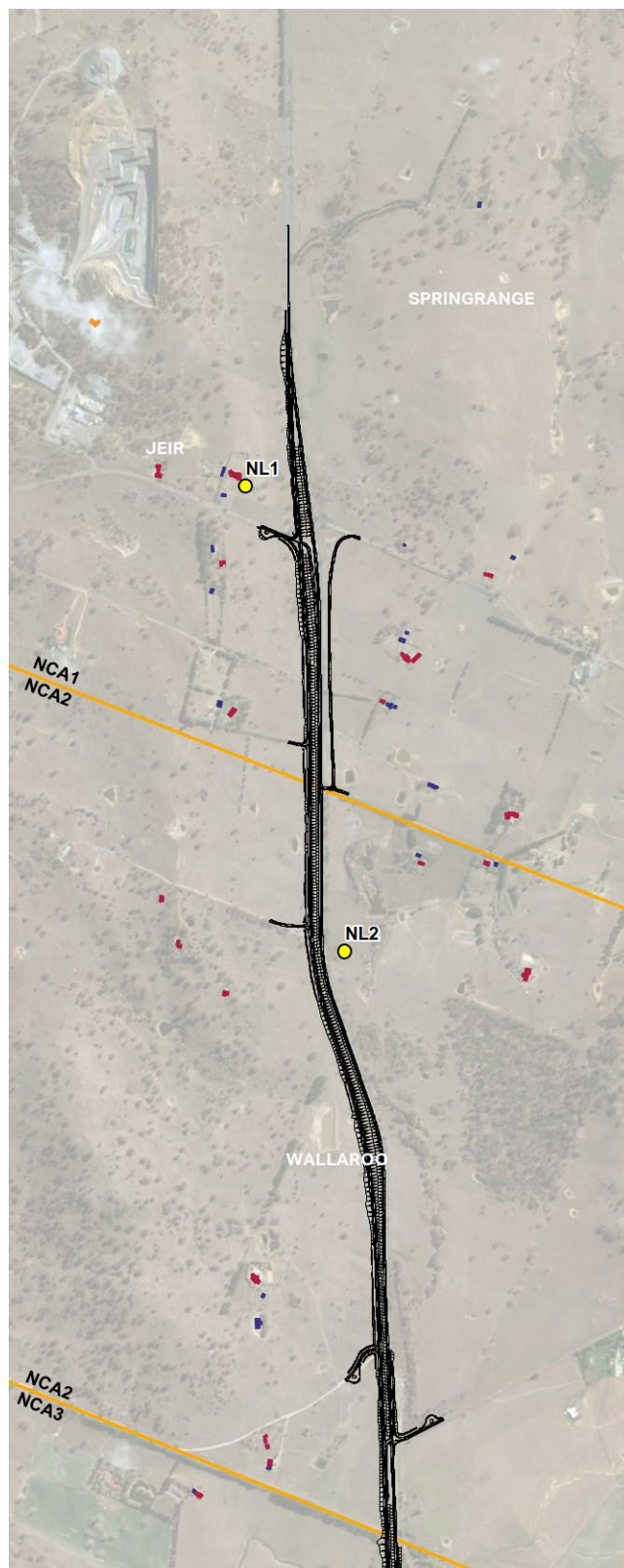
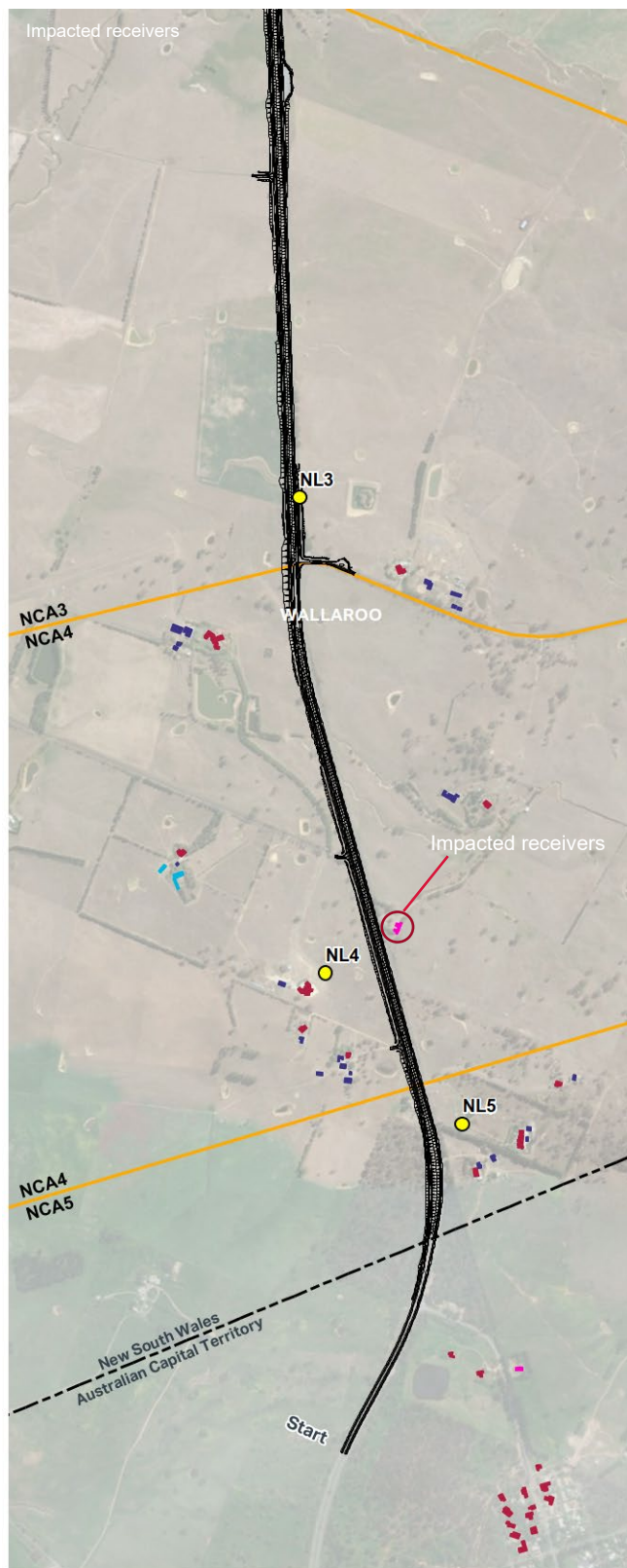
Noise monitoring was carried out between 21 June 2018 to 8 July 2018 at five locations within the construction boundary, including long term unattended and short-term attended measurements. Locations were selected to be representative of noise sensitive receivers within the construction boundary.

Unattended noise measurements were taken to define long term noise environment and were used to calibrate the road traffic noise model and define the noise construction criteria. Attended noise measurements were carried out to determine what noise sources contribute to the local noise environment.

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<sup>3</sup> The Noise and Vibration Impact Assessment study area extended an additional 1.3 km north of the REF construction boundary which ends about 300 metres north of Kaveney's Road.

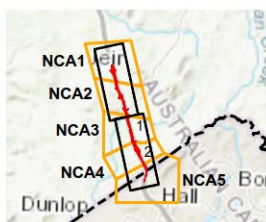




#### NOISE AND VIBRATION

##### KEY

<span style="color: blue;">■</span> Commercial	<span style="color: yellow;">●</span> Noise Monitoring Location
<span style="color: orange;">■</span> Industrial	<span style="color: black;">—</span> Project
<span style="color: magenta;">■</span> Place of Worship	<span style="color: black;">---</span> NSW/ACT boundary
<span style="color: red;">■</span> Residential	<span style="color: orange;">□</span> NCA Boundaries
<span style="color: darkblue;">■</span> Shed	



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Figure 6-7 Noise logging locations and noise catchment areas

Measured noise levels were analysed to provide more detail of the character of the noise environment over each of the 24-hour periods monitored. This information was separated into representative noise levels for day time (7am to 6pm), evening (6pm to 10pm) and night time (10pm to 7am) periods, and used to set construction noise management levels. Details of the noise monitoring methodology is provided in Appendix E.

### ***Construction noise assessment***

Noise impact on sensitive receivers from construction activities during and outside standard construction hours have been assessed. A quantitative assessment was carried out as there are many potentially impacted receivers and the construction duration is greater than three weeks. This assessment provides a detailed analysis of the noise levels at each sensitive receiver location and compares them with the relevant noise management level (NML). To assess the impact of construction noise on sensitive receivers, construction stages, equipment and plant to be used in each of the stages and the location of their use was identified. This information was used to noise model maximum construction noise levels which may be experienced at each sensitive receiver for each stage of construction. Ground topography, ground absorption and reflection, receivers and construction noise sources were included in the noise model.

The construction stages assessed included:

- Site establishment
- Relocation/protection of utilities
- Site preparation
- Earthwork
- Drainage work
- Road and pavement
- Modification of existing highway
- Finishing work

Further details on construction stages and plant and equipment anticipated to be used in each stage can be found in Appendix E. Each of the stages were modelled for both day and night-time periods. Plant and equipment for each stage were assumed to be operating simultaneously using typical sound power levels of construction equipment for each construction stage in a construction noise model. This provides a worse-case scenario as it is unlikely that all construction equipment would be operating at any one time.

### ***Operational noise assessment***

To assess the potential impact of the proposal on noise sensitive receivers during operation, the following noise modelling has been carried out:

- Existing road traffic noise levels have been modelled with existing (2018) road traffic volumes. This model has been validated with noise measurements and road traffic surveys
- Future road traffic noise levels have been modelled for the 'No Build' (without proposal), and 'Build' (with proposal) scenarios for the year of opening (2021) and design year (2031).

Sensitive receivers which require consideration of noise mitigation due to impact from the proposal were identified. Further details of the noise model and traffic inputs can be found in Appendix E.

## 6.2.2 Existing environment

The existing noise environment of the study area is mainly characterised by road traffic noise from the existing Barton Highway as well as noise from local wildlife such as birds and insects. A Boral quarry is located to the north of the construction boundary, contributing to the local noise environment, predominantly from heavy vehicle movements along Kaveney's Road to the highway.

Residential and non-residential receivers potentially affected by construction and operation of the proposal comprise of 52 rural residential properties and three non-residential receivers Wattle Park Uniting Church, Boral Quarry and Dogotel and Purrrfect Cattery.

A summary of noise catchment areas is provided below including a description of audible items from the attended noise monitoring carried out at the identified noise monitoring locations within each of the noise catchment areas on 21 June 2018:

- **NCA 1** – from the northern extents of the construction boundary to Briarwood Lane. Rural area with a quarry in the north western extents. Contains the intersection with Kaveney's Road which is one of the larger local roads within the construction boundary and receives traffic to and from the quarry. Residential receivers are located on both sides of the highway. Constant road traffic from highway measured at 58 dB(A). Heavy vehicle on Kaveney's Road measured at 62 dB(A). Bird and insect noise audible but intermittent
- **NCA 2** – Briarwood Lane south to Gooromon Ponds. Rural area which contains 16 receivers located on either side of the highway mostly set back from the carriageway. Road traffic noise from the highway was dominant. Heavy vehicle passby recorded at 59 dB(A). Bird noise clearly audible
- **NCA 3** - Gooromon Ponds south to Spring Range Road. Relatively flat rural area consisting of mainly improved pastures with scattered trees. Contains the heavy vehicle enforcement bay and very few sensitive receivers. Highway road traffic noise was dominant with individual car passby recorded up to 75 dB(A). Bird noise clearly audible but intermittent
- **NCA 4** – Spring Range Road south to Dellwood homestead. Rural area which contains the Wattle Park Uniting Church and the Dogotel and Purrrfect Cattery. There are six residential receivers located on either side of the highway mostly set back from the carriageway. Highway road traffic noise is dominant at 55 dB(A). Birds in nearby trees, just audible
- **NCA 5** – Dellwood homestead to the southern extent of the proposal. Rural area with one local road and property accesses merging onto the highway. Sensitive residential receivers located to the north east next to the highway and to the south east in Hall village. Contains the Hall TSR and the heavy vehicle rest area. Road traffic dominant at 55 dB(A). Birds in nearby trees just audible.

A summary of the existing background noise levels is provided in Table 6-6.

Table 6-6 Existing background and ambient noise levels, dB(A)

Logger ID	NCA	Rating background level, dB(A)			Ambient noise levels, dB(A)		
		Day <sup>1</sup>	Evening <sup>1</sup>	Night <sup>1</sup>	Day <sup>1</sup>	Evening <sup>1</sup>	Night <sup>1</sup>
NL1	NCA1	49	39	30	60	59	55
NL2	NCA2	46	42	17	59	60	55
NL3	NCA3	46	40	20	71	69	65
NL4	NCA4	43	45	26	56	58	53
NL5	NCA5	49	47	32	61	61	57

Notes:

1. In accordance with the NPfI, time of day is defined as follows :

Day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

Evening – the period from 6pm to 10pm. Night – the remaining periods.

## Heritage items

The Wattle Park Uniting Church (and grounds) is of local heritage significance and is listed on the *Yass Valley LEP 2013* (item #1124) and the non-statutory National Trust of Australia (NSW) heritage list. Wattle Park Uniting Church (the Church) is located directly next to the highway on the eastern side about one kilometre north of the NSW/ACT border. This item is located within NCA4.

The Church land includes Lots 230 and 231 of Deposited Plan 754880 (item #1124). The land contains two structures, the Church and Sunday School Hall and a number of landscape features.

## 6.2.3 Criteria

### Construction noise criteria

The EPA's Interim Construction Noise Guideline (ICNG) provides the basis for construction noise assessments in NSW and is used to establish construction NMLs. Where an exceedance of the NMLs is predicted, the ICNG advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially impacted residents of the nature of the work to be carried out, the expected noise level and duration, as well as contact details.

Where construction noise levels reach 75 dB(A) residential receivers can be considered as 'highly noise affected' and the proponent should, in consultation with the sensitive noise receivers, consider restricting hours to provide respite periods. Provided in Table 6-7 are the NMLs for residential receivers, and guidance on how they should be applied.

Table 6-7 Noise management levels at residences

Time of day	Management level, $L_{Aeq(15min)}$ dB(A) <sup>1</sup>	How to apply
<b>Recommended standard hours:</b> Monday to Friday 7am to 6pm  Saturday 8am to 1pm	Noise affected Rating background level (RBL) +10 dB(A)	<ul style="list-style-type: none"><li>The noise affected level represents the point above which there may be some community reaction to noise</li><li>Where the predicted or measured <math>L_{Aeq(15min)}</math> is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level</li><li>The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details</li></ul>
No work on Sundays or public holidays	Highly noise affected 75 dB(A)	<ul style="list-style-type: none"><li>The highly noise affected level represents the point above which there may be strong community reaction to noise</li><li>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:<ol style="list-style-type: none"><li>Times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences)</li><li>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times</li></ol></li></ul>



Time of day	Management level, $L_{Aeq}$ (15min) dB(A) <sup>1</sup>	How to apply
<b>Outside recommended standard hours</b>	Noise affected RBL +5 dB(A)	<ul style="list-style-type: none"> <li>A strong justification would typically be required for work outside the recommended standard hours</li> <li>The proponent should apply all feasible and reasonable work practices to meet the noise affected level</li> <li>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community</li> <li>For guidance on negotiating agreements see Section 7.2.2 of the ICNG</li> </ul>

Table 6-8 shows the applicable residential receiver NMLs for this proposal.

Table 6-8 Construction noise management levels, residential receivers

Receiver type	Period	Measured rating background level, dB(A)	Standard hours noise management levels dB(A)	Out-of-hours noise management levels dB(A)	Highly noise affected level, dB(A)
NCA1	Day	49	59	54	75
	Evening	39	N/A	44	75
	Night	30	N/A	35	75
NCA2	Day	46	56	51	75
	Evening	42	N/A	47	75
	Night	30 <sup>2</sup>	N/A	35 <sup>2</sup>	75
NCA3	Day	46	56	51	75
	Evening	40	N/A	45	75
	Night	30 <sup>2</sup>	N/A	35 <sup>2</sup>	75
NCA4	Day	43	53	48	75
	Evening	45	N/A	48 <sup>1</sup>	75
	Night	30 <sup>2</sup>	N/A	35 <sup>2</sup>	75
NCA5	Day	49	59	54	75
	Evening	47	N/A	52	75
	Night	32	N/A	37	75

Notes:

- Application notes to the NPfl indicate that the community generally expects a greater control of noise during the evening and night as compared to the day time. Due to this the rating background level for the evening is set to no more than that for the daytime and the night-time to no more than the evening.
- In accordance with NPfl, a minimum NML of 35 dB(A) has been adopted where the measured RBL is less than 30 dB(A).

Table 6-9 provides the NMLs applicable to non-residential receivers such as commercial premises and places of worship.

Table 6-9 Construction noise management levels for non-residential receivers

Land use	Management noise level $L_{Aeq, 15min}$ dB(A) (applies when properties are in use)
Commercial premises (including offices, retail outlets)	70
Industrial premises	75
Place of worship	55 <sup>1</sup>

Note:

1. Based on an internal noise level of 45 dB outlined in the ICNG, where a conservative estimate of 10 dB has been assumed between internal and external noise levels

### Sleep disturbance

The ICNG requires a sleep disturbance analysis to be completed where construction work is planned to extend over more than two consecutive nights. The ICNG makes reference to the NSW Environment Criteria for Road Traffic Noise (NSW EPA, 1999) (ECRTN), now superseded by the Road Noise Policy (DECCW, 2011), for guidance in assessing the potential for sleep disturbance.

The guidance provided in the RNP for assessing the potential for sleep disturbance recommends that to minimise the risk of sleep disturbance during the night-time period (10pm to 7am), the  $L_{A1(1 min)}$  noise level outside a bedroom window should not exceed the  $L_{A90(15 min)}$  background noise level by more than 15 dB(A). The Road Noise Policy contains a review of research into sleep disturbance which represents NSW EPA advice on the subject of sleep disturbance due to noise events. It concludes that having considered the results of research to date that, 'maximum internal noise levels below 50 to 55 dB(A) are unlikely to cause awakening reactions'. Therefore, given that an open window provides around 10 dB in noise attenuation from outside to inside, external noise levels of 60 to 65 dB(A) are unlikely to result in awakening reactions.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers have been determined and are presented in Table 6-10. As part of the assessment the predicted maximum noise levels are first compared against the screening criteria. If the screening criteria is exceeded the maximum noise levels are then compared against the awakening reaction criteria.

Table 6-10 Sleep disturbance criteria

NCA	Background noise level, $L_{A90}$ , dB(A)	Sleep disturbance screening level $L_{A1, 1min}$ , dB(A) <sup>1</sup>	Awakening reaction $L_{A1, 1min}$ , dB(A) <sup>2</sup>
NCA1	30	45	65
NCA2	30	45	65
NCA3	30	45	65
NCA4	30	45	65
NCA5	32	47	65

Notes:

1. Based on the background noise level + 15 dB
2. Based on research presented in the Road Noise Policy

### ***Construction road traffic noise criteria***

To assess noise impact from construction traffic in accordance with the RNP, an initial screening test should be carried out by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion in the RNP, then noise mitigation should be considered for those receivers affected. The RNP does not require assessment of noise impact to commercial or industrial receivers.

### ***Construction vibration criteria***

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent:

- Continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities for example, a tunnel boring machine
- Impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with duration typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- Intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity such as impact pile driving and use of jack hammers.

#### ***Structural damage to buildings***

There is currently no Australian Standard that provides guidance for assessing cosmetic building damage caused by vibration. However, the German standard (DIN 4150-3) *Structural Vibration in Buildings - Effects on structures (1999-02)* provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 6-11. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. A conservative limit provided by Roads and Maritime as part of its environmental procedures, is three millimetres per second at the property boundary.

#### ***Human comfort – Tactile Vibration***

The assessment of intermittent vibration outlined in the EPA guideline *Assessing Vibration: A Technical Guideline* is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods. Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 6-12. The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

Table 6-11 DIN 4150: Structural damage safe limits for building vibration

Group	Type of structure	Vibration velocity in millimetres per second			
		At foundation at a frequency of			Vibration at the horizontal plane of the highest floor
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (eg buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Table 6-12 Preferred and maximum vibration dose values for intermittent vibration (m/s<sup>1.75</sup>)

Location	Daytime (7 am – 10 pm)		Night-time (10 pm – 7 am)	
	Preferred	Max	Preferred	Max
Critical areas <sup>1</sup>	0.1	0.2	0.1	0.2
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship <sup>2</sup>	0.4	0.8	0.4	0.8

Notes:

1. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. Places where sensitive equipment is stored or delicate tasks are carried out require more stringent criteria than the residential criteria specified above.
2. Examples include automotive repair shops, manufacturing or recycling facilities. This includes places where manufacturing, recycling or repair activities are carried out but do not require sensitive or delicate tasks.

### Operational noise criteria

The RNP requires consideration of two scenarios, the 'No Build' option (without the proposal) and the 'Build' option (with the proposal). Each of these scenarios must be considered at two points in time, the year of opening and the design year which is typically ten years after opening. For this proposal, the year 2021 has been assessed as the year of opening, and 2031 has been assessed as the design year.

The operational road traffic noise assessment area extends to where noise levels are dominated by other roads that are not being assessed as part of the proposal, as detailed in the Noise Criteria Guideline. The RNP defines the study area width as '600 m from the centre line of the outermost traffic lane on each side



of the subject road'. Residential receivers may be assigned new, redeveloped, transition zone or relative increase criteria depending on how the proposal would influence their noise levels. For each façade of the residential receiver the most stringent applicable criteria are used in the assessment.

Criteria are based on the road development type which is affecting the residential receiver. Table 6-13 shows the road traffic noise criteria for existing residential land use developments affected by noise from the new freeway/arterial roads and redevelopments of existing freeways/arterial roads. The external noise criteria are applied at one metre from the facade that is most exposed to traffic noise and at a height of 1.5 metres from the floor level. The criteria include an allowance for noise reflected from the façade.

Table 6-13 Residential road traffic noise criteria for new and redeveloped freeways, RNP, 2011

Road category	Type of project/land use	Assessment criteria dB(A)	
		Day (7 am – 10 pm)	Night (10 pm – 7 am)
Freeway/ arterial/sub-arterial	Existing residences affected by noise from new freeways/arterial/ sub-arterial road corridors	L <sub>Aeq</sub> (15 hr) 55 (external)	L <sub>Aeq</sub> (9 hr) 50 (external)
	Existing residences affected by noise from redevelopment of existing freeways/arterial/sub-arterial roads  Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments  Existing residences affected by noise from existing freeway/arterial/sub-arterial roads where no redevelopment is taking place	L <sub>Aeq</sub> (15 hr) 60 (external)	L <sub>Aeq</sub> (9 hr) 55 (external)
	Existing residences affected by both new roads and the redevelopment of existing freeway/arterial/sub-arterial roads in a Transition Zone <sup>1</sup>	Between L <sub>Aeq</sub> (15 hr) 55-60 (external)	Between L <sub>Aeq</sub> (9 hr) 50-55 (external)
	Existing residences affected by increases in traffic noise of 12 dB(A) or more from new freeway/arterial/sub-arterial roads <sup>2</sup>	Between L <sub>Aeq</sub> (15 hr) 42-55 (external)	Between L <sub>Aeq</sub> (15 hr) 42-50 (external)

Notes:

1 The criteria assigned to a façade depend on the proportion of noise coming from the existing road. Please see Roads and Maritimes' Noise Criteria Guideline for further information

2 The criteria at each façade are determined from the existing traffic noise level plus 12 dB(A).

Table 6-14 outlines the road traffic noise criteria applicable to noise sensitive receivers other than residential.

Table 6-14 Road traffic noise criteria for sensitive land uses, Road Noise Policy, 2011

Existing sensitive land use	Assessment criteria	
	Day (7am – 10pm)	Night (10pm – 7am)
1. School classrooms	L <sub>Aeq</sub> (1 hr) 40 (internal)	-
2. Hospital wards	L <sub>Aeq</sub> (1 hr) 35 (internal)	L <sub>Aeq</sub> (1 hr) 35 (internal)
3. Places of worship	L <sub>Aeq</sub> (1 hr) 40 (internal)	L <sub>Aeq</sub> (1 hr) 40 (internal)
4. Open space (active use)	L <sub>Aeq</sub> (15 hr) 60	-
5. Open space (passive use)	L <sub>Aeq</sub> (15 hr) 55	-
8. Child care facilities	Sleeping rooms, L <sub>Aeq</sub> (1 hr) 35 Indoor play areas, L <sub>Aeq</sub> (1 hr) 40 (internal) Outdoor play areas, L <sub>Aeq</sub> (1 hr) 55 (external)	
9. Aged care facilities	-	-

## 6.2.4 Potential impact

### Construction noise

A summary of predicted construction noise impact associated with each stage of construction are presented for standard hours construction activities in Table 6-15 and out of hours construction activities in Table 6-16. Out of hours work has been conservatively assessed against more stringent night-time criteria.

The predicted L<sub>Aeq</sub> noise level contours for the construction activities for individual properties are shown in Appendix D of the Noise and Vibration Impact Assessment (AECOM, 2018c), provided in Appendix E of this REF. The construction staging and scheduling is indicative and is subject to change during detailed design.

Some receivers are predicted to exceed the NML and a number are identified as being highly noise affected. This is due to the close proximity of the work to the receivers and the relatively low levels of noise within this rural noise environment.

Table 6-15 Predicted construction noise impact - Daytime

NCA	L <sub>Aeq</sub> NML dB(A)	Maximum L <sub>Aeq</sub> noise level dB(A)	NML exceedance 1 - 10 dB(A)	NML exceedance 11 – 20 dB(A)	NML exceedance > 20 dB(A)	Highly noise affected
<b>Site establishment</b>						
NCA1	59	56	-	-	-	-
NCA2	56	44	-	-	-	-
NCA3	56	38	-	-	-	-
NCA4	53	54	1	-	-	-
NCA5	59	51	-	-	-	-

NCA	L <sub>Aeq</sub> NML dB(A)	Maximum L <sub>Aeq</sub> noise level dB(A)	NML exceedance 1 - 10 dB(A)	NML exceedance 11 – 20 dB(A)	NML exceedance > 20 dB(A)	Highly noise affected
<b>Relocation / protection of utilities</b>						
NCA1	59	50	-	-	-	-
NCA2	56	44	-	-	-	-
NCA3	56	41	-	-	-	-
NCA4	53	61	1	-	-	-
NCA5	59	54	-	-	-	-
<b>Site preparation</b>						
NCA1	59	66	5	-	-	-
NCA2	56	60	6	-	-	-
NCA3	56	57	-	-	-	-
NCA4	53	77	4	2	1	1
NCA5	59	70	4	1	-	-
<b>Earthwork</b>						
NCA1	59	63	3	-	-	-
NCA2	56	57	-	-	-	-
NCA3	56	54	-	-	-	-
NCA4	53	74	5	2	-	-
NCA5	59	67	3	-	-	-
<b>Drainage work</b>						
NCA1	59	61	2	-	-	-
NCA2	56	55	-	-	-	-
NCA3	56	52	-	-	-	-
NCA4	53	72	5	1	-	-
NCA5	59	65	2	-	-	-
<b>Road and pavement</b>						
NCA1	59	60	1	-	-	-
NCA2	56	54	-	-	-	-
NCA3	56	51	-	-	-	-
NCA4	53	71	4	1	-	-

NCA	L <sub>Aeq</sub> NML dB(A)	Maximum L <sub>Aeq</sub> noise level dB(A)	NML exceedance 1 - 10 dB(A)	NML exceedance 11 – 20 dB(A)	NML exceedance > 20 dB(A)	Highly noise affected
NCA5	59	64	2	-	-	-
<b>Modification of existing highway</b>						
NCA1	59	60	1	-	-	-
NCA2	56	54	-	-	-	-
NCA3	56	51	-	-	-	-
NCA4	53	71	4	1	-	-
NCA5	59	64	2	-	-	-
<b>Finishing work</b>						
NCA1	59	49	-	-	-	-
NCA2	56	43	-	-	-	-
NCA3	56	40	-	-	-	-
NCA4	53	60	1	-	-	-
NCA5	59	53	-	-	-	-

Table 6-16 Predicted construction noise impact - Night-time

NCA	L <sub>Aeq</sub> NML dB(A)	Maximum L <sub>Aeq</sub> noise level dB(A)	NML exceedance 1 - 10 dB(A)	NML exceedance 11 – 20 dB(A)	NML exceedance > 20 dB(A)	Highly noise affected
<b>Tie-ins</b>						
NCA1	35	56	9	1	1	-
NCA2	35	34	-	-	-	-
NCA3	35	30	-	-	-	-
NCA4	35	42	3	-	-	-
NCA5	37	58	11	1	1	-
<b>Material deliveries</b>						
NCA1	35	49	5	1	-	-
NCA2	35	35	-	-	-	-
NCA3	35	31	-	-	-	-
NCA4	35	47	2	1	-	-
NCA5	37	44	2	-	-	-



NCA	L <sub>Aeq</sub> NML dB(A)	Maximum L <sub>Aeq</sub> noise level dB(A)	NML exceedance 1 - 10 dB(A)	NML exceedance 11 – 20 dB(A)	NML exceedance > 20 dB(A)	Highly noise affected
<b>Concrete cutting</b>						
NCA1	35	55	5	6	-	-
NCA2	35	48	5	6	-	-
NCA3	35	43	2	-	-	-
NCA4	35	56	1	4	1	-
NCA5	37	59	6	3	1	-
<b>Concrete pouring / curing</b>						
NCA1	35	60	-	6	5	-
NCA2	35	53	-	11	-	-
NCA3	35	48	-	2	-	-
NCA4	35	61	1	3	2	-
NCA5	37	64	16	2	3	-
<b>Utility adjustment</b>						
NCA1	35	51	6	5	-	-
NCA2	35	44	11	-	-	-
NCA3	35	39	2	-	-	-
NCA4	35	52	2	3	-	-
NCA5	37	55	3	3	-	-
<b>Refuelling operations and maintenance</b>						
NCA1	35	50	4	2	-	-
NCA2	35	36	5	-	-	-
NCA3	35	32	-	-	-	-
NCA4	35	48	2	1	-	-
NCA5	37	45	2	-	-	-

As there are several construction stages which are proposed to incorporate out of hours work, consideration was given to the potential for sleep disturbance to residential receivers during night-time work. A summary of the predicted sleep disturbance noise impact is presented in Table 6-17.

Table 6-17 Predicted LA1(1min) sleep disturbance impact at residential receivers

NCA	Number of sleep disturbance exceedances (nights)					
	1	2	3	4	5	6
NCA1	9	5	11	11 <sup>1</sup>	9	6
NCA2	-	-	11	11	11	-
NCA3	-	-	2	2	2	-
NCA4	3	3	6	6*	5	3
NCA5	9*	2	8*	16*	5	2

Notes:

1. 'awakening reaction' criterion may potentially be exceeded

During construction there would be up to 100 additional heavy vehicle trips per day (peaking during earthwork and paving work) and about 100 light vehicle trips. These traffic movements have been used to assess the impact of construction traffic noise.

The existing daytime 15 hour traffic flow along Barton Highway is presented in Table 6-18. The results indicate that the predicted noise increases on the highway are significantly lower than the 2 dB(A) screening criteria presented in the Road Noise Policy. As a result, no further consideration of construction traffic noise is required at this stage.

Table 6-18 Existing traffic flows and additional traffic flows due to construction traffic

Road	Existing daytime 15 hour flow		Additional daytime 15 hour flow		Relative noise increase, dB(A)
	Light	Heavy	Light	Heavy	
Barton Highway	10,350	1125	100	100	0.2

### Construction Vibration

Vibration intensive work has the potential to occur as part of construction. Work may include the use of rock breaking, pile driving, jackhammering and vibratory rolling activities.

Typical safe working distances for the construction equipment that may be used for this proposal are provided in Table 6-19. Safe working distances have been developed to meet the recommended levels of vibration in British Standard 6472-1992 and DIN 4150, and are developed based upon the safe working distances presented in Roads and Maritime's Construction Noise Strategy and AECOM's library of vibration data.

Safe working distances should be adhered to when operating vibration intensive equipment near on-site buildings in order to minimise the risk of discomfort to occupants and structural damage.

The safe working distances presented in Table 6-19 assume individual items of plant would be operating independently. Concurrent operation of vibration intensive equipment should be avoided, however if it is necessary to operate multiple items of equipment concurrently close to the safe working distance then vibration monitoring is recommended.

The safe working distances for cosmetic damage are generally considered to be conservative and working within them will not necessarily result in damage. However as factors such as work practices and intervening ground conditions can affect vibration levels, vibration monitoring is recommended within these distances, and should be carried out at the commencement of vibration intensive work in order to refine the safe working distances for site specific conditions.

Table 6-19 Recommended safe working distances for vibration intensive equipment

Equipment	Rating/description	Safe working distance (metres)	
		Cosmetic damage	Human response
Vibratory roller	1-2 tonne	5	15 to 20
	2-4 tonne	6	20
	4-6 tonne	12	40
	7-13 tonne	15	100
	13-18 tonne	20	100
	> tonne	25	100
Small hydraulic hammer	(300 kg – 5-12 t excavator)	2	7
Medium hydraulic hammer	(900 kg – 12-18 t excavator)	7	23
Large hydraulic hammer	(1600 kg – 18-34 t excavator)	22	73
Pile driver – vibratory	Sheet piles	2 to 20	20
Piling rig – bored	≤ 800 mm	2 m (nominal)	N/A
Piling rig – hammer	12 t down force	15	50
Jackhammer	Hand held	1 (nominal)	Avoid contact with structure

*Note: More stringent conditions may apply to heritage or other sensitive structures*

## Operation

Road traffic noise contours maps are presented and detailed noise prediction results are provided in Appendix E of the Noise and Vibration Impact Assessment Report (AECOM, 2018c) (see Appendix E of this REF).

Considering the impact in both year 2021 and year 2031 during the daytime period only:

- Daytime road traffic noise levels are predicted to exceed the  $L_{Aeq(15\text{ hr})}$  noise criterion at a total of six sensitive receivers
- Noise levels are not predicted to exceed the applicable night-time noise criterion and increase by more than 2 dB(A) at any noise sensitive receivers
- Noise levels are predicted to exceed the cumulative limit at two sensitive receivers (the Wattle Park Uniting Church and associated Sunday School building) (ie  $\geq L_{Aeq(15\text{ hr})}$  noise criterion + 5 dB(A)). These

receivers, and so are considered eligible for consideration of feasible and reasonable noise mitigation measures

Considering the impact in both year 2021 and year 2031 during the night-time period only:

- Night-time road traffic noise levels are predicted to exceed the  $L_{Aeq(9\text{ hr})}$  noise criterion at a total of six sensitive receivers
- Noise levels are not predicted to exceed the applicable night-time noise criterion and increase by more than 2 dB(A) at any noise sensitive receivers
- Noise levels are predicted to exceed the cumulative limit at two sensitive receivers (ie  $\geq L_{Aeq(15\text{ hr})}$  noise criterion + 5 dB(A)), and these receivers are therefore considered to be eligible for the consideration of feasible and reasonable noise mitigation measures.

A sensitive receiver would be considered eligible for the consideration of noise mitigation where:

- Predicted Build noise level exceeds the Noise Criteria Guideline controlling criterion and the noise level increase due to the proposal (ie the noise predictions for the 'Build minus the No Build') is greater than 2 dB(A)
- Predicted Build noise level is 5 dB(A) or more above the criteria (exceeds the cumulative limit) and the receiver is significantly influenced by proposal road noise, regardless of the incremental impact of the proposal.

If the noise level contribution from the proposal is acute (daytime  $L_{Aeq(15\text{ hr})}$  65 dB(A) or higher, or night time  $L_{Aeq(9\text{ hr})}$  60 dB(A) or higher), a sensitive receiver qualifies for consideration of noise mitigation even if noise levels are dominated by another road.

Table 6-20 provides a summary of the sensitive receivers where predicted road traffic noise levels exceed the applicable noise criteria. Recommended noise mitigation measures for sensitive receivers are considered further in Section 6.2.5. Locations of the impacted sensitive receivers are shown in Figure 6-7.

Table 6-20 Peak hour  $L_{Aeq, 1\text{ hr}}$  road traffic noise levels<sup>1</sup>, dB(A)

Use	Criteria	Year of opening			Design year			Eligible for mitigation
		No build	Build	Difference	No build	Build	Difference	
Place of Worship Main building	40	59	55	-4	60	56	-4	Yes
Place of Worship Sunday School building	40	61	56	-5	62	58	-4	Yes

Note:

<sup>1</sup> The road traffic noise levels presented represent the noisiest one hour period when the place of worship is likely to be in use

Exceedances of the applicable noise criteria have been identified at the Wattle Park Uniting Church and associated Sunday School building given the proximity to the highway. Modelling found that the proposal would reduce the noise at these receivers (in comparison to the existing situation), however due to the exceedances of the Cumulative Noise Limit, these receivers are eligible for the consideration of noise mitigation measures.



Appropriate noise mitigation to minimise noise impact on the Wattle Park Uniting Church and associated Sunday School building would be determined during detailed design when more detailed information is available. Noise mitigation would be determined in consultation with Roads and Maritime, a qualified heritage specialist, a qualified landscape specialist, Yass Valley Council and the church organisation to identify the most suitable mitigation option.

Noise mitigation in the form of low noise pavements and noise barriers may not be considered reasonable and feasible due to the low number of affected receivers in accordance with Roads and Maritime guidelines. Noise barriers may also not be appropriate due to the size (length and height) that would be required to achieve the required noise reductions. At-property treatments may provide required reductions however would need to be developed while considering the heritage aspects of these buildings (ie double glazing of stained glass windows may not be appropriate). The external to internal transmission loss is likely to differ from the 10 dB assumed in this assessment and should be confirmed as part of the determination of reasonable and feasible mitigation measures.

## 6.2.5 Safeguards and management measures

The recommended safeguards and management measures to minimise noise and vibration impact during construction and operation of the proposal are outlined in Table 6-21.

Table 6-21 Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	<p>A CNVMP will be prepared and implemented as part of the CEMP. The CNVMP will generally follow the approach in the Interim <i>Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> <li>• All potential significant noise and vibration generating activities associated with the activity</li> <li>• 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, 2014b)</li> <li>• A monitoring program to assess performance against relevant noise and vibration criteria</li> <li>• Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures</li> <li>• Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria</li> </ul>	Contactor	Detailed design/ pre-construction	Standard safeguard
Noise and vibration	All sensitive receivers (eg church, local residents) likely to be affected will be notified at least five days before commencement of any work associated with the activity that	Contactor	Detailed design/ pre-construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> <li>• The proposal</li> <li>• The construction period and construction hours</li> <li>• Contact information for project management staff</li> <li>• Complaint and incident reporting</li> <li>• How to obtain further information</li> </ul> <p>Receivers who are expected to experience an exceedance of the construction NMLs should be consulted about the proposal before the commencement of the particular activity, with highest consideration given to those that are predicted to be most affected as a result of the work. Additional information to be provided to the receivers expected to experience an exceedance include:</p> <ul style="list-style-type: none"> <li>• Programmed times and locations of construction work</li> <li>• Construction noise and vibration impact predictions</li> <li>• Construction noise and vibration mitigation measures being implemented on site.</li> </ul> <p>Community consultation regarding construction noise and vibration will be detailed in the Communication Plan (CP) for the construction of the proposal and will include a 24 hour hotline and complaints management process</p>			
Construction Noise and vibration	Work to be carried out during normal work hours (ie 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any work that is performed outside normal work hours or on Sundays or public holidays must have measures in place to minimise noise impact. Approvals will be obtained from the Yass Valley Council for work outside normal working hours and the local community would be notified as specified in the CP	Contractor	Construction	Standard safeguard
Construction Noise	Where possible, work outside of standard construction hours will be planned so that noisier work is carried out in the earlier part of the evening or night time	Contractor	Pre-construction / construction	Standard safeguard
Noise and vibration	Where there are complaints about noise from an identified work activity, the work activity	Contractor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	will be reviewed, and where feasible and reasonable, action additional control measures. This may include monitoring to confirm that predicted impacts are in line with levels predicted in this assessment			
Site induction	All personnel working on site will receive training to ensure awareness of requirements of the CNVMP. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers (eg Wattle Park Uniting Church)	Contractor	Pre-construction / construction	Standard safeguard
Construction traffic noise	<p>The following measures will be implemented to reduce and manage noise and vibration impact related to traffic:</p> <ul style="list-style-type: none"> <li>Heavy vehicle drivers will be advised of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (ie minimising the use of engine brakes, and no extended periods of engine idling). Vehicle routes should be reviewed and final selections should consider noise impact on noise sensitive receivers</li> <li>Site access and egress points will be located away from residences and other sensitive land uses, where feasible and reasonable</li> <li>Deliveries and spoil removal will be planned to avoid queuing of heavy vehicles on or around the temporary compound areas</li> </ul> <p>Where feasible and reasonable, non-tonal reversing alarms will be used, taking into account the requirements of the Workplace Health and Safety legislation</p>	Contractor	Pre-construction / construction	Additional safeguard
Construction vibration	Measures, including allowing adequate distance that rollers and other vibration producing equipment can come to nearby buildings and/or using non vibration producing equipment and equipment maintenance will be implemented to minimise or prevent vibration impact	Contractor	Construction	Standard safeguard
Construction vibration	Wherever feasible and reasonable, vibration intensive work should be limited to the least sensitive times of the day	Contractor	Pre-construction / construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction vibration	<p>If the use of vibration intensive plant cannot be avoided within the minimum working distance for cosmetic damage the following procedure will occur as a minimum:</p> <ul style="list-style-type: none"> <li>• Notification of the work to the affected residents and community</li> <li>• Work will not proceed until attended vibration measurements are carried out</li> </ul> <p>If ongoing work is required, a temporary relocatable vibration monitoring system will be installed, to warn operators (via flashing light, audible alarm, short message service etc) when vibration levels are approaching the cosmetic damage objective</p>	Contractor	Pre-construction / construction	Additional safeguard
Construction vibration	<p>Building condition inspection reports must be completed in accordance with QA Specification G36 for all heritage structures in the construction boundary (eg Wattle Park Uniting Church) and any other nearby structures or buildings at risk from vibration impact</p> <p>A follow up building condition inspection of all heritage structures in the work area will be carried out when all the construction work is complete</p>	Contractor	Pre-construction and during construction as required	Additional safeguard
Construction blasting	<p>A series of initial test blasts at reduced scale will be carried out before the commencement of full scale blasting. Airblast overpressure and vibration will be measured from test blasts to establish appropriate propagation characteristics for the size and increase the accuracy of blasting predictions. This information will be used to define maximum allowable blast sizes</p>	Contractor	Construction - before any blasting	Additional safeguard
Operational noise	<p>Appropriate noise mitigation to minimise noise impact on the Wattle Park Uniting Church and associated Sunday School building will be determined during detailed design when more detailed information is available. Noise mitigation will be determined in consultation with Roads and Maritime, a qualified heritage specialist, a qualified landscape specialist, Yass Valley Council and the church organisation to identify the most suitable mitigation option</p>	Contractor	Detailed design/Pre-construction	Additional safeguard



## 6.3 Biodiversity

A Biodiversity Assessment Report was prepared by Niche Environment and Heritage Pty Ltd (2018) to identify the potential impact of the proposal on biodiversity. The assessment is provided in Appendix F and the findings are summarised in this section.

### 6.3.1 Methodology

The methodology for the biodiversity assessment involved:

- Background research, including database searches and a literature review, to compile information on the presence or likelihood of occurrence of the following within the study area:
  - Threatened and protected terrestrial species and aquatic flora and fauna species and their habitat
  - Endangered populations
  - Threatened ecological communities
  - Important habitat for migratory species
  - Critical habitats.
- Habitat assessment to assess the likelihood of occurrence of each threatened species, population or community (threatened biodiversity) identified with the potential to occur in the study area
- Field surveys including vegetation and targeted fauna surveys to ground-truth results of previous ecological assessments carried out within the study area (namely Umwelt 2018) and fill in required knowledge gaps:
  - Vegetation surveys included meandering transects and rapid vegetation assessments (Rapid Data Points) to broadly map vegetation and search for threatened flora species; and full floristic plots (using a nested 20 m by 50 m quadrat and carried out in line with the Framework for Biodiversity Assessment (OEH, 2014)) to determine vegetation community type and condition where necessary
  - Targeted flora surveys were carried out during each of the vegetation survey periods for species identified during database searches
  - Targeted fauna surveys were carried out for threatened species identified as having a moderate to high chance of occurring and were considered likely to be impacted by the proposal. Targeted surveys included Golden Sun Moth surveys during peak flying period, threatened reptile searches – diurnal/nocturnal habitat surveys and reptile refugia (tile) trapping, bird surveys, nocturnal call playback for arboreal mammals and owls, spotlighting, ultrasonic bat call detection, harp trapping for microbats, arboreal mammal trapping and arboreal hair tube trapping.
- An assessment of threatened species to identify the likely occurrence of State and nationally listed threatened species; these were identified from background reviews based on their habitat requirements
- An assessment of significance for threatened species and ecological communities positively identified during surveys or that are considered to have a moderate or high likelihood of occurring in the study area
- Identification of impact and associated mitigation measures to reduce and manage impact.

The biodiversity assessment survey effort focussed within the construction boundary. A broader 'study area' including land within about 100 m either side of the construction boundary, was also surveyed, where possible, to identify potential biodiversity constraints and allow for appropriate avoidance/mitigation/management of features/areas of biodiversity significance.

#### **Database review**

The following databases were interrogated for records or habitat of threatened biodiversity recorded, or with the potential to occur, within 10 km (the locality) of the study area:

- NSW BioNet database for records of threatened biodiversity listed under the *BC Act* (OEH, 2018a)
- The federal Department of Environment and Energy's Protected Matters Search Tool and Threatened Species Profile and Threats Database (SPRAT) for MNES and critical habitat listed under the *EPBC Act* (DoEE, 2018a and DoEE, 2018b)
- Threatened Species Profile Database for threatened species, endangered populations and endangered ecological communities listed under the *BC Act* (OEH, 2018b)
- NSW DPIE - Fisheries Critical habitat register (DPI, 2018)
- Canberra Nature Map (Canberra Nature Map, 2018)
- eBird Range Map (eBird, 2018)
- NSW of Declared Areas of Outstanding Biodiversity Value (OEH, 2016).

Records were obtained before the field surveys. Results were considered during field survey planning and to inform the likelihood of occurrence analysis, performed before the field survey and updated post field survey.

### 6.3.2 Existing environment

The study area is located primarily within the Southern Tablelands region of NSW, within the Yass Valley Council LGA. It is about eight km long, extending from about 700 m south of the NSW/ACT border at the southern end to about 300 m north of Kaveney's Road in the north (CH23800). The study area is largely zoned SP2 Infrastructure (Classified Road) under the *Yass Valley LEP 2013*. The private land holdings within the study area are mainly zoned RU1 Primary Production (Umwelt, 2018). Current recommendations within the *Yass Valley Settlement Strategy 2036* (Yass Valley Council, 2017) would see amendments to the *Yass Valley LEP 2013* such that a five kilometre area along the NSW/ACT border (through which the Barton Highway passes) be re-zoned to RU6 Transition zone – to protect and maintain land that provides a transition between rural and other land uses of varying intensities or environmental sensitivities, from the urban residential spread of Canberra.

The study area is located within the South Eastern Highlands Interim Biogeographic Regionalisation for Australia (IBRA) region and the subregion is South Eastern Highlands – Murrumbateman. The topography of the study area consists of gently undulating valleys and hills.

Agriculture is the dominant land use within the region. Development associated with building and operating roads, power line easements, telecommunication lines and other infrastructure has resulted in historic and ongoing native vegetation removal or disturbance within and next to the study area. Vegetation within the study area is generally characterised by cleared and/or grazed land with limited native woodland stands remaining. Field surveys carried out as part of the 2010 PEI and more recent surveys (Umwelt, 2018) indicate that these native woodland stands appear to be regenerating post-clearing and have a limited understorey or are grazed. No dedicated conservation reserves are located within the study area.

As described by Umwelt (2018), the geology of the study area generally consists of Silurian volcanics, with various tuffs consisting of minor siltstone, shale, sandstone and limestone and some areas of Quarternary alluvium, gravel, sand, loam and clay. The soil landscapes present within the study area include Williamsdale, Burra and Ginninderra Creek (see Section 6.6).

Aquatic environments occurring within the study area include Gooromon Ponds, Cow Flat Creek, Little Bedulluck Creek and a number of unnamed creeks. Cow Flat Creek joins Gooromon Ponds to the east of the Barton Highway and crosses the Barton Highway about four km north of the ACT border. Little Bedulluck Creek flows from the north into Gooromon Ponds, crossing the Barton Highway about 4.5 km north of the ACT border. Gooromon Ponds flows south west into Ginninderra Creek (see Section 6.7.2).

Next to the NSW/ACT border and on either side of the Barton Highway is the Hall TSR. This TSR supports a stand of relatively well developed native vegetation, covering an area of around 29 hectares. This TSR is

classified as having a High Conservation Value by NSW Local Land Services (NSW Local Land Services, 2017). The vegetation within the TSR is better developed (ie a larger stand of vegetation supporting a greater diversity of plants) on the western side of the highway. The Bedulluck TSR is located in the study corridor near Little Bedulluck Creek, and supports open grasslands and a line of planted native trees.

A total of 67 native fauna species and 98 native flora species were recorded in the study area during the current assessment. Native fauna species recorded included 48 bird species, five reptile species, five frog species and one mammal species (the Brush-tailed Possum, *Trichosaurus vulpecula*). Exotic fauna species recorded included three bird species: Common Starling (*Sturnus vulgaris*), Common Blackbird (*Turdus merula*) and Common Myna (*Sturnus tristis*).

Threatened biodiversity recorded in the vicinity of the study area prior to current surveys include one Threatened Ecological Community (TEC), *White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (listed at the state, territory and Commonwealth level) and three threatened bird species: Little Eagle (*Hieraaetus morphnoides*), Superb Parrot (*Polytelis swainsonii*) and White-winged Triller (*Lalage tricolor*) (AECOM, 2018h and Umwelt, 2018).

One other TEC, *Natural Temperate Grassland of the South Eastern Highlands* was identified as potentially occurring and requiring verification (Umwelt, 2018). An additional four threatened fauna species were considered to have potential habitat in the study area:

- Little Whip Snake (vulnerable under the *BC Act*)
- Pink-Tailed Worm-lizard (vulnerable under the *BC Act*, *EPBC Act* and *NC Act*)
- Striped Legless Lizard (vulnerable under the *BC Act*, *EPBC Act* and *NC Act*)
- Golden Sun Moth (endangered under the *BC Act*, critically endangered under the *EPBC Act*).

### Plant community types

Two plant community types (PCT) were identified within the study area. The PCTs are described below and the area is provided in Table 6-22 and shown in Figure 6-8 and Figure 6-9.

Table 6-22 Vegetation within the study area

PCT	Vegetation community	Area (hectares) in study area	Percent of study area
277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion - present in both the woodland and derived native grassland forms (see Figure 6-8)	65.73	22
350	Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South Western Slopes Bioregion and South Eastern Highland Bioregion (see Figure 6-9)	7.32	2
<b>Total native vegetation</b>		<b>73.05</b>	<b>24</b>
None	Exotic pasture	229.95	76



Figure 6-8 Blakely's Red Gum – Yellow Box grassy tall woodland in the biodiversity study area



Figure 6-9 Candlebark – Blakely's Red Gum – Long-leaved Box grassy woodland in the biodiversity study area



### Threatened ecological communities

Results of the database searches and literature review revealed that three TECs were found to have been previously recorded and/or have the potential to occur within a 10 km radius of the study area. These are described in Table 6-23.

Table 6-23 Threatened ecological communities likely to occur within the study area

Vegetation community	Plant community Type	Threatened Ecological Community	Legislative listing		
			EPBC Act	BC Act	NC Act
Box-Gum Woodland (and Derived native grassland form)	Blakely's Red Gum-Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277)	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Commonwealth listed	CEEC	-	E
		White Box-Yellow Box-Blakely's Red Gum Woodland	-	EEC	-
Natural Temperate Grassland	Natural Temperate Grassland of the South Eastern Highlands	Natural Temperate Grassland of the South Eastern Highlands	EEC	-	E
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South	-	EEC	-

Note: E = Endangered, EEC = Endangered Ecological Community, CEEC = Critically Endangered Community

A summary of the characteristics required for PCT 277 and PCT 350 to meet the requirements of their respective State and Commonwealth listings of the *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* TEC is provided in Table 6-24.

Ecological community descriptions provided below are based on those provided in the DPIE (OEH, 2018b) online species profiles, unless otherwise noted.

Table 6-24 Characteristics required for threatened ecological communities found within the study area

PCT	TEC	Structure	Community definition criteria
Blakely's Red Gum-Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277).	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland)	Woodland	<ul style="list-style-type: none"> <li>At least one of the following is or was previously the most common overstorey species: White Box, Yellow Box or Blakely's Red Gum</li> <li>The patch has a predominantly native understorey</li> <li>The patch is greater than 0.1 hectare in size</li> </ul>
		Derived native grassland	



PCT	TEC	Structure	Community definition criteria
	CEEC ( <i>EPBC Act</i> )		<ul style="list-style-type: none"> <li>There are 12 or more native understorey species present with at least one important species</li> </ul>
Blakely's Red Gum–Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277).	White Box-Yellow Box-Blakely's Red Gum Woodland (Box-Gum Woodland) EEC ( <i>BC Act</i> )	Woodland	<ul style="list-style-type: none"> <li>Located in the South Eastern Highlands IBRA Region</li> <li>Native understorey</li> <li>Sites have trees/or likely supported White Box, Yellow Box or Blakely's Red Gum</li> <li>Site is predominantly grassy</li> </ul>
		Derived native grassland	
Yellow Box/Red Gum Grassy Woodland (Box-Gum Woodland) EEC ( <i>NC Act</i> )	Yellow Box/Red Gum Grassy Woodland (Box-Gum Woodland) EEC ( <i>NC Act</i> )	Woodland	<ul style="list-style-type: none"> <li>Partially and moderately modified lowland woodland or moderately modified lowland woodland –secondary grassland.</li> <li>Modified woodland: 2-50 per cent tree cover and moderate diversity and cover of native species, including disturbance tolerant species (but excluding sensitive and moderately sensitive species)</li> <li>Modified secondary grassland: less than two per cent trees cover (trees cleared) and moderate diversity and cover of native species, including disturbance sensitive/and/or disturbance tolerant species</li> </ul>
Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland (PCT 350)	White Box-Yellow Box-Blakely's Red Gum Woodland (Box-Gum Woodland) EEC ( <i>BC Act</i> )	Woodland	<ul style="list-style-type: none"> <li>Located in the South Eastern Highlands Interim Biogeographic Regionalisation for Australia (IBRA) Region</li> <li>Native understorey</li> <li>Sites have trees/or likely supported White Box, Yellow Box or Blakely's Red Gum</li> <li>Site is predominantly grassy</li> </ul>

### Box-Gum Woodland

Box-Gum Woodland is generally an open woodland community with the most commonly occurring species being one or more of the following: White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*). Depending on the site's disturbance, a variety of other plant species may be present, including tree species, shrubs and a highly diverse ground layer consisting of grasses and forbs. This community occurs from the NSW/Queensland border south to the Victorian border in the tablelands and western slopes of NSW (OEH, 2018b).

Field surveys identified multiple areas that contained patches of Box-Gum Woodland. Only a relatively small area (about 24 per cent) of Box-Gum Woodland present within the study area met the *EPBC Act* definition while the remainder met either the *BC Act* definition (for those areas in NSW) or the *NC Act* definition (for those areas in the ACT).

Four different condition classes of the community were recorded in the study area (as described in Table 6-24). Typically, the best condition of the community consisted of a tree layer ranging in height from 15 to 25 m consisting of *E. blakelyi*, *Eucalyptus chloroclada* and *E. melliodora*. A midstorey contained juvenile Eucalypts. The shrub layer consisted of *Acacia decora*, *Acacia implexa*, *Pimelea neo-anglica*, *Hibbertia*

*riparia* and *Cassinia aculeata*. The ground layer consisted of *Einadia hastata*, *Austrodanthonia racemosa*, *Lomandra filiformis* subsp. *coriacea*, *Thysanotus patersonii*, *Anisopogon avenaceus*, *Poa sieberiana*, *Austrostipa scabra* and *Aristida ramosa*.

This vegetation community in all four condition classes aligns to the NSW *BC Act* description of *Blakely's Red Gum - Yellow Box - Grassy open woodland* TEC (EEC) due to the following listing criteria (as identified in the Scientific Committee Final Determination, 2002) being satisfied within the study area:

- Characterised by the presence or prior occurrence of Blakely's Red Gum - Yellow Box - Grassy open woodland
- The understorey in intact sites is characterised by native grasses and a high diversity of herbs
- Shrubs are generally sparse or absent, though they may be locally common
- Characteristic species (as identified in the Final Determination) are present
- Occurs within the known range of the TEC.

In regards to the *EPBC Act* listing, an analysis of the Determination and Flow Chart Diagram within the *EPBC Act* Policy Statement (DoEE, 2006) was carried out.

The four different condition classes present within the study area met the criteria as follows:

- Class A: *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland* (Commonwealth listed CEEC and NSW/ACT State listed EEC)
- Class B: *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland* (NSW/ACT State listed EEC)
- Class C: *White Box-Yellow Box-Blakely's Red Gum Woodland- Derived Native Grassland* (Commonwealth listed CEEC and NSW State listed EEC)
- Class D: *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland – Derived Native Grassland* (NSW/ACT State listed EEC).

### *Resilience and ability to regenerate*

The historic clearing coupled with the existing and historic grazing within the study area has resulted in most of the study area having a low to moderate resilience.

Of the TECs present within the study area, only Condition Class A consists of patches which are considered to be of high resilience. These patches together occupied about 17.2 hectares of the study area. It is likely that these patches would continue to naturally regenerate and the abundance and cover of native flora would persist/increase. However given the small size of the patches, regular weed management would need to be established in order to help natural regeneration in the face of edge effects.

Condition Classes B and C are considered to have moderate resilience and comprised about 23.2 hectares of the study area. It is likely that these areas would naturally regenerate given time and favourable conditions. Extensive plantings, importation of logs, installation of nest boxes and intensive weed management would be required to extend these patches and increase overstorey and midstorey cover, native ground cover, native shrub cover and fallen logs towards a benchmark condition.

### **Threatened flora**

No threatened flora species were found during extensive on-ground searches across the study area during the current or previous (Umwelt, 2018) survey. Moreover, no suitable habitat for any of the more cryptic threatened species with potential to occur locally (eg, Basalt Peppercreess or Tarengo Leek Orchid) was identified.

As such, none of the 16 species identified with a potential to occur were considered to have a moderate to high likelihood of occurrence. This is due to the fact that they were not recorded during current or previous

(Umwelt, 2018; AECOM 2018h) targeted surveys and potential habitat, if present, was considered too disturbed/degraded to provide suitable habitat.

### Threatened fauna

Database searches of locally occurring State (*BC Act*), Territory (*NC Act*) and Commonwealth (*EPBC Act*) listed threatened species revealed 67 species of threatened fauna have been previously recorded and/or have potential habitat within the study area.

Twenty-two of these species are considered to have a moderate or higher likelihood of occurring within the study area – based on previous records within the study area, locality or the presence of suitable habitat as determined from the previous and current field surveys. These species, along with the results of the likelihood of occurrence assessment are listed in Table 6-25.

A total of seven (including one possible recording) species of threatened fauna, consisting of four bird species and two bat species, and one invertebrate species were recorded within the study area during the current surveys. These were: Swift Parrot (*Lathamus discolor*), Scarlet Robin (*Petroica boodang*), Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), Large Bent-wing Bat (*Miniopterus orianae oceanensis*), a possible record for the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), and the Golden Sun Moth (*Synemon plana*). The White-winged Triller, listed as threatened under the *NC Act*, was also previously recorded in the study area (Umwelt, 2018).

Table 6-25 Fauna habitat assessment and survey results

Scientific name	Common Name	Status			Likelihood of occurrence within the study area	Assessment of Significance carried out?
		BC Act	EPBC Act	NC Act		
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	-	High (Possible record by Niche in 2018)	Yes
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	-	Known (recorded by Niche in 2018)	Yes
<i>Lathamus discolor</i>	Swift Parrot	E	CE	V	Known (recorded by Niche in 2018)	Yes
<i>Petroica boodang</i>	Scarlet Robin	V	-	V	Known (recorded by Niche in 2018)	Yes
<i>Petroica phoenicea</i>	Flame Robin	V	-	-	High (recorded by Niche in 2018 to the north of the study area near Murrumbateman)	Yes
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	V	High (recorded to the north of the study area, Umwelt 2018)	Yes
<i>Callocephalon fimbriatum</i>	Gang-Gang Cockatoo	V	-	-	High	Yes

Scientific name	Common Name	Status			Likelihood of occurrence within the study area	Assessment of Significance carried out?
		BC Act	EPBC Act	NC Act		
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	V	High (recorded to the north of the study area, Umwelt 2018)	Yes
<i>Merops ornatus</i>	Rainbow Bee-eater	-	M	-	High	No (see below)
<i>Climacteris picumnus</i>	Brown Treecreeper	V	-	V	Moderate	Yes
<i>Chthonicola sagittata</i>	Speckled Warbler	V		-	High	Yes
<i>Melanodryas cucullata</i>	Hooded Robin	V	-	V	Moderate	Yes
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	V	High	Yes
<i>Lalage sueurii</i>	White-winged Triller	-	-	V	High (recorded in the study area, Umwelt 2018)	Yes
<i>Artamus cyanopterus</i>	Dusky Woodswallow	V	-	-	Known (recorded by Niche in 2018)	Yes
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	-	High	Yes
<i>Suta flagellum</i>	Little Whip Snake	V	-	-	Moderate	Yes
<i>Delma impar</i>	Striped Legless Lizard	V	V	V	Moderate	Yes
<i>Aprasia parapulchella</i>	Pink-tailed Worm-lizard	V	V	V	Moderate	Yes
<i>Varanus rosenbergi</i>	Heath (Rosenberg's) Goanna	V	-	-	Moderate	No (see below)
<i>Synemon plana</i>	Golden Sun Moth	E	CE	E	Known (recorded by Rowell 2019)	Yes
<i>Perunga ochracea</i>	Perunga Grasshopper	-	-	V	Moderate	No

Note: V = Vulnerable, E = Endangered, CE = Critically endangered

### **Aquatic results**

Water sources within the study area primarily consisted of farm dams. Thirty one waterways also occur within the study area; these were highly modified and intermittent or ephemeral. There was no flowing water within any of the waterways in the study area at the time of survey. Habitat-based assessments (excluding macroinvertebrate and fish surveys) were carried out at 15 sites in conjunction with bird water source surveys. No threatened species, populations or potential habitat for threatened aquatic fauna were recorded during these surveys. All water bodies observed were less than 0.5 m deep.

Two of the waterways that cross the Barton Highway within the study area, ie Gooromon Ponds and Little Bedulluck Creek are mapped as Key Fish Habitat (DPI, 2013). Gooromon Ponds is a third order, intermittent stream and is considered a '*Type 3 – Minimally sensitive key fish habitat*' whereas Little Bedulluck Creek is a third order, ephemeral stream which constitute a '*Type 2 – Moderately sensitive key fish habitat*' (DPI 2013). Cow Flat Creek, which occurs to the east of the study area and joins Gooromon Ponds just before it crosses the highway, is also identified as Key Fish Habitat.

### **Critical habitat**

No critical habitat listed under the *BC Act*, *EPBC Act* or *FM Act*, or declared areas of outstanding biodiversity value, was identified within the study area, or in previous surveys by Umwelt conducted in 2017 (Umwelt, 2018).

### **Wildlife connectivity corridors**

A portion of the study area falls within the South East and Tablelands Biodiversity Corridor (South East and Tablelands Regional Plan 2036 (DPE 2018)). The corridor extends about 25 km from the north of the ACT near Sutton, Gundaroo and Mulligans Flat through to the Murrumbidgee River to the west. The corridor is located across the southern half of the study area within the region of Nanima Road and Kaveney's Road. The corridor includes a roughly 2,240 hectare area in total. The corridor is documented as providing an important corridor for a variety of fauna species (DPE, 2018). A number of High Environmental Value lands have also been identified in the study area by DPIE, though these are not detailed in the Regional Plan (DPE, 2017).

### **State Environment Planning Policy (SEPP) No. 44 – Koala habitat**

Yass LGA is listed on Schedule 1 of SEPP 44 Koala Habitat Protection. The study area does not support core or potential Koala habitat, as per the definitions in SEPP 44 Koala Habitat protection (no Koalas or Koala feed trees, as listed on Schedule 2 of SEPP 44, were present within the study area).

### **Matters of National Environmental Significance**

Threatened species, populations, communities and migratory species listed under the *EPBC Act* that have the potential to occur in the study area were identified in the desktop assessment as detailed above.

In summary:

- No threatened flora species listed under the *EPBC Act* were recorded or are considered likely to occur
- The study area supports 19.91 hectares of *EPBC Act* listed *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, of which 2.23 hectares occurs within the construction boundary
- Two species of threatened and/or migratory fauna has been recorded (Swift Parrot, listed as critically endangered, recorded in the Hall TSR; and Golden Sun Moth listed as critically endangered) and a further four species are considered to have a moderate to high likelihood of occurrence. These include the vulnerable Superb Parrot, Striped Legless Lizard, Pink-tailed Worm-lizard; and the migratory species Rainbow Bee-eater.



No world, national heritage areas or wetlands of importance were identified within the study area.

### *EPBC Act Box-Gum Woodland*

Based on analysis of the Determination and Flow Chart Diagram within the *EPBC Act* Policy Statement (DoEE 2006), a total of five patches of *EPBC Act* listed Box-Gum Woodland community were identified in the study area including 17.24 hectares of the woodland form of the community and 2.67 hectares of the derived native grassland form of the community. A notable portion of the this woodland community occurred within the area constituting the Hall TSR (See Figure 3.1 in Appendix F). The survey conducted concurred with the findings reported by Umwelt (2018) that the woodland community within Hall TSR meet the criteria for listing.

## 6.3.3 Potential impact

### **Construction**

#### *Removal of native vegetation*

Table 6-26 summaries the native vegetation loss as a result of the proposal. It is estimated that about 19.29 hectares of native vegetation clearing would be required for the proposal. The majority (80 per cent) of vegetation to be removed by the proposal is non-native exotic vegetation (mainly pasture grasses). Table 6-26 also describes the breakdown of vegetation removal in each PCT.

Table 6-26 Impact on vegetation

PCT	Threatened Ecological Community	Condition class (Section 3.2.1)	Legislative Status			Total area (hectares) in construction boundary <sup>1</sup>
			NC Act	BC Act	EPBC Act	
Blakely's Red Gum-Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277)	White Box-Yellow Box-Blakely's Red Gum Grassy <b>Woodland</b> ( <i>Commonwealth and NSW listed</i> )	A	-	EEC	-	1.36
	White Box-Yellow Box-Blakely's Red Gum Grassy <b>Woodland</b> ( <i>Commonwealth and ACT listed</i> )	A	E	-	CEEC	0.33
	White Box-Yellow Box-Blakely's Red Gum Grassy <b>Woodland</b> ( <i>NSW listed</i> )	B	-	EEC	-	5.54
	White Box-Yellow Box-Blakely's Red Gum Grassy <b>Woodland</b> ( <i>ACT listed</i> )	B	E	-	-	0.21
	White Box-Yellow Box-Blakely's Red Gum Woodland - <b>Derived Native Grassland</b> ( <i>Commonwealth and NSW listed</i> )	C	-	EEC	CEEC	0.54
	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland – <b>Derived</b>	D	-	EEC	-	9.85

PCT	Threatened Ecological Community	Condition class (Section 3.2.1)	Legislative Status			Total area (hectares) in construction boundary <sup>1</sup>
			NC Act	BC Act	EPBC Act	
	<b>Native Grassland (NSW listed)</b>					
Candlebark - Blakely's Red Gum - Long-leaved Box grassy woodland (PCT 350)	White Box-Yellow Box-Blakely's Red Gum Grassy <b>Woodland (NSW listed)</b>	B	-	EEC	-	1.46
<b>Total native vegetation</b>						<b>19.29</b>
Exotic vegetation	Non-native	N/A	-	-	-	75.49

Notes:

1- Based on ground-truthed vegetation mapping within the study area.

2- EEC = Endangered ecological community, CEEC = Critically endangered ecological community

### Removal of threatened fauna habitat

Developments can impact upon fauna in a number of ways. The significance of an impact would be large if any of the following situations occur:

- Death or injury of individuals
- Loss or disturbance of limiting foraging resources
- Loss or disturbance of limiting breeding resources.

As detailed in Section 6.3.2, the study area provides known habitat for eight threatened fauna species (including one possible recording) and potential habitat for a further 14 species. These include birds, bats, reptiles and invertebrates.

The proposal will result in the removal of the following within the construction boundary which provide known and potential foraging and roosting/nesting resources for these species:

- 8.90 hectares of woodland vegetation (occurring as small, isolated, clusters of trees within narrow areas along the edge of the existing highway); including about 1.7 hectares within the Hall TSR
- 85.88 hectares of open native and exotic grassland located next to the existing highway (including 10.39 hectares of native grassland and 75.49 hectares of exotic grassland)
- About 27 hollow bearing trees/stags

The proposal would also require the maintenance of existing bridges/culverts along the existing Barton Highway.

Detailed consideration of the likely impact to each of the species with the potential to be impacted by the proposal is provided in the Assessments of Significance. Table 6-27 provides a summary of the potential impact considered for each of these species and the outcome of the assessment. A summary of the findings is provided below.

Table 6-27 Impact on threatened fauna and fauna habitat

Species		Likely occurrence	Potential impact	Significant impact?
Scientific name	Common Name			
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Possible record (Niche 2018)	8.90 hectares of potential foraging habitat (woodland); 27 potential roost trees	No
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Recorded (Niche 2018)	8.90 hectares of foraging habitat (woodland); culverts/bridges for roosting	No
<i>Lathamus discolor</i>	Swift Parrot	Recorded (Niche 2018)	8.90 hectares foraging habitat (woodland)	No
<i>Petroica boodang</i>	Scarlet Robin	Recorded (Niche 2018)	8.90 hectares of woodland and 85.88 hectares of native and exotic grassland habitat	No
<i>Petroica phoenicea</i>	Flame Robin	High. Recorded to the north of the study area near Murrumbateman (Niche 2018)	8.90 hectares of potential woodland habitat and 85.88 hectares of potential native and exotic grassland habitat	No
<i>Hieraaetus morphnoides</i>	Little Eagle	High	8.90 hectares of woodland and 85.89 hectares of potential native and exotic grassland	No
<i>Callocephalon fimbriatum</i>	Gang-Gang Cockatoo	High	8.90 hectares of potential foraging habitat (woodland)	No
<i>Polytelis swainsonii</i>	Superb Parrot	High	8.90 hectares of potential foraging habitat (woodland); 27 potential roost trees	No
<i>Climacteris picumnus</i>	Brown Treecreeper	Moderate	8.90 hectares of potential foraging habitat (woodland); 27 potential roost trees	No
<i>Chthonicola sagittata</i>	Speckled Warbler	High	8.90 hectares of potential foraging habitat (woodland)	No
<i>Melanodryas cucullata</i>	Hooded Robin	Moderate	8.90 hectares of woodland and 85.88 hectares of native and exotic grassland habitat	No
<i>Daphoenositta chrysoptera</i>	Varied Sittella	High	8.90 hectares of potential foraging habitat (woodland)	No
<i>Lalage sueurii</i>	White-winged Triller	High	8.90 hectares of potential foraging habitat (woodland)	No

Species		Likely occurrence	Potential impact	Significant impact?
Scientific name	Common Name			
<i>Artamus cyanopterus</i>	Dusky Woodswallow	Recorded (Niche 2018)	8.90 hectares of potential foraging habitat (woodland)	No
<i>Stagonopleura guttata</i>	Diamond Firetail	High	8.90 hectares of potential foraging habitat (woodland)	No
<i>Suta flagellum</i>	Little Whip Snake	Moderate	No suitable habitat within the construction boundary.	No
<i>Delma impar</i>	Striped Legless Lizard	Moderate	31.1 hectares of potential marginal habitat and about 0.54 hectares of potential high quality habitat.	No
<i>Aprasia parapulchella</i>	Pink-tailed Worm-lizard	Moderate	19.29 hectares of derived native grassland and Box-Gum Woodland.	No
<i>Synemon plana</i>	Golden Sun Moth	Recorded (Rowell 2019)	0.6 hectares of low quality unoccupied habitat	No
<i>Perunga ochracea</i>	Perunga Grasshopper	Moderate	0.3 hectares of potential habitat	No

### Golden Sun Moth

About 1.73 hectares of Golden Sun Moth (GSM) habitat (potential and known), located within isolated patches ranging in size from 0.03 - 0.34 hectares was identified within the study area (See Sites 1-5 in Figure 3.3 in Appendix F). No high quality GSM habitat was found in the study area, and no Chilean Needlegrass (*Nassella trichotoma*) (which may also provide suitable habitat) was recorded. None of the known or potential habitat patches were considered to be of high quality; habitat quality was variably considered to be low to moderate at best (Niche 2019). This was reflected in the fact that GSM were recorded at only one of the sites (Site 4), and only two male GSM were observed. No females (which would indicate a breeding population) were recorded.

The proposal would result in the removal of 0.6 hectares of low quality, unoccupied habitat where GSM are considered not to be present (Sites 2a, 2b, 3a and 3b). In order to avoid impact to the species at Site 4, the occupied habitat at Site 4 will be protected from direct and indirect impact through establishment of a fenced exclusion zone with a 20 m buffer area.

An assessment of the significance of potential impact to the species under the BC Act and EPBC Act was carried out (Appendix F).

The EPBC Act assessment concluded that the proposal is considered unlikely to have a significant impact on the GSM population within the study area given that no areas of occupied habitat will be directly or indirectly impacted by the proposal.

The BC Act assessment indicated that the proposal is considered unlikely to have a significant impact on the GSM due to the following:

- Only a small area (0.6 hectares) of low quality, unoccupied potential habitat would be cleared
- 0.43 hectares of known habitat at Site 4 would be retained and protected within a fenced exclusion zone with a 20 m buffer area.

As such a SIS or BDAR is not required.

### *Removal of threatened flora*

No threatened flora species were detected within the study area during the previous (Umwelt, 2018) or current, comprehensive targeted surveys, and no threatened flora species are considered likely to occur. As such, the proposal is considered unlikely to impact upon any threatened flora species.

### *Aquatic impact*

Construction work may require some obstruction to potential fish passage during work on the creek crossings. The installation of any culverts is also considered a Key Threatening Process for in-stream structures and other mechanisms that alter natural flows. Culverts under the Barton Highway would be widened as a result of the duplication, thus altering shading regimes of waterways. However, there would be a median between the existing highway and the new carriageway which would allow natural light to reach the waterway below.

Minor realignment of Gooromon Ponds and Little Bedulluck Creek is required next to the highway and the existing culverts. Installation of box culverts would be required and also the construction of open drainage swales to re-direct water under the highway. Specific measures to mitigate impact to aquatic habitat/flora and fauna and ensure fish passage is maintained have been incorporated into the highway design.

Construction work is likely to result in the temporary displacement of aquatic fauna (such as frogs and tadpoles) and temporary changes to the turbidity and sedimentation of waterways.

### *Injury and mortality*

Injury and mortality of fauna could occur during construction activities and during operation of the upgraded highway.

The removal of 94.79 hectares of vegetation, including 27 hollow bearing trees, may result in fauna injury and mortality for species such as bats, arboreal mammals, nesting birds, hollow dependent birds, reptiles and invertebrate species.

Local fauna are currently exposed to the risk of injury and/or mortality from vehicle strike on the existing Barton Highway. Limited records of road kill along the highway include foxes, short-beaked echidnas, kangaroos and a Black-shouldered Kite (OEH, 2018a; Canberra Nature Map, 2018; Niche, 2018).

The volume and speed of traffic may be expected to increase slightly with the duplication of the highway and as such the proposal may slightly increase the risk of vehicle/fauna interactions and fatalities. However, the increase is unlikely to be substantial as road speeds would be similar to what they are currently and the widening of the highway would not expose local fauna to risks to which they are not already exposed. The road widening would result in improved sight lines, and addition of an extra lane may also better allow for evasive action from drivers should fauna cross the highway.

The proposal would not result in new watering or feed sources or other artificial habitat next to the highway.

### *Key threatening processes*

As part of an assessment of impact under the *BC, NC, FM* and *EPBC Acts*, consideration must be given as to whether the action proposed constitutes, or is part of, a key threatening process (KTP) or is likely to result in the operation of, or increase the impact of a KTP on threatened biodiversity. The KTPs listed in Table 6-28 are known to exist or have the potential to be exacerbated by the proposal. These KTPs constitute threats to biodiversity that may require management at the site. While the KTPs listed are an unavoidable impact of the proposal, the impact is minimal and amelioration measures implemented during and post construction work are anticipated to mitigate against the associated impact.



Table 6-28 Key threatening processes applicable to the proposal

Key Threatening Process ( <i>BC Act</i> and <i>FM Act</i> <sup>#</sup> )	<i>EPBC Act</i> Equivalent (x)	Increased by proposal?
Bushrock removal	x	Yes
Clearing of native vegetation	-	Yes
Loss of hollow-bearing trees	x	Yes
Removal of dead wood and dead trees	x	Yes
Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis	-	Potential but unlikely
Infection of native plants by <i>Phytophthora cinnamomi</i>	-	Potential but unlikely
Invasion and establishment of exotic vines and scramblers	x	Potential
Invasion of native plant communities by exotic perennial grasses	(only North Australia)	Potential
Instream structures and other mechanisms that alter natural flows	-	Yes
The removal of large woody debris from NSW rivers and streams <sup>#</sup>	-	No

## Operation

### Wildlife connectivity and habitat fragmentation

The proposal includes the widening of the existing highway and the removal of some marginal areas of edge-affected vegetation next to the highway (8.90 hectares of woodland habitat and 85.88 hectares of open native and exotic grassland). There will be a slight increase in habitat fragmentation due to the removal of narrow corridors of vegetation next to the highway. However, given the limited extent of clearing, the proposal is not expected to substantially further fragment habitat or impact upon wildlife connectivity across the landscape.

### Edge effects on nearby native vegetation and habitat

Edge effects are an indirect impact and relate to how ecological interactions are altered along the edge between two nearby and competing land uses. Edge effects often result in an altered microclimate (light, heat and moisture) which can lead to a reduction in the resilience of native bushland, potential for weed invasion, and potential for altered predator-prey relationships.

Weed invasion is currently prevalent throughout the study area next to the existing highway. In the case of the proposal, it is anticipated that the only un-mitigated edge effects will be a minor level of weed invasion into the previously less-disturbed vegetated areas next to the highway. It is anticipated that such weed invasion would be limited to a few minor annual herbaceous weeds with, at worst, the potential for some invasion of perennial exotic grasses and Blackberry within two or three metres of the disturbance edge.

### *Invasion and spread of weeds*

There is a high chance that weeds could be spread as a result of the proposal as machinery and vehicles will pass through areas where there are high levels of weeds, and soil will be disturbed and transported around the area. Due to the creation of exposed edges through the Woodland community, there will be an opportunity for weeds to invade the new road edges.

### *Invasion and spread of pests*

The proposal is located within a highly fragmented and cleared rural landscape. Common Blackbirds (*Turdus merula*) and Common Starlings (*Sturnus vulgaris*) were present throughout the study area. The removal of small areas of edge-affected vegetation next to the highway is considered unlikely to affect the distribution or abundance of pest species that may already be present across the landscape or lead to the invasion of new pest species.

Farm dams may harbour exotic or pest aquatic or fish species. Should de-watering of farm dams be required, a de-watering plan should be developed and implemented to avoid the introduction of exotic and/or pest species into local waterways.

### *Invasion and spread of pathogens and disease*

The prevalence of pathogens and disease within the area is unknown. The spread of potential pathogens will be managed in accordance with Guide 2: Exclusion zones of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011).

### *Changes to hydrology*

The proposal includes installation of box culverts across two key creeks: Gooromon Ponds and Little Bedulluck Creek on the new northbound dual carriageway. Box culverts are currently in place where the existing highway crosses these creeks. As previously discussed, a minor realignment of Gooromon Ponds and Little Bedulluck Creek is required next to the highway and the existing culverts. Installation of box culverts would be required and also the construction of open drainage swales to re-direct water under the highway. Specific measures to mitigate impact to aquatic habitat/flora and fauna and ensure fish passage is maintained have been incorporated into the highway design.

### *Noise, light and vibration*

The study area is already subject to noise, light and vibration from traffic on the existing highway. Fauna habitat in the immediate vicinity of the highway is considered to be sub-optimal habitat for these reasons. The proposal is unlikely to further increase these effects such that the habitat would be unsuitable for the suite of fauna species that currently utilise it.

### *Cumulative impact*

The current proposal represents the first stage of a broader program of work to upgrade the Barton Highway. The proposal includes the southern-most section of the proposed highway upgrade - a eight kilometre stretch located from about 700 m south of the NSW/ACT border to about 300 m north of Kaveney's Road in the north (at CH23800). As such, the current report identifies impact to biodiversity within this section only (including the ACT section). Future upgrade/duplication work should consider the cumulative impact to biodiversity of the proposed development as the development progresses.

## **Conclusion on significance of impacts**

A summary of the outcome of the assessments of significance is provided in Table 6-29.

Table 6-29 Summary findings of assessments of significance

Threatened species and ecological communities		NC Act assessment Significant impact?	BC Act assessment Significant impact?	EPBC Act assessment Significant impact?
<b>Threatened ecological communities</b>				
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland)		No	No	No
<b>Threatened species</b>				
<i>Lathamus discolor</i>	Swift Parrot	N/A	No	No
<i>Polytelis swainsonii</i>	Superb Parrot	N/A	No	No
<i>Delma impar</i>	Striped Legless Lizard	N/A	No	No
<i>Aprasia parapulchella</i>	Pink-tailed Worm-lizard	N/A	No	No
<i>Synemon plana</i>	Golden Sun Moth	N/A	No	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	N/A	No	N/A
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	N/A	No	N/A
<i>Petroica boodang</i>	Scarlet Robin	N/A	No	N/A
<i>Petroica phoenicea</i>	Flame Robin	N/A	No	N/A
<i>Hieraaetus morphnoides</i>	Little Eagle	N/A	No	N/A
<i>Callocephalon fimbriatum</i>	Gang-Gang Cockatoo	N/A	No	N/A
<i>Climacteris picumnus</i>	Brown Treecreeper	N/A	No	N/A
<i>Chthonicola sagittata</i>	Speckled Warbler	N/A	No	N/A
<i>Melanodryas cucullata</i>	Hooded Robin	N/A	No	N/A
<i>Daphoenositta chrysoptera</i>	Varied Sittella	N/A	No	N/A
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	N/A	No	N/A

Threatened species and ecological communities		NC Act assessment Significant impact?	BC Act assessment Significant impact?	EPBC Act assessment Significant impact?
<i>Stagonopleura guttata</i>	Diamond Firetail	N/A	No	N/A
<i>Suta flagellum</i>	Little Whip Snake	N/A	No	N/A
<i>Lalage sueurii</i>	White-winged Triller	No	N/A	N/A
<i>Perunga ochracea</i>	Perunga Grasshopper	No	N/A	N/A

The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the *BC Act* or *FM Act* and therefore a SIS or BDAR is not required.

The proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the *EPBC Act* and therefore referral under the *EPBC Act* is not required.

### 6.3.4 Safeguards and management measures

The recommended safeguards and management measures to safeguard biodiversity are provided in Table 6-30.

Table 6-30 Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	<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"> <li>Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and potential revegetation areas</li> <li>Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008)</li> <li>Pre-clearing survey requirements</li> <li>Procedures for unexpected threatened species finds and fauna handling</li> <li>Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013)</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>Protocols to manage weeds and pathogens</li> </ul>			
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal, especially within the Hall TSR, will be investigated during detailed design and implemented where practicable and feasible	Contractor	Detailed design / pre-construction	
Removal of vegetation	<p>Exclusion zones will be set up at the limit of clearing (ie the edge of the impact area) in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p> <p>Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p> <p>Vegetation and habitat removal will be carried out in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p>	Contractor	Construction	Additional safeguard
Removal of threatened species habitat and habitat features	<p>Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p> <p>Hollows from hollow-bearing trees that are removed will be salvaged and re-used/installed</p> <p>The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened fauna, not assessed in the Biodiversity Assessment, are identified in the proposal site</p>	Contractor	Construction	Additional safeguard



Impact	Environmental safeguards	Responsibility	Timing	Reference
Tarengo Leek Orchid ( <i>Prasophyllum petilum</i> )	All personnel working on site will receive training to ensure awareness of the potential for Tarengo Leek Orchid ( <i>Prasophyllum petilum</i> ) within the construction boundary. Training will include photographs of the orchid and protocols if its identified during work	Contractor	Pre-construction / construction	Additional safeguard
Golden Sun Moth ( <i>Synemon plana</i> )	About 0.43 hectares of known Golden Sun Moth ( <i>Synemon plana</i> ) habitat at Site 4 will be retained and protected within a fenced exclusion zone with a 20 m buffer area. All personnel working on site will receive training to ensure awareness regarding this no go zone. This habitat will be monitored and these requirements specified in the FFMP and CEMP	Roads and Maritime/ Contractor	Detailed design/ Pre-construction / construction	Additional safeguard
Aquatic habitat	<p>All new drainage structures will be designed in accordance with the requirements specified in <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge, 2003)</p> <p>Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013)</p>	Contractor	Detailed design/ construction	Additional safeguard
Aquatic habitat - Gooromon Ponds and Little Bedulluck Creek	<p>Specific measures to mitigate impact of the minor realignment work at Gooromon Ponds and Little Bedulluck Creek next to the highway will include:</p> <ul style="list-style-type: none"> <li>Burying required culverts slightly, so they are slightly below the level of the creek bed, allowing for pooling in the culvert and minimising the potential for erosion within the receiving creek bed from the relatively high velocity water passing through the culvert</li> <li>Installing some baffling/rock protection within the bed/walls of the culvert to reduce flow velocity/provide fauna habitat</li> <li>Use of open, vegetated, drainage swales to provide more natural drainage</li> </ul>	Contractor	Detailed design/ construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	channels (providing habitat and sunlight)			
Injury and mortality of fauna	<p>Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p> <p>Clearing will be Implemented in a two stage clearing process to allow fauna to disperse from habitat voluntarily and inspection of hollows by experienced ecologist/fauna spotter/catcher before and after clearing of hollow bearing trees/stags to safely remove and relocate any injured /displaced fauna</p>	Contractor	Construction	Additional safeguard
Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Construction	Additional safeguard
Invasion and spread of pests	Pest species will be managed within the proposal site	Contractor	Construction	Additional safeguard
Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Construction	Additional safeguard
Lighting	Shading and artificial light impact to biodiversity will be minimised through detailed design. Lighting will be designed in accordance with AS 4282-1997 <i>Control of the obtrusive effects of outdoor lighting</i>	Contractor	Detailed design/pre-construction	Additional safeguard

Other safeguards and management measures that would address biodiversity impact are identified in sections 6.7.4 and 6.8.4.

### 6.3.5 Biodiversity offsets

The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the *BC Act*, *FM Act* or the *EPBC Act* (see section 6.3.3) and therefore provision of biodiversity offsets is not legally required. Measures to avoid impacts to biodiversity have been incorporated in design and pragmatic mitigation measures have been formulated as specified in Table 6-30.

Roads and Maritime will provide biodiversity offsets for residual impacts on biodiversity in accordance to the Roads and Maritime Biodiversity Offset Guidelines (see Section 6.1 in Appendix F). Offsets would be provided for 16.85 hectares of BC Act-only listed Box-Gum Woodland (consisting 15.39 hectares PCT 277

and 1.46 hectares PCT 350) which includes 2.23 hectares of Commonwealth (BC Act and NC Act) listed Box-Gum Woodland and habitat for ecosystem credit species recorded in the study area, ie: Eastern Bentwing Bat, Scarlet Robin, Flame Robin, Dusky Woodswallow and Swift Parrot (no important areas identified for species credits).

The biodiversity offset strategy would be finalised during the detailed design stage based on ground-truthing of the final design impact area.

## 6.4 Aboriginal heritage

An ACHAR<sup>4</sup> was prepared by AECOM for the proposal (AECOM, 2018g) to identify the potential impact of the proposal on Aboriginal heritage items. The assessment is provided in Appendix G and the findings are summarised in this section.

### 6.4.1 Methodology

The Aboriginal Cultural Heritage Assessment was carried out in accordance with Section 3.1 of the NSW OEH *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011). An Aboriginal Archaeological Report (AAR) was also prepared, which satisfies the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010) with reference to Stage 3 of the Procedure for Aboriginal Cultural Heritage Consultation. In addition, a Cultural Values Report (CVR) was carried out by Waters Consultancy and an arboricultural assessment was carried out by Urban Tree Management Australia Pty Ltd.

The Aboriginal cultural heritage assessment comprised of:

- Desktop investigation, including a search of the Aboriginal Heritage Information Management System (AHIMS) database carried out on 10 October 2018 and consideration of previous Aboriginal assessments
- Archaeological survey of the construction boundary over a three day period from 20 to 22 August 2018. The survey was carried out on foot, with a total of 15 transects. All safely accessible and non-severely disturbed portions of the construction boundary were sampled
- Test excavations carried out in six areas identified during the survey as containing potential archaeological deposits (PAD) to collect information about the nature and extent of any subsurface Aboriginal objects. The test excavations were carried out over a non-consecutive 13 day period between 3 and 18 September 2018
- Consultation with RAPs to determine cultural heritage values of the proposal which included a request for initial comments on the draft cultural assessment methodology, Aboriginal focus group (AFG) meetings, discussions of cultural heritage values during fieldwork, invitation for RAPs to comment on the draft ACHAR and CVR as well as to gain consensus on the management of aboriginal heritage items
- Arboricultural assessment to determine the status of scarred and ring trees identified by RAPs.

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<sup>4</sup> The ACHAR study area extended an additional 1.3 km north of the REF construction boundary which ends about 300 metres north of Kaveney's Road.

## 6.4.2 Existing environment

### ***Land use, history and Aboriginal background***

Available archaeological data indicates that Aboriginal people have occupied the Southern Tablelands and northernmost ranges and plateaus of the Australian Alps<sup>5</sup> for at least 21,000 years. Surface and subsurface distributions of stone artefacts, variously referred to as open artefact sites, open sites and open campsites are the most common and widely distributed form of Aboriginal archaeological site across the southeastern tablelands and highlands. Other site types, such as rockshelters, burials, scarred trees, quarries, grinding grooves and stone arrangements have also been identified but are comparatively rare. Existing archaeological survey data for the southeastern tablelands and highlands indicate a strong trend for the presence of open artefact sites on landform elements next to creeks, rivers, lakes, swamps and springs (eg beach-ridges, source-bordering dunes, creek flats, terraces, lower slopes and spur crests).

Available sources indicate that the construction boundary falls wholly within the traditional country of Ngunawal-speaking peoples. As highlighted by Flood (1996: 5), Ngunawal was first identified as the name of both the language and “tribe” of the Southern Tablelands by the anthropologist R.H. Matthews, who worked among Aboriginal people in southeastern Australia around the turn of the century. According to Matthews (1904 cited in Flood 1996: 5), the boundaries of the Ngunawal language group were from “Goulburn to Yass and Burrowa, extending southerly to Lake George and Goodradigbee” and “from Queanbeyan to Yass, Boorroowa and Goulburn”.

Flood (1980) has speculated, on the basis of available archaeological and ethnohistoric data, that the annual settlement and subsistence cycles of Aboriginal groups living in the Canberra region were based around the seasonal exploitation of animal and plant resources within three principal ecological zones: large rivers, montane valleys and ‘high’ Bogong Moth localities. The rich animal and plant resources of the montane valleys and rivers facilitated both winter and summer occupation. The bogong moth localities, in contrast, were visited only in summer and for relatively short periods of time (Flood 1980: 127).

### ***Search of Aboriginal Heritage Information Management System database***

A search of DPIE AHIMS database on 10 October 2018 for a 20 by 20 km area surrounding the construction boundary identified 489 Aboriginal sites, comprising 240 open artefact sites (ie, isolated artefacts and artefact scatters) (four of which have associated areas of PAD), 25 modified trees, 18 Aboriginal places, 16 areas of PAD, seven quarries (one with associated artefacts), three grinding groove sites, one art site, one burial, one possible modified tree, one resource and gather site, and one rockshelter with artefacts and deposit. Consideration of the location of previously recorded sites indicates that nine are either partially or wholly within the construction boundary. Summary information on these sites, including their location relative to the proposal area, is provided in Table 6-31. Site locations are shown in Figure 6-10. Previously recorded sites located within the construction boundary include five open artefact sites (ie artefact scatters and isolated artefacts), two of which have associated areas of PAD and three areas of PAD.

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<sup>5</sup> Following Flood (1980), we refer here to the ‘Namadgi Ranges’, comprising the Tidbinbilla, Brindabella, Bimberi, Scabby and Booth Ranges, as well as the Bogong Mountains and Yarrangobilly Plateau to their west.

Table 6-31 Previously recorded Aboriginal sites within the construction boundary

AHIMS ID	Site Name	State	Site type	AHIMS status	Recorder	Location relative to project area
57-2-0643	BH1 (Hall)	NSW	Isolated artefact	Valid	AHMS, 2010	Wholly within
57-2-0644	BH3 (Hall)	NSW	PAD	Valid	AHMS, 2010	Partially within
57-2-0645	BH4 (Hall)	NSW	Wattle Park Uniting Church	Valid	AHMS, 2010	Partially within
57-2-0646	BH5 (Hall)	NSW	PAD	Valid	AHMS, 2010	Partially within
57-2-0647	BH6 (Hall)	NSW	Artefact scatter with PAD	Valid	AHMS, 2010	Partially within
57-2-0648	BH7 (Bedulluck)	NSW	Artefact scatter with PAD	Valid	AHMS, 2010	Partially within
57-2-0649	BH8 (Bedulluck)	NSW	Artefact scatter	Valid	AHMS, 2010	Wholly within
57-2-0650	BH9 (Bedulluck)	NSW	PAD	Valid	AHMS, 2010	Partially within
57-2-0651	BH10 (Bedulluck)	NSW	Artefact scatter	Valid	AHMS, 2010	Wholly within





Figure 6-10 AHIMS Registered Aboriginal sites



## Field survey results

Archaeological survey within the construction boundary was carried out over a three day period from 20 to 22 August 2018, with the survey team consisting of two AECOM archaeologists and up to eight rostered RAP field representatives per day. As per the survey strategy, all safely accessible and non-severely disturbed portions of the construction boundary were sampled during the survey, with particular attention paid to ground surfaces with higher archaeological visibility. All mature trees encountered during the survey were inspected for cultural modification. All survey completed for the assessment was conducted on foot, with a total of 15 transects executed across the construction boundary. In addition to previously recorded sites within the construction boundary (AHIMS IDs 57-2-0650, 57-2-0646, 57-2-0647, 57-2-0648), a total of three new surface sites were identified during the archaeological survey, all comprising isolated artefacts (BH-IA1-18, BH-IA4-18 and BH-IA5-18).

In recognition of generally poor ground surface visibility conditions across the construction boundary in identified areas of PAD, a 13 day program of archaeological test excavation was completed in September 2018. Excavation was only completed in the NSW portion of the construction boundary with no PADs identified within the ACT section. Taking into account the results of the survey and test excavation program, as well as the findings of the arboricultural assessment of modified trees identified during survey, nine Aboriginal archaeological sites have been recognised within the construction boundary including seven open artefact sites, two with associated areas of PAD, one site with only subsurface artefacts and one Scarred Tree as summarised in Table 6-32 and shown in Figure 6-11.

Table 6-32 Aboriginal archaeological sites within the construction boundary

AHIMS Site ID	Site name	AHIMS Centroid Coordinates		Site type
		MGAE	MGAN	
57-2-0646	BH5	687165	6108700	Artefact scatter with PAD (surface & subsurface)
57-2-0647	BH6	686487	6110952	Artefact scatter with PAD (surface & subsurface)
57-2-0648	BH7	685987	6112508	Artefact scatter (surface)
57-2-0649	BH8	685728	6113504	Artefact scatter (surface)
57-2-0650	BH9	685375	6114662	Isolated artefact (surface)
57-2-1114	BH-IA1-18	686955	6109022	Isolated artefact (surface)
57-2-1116	BH-IA3-18	685768	6112969	Isolated artefact (surface)
57-2-1121	BH-IA4-18	686243	6111544	Isolated artefact (subsurface)
57-2-1115	BH-ST1-18	687079	6108711	Scarred Tree



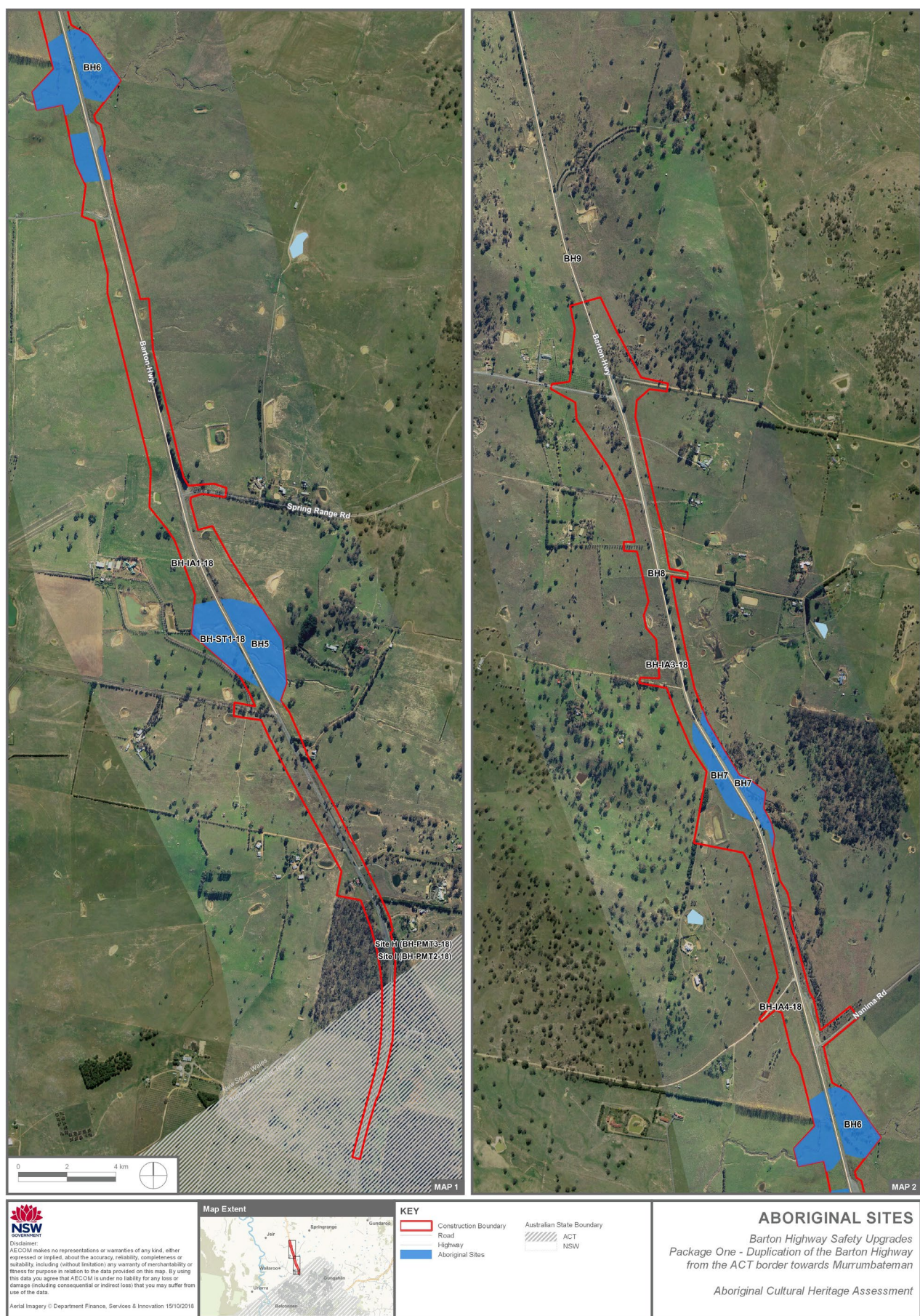


Figure 6-11 Aboriginal sites within the construction boundary



## Cultural heritage items

The concept of cultural significance encompasses all the cultural values and meanings that could potentially be associated with a place. The cultural and natural values of a place are generally indivisible in the context of Aboriginal cultural heritage and can be both tangible and intangible.

*Aboriginal cultural heritage consists of any places and objects of significance to Aboriginal people because of their traditions, observances, lore, customs, beliefs and history. It provides evidence of the lives and existence of Aboriginal people before European settlement through to the present... For Aboriginal people, cultural heritage and cultural practices are part of both the past and the present and that cultural heritage is kept alive and strong by being part of everyday life (OEH, 2011).*

The concept of cultural significance is used in Australian heritage practice and legislation to encompass all of the cultural values and meanings that might be recognised in a place. Cultural significance is often defined as the sum of the qualities or values that a place has with particular reference to the five values – aesthetic, historic, scientific, social and spiritual – that are listed in the *Burra Charter*.

As part of the ACHAR, a CVR was conducted by Waters Consultancy. Within the construction boundary consultation with the knowledge holders has identified two items of cultural significance as set out in Table 6-33 and shown in Figure 6-34.

Table 6-33: Summary of Significance of Identified Cultural Sites

Site Name	Description	Cultural significance
Site H: Cultural Tree (BH-PMT3-18)	A culturally significant Ring Tree	This site has high significance to the Aboriginal community as a tree that is understood to be culturally modified
Site I: Cultural Tree (BH-PMT2-18)	A culturally significant Ring Tree	This site has high significance to the Aboriginal community as a tree that is understood to be culturally modified

## Assessment of significance

This assessment found that the archaeological values of the construction boundary rest principally with the eight archaeological and three cultural sites identified within it. These sites attest to past Aboriginal use of the construction boundary and show an emphasis on the utilisation of Gooromon Ponds in the local area. While individually seven of these sites have been assessed as of low scientific significance, two of moderate scientific significance and two of high cultural significance (Ring Trees), they form part of a much larger and cultural landscape for Aboriginal people.

Although situated within a broader landscape of historical significance for contemporary Aboriginal people, the construction boundary itself is assessed as having low historical significance. No evidence of post-contact Aboriginal occupation has been identified within the construction boundary. In addition, no historical records or oral histories specific to the use of the site by Aboriginal people have been identified as part of this assessment. The construction boundary is likewise considered to have low aesthetic significance on the grounds that the natural environment of the subject properties has been extensively modified by historical land use practises.

### 6.4.3 Potential impact

#### **Construction**

The proposal is anticipated to directly impact all eight open artefact sites, with newly identified Scarred Tree BH-ST1-18 and the two cultural Ring Trees avoided and conserved *in-situ*. The impact is summarised in Table 6-34.

Further refinement will occur during detailed design to avoid impact to Scarred Tree BH-ST1-18 (57-2-1115) and the two cultural Ring Trees BH-PMT3-18 (Site H, 57-2-1118) and BH-PMT2-18 (Site I, 57-2-1117) given their level of significance to the local Aboriginal community.



Table 6-34 Impact assessment for Aboriginal sites

AHIMS site information									Proposed harm		
Portion of site (whole or part – include map reference if part)	AHIMS site ID	Site feature (there may be more than one site feature per site ID)	Site name	Information access restriction and map reference? (Yes + map ref. or No)	Easting	Northing	Datum (AGD or GDA)	Zone	Type of harm <sup>1</sup>	Degree of harm <sup>2</sup>	Consequence of harm <sup>3</sup>
Whole	57-2-0646	Artefact scatter with PAD	BH5	No	687165	6108700	GDA	55	Directly harmed	Whole	Total loss of value
Whole	57-2-0647	Artefact scatter with PAD	BH6	No	686487	6110952	GDA	55	Community collection Excavation	Whole	Total loss of value
Whole	57-2-0648	Artefact scatter	BH7	No	685987	6112508	GDA	55	Community collection	Whole	Total loss of value
Whole	57-2-0649	Artefact scatter	BH8	No	685728	6113504	GDA	55	Community collection	Whole	Total loss of value
Whole	57-2-0650	Isolated artefact	BH9	No	685375	6114662	GDA	55	Surface collection	Whole	Total loss of value
Whole	57-2-1114	Isolated artefact	BH-IA1-18	No	686955	6109022	GDA	55	Surface collection	Whole	Total loss of value
Whole	57-2-1116	Isolated artefact	BH-IA3-18	No	685768	6112969	GDA	55	Directly harmed	Whole	Total loss of value
Whole	57-2-1121	Isolated artefact	BH-IA4-18	No	686243	6111544	GDA	55	Surface collection	Whole	Total loss of value
Whole	57-2-1115	Scarred Tree	BH-ST1-18	No	687079	6108711	GDA	55	Will not be harmed	None	No loss of value
Whole	57-2-1118	Cultural Ring Tree	Site H BH-PMT3-18 (Site H)	No	687734	6107489	GDA	55	Will not be harmed	None	No loss of value

AHIMS site information									Proposed harm		
Whole	57-2-1117	Cultural Ring Tree	BH-PMT2-18 (Site I)	No	687751	6107430	GDA	55	Will not be harmed	None	No loss of value

<sup>1</sup> 'Will not be harmed' / 'Movement (collection) only' / 'Excavation' / 'Community collection' / 'Directly harmed'

<sup>2</sup> 'Whole' / 'Partial' / 'None'

<sup>3</sup> 'Total loss of value' / 'Partial loss of value' / 'No loss of value'

<sup>4</sup> GDA = Geocentric Datum of Australia

<sup>5</sup> ID = Identification

## Operation

Operation of the proposal would not adversely impact Aboriginal heritage significance or archaeological potential along the Barton Highway within the construction boundary. Management measures to safeguard the Aboriginal Scarred Tree BH-ST1-18 (57-2-1115) and cultural Ring Trees BH-PMT3-18 (Site H, 57-2-1118) and BH-PMT2-18 (Site I, 57-2-1117) as specified in an Aboriginal Heritage Management Plan (AHMP) would continue to be implemented during the operation of the proposal.

### 6.4.4 Safeguards and management measures

The recommended safeguards and management measures for Aboriginal heritage are provided in Table 6-35.

Table 6-35 Aboriginal heritage safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	An AHMP will be prepared in accordance with the <i>Procedure for Aboriginal cultural heritage consultation and investigation</i> (Roads and Maritime, 2012) and <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impact on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups	Contactor	Detailed design / pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015a) 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	Contactor	Detailed design / pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
Aboriginal heritage	Any potential activities that may need to occur outside the assessed construction boundary will require an additional environmental assessment	Contractor	Detailed design / pre-construction	Additional safeguard
AHIP	An AHIP will be sought for the overall construction boundary. Collection of surface artefacts and salvage excavations will be completed before any activities (including	Roads and Maritime	Detailed design / pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	pre-construction activities) which may harm Aboriginal objects at these locations			
Aboriginal heritage	Scarred Tree BH-ST1-18 (57-2-1115) will be conserved in-situ. The tree will be protected during construction via permanent stock-proof fencing and appropriate associated signage. All relevant staff and contractors will be made aware of the nature and location of this site as well as Roads and Maritime's legal obligations with respect to it. Details for the long-term management of the site will be included within the AHMP	Roads and maritime, Contractor	Detailed design / pre-construction/ construction/ operation	Additional safeguard
Aboriginal heritage	Cultural Ring Trees BH-PMT3-18 (Site H, 57-2-1118) and BH-PMT2-18 (Site I, 57-2-1117) will be conserved in-situ within the proposed new median area. Further design refinements during detailed design will be investigated to retain these cultural trees in consultation with RAP's. During construction the trees will be protected via permanent stock-proof fencing and appropriate associated signage with the location of the temporary fencing confirmed by a cultural values consultant and relevant Knowledge Holders. All relevant staff and contractors will be made aware of the nature and location of this site as well as Roads and Maritime's legal obligations with respect to it. The sites will be marked on all operational maps as areas of high environmental and heritage sensitivity. Provisions for the long-term management of the sites will be included within the AHMP and developed in consultation with a cultural values specialist and RAPs	Roads and maritime, Contractor	Detailed design / pre-construction/ construction/ operation	Additional safeguard
Aboriginal heritage	Management of stone artefacts will be carried out in accordance with the <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW</i> (DECCW 2010b). All stone artefacts recovered from the construction boundary as part of the test excavation program should be stored temporarily at a suitable location. After completion of the Aboriginal archaeological salvage program, artefacts from the test excavation and salvage programs should be reburied on Country as soon as practicable to a location close to where they originated from, where no developmental impact is proposed. A reburial location will be determined through consultation with Roads and Maritime and RAPs	Roads and Maritime	Detailed design / pre-construction	Additional safeguard



## 6.5 Non-Aboriginal heritage

A Non-Aboriginal Heritage Impact Assessment was prepared for the proposal (AECOM 2018b). This assessment is included in Appendix H and is summarised below.

### 6.5.1 Methodology

A search of relevant heritage registers was carried out including:

- World Heritage List (World Heritage Committee, UNESCO, Australian Heritage Council)
- National Heritage List (Australian Heritage Council)
- Commonwealth Heritage List (Australian Heritage Council)
- NSW State Heritage Register and NSW State Heritage Inventory (NSW Heritage Branch, DPIE)
- NSW section 170 Heritage and Conservation Registers (hereafter referred to as S170 Registers) compiled by Sydney Water, Sydney Trains and Roads and Maritime and other Government agencies as relevant
- *Yass Valley LEP 2013*
- Register of the National Estate (Australian Heritage Council) (non-statutory)
- National Trust of Australia (NSW).

The non-Aboriginal heritage impact assessment also included:

- A review of historic materials, such as historical parish maps and plans, to determine the historic context of the construction boundary and to identify any potential for archaeological heritage items
- Assessment of mapped historic heritage listings identified to be within the construction boundary with possible direct and indirect impact during construction and operation of the proposal
- Consideration of activities required as part of the proposal and identification of direct impact (which may include ground disturbance) and indirect impact (which may include vibration or settlement from work)
- Consideration that operation may result in indirect impact, being visual presence of permanent features
- Available heritage listing information of the potentially impacted listings, including past photographs, where available
- An archaeological field survey of the construction boundary carried out by an AECOM heritage specialist over two non-consecutive days on 31 May 2018 and 4 July 2018. Existing background information was updated with field survey results
- Investigation of areas of potential heritage value during field surveys to look for historic heritage outside the recorded listing locations that may be impacted by the proposal
- Statements of Heritage Impact for the identified heritage sites considering direct and indirect impact during construction and operation.

The significance of identified items was assessed following the NSW Heritage Division publications *Assessing Heritage Significance* (NSW Heritage Office, 2001) and *Statements of Heritage Impact* (NSW Heritage Office, 2002).

After the identification of heritage items, feasible and reasonable mitigation and management measures have been recommended to address direct and indirect impact on these heritage items.

## 6.5.2 Existing environment

The following items were identified as areas of archaeological potential as shown in Figure 6-12 and Figure 6-13:

- Wattle Park Uniting Church (and grounds)
- Dellwood homestead
- Staging post for Ainslie Post office to Yass Coach (could not be located)
- Fence and pine trees (see Figure 6-13).

### ***Wattle Park Uniting Church and grounds***

Wattle Park Uniting Church (the Church) is located on the eastern side of Barton Highway, about one kilometre north of the NSW/ACT border. The Church land includes Lots 230 and 231 of Deposited Plan 754880, owned by the Uniting Church of Australia. The Wattle Park Uniting Church and grounds is made up of three main components (Figure 6-13), including:

- Wattle Park Uniting Church
- Sunday School
- Setting and Landscape features that have been erected or planted as memorials.

The Wattle Park Uniting Church and grounds is listed in the Yass Valley LEP 2013 (#1124) and is of local historical, associative, aesthetic, social and representative significance. The Church was opened in 1882 and demonstrates the growing population in the local area at that time. It's been a continuous place of worship since 1882 and demonstrates the importance of religious observance of the Methodist faith, as brought to the area by the Southwell family.

The Church has strong and special associations with the history and work of the Church itself in its service to the community. Additionally, it has strong and special ties to many local families, most notably the Southwell family. The Memorial Gates erected in memory of Reverend Norman James Clive Southwell demonstrate the service of the Reverend to the community.

Wattle Park Uniting Church and grounds is of local aesthetic significance as a Church in the Victorian Rustic Gothic/Australian Bush Gothic style. It is an aesthetically appealing Church due to the exposed bluestone walls and complimented by the steeply pitched roof and scalloped bargeboards. The interior is largely intact, with timber lined ceiling, stained glass windows and ecclesiastical furniture. The plantings clearly delineate the Church, both physically and functionally, from the surrounding paddocks and points to the spiritual sanctuary provided by the Church. The landscape setting contributes to the aesthetic significance of the Church.

### ***Dellwood homestead***

The Dellwood homestead is located on Lot 1 of Deposited Plan 846623 immediately north of the NSW/ACT border to the west of the highway. The property includes a number of elements (Figure 6-14) including:

- Dellwood (house)
- Granary shed
- Tanning shed
- Tanning tank
- Cultural plantings
- Modern shed.

The Dellwood homestead is not identified on any heritage registers.

The Dellwood homestead is of local historical, associative, research, rarity and representative significance. The construction of Dellwood and the relocation of William and Louisa Morris to the local area demonstrates the increasing intensification of population in the area to the point that a bootmaker could be supported by the local community. Dellwood is strongly associated with the Morris family, who occupied the property from c.1884 until the early 1980s. The intact structures associated with the tanning of hides for leather on a small scale may allow for research into the techniques used that may provide information unavailable elsewhere. The tanning tank is thought to be a rare item. As a whole, the Dellwood homestead demonstrates principal characteristics of a rural property established as a self-sufficient family business.

### ***Staging post for Ainslie Post office to Yass Coach***

Oral history indicated that there was a staging post for the horse and coach service that ran between the Ainslie Post Office and Yass, however, sources were unclear on a specific location. Two possible locations were suggested: the northern side of Boundary Lane and a vehicle turnout area on the eastern side of the highway. Both of these areas were examined during field investigations, but no surface indications of former structures or use of the sites was evident. The nature and extent of the staging post is unknown, however, as there has been limited ground disturbance or development in the area, it is considered that the potential for archaeological relics and deposits to be retained sub-surface is high. Archaeological relics may include footings related to stables and ancillary buildings, yard complexes represented by post holes and artefact deposits.

### ***Fence and pine trees***

The boundary of Lot 21 of Deposited Plan 1135981 has been planted with a row of pine trees. The boundary with the highway measures about 1.3 km. Of this length, about 272 m is within the construction boundary. The pine trees are associated with a timber post and wire fence. The fence is made up of posts, which have been drilled and threaded with plain and barbed wire across the top two strands. The lower part of the fence has been filled with chicken wire. The timber posts show evidence, in the form of rectangular holes (mortise cuts), that the fence was at one time a timber post and rail fence (Figure 6-15, Figure 6-16). This is an early form of fencing, which has not generally used after 1900 (Pickard, 2009). The pine trees, in conjunction with the fence, contribute to the cultural landscape.



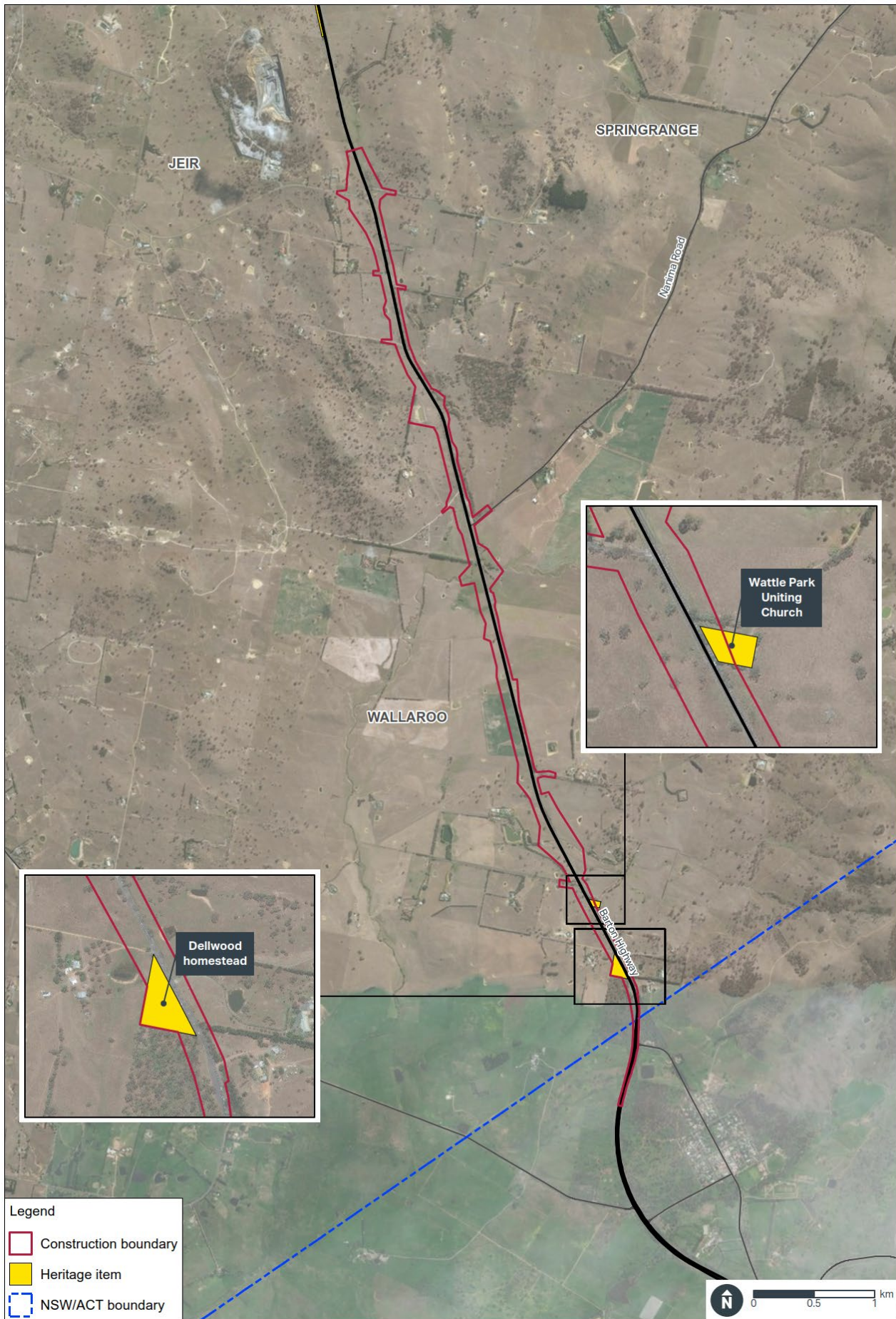


Figure 6-12 Location of areas of non-Aboriginal heritage interest





Figure 6-13 Elements of the Wattle Park Uniting Church and grounds



Figure 6-14 Elements of Dellwood homestead





Figure 6-15 View south of fence and pines



Figure 6-16 View south of fence. Note mortice for rails

The fence and pine trees are not identified on any heritage registers. The 'fence and pine trees' do not meet the threshold associated with any of the seven significance criteria. The item does not meet the criterion at a State or local level and is not considered to be of heritage significance as set out in the *Assessing Heritage Significance* (NSW Heritage Office, 2001) document.

### 6.5.3 Potential impact

The NSW Heritage Division uses standardised terms to define impact to heritage items. The terms and their definitions are provided in Table 6-36.

Table 6-36 Impact type definitions

Impact Type	Impact
Major negative impact	Substantially affects fabric or values of state significance
Moderate negative impact	Irreversible loss of fabric or values of local significance; minor impact on State significance
Minor negative impact	Reversible loss of local significance fabric or where mitigation retrieves some value of significance; loss of fabric not of significance but which supports or buffers local significance values
Negligible or no impact	Does not affect heritage values either negatively or positively
Minor positive impact	Enhances access to, understanding or conservation of fabric or values of local significance
Major positive impact	Enhances access to, understanding or conservation of fabric or values of state significance

## Construction

### *Wattle Park Uniting Church and grounds*

Direct impact to the Wattle Park Uniting Church and grounds would be limited to the plantings of pine trees along the northern, western and southern boundaries – the Victory Tree would not be impacted. These trees would be removed as they are reaching the end of their life span and may fall onto the highway posing a safety hazard to road users. These plantings have been assessed as holding moderate significance in association with the Church, having been planted to celebrate the 50<sup>th</sup> anniversary of the Church in 1932. The Memorial Gates, of exceptional significance, are within the construction boundary, however, it is anticipated these would be protected in situ during construction and returned to use as the entrance to the Church on completion of the proposal. Direct impact to the built elements that make up the Wattle Park Uniting Church and grounds, such as the church building, Sunday School and Victory Tree would be avoided by the proposal.

Indirect impact on the Wattle Park Uniting Church and grounds during construction would include changes in the visual setting through the removal of the existing pine trees and the landscaping of the verge area. Noise, vibration and dust from construction activities may affect services and/or ceremonies. This impact is anticipated to be minor negative.

### *Dellwood homestead*

The proposal includes the demolition of Dellwood homestead directly impacting all elements of this item. The proposal is constrained by the current route of the Barton Highway and through the options selection process the new carriageway has been selected on the western side of the existing carriageway in order to avoid directly impacting the locally listed Wattle Park Uniting Church and grounds. Retention of Dellwood homestead would result in the use of land between the existing carriageway and the structures associated with the Wattle Park Uniting Church and grounds. This would likely result in direct impact (or full demolition) of the Wattle Park Uniting Church and grounds.

The impact to the heritage significance of the Dellwood homestead overall has been assessed as being moderate negative impact. Under the impact definitions, this is the highest negative impact that can be applied to an item identified as being of local significance.

An archival recording would be completed before the commencement of construction. The slab portion of the Dellwood homestead could be relocated to another location, if a suitable owner could be found. The Hall School and Museum have expressed an interest in taking ownership of the tanning tank. The tank is a rare item and its preservation in a setting where it can be interpreted would be a positive outcome.

It is considered likely that the Dellwood homestead subfloor space contains archaeological deposits of heritage significance which may be revealed during demolition activities. The archaeological potential of the Dellwood homestead would be managed through archaeological assessment of the area in accordance with a Section 140 permit under the *Heritage Act 1977*. An Archaeological Research Design and Methodology should be prepared and submitted to the Heritage Council of NSW for approval under Section 140.

### *Staging post for Ainslie Post office to Yass Coach*

As evidence of the location of the staging post was not identified, it is unknown if there will be direct or indirect impact. No Statement of Heritage Impact can be prepared at this time. Should archaeological elements of this item be uncovered during construction the find would be managed in accordance with the *Standard Management Procedure - Unexpected Heritage Items Procedure* (Roads and Maritime, 2015a).

### *Fence and pine trees*

The proposal would result in the removal of about 272 m of the total 1.3 km of the fence and pine trees. The fence and pine trees have been assessed as not being of local heritage significance.

### **Operation**

#### *Wattle Park Uniting Church and grounds*

The noise and vibration assessment carried out for the proposal (see Section 6.2 and Appendix H) identified that there would be exceedances of the applicable noise criteria at the Wattle Park Uniting Church and associated Sunday School building. These exceedances are due to the proximity of the Church to the existing highway. Modelling has found that the proposal would reduce the noise at the Church (in comparison to the existing situation), however due to the identified exceedances of the Cumulative Noise Limit the Church is eligible for the consideration of noise mitigation measures. See Section 6.2.5 for proposed mitigation.

#### *Dellwood homestead*

After its demolition there would be no direct or indirect impact on the Dellwood homestead during operation.

#### *Staging post for Ainslie Post office to Yass Coach and Fence and pine trees*

No direct or indirect impact considered likely during operation of the proposal.

## 6.5.4 Safeguards and management measures

The recommended safeguards and management measures for non-Aboriginal heritage are provided in Table 6-37.

Table 6-37 Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage - General	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 impact to Non-Aboriginal heritage	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
Non-Aboriginal heritage - General	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015a) 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	Section 4.10 of QA G36 <i>Environment Protection</i>
Non-Aboriginal	Where possible, detailed design will seek to avoid or further minimise	Contractor	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
heritage – General	impact to the identified heritage values within the construction boundary			
Non-Aboriginal heritage – Wattle Park Uniting Church	The construction boundary will be temporarily fenced in the vicinity of the Wattle Park Uniting Church and grounds to ensure inadvertent damage is not done to elements of the Church outside the proposal. The Memorial Gates will be temporarily fenced with a two metre exclusion zone buffer. A pre and post construction building condition inspection will be carried out as part of the CNVMP for the Church.	Contractor	Construction	Additional safeguard
Non-Aboriginal heritage – Dellwood homestead	Photographic archival recording will be prepared before Dellwood homestead is disturbed. The archival recording will adhere to the guidelines Photographic recording of heritage items using film or digital capture (NSW Heritage Office, 2006) and How to prepare archival records (NSW Heritage Office, 1998). The resulting information should be used to aid in the interpretation of heritage in the area	Contractor	Detailed design / pre-construction	Additional safeguard
Non-Aboriginal heritage – Dellwood homestead	An archaeological research design and methodology will be prepared and submitted to the Heritage Council of NSW for approval under Section 140 of the <i>Heritage Act 1977</i> to investigate the archaeological potential identified. Dellwood has been assessed as possibly containing archaeological deposits that could provide information on life in the area in the 1890s that is not available from the historical records or elsewhere	Roads and Maritime	Detailed design/Pre-construction	Additional safeguard
Non-Aboriginal heritage – Dellwood homestead	The tanning tank has been identified as a rare item. The tanning tank will be relocated if feasible to a suitable institution for preservation and interpretation. The Hall School and Museum has expressed an interest in obtaining this item. Roads and Maritime will consult with the Hall School and Museum to come to an agreement on the relocation of the tanning tank	Roads and Maritime	Detailed design/Pre-construction	Additional safeguard

Other safeguards and management measures that would address non-Aboriginal heritage impact are identified in Sections 6.2.5 and 6.8.4.



## 6.6 Soil

Geotechnical and contamination investigations were carried out as part of the proposal. The Phase I Preliminary Site Investigation (AECOM, 2018d) for contamination is provided in Appendix I. The findings of this assessment and the geotechnical assessments carried out by SMEC (2018) is summarised below.

### 6.6.1 Methodology

#### ***Geology and soils***

A review of geology and soil landscape information was carried out using available reference material sources including soils and landscape maps (Jenkins B.R., 2000), geological maps (Colquhoun, G.P., 2013) and online databases. A geotechnical investigation was carried out by SMEC in June 2018 for the proposal and the site specific information is summarised below.

#### ***Contamination***

The assessment of potential sources of contamination in the construction boundary included a review of historical information to identify any known areas of potential site contamination, including:

- Previous site contamination reports
- Vehicle incident data provided by Roads and Maritime (from July 2013 and June 2017)
- Contaminated sites notified to the NSW EPA under Section 60 of the *CLM Act*
- Contaminated sites currently or formerly regulated by the NSW EPA (Record of Notices)
- Records of former gaswork sites
- Per- and Poly-Fluoroalkyl Substances (PFAS) investigation program (NSW EPA)
- Sites listed on the National Waste Management site database
- Historical business activities, aerial photographs, topographic and parish survey maps
- Registered groundwater wells
- Geology, soils, acid sulfate soil risk and dryland salinity potential
- Heritage sites
- Bushfire prone areas
- Ecological communities of interest
- LEP zones and Territory Plan Zones.

An inspection of the Dellwood homestead (with former tannery) was carried out on 31 May 2018 and the remainder of the construction boundary was inspected by two qualified professionals on 21 June 2018 to identify current land use features and areas of potential contamination concern.

After the identification of areas of contamination, a preliminary conceptual site model was developed taking into consideration potential contamination sources, exposure pathways and receptors in order to assess the risk of contamination.

## 6.6.2 Existing environment

### Topography

The land within and surrounding the construction boundary generally consists of undulating hills ranging from around 600 m Australian height datum (AHD) to around 640 m AHD. The land just south of Kaveney's Road and just north of the NSW/ACT border have the greatest elevation at around 640 m AHD. Land around one kilometre north of Spring Range Road and one kilometre north of Kaveney's Road, have the lowest elevation of around 595 m and 605 m AHD.

### Soils

The Canberra 1:100,000 Soil Landscape Sheet indicates that soils within the construction boundary are Williamsdale transferral, Ginninderra Creek alluvial and Burra transferral. The Williamsdale transferral is the most widespread throughout the construction boundary, with the Ginninderra Creek alluvial generally restricted to the lower elevations where creeks intersect, and the Burra transferral generally restricted to the higher elevations. Key characteristics and constraints of these soil type are as follows:

- Williamsdale: Soils are characterised by moderately deep, moderately well-drained yellow chromosols on red and brown kandosols (red and yellow earths on upper rises and fan elements). Soil landscape is limited by hardsetting being erodible and locally dispersible soils. They are typically acidic with seasonal waterlogging and typified by localised risk of flood hazard, run-on and dieback
- Burra: Soils are typically shallow (less than 60 cm) well-drained rudosols and tenosols on crests and upper slopes. Soils are strongly acidic with low fertility and low available water-holding capacity whereas subsoils have low permeability. Soils have a moderate risk of mass movement hazard (terracing), sheet erosion, run-on and localised shallow soils
- Ginninderra Creek: Soils are deep (greater than 100 cm) imperfectly drained sodic brown chromosols (brown and yellow podzolic soils) on margins of the unit and deep (greater than 100 cm), poorly drained stratic rudosols (alluvial soils) on floodplain elements. Soils are highly erodible with localised risk of flood hazard, run-on, waterlogging, gully erosion and wind erosion.

Williamsdale and Burra soil landscapes have a moderate risk of erosion while Ginninderra Creek soils are highly erodible and susceptible to gully erosion. The soil type within the construction boundary, identified from the Atlas of Australian Soils, is predominantly sodosol.

### Geology

Geological features within the construction boundary includes:

- Gullies and valleys: consist of Cainozoic alluvium and fluvial deposits including gravel, silt and sand. Lower elevations may also consist of Palaeozoic Mount Painter Volcanics including dacitic ignimbrite with lithic xenoliths and dacitic autoliths, minor tuff and ashstone
- Slopes: Palaeozoic Yass Formation interbedded shale and siltstone. Palaeozoic Mount Ainslie Volcanics of dacitic ignimbrite, minor ashstone, agglomerate and shale
- Higher elevations: Palaeozoic Deakin Volcanics including rhyodacitic ignimbrite and minor volcanoclastic and argillaceous sediments and Palaeozoic Mount Painter Volcanics.

There were no mapped areas of naturally occurring asbestos within the construction boundary.

### Salinity

The National Assessment of Dryland Salinity has indicated that the nearest area with a high hazard or risk of dryland salinity is found about 800 m north of Kaveney's Road, ie about 500 m north of the construction boundary. No saline soils are located within the construction boundary.

## Acid sulphate soils

The *Yass Valley LEP 2013* does not contain acid sulphate soils (ASS) maps. A search of the Australian Soils Resource Information System indicated a low likelihood of occurrence of ASS towards the southern part of the Barton Highway, within the construction boundary. Soil characterisation would confirm whether ASS is present within the construction boundary and if so inform detailed design and the CEMP.

## Contamination

Dellwood homestead located on Lot 1 Deposited Plan 846623 immediately north of the NSW/ACT border would be demolished as part of the proposal. Historical leather tanning activities may have occurred at the property, however only water, salt and native wattle bark were reportedly used during the tanning process. Due to the small scale of the tannery operation and inert materials used, contamination, if any would be isolated and localised and not expected to have impacted the construction boundary.

Areas of environmental concern identified by AECOM (2018d) within the construction boundary which may be sources of historical soil, surface water or groundwater contamination are detailed in Table 6-38.

Table 6-38 Areas of concern and contaminants of potential concern

Area of concern	Activity	Contaminants of potential concern	Risk
Parts of the construction boundary used for agriculture, mainly graziers with some former orchards	Use of pesticides	Arsenic, lead, organochlorines (OCPs), Organophosphates (OPPs), sodium tetraborate, carbamates, sulfur, synthetic pyrethroids	Low
	Use of herbicides	Ammonium thiocyanate, carbamates, OCPs, OPPs, arsenic, mercury, triazines	Low
	Use of fungicides	Carbamates, copper sulfate, copper chloride, sulfur, chromium, zinc	Low
	Potential buried farm waste (unknown locations)	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), OCPs, OPPs, asbestos	Low
Stockpiles north of Namina Road	Soil of unknown origin	Heavy metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and total xylenes (BTEX), semi-volatile organic compounds (SVOCs) including PAHs, phenols, OCPs, OPPs, polychlorinated biphenyls (PCBs), asbestos	Medium
Filled areas of the existing Barton Highway	Soil of unknown origin during construction of the Barton Highway in the early 1980s (pre POEO and CLM Acts 1997)	Heavy metals, TRH, BTEX, SVOCs including PAHs, OCPs, OPPs, PCBs, asbestos	Medium
Known and unknown locations along the verge of the Barton Highway	Historical traffic crashes resulting in fuel/oil spills and/or chemical spills	Lead, TRH, BTEX and PFAS	Medium

Potential for contamination in the construction boundary is considered low for agricultural areas but medium for stockpiles north of Nanima Road, fill areas of the existing Barton Highway and past fuel/chemical spills

along the verge of the highway due to crashes. In the event asbestos is detected during construction, it would be managed in accordance to waste management procedures describe in Section 6.11.

### 6.6.3 Potential impact

#### **Construction**

Development of the proposal requires significant earthwork to be carried out along the new northbound carriageway, temporary access roads and new service road. Earthwork would involve establishing temporary haulage roads, cut and fill activities and drainage work as well as stockpiling materials during construction of the proposal.

#### *Erosion and sedimentation*

Construction activities that could cause erosion and sedimentation include:

- Site clearing and grubbing work
- Bulk earthwork particularly cut and fill work in sloping terrain and forming slopes and batters. The cut and fill areas along the proposal is shown in Figure 3-1 to Figure 3-3.
- Movement of heavy machinery and vehicles on unpaved areas
- Drainage work including construction of cross drainage and waterways
- Temporary waterway crossings
- Stockpiling of materials at temporary compound areas or at other locations in construction boundary.

Considering that Williamsdale and Burra soil landscapes with a moderate risk of erosion and Ginninderra Creek soils which have a high risk of erosion occur within the construction boundary, ground disturbing construction activities, particularly cut and fill work, have the potential to cause significant erosion and sediment transport that could adversely impact water quality and aquatic life in receiving waterbodies. Erosion and sediment transport during significant weather events could also cause sediment to flow offsite impacting surrounding land uses.

Construction at waterway crossings, including at Gooromon Ponds and little Bedulluck Creek could result in erosion and sedimentation that directly impact waterways, creeks and aquatic ecosystems. A site specific SWMP would be prepared and implemented to minimise and control potential impact. A site specific ESCP would also be prepared and implemented as part of the SWMP.

Inadequately controlled stockpiles would be subject to water and wind erosion and could become a source of sediments that impact waterbodies and off site areas if not controlled. Siting of stockpiles would adhere to the criteria specified in Table 3-10 and stockpiles would be managed in accordance with Roads and Maritime *Stockpile Management Guideline* (Roads and Maritime, 2015d) throughout construction.

#### *Salinity*

Excavation of soil about 800 m north of Kaveney's Road has a high risk of unearthing saline soils which could change soil chemistry and result in highly saline runoff. Highly saline runoff from excavated material and stockpiles could adversely impact local vegetation, water quality of receiving watercourses and aquatic ecology as well as impede subsequent landscaping work. Soil testing would be warranted before excavation work at the northern end of the proposal to confirm the presence and extent of high saline soils to inform the CEMP.



### *Acid sulphate soil*

The presence of ASS could affect concrete drainage structures and water crossings and acidic leachate from excavated ASS could contaminate receiving surface waters if not properly managed. Soil characterisation would confirm the presence of ASS within the construction boundary and inform detailed design and the CEMP.

### *Contamination*

Excavation work within the construction boundary may unearth contaminated material that could pose a health risk to construction workers or residential dwellings in the vicinity of the working area, nearby terrestrial habitats, freshwater aquatic ecosystems in Little Bedulluck Creek and Gooromon Ponds and associated tributaries and dams as well as shallow groundwater used for domestic and stock watering purposes.

The Phase I Preliminary Site Investigation (AECOM, 2018d) concluded that the stockpiles north of Nanima Road from an unknown source, areas of fill from an unknown source used in the construction of Barton Highway and spills and leaks associated with historical traffic crashes pose a medium risk to human and ecological receptors during construction. As the identified sources of potential contamination are widespread and point sources are unknown (with the exception of the existing stockpiles and known vehicle crash sites), it is recommended that soil characterisation is carried out in those locations requiring excavation of soil and fill materials, so that excavated materials can be appropriately managed and disposed or re-used.

Plant and equipment that would be used for the proposal are listed in Table 3-6. The storage and use of fuel, oil and chemicals for operation and maintenance of these plant and equipment if not properly managed could result in localised soil contamination with the potential to migrate to surface water or leach/migrate into shallow groundwater. This could occur at the construction compounds or at other parts of the construction boundary during construction activities. This risk would be managed by provision of adequate secondary containment for fuel and chemical storage areas, and establishing storage, handling and spill response procedures in the CEMP.

### *Operation*

During operation of the highway all formed slopes and batters, road verge, median, drainage channels and riparian areas in the vicinity of crossings would have been stabilised with top soil, hydromulching, landscaping or by other methods. Potential for erosion and sedimentation during the operation stage is anticipated to be negligible. During operation there is a potential for erosion upstream and downstream along the highway alignment including scouring in the vicinity of crossings and cross drainage if inadequately designed. All crossings and cross drainage have been designed to cater for 100 year ARI high flow events as described in Section 3.3.9.

During operation of the proposal there is only minor risk of land contamination, which would be from spillage and leakage from vehicle crashes including fuel or chemicals from tankers. Spillages during the operation of the highway would be managed by implementation of emergency spill response measures. With the implementation of emergency spill response measures, the potential impact of the proposal during the operation phase is considered to be negligible.

## 6.6.4 Safeguards and management measures

The recommended safeguards and management measures for soil and land contamination is provided in Table 6-39.

Table 6-39 Soil and land contamination safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	<p>A SWMP will be prepared and implemented as part of the CEMP in line with Roads and Maritimes QA G38 – ‘Soil and Water Management’. 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. The SWMP will be prepared in accordance with:</p> <ul style="list-style-type: none"> <li>• The Blue Book – ‘<i>Managing Urban Stormwater: soils and construction Volume 1</i>’ (Landcom 2004) and Volume 2D (DECC 2008)</li> <li>• Technical Guideline: <i>Temporary Stormwater Drainage for Road Construction</i> (Roads and Maritime 2011b)</li> <li>• <i>Guideline for Batter Surface Stabilisation Using Vegetation</i> (Roads and Maritime, 2015b)</li> </ul> <p>The SWMP and CEMP will detail site specific measures to ensure compliance to stipulated EPL conditions</p>	Contractor	Detailed design / pre-construction	Section 2.1 of QA G38 <i>Soil and Water Management</i>
Soil and water	<p>A site specific ESCP will be prepared and implemented as part of the SWMP. The Plan will include 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. The ESCP will also include:</p> <ul style="list-style-type: none"> <li>• A maintenance schedule for ongoing maintenance of temporary erosion and sediment controls</li> <li>• A sediment basin management plan to guide appropriate management of runoff during construction and operation</li> <li>• A site specific emergency spill plan, which will include spill management measures in line with the Roads and Maritime <i>Code for Proactive for Water Management</i> (RTA 1999) and</li> </ul>	Contractor	Detailed design / Pre-construction	Section 2.2 of QA G38 <i>Soil and Water Management</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	relevant NSW EPA guidelines. This plan will include measures to be implemented in the event of a spill			
Soil and water – soil erosion and water quality	<p>A Roads and Maritime approved soil conservationist will be engaged to provide advice on erosion and sediment control, including progressive preparation of the ESCP. The soil conservationist must regularly (at least once a month and before and after rain events) review and inspect work throughout construction and provide written recommendations on the ESCP drawings and the effectiveness of controls used.</p> <p>Controls will be implemented before topsoil removal and start of earthwork within the catchment of each structure. This includes construction of sediment basins and other water quality structures</p>	Contractor	Construction	Additional safeguard
Acid sulphate soil	Soil sampling will be conducted before earthwork to confirm the presence of acid sulphate soils within the construction boundary to inform the design and CEMP	Contractor	Detailed design / Pre-construction	Additional safeguard
Acid sulphate soil	Potential for actual acid sulphate soils are to be managed in accordance with the Roads and Maritime Guidelines for the <i>Management of Acid Sulphate Materials 2005</i>	Contractor	Construction	Standard safeguard
Erosion and sedimentation	<p>Proactive and appropriate erosion and sediment control will be implemented, including:</p> <ul style="list-style-type: none"> <li>Sediment and erosion controls (including sediment basins), clean water diversions and culverts will be constructed and be on line before earthwork commence</li> <li>Sediment basins will be regularly serviced and maintained to comply with water quality and capacity requirements</li> <li>Vegetation clearing and stabilisation/revegetation activities will be carried out progressively to limit the time disturbed areas are exposed to erosion processes</li> </ul>	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>Site stabilisation of disturbed areas will be carried out progressively as stages are completed</li> <li>Topsoil and mulch will each be stockpiled separately for possible re-use in rehabilitation work. Mulch may also be used for erosion and sediment controls</li> <li>High risk soil erosion activities such as earthwork will not be carried out immediately before or during high rainfall or wind events</li> <li>Any material transported onto road surfaces will be swept and removed at the end of each working day</li> <li>Erosion and sediment control measures will be maintained until the work is complete and areas are stabilised</li> <li>Work areas are to be stabilised progressively during the work</li> </ul>			
Erosion and sedimentation	The maintenance of established stockpile sites is to be in accordance with the Roads and Maritime <i>Stockpile Site Management Guideline</i> (EMS-TG-10)	Contractor	Construction	Standard safeguard
Contaminated land management plan	<p>A Contaminated Land Management Plan (CLMP) will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Roads and Maritime, 2013a) and implemented as part of the CEMP. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>Identification of potentially contamination land through monitoring: <ul style="list-style-type: none"> <li>For discolouration or staining of soil</li> <li>Bare soil patches both on-site, and off-site adjacent to site boundary</li> <li>Visible signs of plant stress</li> <li>Present of drums or other waste material</li> <li>Presence of stockpiles or fill material</li> <li>Odours.</li> </ul> </li> <li>Carrying out further contamination assessment where necessary and advising on the need for remediation or other action. This includes further</li> </ul>	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>



Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>investigation of any unexpected contamination finds.</p> <ul style="list-style-type: none"> <li>• Diversion of surface runoff away from the contaminated land.</li> <li>• Management of any surface runoff contaminated by exposure to the contaminated land</li> <li>• Assessment of any requirement to notify relevant Authorities, including the EPA</li> <li>• Management of any remediation and subsequent validation, including any certification required</li> <li>• Review and updating the plan</li> </ul>			
Contaminated land	<p>If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA</p>	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
Contaminated land - assessment of excavation areas	<p>Soil characterisation will be carried out before construction in areas where excavation of soil is required to:</p> <ul style="list-style-type: none"> <li>• Assess the presence of contamination and risks posed to construction workers and the environment, so that appropriate controls can be adopted during construction</li> <li>• Chemically classify the soil in situ, for off-site disposal to licensed landfill in accordance with the NSW EPA (2014) <i>Waste Classification Guidelines or applicable Resource Recovery</i> exemption order or assess for re-use within the construction boundary</li> <li>• A Sampling, Analysis and Quality Plan (SAQP) will be prepared for soil investigation/material characterisation in accordance with the <i>National Environment Protection (Assessment of Site Contamination) Measure 2013</i>. The SAQP will detail:</li> </ul>	Contractor	Detailed design / Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>Data quality objectives and data quality indicators</li> <li>Justification of the number, density and sampling locations based on the potential for contamination, excavation extent and quantities requiring off-site disposal</li> <li>Analytical suite and schedule, including contaminants of concern identified in this contamination impact assessment</li> <li>Assessment criteria for on-site reuse for the land use and waste classification</li> <li>Sampling and laboratory methodologies, field and laboratory quality assurance and control.</li> </ul> <p>Documentation will be prepared with reference to the Roads and Traffic Authority of NSW (RTA) 2005, <i>Contaminated Land Management Guideline</i>, April 2005, Roads and Traffic Authority of NSW (RTA), Sydney, Australia</p>			
Asbestos management	Asbestos removal must be carried out in accordance with <i>Working with Asbestos: Guide 2008</i> published by WorkCover Australia	Contractor	Construction	Standard safeguard

Other safeguards and management measures that would address accidental spills and surface water impact are identified in Sections 6.7.4 and 6.12.2.

## 6.7 Water

This section assesses the potential impact of the proposal on surface water, groundwater and flooding. The findings of these assessments have informed the development of the drainage design for the proposal that meets water sensitive urban design standards.

### 6.7.1 Methodology

#### **Water quality**

The water quality assessment included:

- Review of water quality data provided by Waterwatch and from the Waterwatch Upper Murrumbidgee Catchment Health Indicator Program
- Review of aerial photography and mapped hydrology data to identify local farm dams and the characteristics of local waterways
- Use of the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) modelling software to assess pollutant loading during existing and proposed conditions
- Review of background groundwater data from the Bureau of Meteorology and NSW Department of Primary Industries – Office of Water databases
- Interpretation of geotechnical investigations carried out for the proposal
- Qualitative assessment of potential impact to the water quality, hydrology and geomorphology of local surface water features.

MUSIC modelling included identification of:

- Catchment areas upstream of the proposal, waterways and creeks (see Figure 6-18)
- Existing water quality conditions which incorporated swales to treat runoff from the existing highway
- Proposed conditions with no treatment of runoff from new road pavements
- An assessment of the residual pollutant loads based on the assumption that swales remove 85 per cent of total suspended solids and 65 per cent of total phosphorus generated from new road pavements.

#### **Flooding**

An assessment of existing flooding conditions within the hydrological study area was carried out including the identification of potential flooding impact that may occur as a result of the proposal and relevant mitigation. This included:

- Review of ground survey data, reference design and MUSIC model (described above)
- Determination of key flood design criteria for the new northbound carriageway, including flood immunity and desirable limits on potential increases in peak flood levels
- Refinement of the TUFLOW and XP-RAFTS models (the 'flood model') and their use to characterise existing flooding conditions, as well as to assess potential flooding impact during operation of the proposal. The TUFLOW model boundary presented in Figure 6-19 shows the extent over which flooding and erosion conditions have been assessed
- Qualitative assessment of potential flooding impact during construction of the proposal
- Development of relevant safeguards and management measures for construction and operation.

## 6.7.2 Existing environment

### *Hydrology*

The construction boundary is located within the Murrumbidgee catchment which has an area of around 84,000 square km. The annual average total rainfall in the region is 682 mm, with the months of July, August and November typically being the wettest (Bureau of Meteorology, 2018).

The majority of the construction boundary is located within the sub-catchments of Gooromon Ponds and its sub-catchment Little Bedulluck Creek which are part of the Ginninderra Creek catchment. The northern extents of the construction boundary is located in the Jeir Creek catchment. Regional catchments and hydrological features are shown in Figure 6-17.

The majority of the catchment area that generates runoff in the construction boundary has been cleared for agricultural use, with only small pockets of remnant bushland remaining. Several rural residences and associated farm sheds, outbuildings and shelters are located within the construction boundary, though generally these are offset from both the existing highway and waterways.

The existing highway is crossed by 31 culverted waterways with contributing catchment areas ranging from a few hectares to more than 20 square km, all of which ultimately drain to the Murrumbidgee River. From the NSW/ACT border moving north to about CH23000, surface water generally drains east to west across the highway corridor and forms part of the Gooromon Ponds catchment. North of CH23000, surface water generally drains west to east across the highway and forms part of the Jeir Creek catchment.

Gooromon Ponds, Little Bedulluck Creek and a number of ephemeral waterways cross the proposal. Various farm dams are also located within or near to the construction boundary. There are no Ramsar wetlands near to the construction boundary.

Gooromon Ponds is an ephemeral creek with intermittent pools (Waterwatch, 2017). The creek traverses the existing highway at around CH20230, before flowing south westerly to its confluence with Ginninderra Creek, around three km south west of the southern extent of the proposal. Ginninderra Creek discharges to the Murrumbidgee River, around 1.7 km west of the Gooromon Ponds confluence.

Little Bedulluck Creek, a tributary of Gooromon Ponds is an ephemeral creek which flows south westerly, crossing the highway corridor at around CH20800 before meeting its confluence with Gooromon Ponds around 400 m west of the construction boundary.

The majority of the ephemeral unnamed waterways which traverse or are immediately downstream of the existing highway drain to either Gooromon Ponds Creek or Little Bedulluck Creek. However, the catchment in the northern extents of the proposal drains via an unnamed waterways to a confluence with Jeir Creek around 2.4 km to the north of the construction boundary. The local hydrology and extent of catchments upstream of the construction boundary are presented in Figure 6-18.

### *Water quality and waterway health*

Gooromon Ponds contains sections of moderate erosion and extensive areas with low habitat value and degraded riparian condition, typical of waterways impacted by farming practices in the region (Waterwatch, 2017). The waterway health of Gooromon Ponds Creek was reported (Waterwatch, 2017) to be fair, based on good water quality, poor macro-invertebrate abundance and degraded riparian condition.

Sampling data was obtained from Waterwatch (2018) for Little Bedulluck Creek and Gooromon Ponds. A summary of the water quality data and Waterwatch's more general water quality assessment of Gooromon Ponds waterway is provided in Table 6-40, with the Australian and New Zealand Environment Conservation Council (ANZECC, 2000) trigger values for slightly to moderately disturbed ecosystems for reference. Water quality was representative of a rural waterway slightly affected by agricultural practices. The monitoring locations are shown in Figure 6-17.



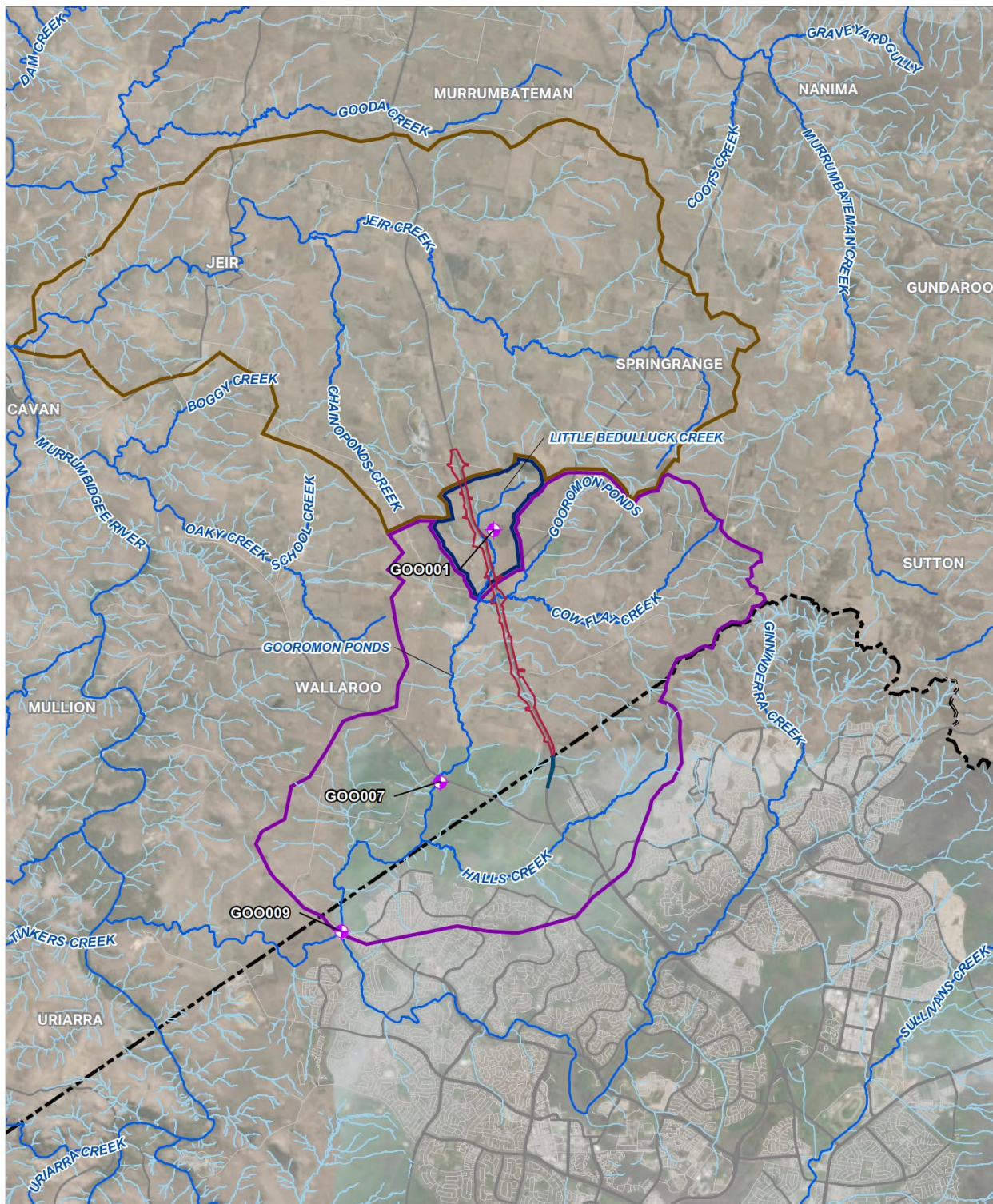


FIGURE 6-1: REGIONAL HYDROLOGY

**AECOM**



**Legend**

- Construction boundary
- ACT section of proposal
- Named watercourse
- Waterway
- Water quality monitoring location

**Catchments**

- Little Bedulluck Creek Catchment
- Gooromon Ponds Catchment
- Jeir Creek Catchment

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Figure 6-17 Regional hydrology



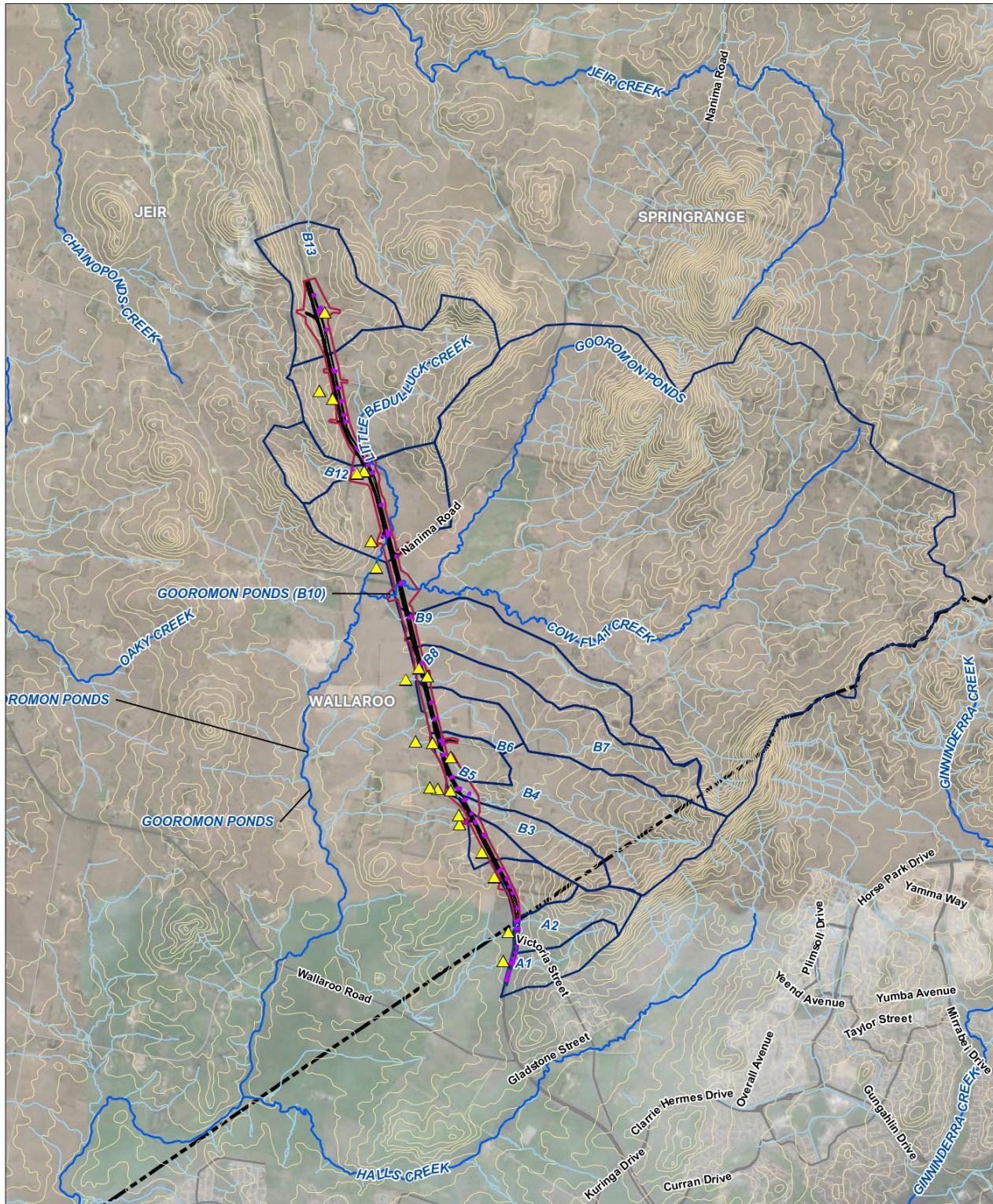
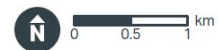


FIGURE 6-2: LOCAL HYDROLOGY

**AECOM**



**Legend**

- Project area
- Catchments upstream of road corridor
- ▲ Farm dam within close proximity
- Existing culvert
- Named watercourse
- Waterway
- 10m contour

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Figure 6-18 Local hydrology



Table 6-40 Local water quality summary

Description	ANZECC (2000) <sup>3</sup>	GOO007		GOO001		GOO009
Waterway	-	Gooromon Ponds		Little Bedulluck Creek		Gooromon Ponds
Reference	-	Waterwatch (2018) <sup>4</sup>		Waterwatch (2018) <sup>4</sup>		Waterwatch (2017) CHIP <sup>1</sup>
No. of Samples	-	212		59		-
Statistic	Trigger value	Max	Median	Max	Median	-
Temperature (°C)	-	29	15	23	14	-
pH (pH units)	6.5 – 8.0	6-8.7	7.4	6 - 9.4	8.1	Excellent
Electrical Conductivity (µS/cm)	125 - 2200	2813	1230	1078	320	Degraded
Turbidity (NTUs)	50	100	10	60	30	Excellent
Phosphorus (mg/L)	0.05	0.23	0.02	0.01 <sup>2</sup>	0.01 <sup>2</sup>	Excellent
Dissolved Oxygen (mg/L)	-	11.2	6	7.8 <sup>2</sup>	7.8 <sup>2</sup>	Degraded
Nitrates (mg/L)	0.04	25	0	1 <sup>2</sup>	1 <sup>2</sup>	Good

<sup>1</sup> Waterwatch Upper Murrumbidgee, Catchment Health Indicator Program 2016-17

<sup>2</sup> Only one sample was collected for phosphorus, dissolved oxygen and nitrates

<sup>3</sup> ANZECC (2000) 'freshwater' default trigger values for slightly to moderately disturbed systems.

<sup>4</sup> Waterwatch Upper Murrumbidgee, water quality monitoring data. Provided by Waterwatch (01/08/2018)

### Sensitive surface water receivers

Sensitive surface water receivers in the construction boundary are described in Table 6-41.

Table 6-41 Sensitive surface water receivers

Potentially sensitive environments	Sensitive Receivers
Type 2/3, Class 2/3 waterways <sup>1</sup>	See Section 6.3.2 for creeks and waterways which are classified as Type 2/3, Class 2/3 waterways.
Farm dams	Farm dams within the proposed impact area and up to 200 m downstream of discharge points. The sensitive farm dams are shown in <a href="#">Figure 6-18</a> .
Threatened aquatic habitat and species	Threatened aquatic habitat and species within 500 m of discharge points. See Section 6.3 for identification of any threatened aquatic habitat and species.

<sup>1</sup> As described in the Policy and guidelines for fish habitat conservation and management (NSW DPI, 2013)

## Groundwater

The Hydrogeology Map of Australia describes aquifers within the construction boundary as fractured or fissured and extensive with low to moderate productivity. A search of the NSW Department of Primary Industries – Office of Water and the BOM datasets identified 35 registered groundwater bores within one kilometre of the proposal (see Appendix J). Four groundwater bores are located within the construction boundary.

Groundwater data identifies that a shallow aquifer between around six metres below ground level (bgl) and 20 m bgl may be present within the construction boundary. A deeper aquifer may also be present at anticipated depths between 35 m bgl and 55 m bgl. Geotechnical investigations (SMEC, 2018) recorded shallow groundwater levels within the construction boundary that ranged from 1.93 m bgl to 10.8 m bgl.

Groundwater bores within the construction boundary could be used for irrigation, domestic, stock, industrial and general use purposes. The shallow aquifer is considered moderately vulnerable to contamination given the likelihood of a shallow water table at less than two metres bgl in some areas. Groundwater is considered to be fresh/good quality (low salinity < 500-1,000 milligrams per litre) in the vicinity of the construction boundary.

There are no drinking water catchments in the construction boundary.

## Flooding

The existing flooding condition relevant to the proposal for a range of flood events, which may occur as a result of small frequent rainfalls ranging up to rare and extreme storm events is shown in Figure 6-19 to Figure 6-22.

Transverse drainage structures in the form of either reinforced concrete pipes or reinforced concrete box culverts convey runoff across the existing highway. There are 31 waterways with existing transverse drainage structures within the construction boundary. Appendix J provides a summary of the 31 existing transverse drainage structures that have been identified by recent ground survey. These range in size from small single cell pipe culverts with a minimum diameter of 375 mm up to large multi-cell box culverts measuring close to 10 m in total width.

Appendix J also provides a summary of the assessed flood immunity of the existing highway at the location of each existing transverse drainage structure, based on interpretation of the flood model results for several design storm events. It should be noted that this assessment considers only whether flooding (of any depth) of the existing highway occurs, and that surcharging of structures along the upstream side of the highway may occur for more frequent events. In summary, the existing highway was found to have variable flood immunity, ranging from less than five year ARI to greater than 500 year ARI.

Locations where flood immunity is less than five year ARI generally relate to small catchments with relatively low runoff potential and where the capacity of roadside drains is likely the limiting factor. Flows on the highway are expected to be minor only with associated shallow depths of flow, and may not significantly affect vehicle passage.

For the larger crossings at Gooromon Ponds and Little Bedulluck Creek, flood immunity is in the range 20-50 year ARI. It is noted that flows overtopping the highway at these locations are associated with more significant and hazardous flow depths and velocities across the full width of the highway that would likely make the highway impassable in both directions for a period of time, potentially in the order of one to two hours but highly dependent on the unique storm rainfall characteristics.

Anecdotally there has not been a storm event which has led to a significant temporary closure of the existing highway within the construction boundary for at least 10 years.



### *Existing flooding conditions*

Beyond the immediate carriageway of the existing highway, a broader assessment of existing flooding conditions within the hydrological study area was carried out using the flood model. The purpose of this assessment was to establish baseline flooding conditions in sufficient detail to identify areas of potential sensitivity to adverse flooding impact, and to inform drainage requirements.

Figure 6-19, Figure 6-20, Figure 6-21 and Figure 6-22 shows existing flooding conditions of the existing highway and indicative flood extents and depths for the five, 100, 200 and 500 year ARI design event respectively.

Key observations from the modelling of existing flood conditions include:

- Extensive out of bank flow occurs both upstream and downstream of the highway corridor for the 100 year ARI event. This engages large areas of floodplain used predominantly for agriculture and grazing and, closer to the highway, results in flows combining and pooling where existing highway transverse drainage structures have insufficient capacity to convey the local catchment runoff
- Overtopping of the existing highway occurs at several locations along the length of the proposal. This requires detailed consideration as part of future design development in order to ensure that overtopping flows can be captured within the median between the existing and new northbound carriageway, and safely discharged to an appropriate receiving waterway
- During a five year ARI event flow velocities may become erosive (exceed two metres per second) within Gooromon Ponds and the un-named waterway at CH17800.

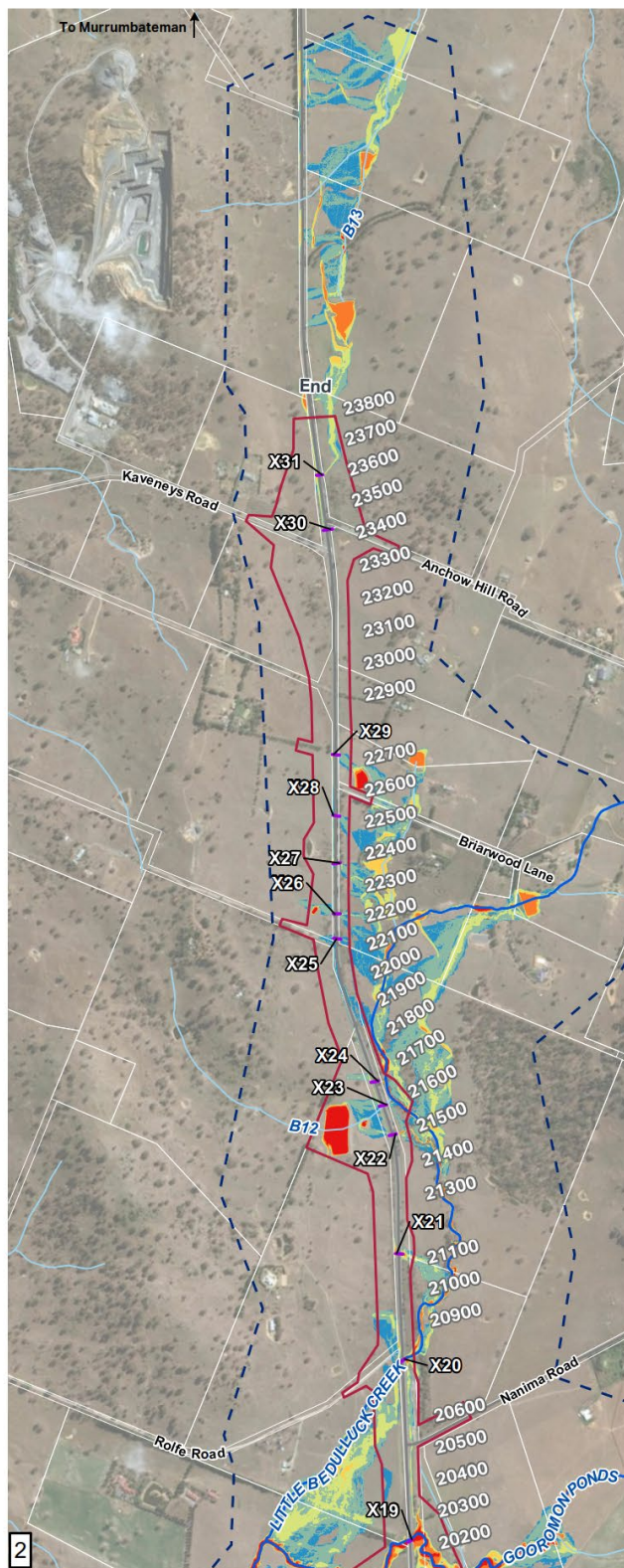
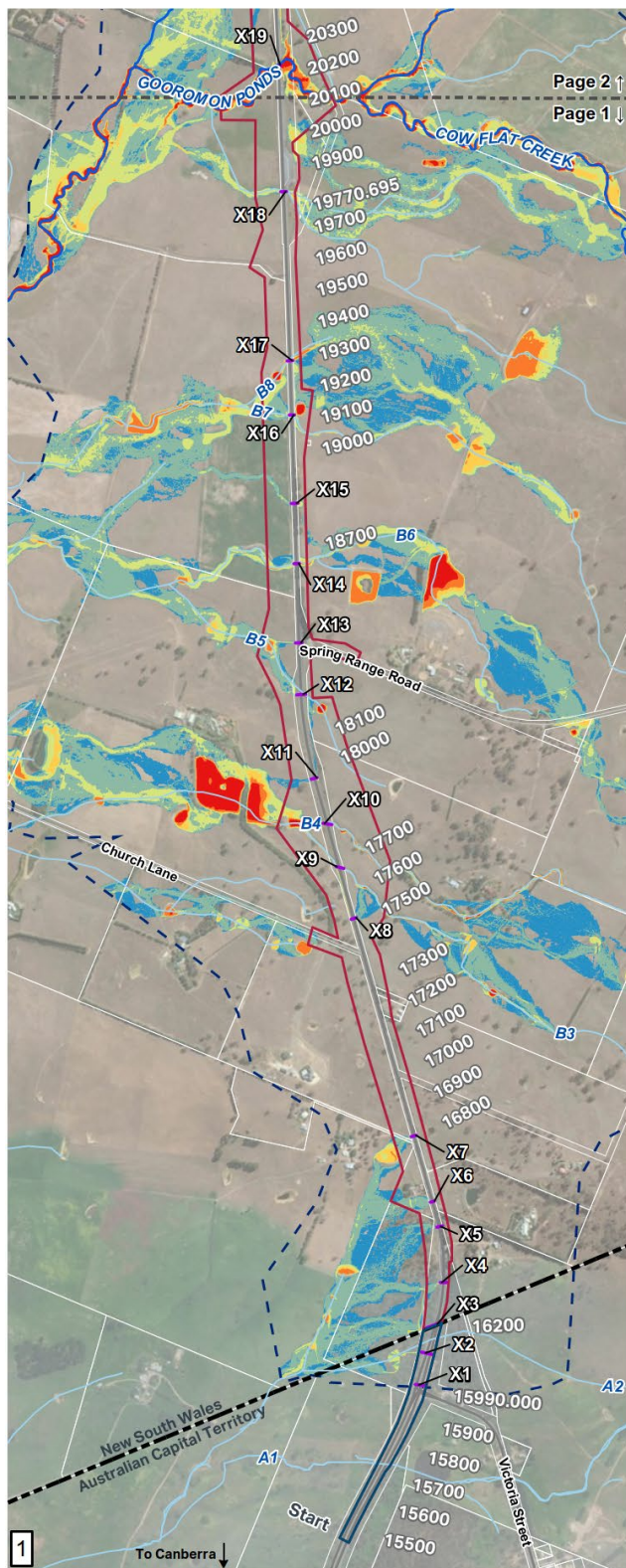
### *Areas of potential sensitivity to adverse flooding impact*

Hydraulic categorisation mapping shows significant flow zones (mapped as Floodways) are likely to occur at CH17800, CH19300, CH19780 and Gooromon Ponds. Flooding in these areas is likely to be sensitive to increased obstructions across the floodplain and blockage conditions.

Existing rural residences are shown to lie outside the extent of flooding for events up to and including the 500 year ARI. It is however noted that a number of smaller structures (eg non-habitable sheds and shelters) are affected by flooding of this magnitude.

Other areas of potential sensitivity to adverse flooding impact, including significant changes to flow patterns and diversion of flows, include:

- Existing farm dams
- Existing waterways with little or no riparian vegetation or which are otherwise prone to scouring and erosion
- Other environmentally sensitive areas including waterways with fish habitat potential or riparian corridors next to identified threatened habitat and/or species.



#### FLOOD DEPTHS - 5YR ARI KEY

- Construction boundary
- ACT section of proposal
- Existing transverse drainage
- TUFLOW model boundary
- Named watercourse
- Waterway

#### Flood Depth (m)

- 0 - 0.01
- 0.01 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1



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Figure 6-19 Existing flood conditions – 5 year ARI



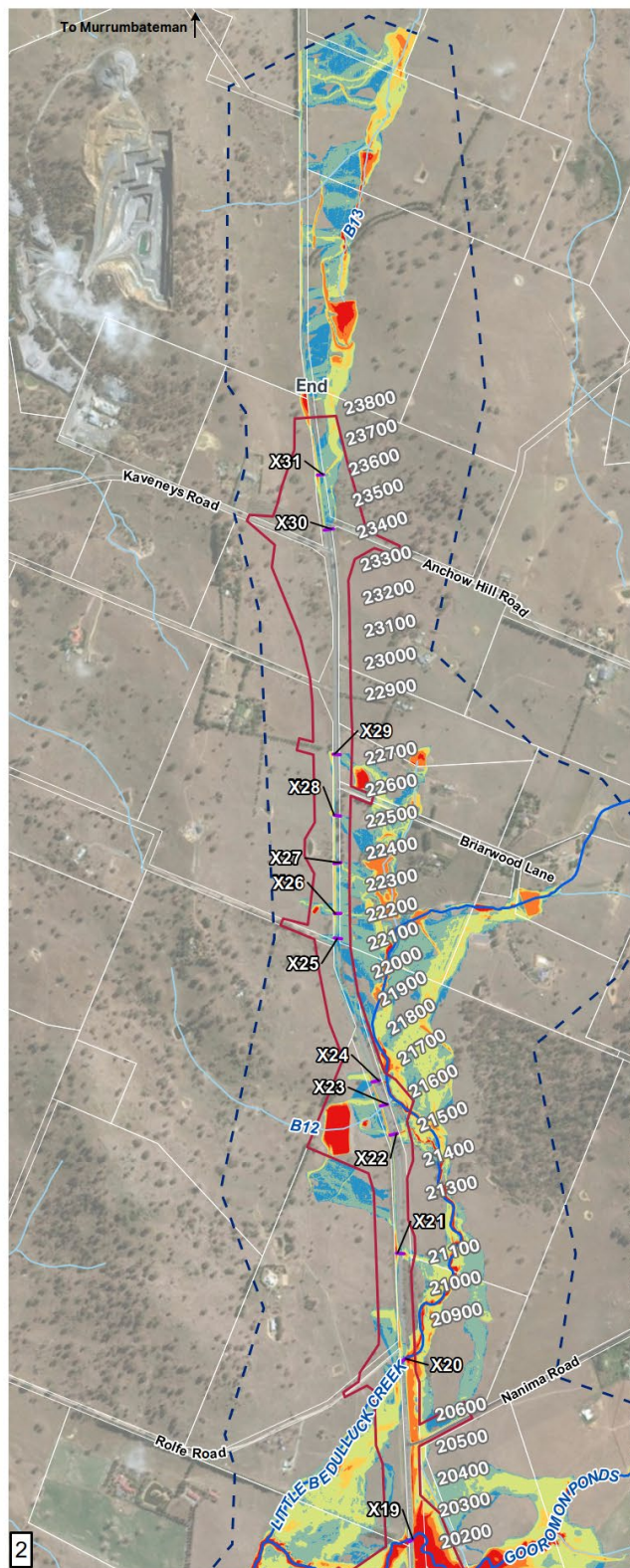
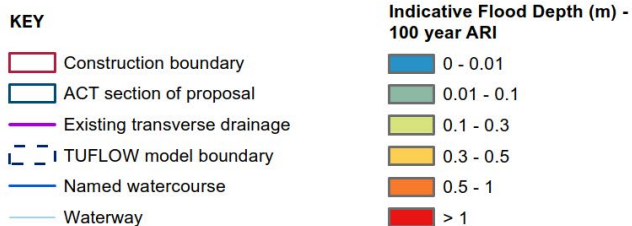
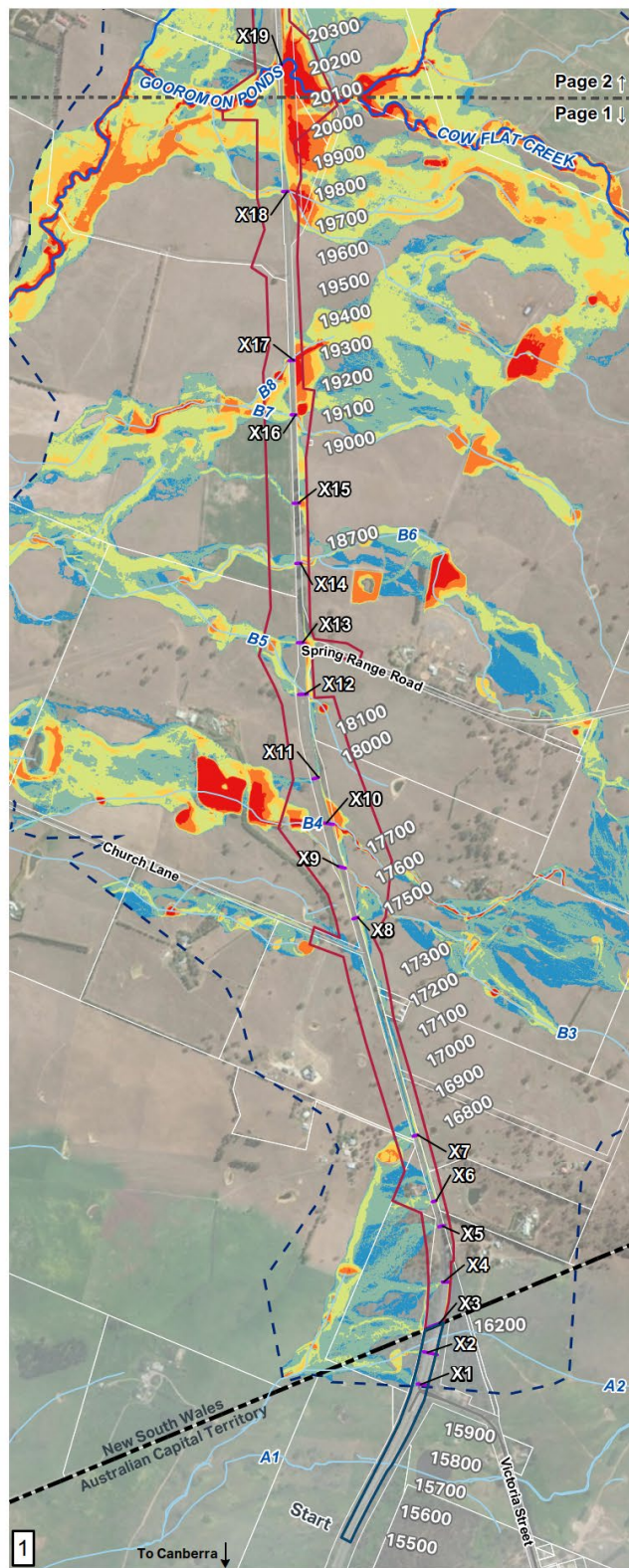


Figure 6-20 Existing flooding conditions – 100 year ARI



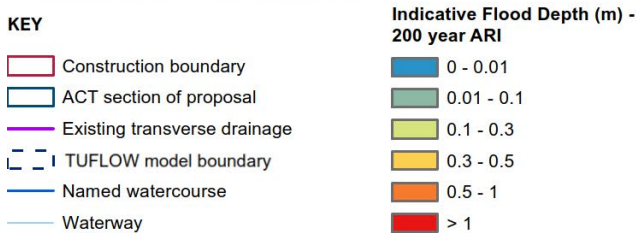
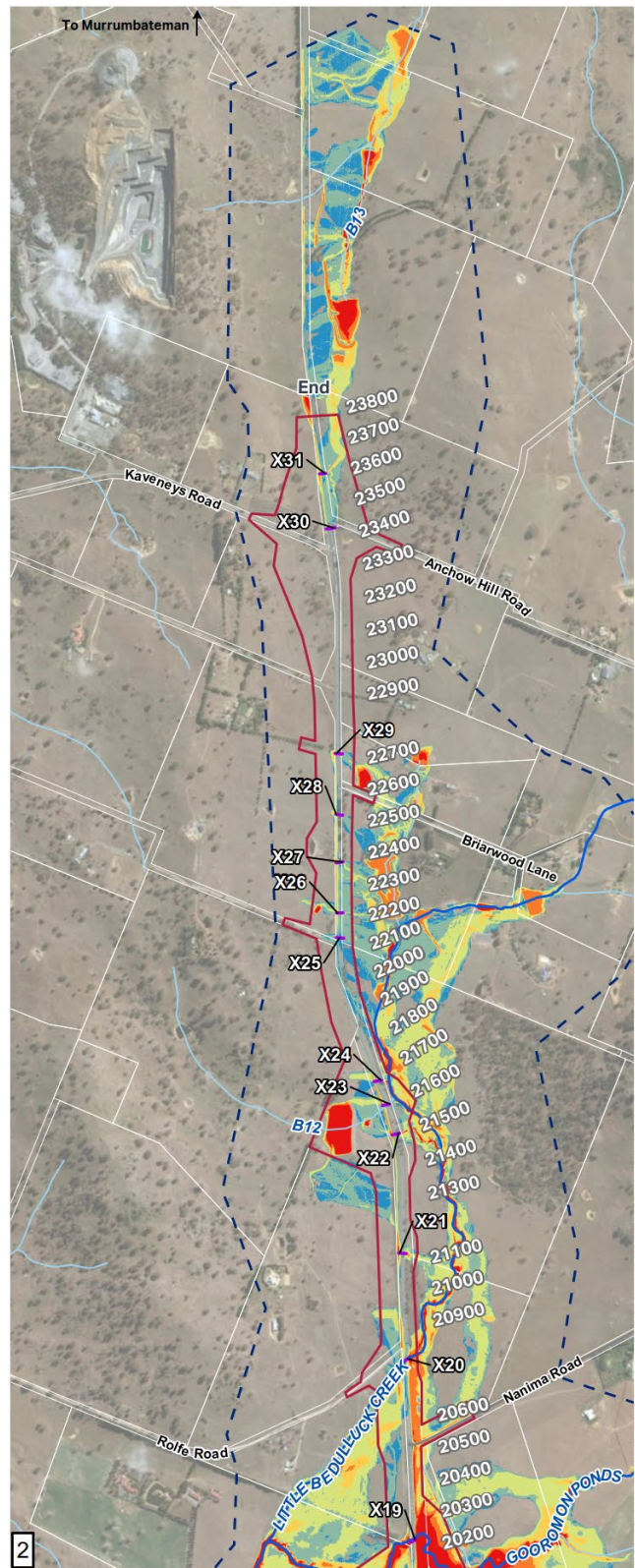
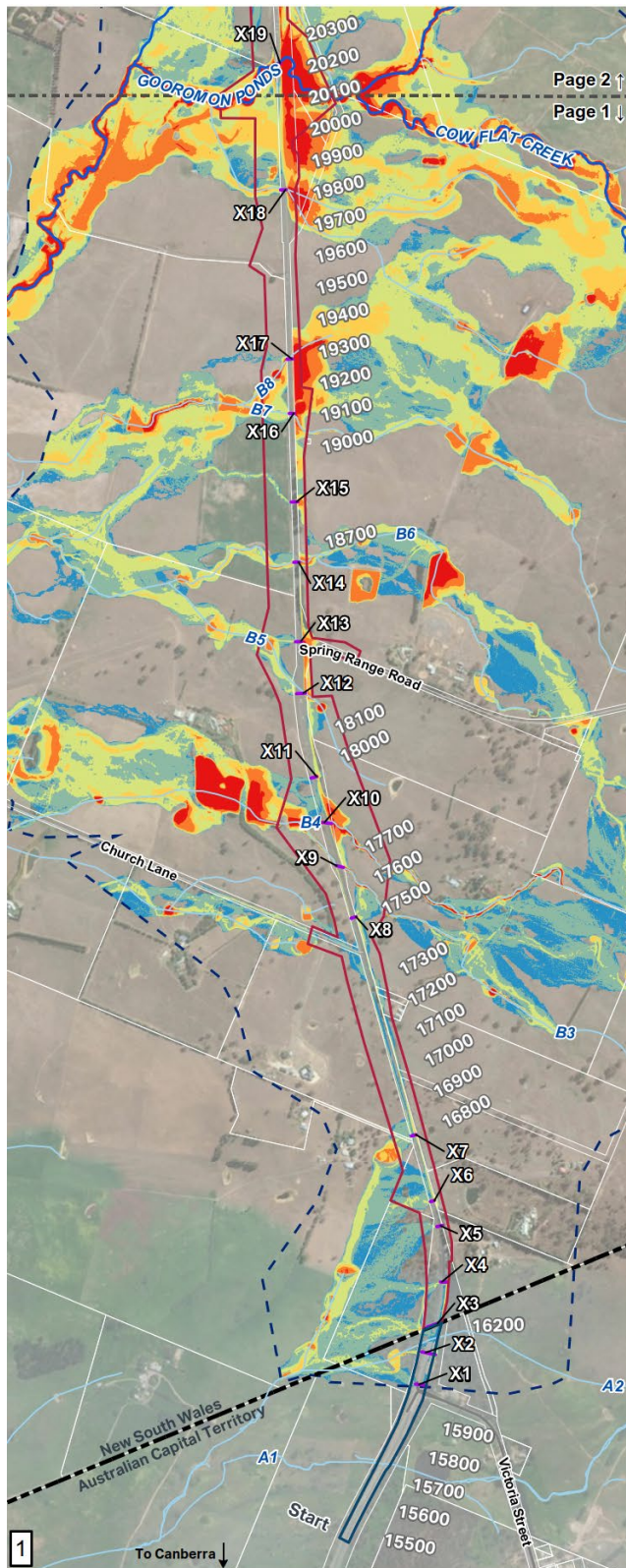


Figure 6-21 Existing flooding conditions – 200 year ARI





## 6.7.3 Potential impact

### **Construction**

#### *Surface water*

Construction of the proposal has the potential to impact on water quality due to erosion and sedimentation. During site establishment vegetation would be removed and topsoil stripped, leaving underlying soil material exposed. Exposed soils are susceptible to erosion which could result in sedimentation of nearby downstream ephemeral creeks, waterways and hydrologically connected farm dams. Erosion of stockpiles and excavated spoil, fill and other erodible materials could also result in sedimentation of the creeks, waterways and farm dams if not managed appropriately.

During construction, temporary sediment control measures would be used to improve the quality of surface water before discharge. This would include use of temporary sediment basins in conjunction with localised treatments such as sediment fences, bunding and clean water diversions and the protection of existing stormwater pits (eg with sand bags). The locations and the design of the sediment basins would be refined during detailed design and detailed in ESCPs.

The construction of new waterway crossings and extension of existing culverts would temporarily disturb the bed and banks of affected creeks and waterways. Instream sediment controls which are appropriate for ephemeral waterways (such as instream sediment traps) would be installed to control sedimentation impact during low flow periods. All disturbed waterways would be stabilised, rehabilitated, monitored and maintained to adequately restore the integrity of the waterway and riparian corridor.

There is also potential for pollution of downstream waters to occur in the event of an accidental spill or major leakage of fuels, oils or other potentially harmful substances during a rainfall event or through mobilisation of soils to waterways once contaminated. Spill management measures and procedures would be implemented during construction to manage potential impact (see Section 6.7.4).

A number of farm dams could potentially be disturbed as a result of the proposal or their catchments altered resulting in reduced water inflow. Nine farm dams are located within the construction boundary, with one dam directly impacted by the alignment of the new northbound carriageway. Where feasible, farm dams would be retained and protected. Property owners would be consulted if farm dams could potentially be disturbed by the proposal to agree on a suitable mitigation approach.

With consideration to the proposed environmental safeguards (see Section 6.7.4), the impact of the proposal on water quality, geomorphology and low flow hydrology is expected to be minor during construction.

The construction of new waterway crossings, extension of existing culverts or temporary diversion of Gooromon Ponds or Little Bedulluck Creek would temporarily disturb the bed and banks of affected creeks and waterways.

#### *Groundwater*

Construction activities have the potential to impact groundwater levels as a result of changes to groundwater flow patterns, recharge and discharge characteristics of the construction boundary. Deep excavations and cuttings for the proposal may experience groundwater inflows as a result of intercepting groundwater. Preliminary assessments indicate that groundwater would seep into cuttings of greater than around two metres. Additional geotechnical investigations and modelling would be carried out during the detailed design phase of the proposal to determine the degree of seepage that may occur at exposed cuttings.

Temporary dewatering may also be required to maintain dry working conditions within excavations of greater than around two metres. This would likely draw down local groundwater levels in the immediate



vicinity of the excavation. The original groundwater flows would be re-established once dewatering is complete.

Excavation for cuttings beneath the watertable or intersecting perched groundwater also has the potential to reduce groundwater recharge as a result of groundwater draining into waterways, culverts, or creeks. Compaction of shallow soils in areas of unconsolidated alluvial sediments, and the construction of access roads, tracks and stockpiling areas could also reduce rates of recharge.

Construction activities may also impact on the water quality of groundwater. Fuel and chemical spills including petrol, diesel, hydraulic fluids, lubricants and explosive residues could potentially contaminate groundwater, particularly if a leak or spill occurs on highly permeable sandy soils. Spills as a result of accidents could occur during construction, refuelling operations or from storage areas.

Four groundwater wells located within the construction boundary would be directly impacted and would likely need to be decommissioned. Two wells are used for industrial purposes (GW037880 and GW037881) and the other two wells are used for domestic and/or stock purposes (GW054372 and GW401315). The loss of these groundwater sources would directly impact local landowners if being actively used. In addition, the proposal could result in contamination of groundwater through these wells if they are decommissioned incorrectly. Consultation would be carried out with land owners during land acquisition to address the loss and possible replacement with wells of equivalent capacity or compensation for the loss of the groundwater wells impacted. Although unlikely, if groundwater is to be used for construction, a license would be required under the WM Act.

### *Flooding*

Potential adverse flooding impact associated with construction of the proposal are primarily associated with blockage or diversion of flow paths by the inappropriate location of temporary facilities and work including temporary compound areas, access roads, fencing, stockpiles and other temporary work. Flow diversions could result in potentially sensitive areas being impacted by flooding more frequently, with higher severity, or both.

Indicative ancillary facility locations have been identified, and these are shown in Figure 3-7 to Figure 3-9. As noted in Section 3.4, the site selection process has given consideration to potential flood risk and offsets from existing waterways. As these sites are subject to confirmation during future design development, at this stage it is sufficient to identify the issue as a broad risk, and to ensure that adequate safeguards and management measures are captured to mitigate the risk to an acceptable level. These are included in Section 6.3.4.

## **Operation**

### *Surface water*

Road runoff typically contains pollutants such as sediment, nutrients, heavy metals (typically bound to sediments) and spilled/leaked fuels and oils which could potentially impact the water quality of permanent or semi-permanent pools within the ephemeral creeks and waterways and downstream farm dams.

Grassed lined open channels (swales) would be installed next to the new northbound carriageway for drainage and to provide water quality treatment. Swales are effective at trapping a proportion of the pollutants mentioned above.

MUSIC modelling determined the quantity of potential pollutant load impact to downstream water receivers with consideration to the load that would be removed by swales. The load reduction was assumed to be equivalent to the environmental safeguard pollutant load reduction target which are achievable with the use of grass lined swales. A summary of the overall results for the construction boundary is provided in Table 6-42.

Table 6-42 MUSIC modelling results

Pollutant	Existing Conditions <sup>1</sup> (kg/year)	Proposal conditions <sup>2</sup> (kg/year)
Total Suspended Solids	33,476	39,838
Total nitrogen	216	220
Total phosphorus	2,483	2,593

<sup>1</sup> Includes existing highway road surface with swale treatment and upstream agricultural catchment

<sup>2</sup> Includes both existing highway and proposal with swale treatment and upstream agricultural catchment

The results indicate that with the provision of swales (which provide total suspended solids and total phosphorus treatment), pollutant load impact to downstream creeks and waterways are likely to be minor for total suspended solids and negligible for total phosphorus and total nitrogen. While swales would only trap a small amount of total nitrogen, the total nitrogen load generated from the highway catchment is relatively insignificant compared to the local agricultural runoff, resulting in a negligible impact.

Spill response controls (see Section 6.7.4) would be implemented to manage the potential risk of contamination of downstream waters as a result of oil/fuel spill occurring during operation. Taking into consideration that the proposal would improve traffic safety on the highway and spillages would be managed by implementation of emergency response procedures, the risk of downstream water pollution during the operation phase is considered to be negligible.

With incorporation of the proposed water quality measures (swales) and environmental safeguards, the incremental increase in pollutant loading to the ephemeral creeks, waterways and farm dams is considered to be negligible. Therefore impact to downstream water quality in pools and during ephemeral flow conditions are considered to be negligible.

The reference design incorporates swales and transverse drainage structures to positively drain off all local drainage depressions and watercourses across the highway upgrade. This approach will minimise the risk of salinity impact associated with infiltration. The flood modelling demonstrates that the reference design does not cause prolonged impoundment of frequent flows and the proposal would not have an impact on environmental flows or inundation patterns in habitat areas.

Erosion and scour could potentially occur as a result of increases in runoff volumes to downstream waterways and concentrated flows at new drainage outlets. The increase in runoff volume as a result of the new highway surfaces would be minor and impact to stream erosion is likely to be negligible given increases in catchment imperviousness would be no greater than two per cent within the individual drainage line sub-catchments. Appropriately designed scour protection and dissipation measures would be provided to control potential for localised scour and erosion impact at new drainage outlets.

Flood modelling of frequent storm events (five year ARI) determined that areas where flow velocities exceed two metres per second would not increase in extent beyond the road corridor. Rare and extreme events are not considered due to the infrequency of such events and the potential for natural erosion. Figure 6-23 shows a small area of potentially erosive flow conditions may form at CH17700 and CH20200. Conventional rock and vegetation scour protection work within this area would sufficiently mitigate any localised erosion risk occurring as a result of the highway upgrade. Velocity mapping beyond the corridor shows no increased risk of siltation, destruction of riparian vegetation or reduction in the stability of water courses.





With consideration to the minor increases in runoff volume, provision of environmental safeguards and existing condition of the local waterways and creeks, erosion and scour impact are likely to be negligible.

### *Groundwater*

During operations the improved road safety of the construction boundary would reduce the risk of accidental spillage/leakage of fuel, oils or chemicals causing groundwater contamination. Any accidental spillage would be managed by spill response procedures of the responsible parties in consultation with the authorities and Roads and Maritime.

Potential future groundwater use in this area has not been identified at this stage. The impact on bores would be confirmed as part of the additional geotechnical field investigations that would be carried out during the detailed design of the proposal.

### *Flooding*

Potential impact associated with the proposal once operational include:

- Potential increases in peak flood levels as a result of:
  - Loss of existing floodplain storage by the new northbound carriageway within areas currently subject to inundation and available for flood storage
  - Changes in conveyance of the highway transverse drainage system by extension or duplication of existing drainage or construction of new drainage structures. Both increases and reductions in conveyance could potentially produce adverse impact depending on local sensitivity to flow diversions
  - Increase in runoff potential as a result of construction of additional impervious surface.
- Potential increases in peak flow rates and velocities in receiving waterways, which are unlikely to increase scouring and erosion
- Potential changes to flow distributions that may adversely affect:
  - Runoff volumes and the yield of existing farms
  - Frequency of inundation of other environmentally sensitive areas that support threatened habitat and/or species.

As part of reference design development, an indicative transverse drainage strategy was developed to provide the desired 100 year ARI level of flood immunity to the new northbound carriageway (see Appendix J for more details). It is intended to retain the existing highway and existing transverse drainage structures as far as possible. Residual flooding impact for the 100 year ARI event is shown on Figure 6-24. Residual flooding impact for the 200 and 500 year ARI event are shown in Figure 6-25 and Figure 6-26.

A key outcome is the feasibility to construct a new northbound carriageway with the desired level of flood immunity while maintaining flooding impact on the existing highway within the identified afflux criteria. The flood immunity of the northbound carriageway provides improved evacuation and access for existing road users and improved emergency response.

The majority of flood affected land in the construction boundary is used for agriculture, and there are no identified habitable buildings affected by flooding for events up to 500 year ARI. Figure 6-26 shows that increases in peak flood level beyond the proposal are typically far less than 250 mm, and in most cases are limited to 50-100 mm. It is expected that any minor localised increases that exceed the identified afflux criteria can be reduced through refinement as part of future design development.

Flooding impact was also assessed for smaller more frequent flood events, as well as an extreme flood (500 year ARI). For the purposes of this assessment the extreme flood was defined as an event with a peak discharge about five times that of the 100 year ARI flood. The 200 and 500 year ARI flood events are provided as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to potential climate change.

In general it was found that relative changes in peak flood levels reduce with increasing storm frequency. For example, for the five year ARI storm event only relatively minor changes in peak flood level were identified outside the proposed highway corridor boundary, with increases and reductions typically less than about 50 mm when compared to present day conditions.

For an extreme flood, changes in peak flood level are larger and more widespread than for the 100 year ARI event. The impact occurs because the new northbound carriageway generally lies at a higher elevation than the existing highway, in part to increase its flood immunity, so that flows in excess of the capacity of the transverse drainage system are required to pool to a higher level before overtopping the new northbound carriageway. This has the effect of detaining flows on the upstream side of the existing highway where flood levels are increased accordingly, with consequent reductions in downstream flood levels.

In one case, the reference design is shown to alter 200 and 500 year ARI flow conditions within paddocks to the north of Church Lane, causing 100 mm of overland flow to break out of an existing farm dam and follow a suspected historical flood runner that is depicted in the LiDAR survey. The potential impact of this event can be mitigated by modifying the existing dam edges, as necessary. However, given that flooding associated with this event is relatively minor in extent, affects rural land and there is no associated risk to life or impact on existing private structures, the impact is considered to be relatively minor and can be designed out as part of future design development.

It is noted that impact during an extreme flood is localised and no flood evacuation would be required because the existing highway would be impassable for such an extreme flood, and it is not practical nor cost effective to design the new northbound carriageway to such a high level of flood immunity.

The relatively minor changes in peak flood levels show that significant changes in flow distribution across the various floodplains can be avoided. This is particularly the case for smaller more frequent flood events that are of relatively higher importance for ensuring that adverse changes to runoff volumes, frequency of inundation and scour potential along receiving waterways are avoided. Impact on receiving waterways, including farm dams and other environmentally sensitive areas, would be subject to further assessment and confirmation as part of future design development.



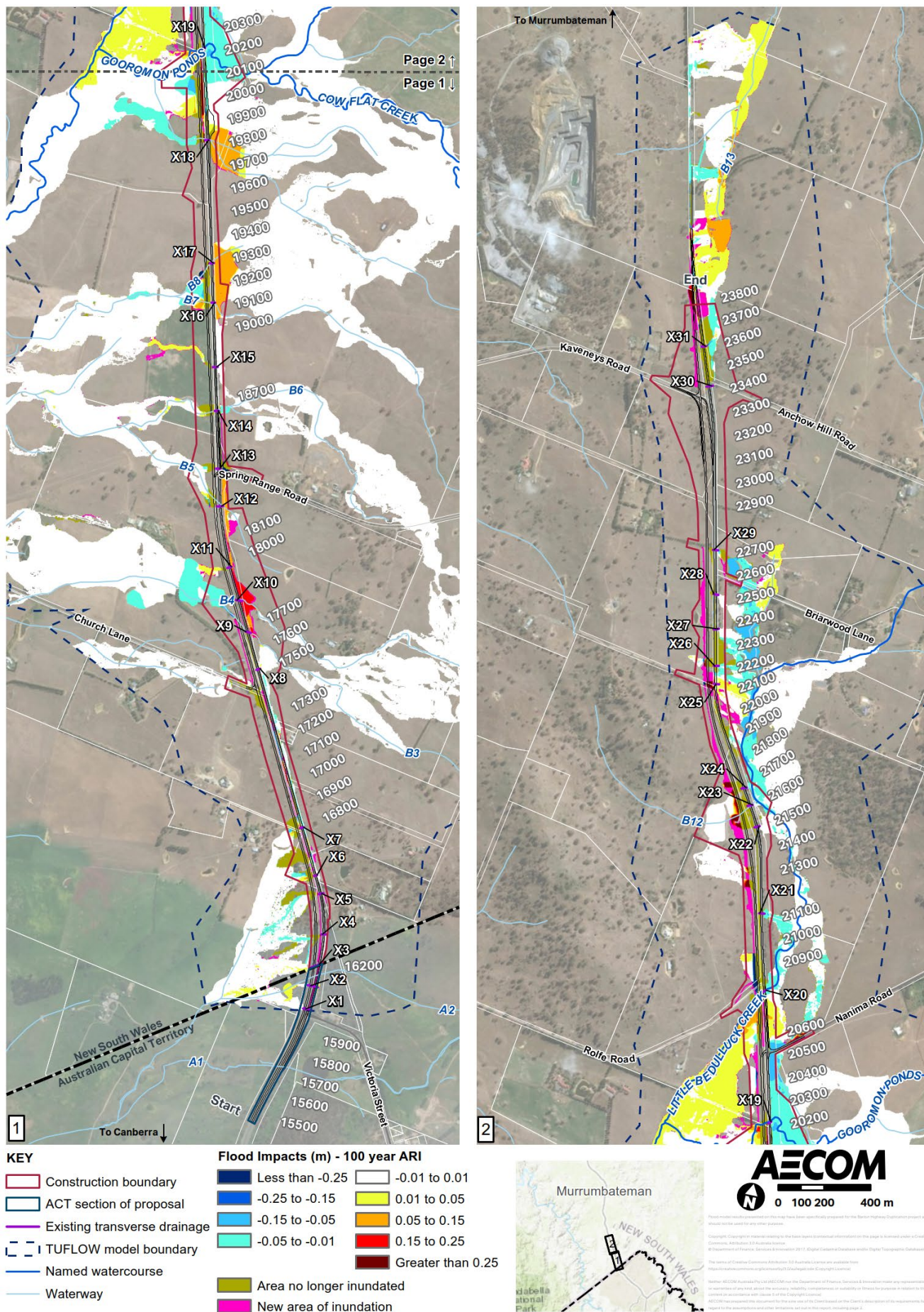


Figure 6-24 Residual flooding impact – 100 year ARI



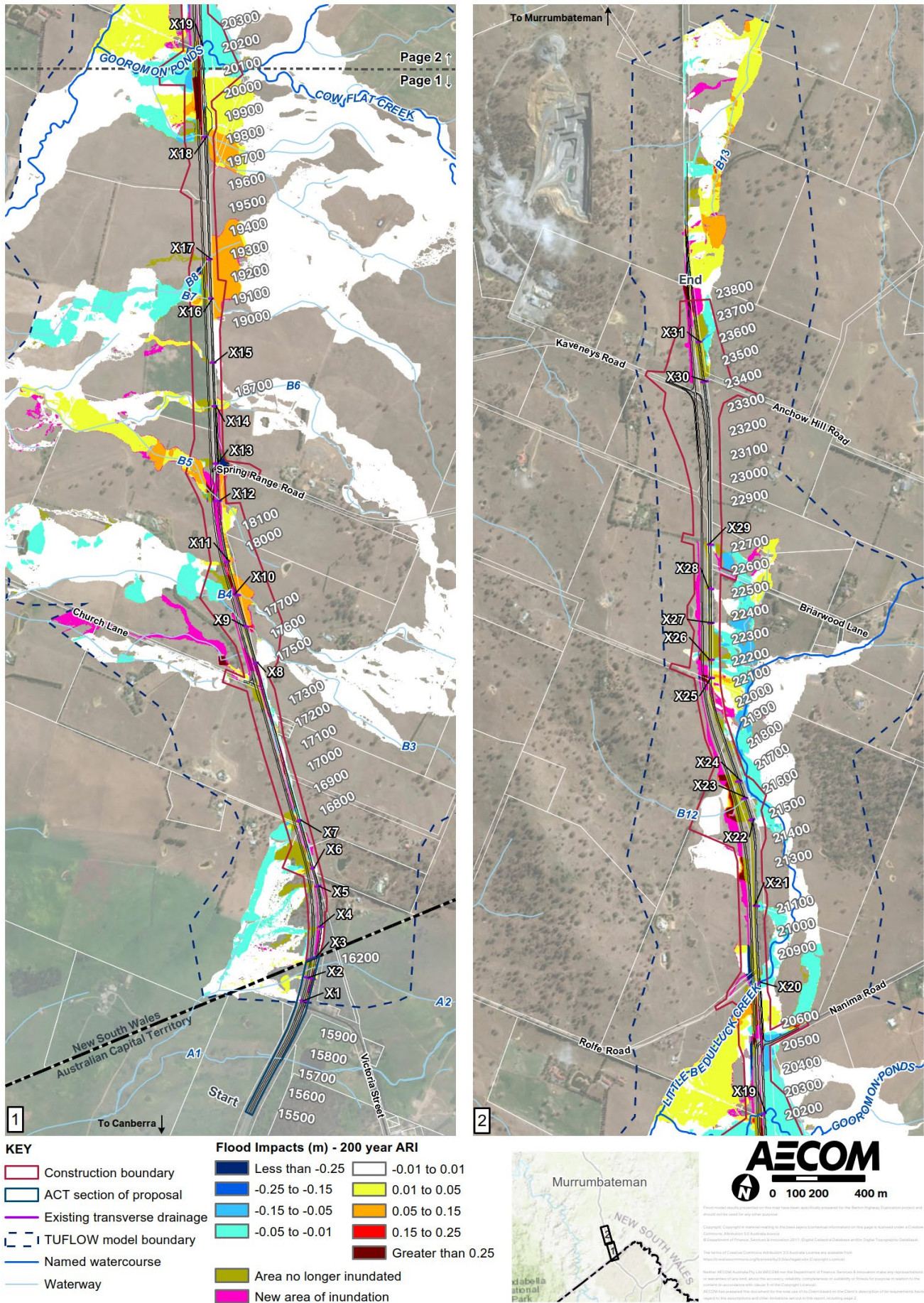


Figure 6-25 Residual flooding impact – 200 year ARI



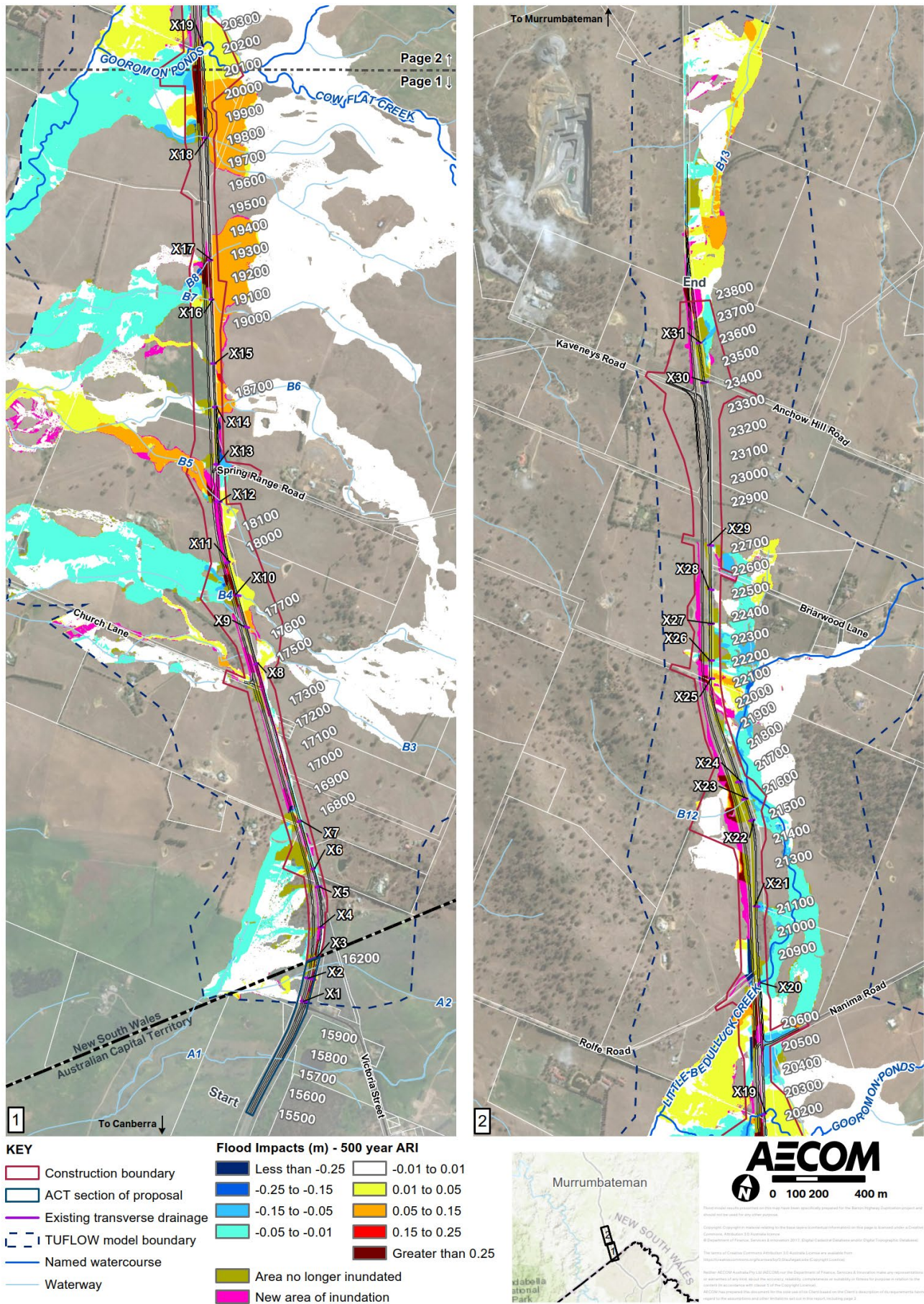


Figure 6-26 Residual flooding impact – 500 year ARI

## 6.7.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impact to water during construction and operation of the proposal are outlined in Table 6-43.

Table 6-43 Surface water, groundwater and flooding safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Water	MUSIC modelling will be carried out during detailed design to demonstrate that the proposed swales (or alternative water quality treatment measures) achieve the project objectives	Contractor	Detailed design	Additional safeguard
Water	Where feasible, farm dams will be retained and protected. Landholders will be consulted with regards to any farm dams that could potentially be disturbed	Contractor	Detailed design / Pre-construction	Additional safeguard
Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers)	Contractor	Detailed design / Pre-construction	Section 4.3 of QA G36 <i>Environment Protection</i>
Flooding impact and flow diversions	<p>Design drainage structures to ensure that the natural flow of floodwaters and existing flow paths, flow volumes, flow rates and flow velocities will be maintained post-construction where possible</p> <p>Further detailed hydrologic and/or hydraulic modelling will be carried out as appropriate to confirm flow and flooding impact as required during design development</p> <p>The flooding impact of temporary work, including construction staging that requires temporary departure from the design, as well as road surfacing work will be assessed</p> <p>The impact of future climate change and potential blockage of hydraulic structures on flooding conditions will be considered</p> <p>Maintain documentation that will demonstrate flooding and final flooding impact have been appropriately considered in detailed design</p>	Contractor	Detailed design / Pre-construction	Additional safeguard



Impact	Environmental safeguards	Responsibility	Timing	Reference
Flood impact on traffic	Consult with Council and SES on potential road closure and traffic management measures to divert traffic from the existing highway during flood events	Roads and Maritime	Detailed design / Pre-construction	Additional safeguard
Water	<p>All fuels, chemicals, and liquids will be stored in an impervious bunded area at least 50 m away from any rivers, creeks or any areas of concentrated water flow, flooded or poorly drained areas and slopes above 10 per cent</p> <p>Refuelling of plant and planned maintenance of machinery and plant will be carried out 50 m away from waterways and drainage lines</p> <p>Vehicles and plant will be properly maintained and regularly inspected for fluid leaks</p> <p>Dirty water will be managed on site to avoid release into drainage lines and/or waterways</p> <p>Potable water will be used for wash down</p> <p>Containment material will be used to capture/filter water used in vehicle wash-downs</p> <p>Vehicle and plant wash downs and/or concrete truck washouts will be carried out within a designated bunded area with an impervious surface or will be carried out off site</p> <p>Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) of waterways will be carried out on a regular basis to identify any potential spills or deficient erosion and sediment controls. Inspection records will be kept</p> <p>Emergency spill kits will be kept on site at all times</p> <p>All staff will be inducted about incident and emergency procedures and made aware of the locations of emergency spill kits</p> <p>Should a spill occur during construction, the emergency response plan will be implemented, and the Roads and Maritime senior regional environmental officer contacted. The EPA will also be notified as per Part 5.7 of the <i>POEO Act</i></p>	Contractor	Construction	Standard safeguard

Other safeguards and management measures that would address water impact are identified in Section 6.2.5.



## 6.8 Landscape character and visual impact

A Landscape Character and Visual Impact Assessment (LCVIA) was carried out for the proposal (AECOM 2018e) in accordance with the *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment* (EIA-N04)(Roads and Maritime, 2013c) and the *Barton Highway Urban Design Framework* (Roads and Maritime, 2018d) developed specifically for the *Barton Highway Upgrade*. This assessment is provided in Appendix K and summarised in this section.

### 6.8.1 Methodology

The following assessments have been carried out for the proposal:

- Visual assessment – to evaluate the impact of the proposal on views
- Landscape character assessment – to evaluate the impact of the proposal on the areas combined built, natural and cultural character or sense of place.

Landscape and visual impact was assessed using value judgements against a standardised grading matrix. The sensitivity and magnitude of the impact were determined to ascertain a combined impact of negligible, low, moderate and high. The assessment methodology is described in detail in Appendix K.

### 6.8.2 Existing environment

#### *Landscape characteristics*

Key features of the landscape characteristics within the construction boundary include:

- **Topography and hydrology:** The proposal traverses a landscape of gently undulating topography mostly cleared for grazing with a backdrop of long distance views of the Brindabella Ranges to the west. The central portion of the construction boundary lies within a wide floodplain where the main waterways are Gooromon Ponds and Little Bedulluck Creek, along with a number of minor tributaries
- **Vegetation:** The dominant vegetation within the construction boundary consists of cleared, ecologically degraded pasture land, non-native boundary definition vegetation, small parcels of remnant native vegetation (including that fringing some waterways, such as Little Bedulluck Creek) and road side vegetation, both native and cultural
- **Land use:** The land use in the vicinity of the proposal is rural consisting mainly of grazing land, rural residences and small orchards
- **Heritage:** Key heritage items that form part of the landscape character of the construction boundary include Wattle Park Uniting Church, Dellwood homestead and fence and pine trees
- **Travelling stock reserve:** The Hall TSR is at the NSW/ACT border and the Bedulluck TSR along Little Bedulluck Creek to the east of the existing highway.

#### *Landscape character zones*

Landscape Character Zones (LCZs) were identified by grouping zones within the construction boundary with broadly homogenous characteristics or spatial qualities. Four LCZ were identified within the construction boundary as described below and shown in Figure 6-27.

- **LCZ 1: Woodland:** This LCZ is distinguished by its woodland cover, with landform broadly corresponding with that of the LCZ 2 rolling hills. The southern approaches to the proposal are characterised by substantial patches of woodland and grassland, which is listed as Box-Gum Woodland (Commonwealth and NSW listed); and Box-Gum Woodland – Derived Native Grassland (NSW listed). It

includes relatively flat land and the wooded One Tree Hill range which is densely vegetated in parts. The highway is visually contained by vegetation

- **LCZ 2: Rolling hills with sporadic vegetation:** Rolling hills, small patches of vegetation of often sparse woodland characterise this LCZ. The existing highway is visually exposed and the construction boundary situated between ridgelines with some distant views
- **LCZ 3 Floodplain:** This LCZ is characterised by the broad, open, gently undulating floodplain valley with a lush pasture cover. It consists of relatively flat land with improved pasture grasses, creating lush, green panoramic views. Trees are limited typically to driveways, property boundaries, some verges and landscaping around homes
- **LCZ 4 Cultural planting:** This LCZ is distinguished by its cultural land cover, with the landform corresponding to that of the LCZ 2 rolling hills. It is made up of small areas contained within the greater LCZ 2 zone where exotic vegetation (typically pines and other exotic shelterbelt species) influences the local character.

### ***Urban design and landscape strategy***

Roads and Maritime has developed the *Barton Highway Urban Design Framework* (Roads and Maritime, 2018d) for the *Barton Highway Upgrade* to provide strategic design guidance and direction for developing each package of work (which includes the proposal) to achieve a well-integrated design outcome of consistent quality throughout. Key recommendations from the *Barton Highway Urban Design Framework* that are applicable to the proposal cover the following elements and are summarised as follows:

- **Tree management strategy:** Prepare a strategy in line with the *Landscape Guidelines* (Roads and Maritime, 2013b)
- **Soil management strategy:** Prepare a strategy which minimises the construction boundary, identifies valuable seed banks and reduces the reliance for imported soils and planting
- **Ecological assessment:** Conduct detailed ecological assessments for the Hall TSR and Bedulluck TSR to inform detailed design
- **Rest areas:** Expand the heavy vehicle enforcement bay south of Nanima Road to take advantage of long 360 degree views. The proximity of the Bedulluck TSR presents an opportunity to develop a rest area precinct that could incorporate the bus stop, and interpretation facilities focused on the TSR and nearby cultural landscape. Design rest area amenity and traffic functions with careful attention to *Safety In Design and Crime Prevention Through Environmental Design* issues
- **Bus stops, pedestrians and cycle safety:** Reinstate the existing bus stops opposite Spring Range Road, Bedulluck TSR and Nanima Road on each side of the highway to maximise pedestrian safety.
- **Alignment:** Consider locating the alignment further west to avoid the existing shelterbelt planting opposite Spring Range Road.

The urban design objectives are described in Section 3.2.3 and provided in Appendix K.

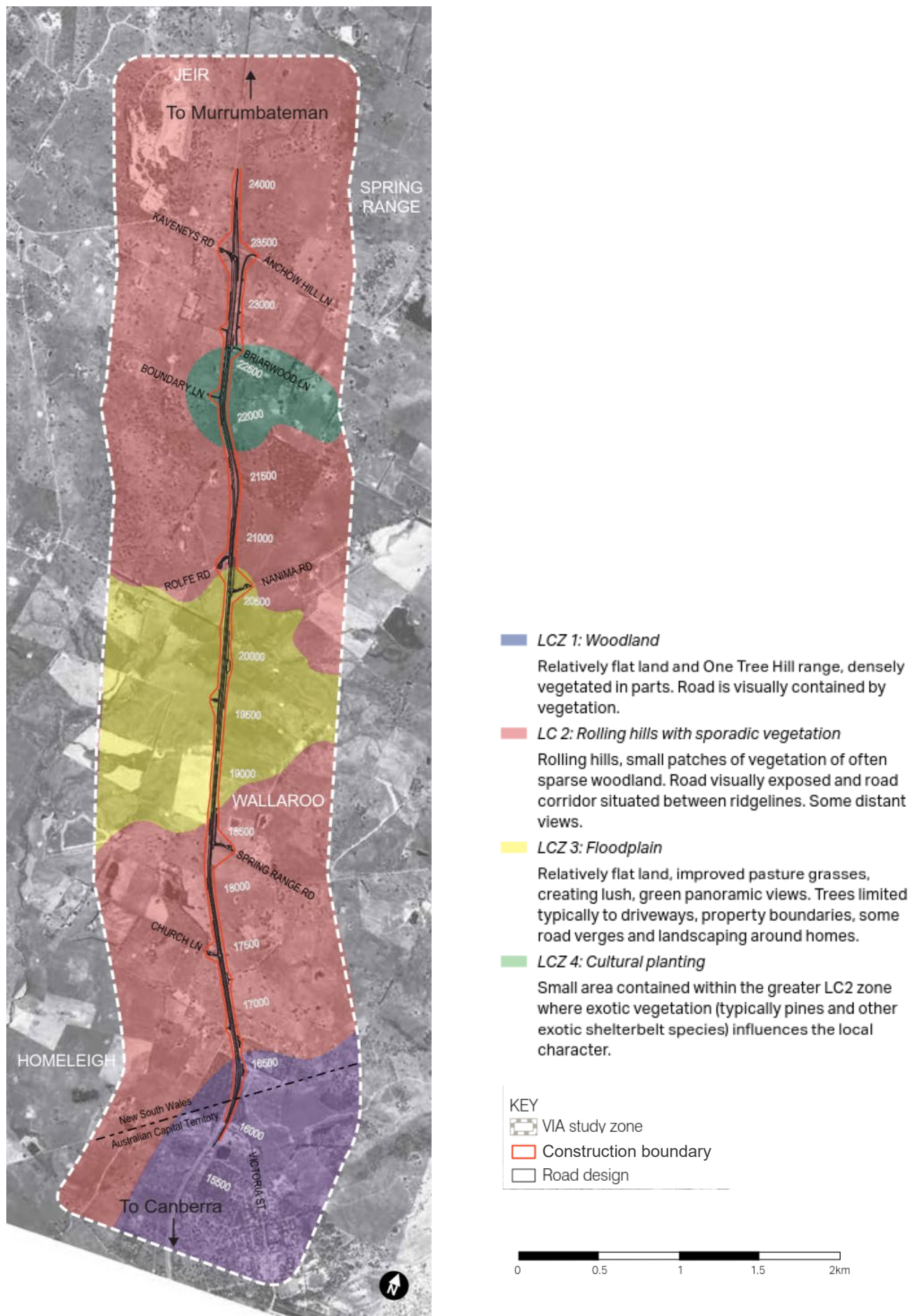


Figure 6-27 Landscape character zones within the LCVIA study area

## Visual Receivers

Visual receivers are individuals or groups of people whose views may be impacted by the proposal. In order to assess the potential visual impact of the proposal on the surrounding landscape, an area of theoretical views was prepared taking landform into consideration which is shown in Figure 6-28.

Visual receivers within the surrounding landscape include:

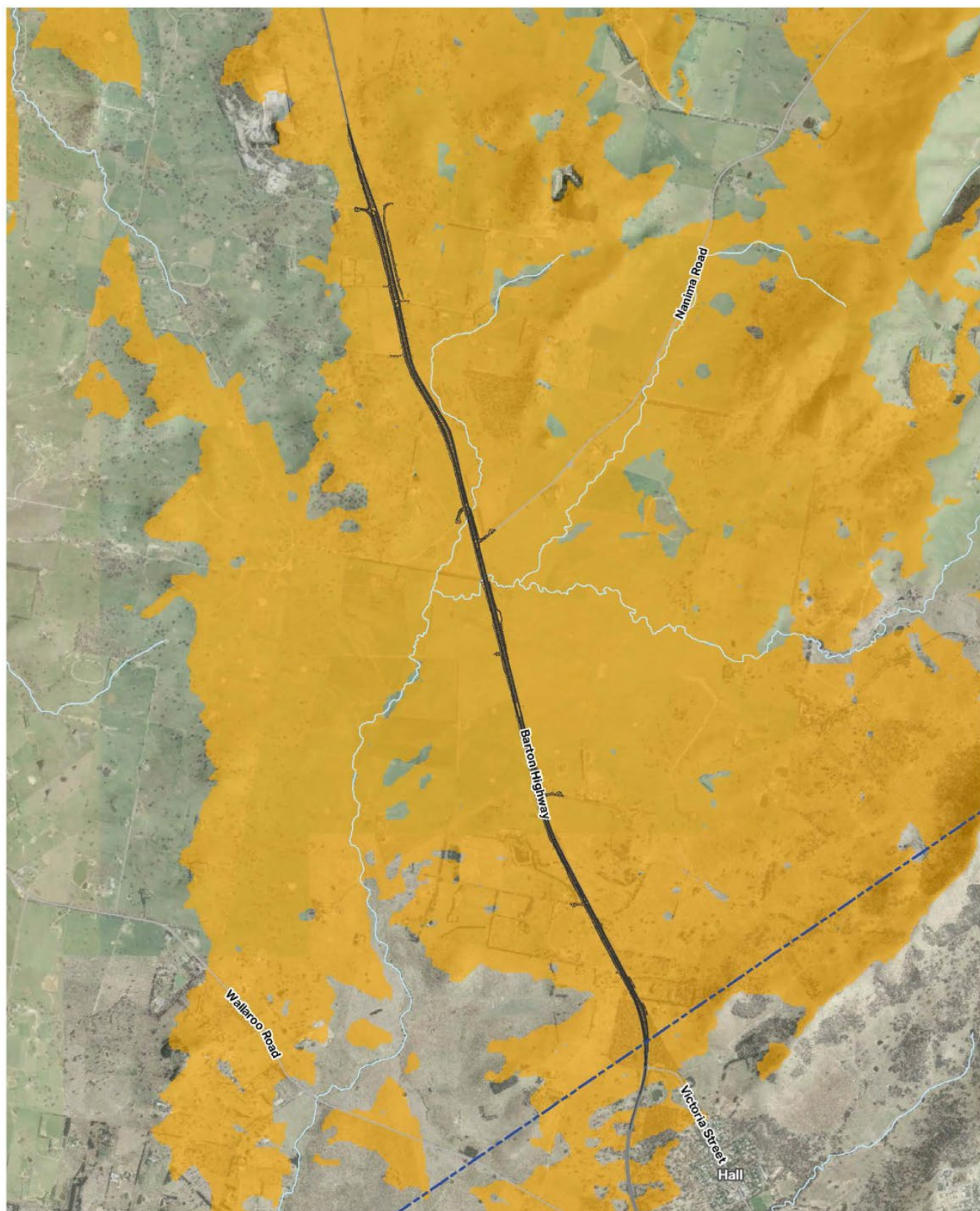
- Road users on the Barton Highway
- Residents in homes theoretically up to five km from the highway, but realistically those up to two km from the highway would get reasonable views to the proposal
- Visitors to and workers at commercial properties scattered throughout the surrounding area, including bed and breakfast hotels, farms and horticultural enterprises (eg vineyards)
- Visitors to the Wattle Park Uniting Church.

A total of seven key visual receiver views were identified for which the visual assessment was carried out. These visual receivers are described in Table 6-44 and shown in Figure 6-29.

Table 6-44 Impact assessment for visual receivers

No	Visual receivers	Description
1	Victoria Street, ACT	This viewpoint represents views seen of the proposal by northbound traffic, leaving the ACT, representing the anticipated changes from the removal of vegetation associated with the Hall TSR
2	Dellwood homestead	This viewpoint shows the view to the proposal seen by southbound traffic on the highway, travelling towards the Canberra
3	Wattle Park Uniting Church	This viewpoint shows views to the anticipated changes along the highway from traffic heading north, showing the relationship of the proposal to the Wattle Park Uniting Church
3a	Wattle Park Uniting Church	A secondary viewpoint at this location represents the view seen by visitors to the Wattle Park Uniting Church, viewing the anticipated changes to the highway from within the church grounds
4	Spring Range Road	This viewpoint shows the view to the proposal seen by northbound traffic on the highway as the receiver enters the floodplain
5	Driver rest stop, Gooromon Ponds	This viewpoint shows the view to the proposal seen by northbound traffic on the highway near the lowest point in the floodplain. It represents the views seen to the area around Gooromon Ponds. This location is important as it shows a typical extent of the proposal spanning the Gooromon Ponds creek line
6	Anchow Hill Lane intersection	This viewpoint shows the anticipated changes in the view seen by southbound traffic. This location particularly represents a typical intersection measure, in this case the intersection with Kaveney's Road from the intersection with Anchow Hill Lane
7	Homes on Anchow Hill Lane	This viewpoint shows a typical view from a higher location in the landscape, representing the anticipated changes seen from a residential home or from a farm paddock, looking back to the proposal as it passes through the landscape





#### KEY

- Primary road
- Local road
- Named watercourse
- - - NSW/ACT border
- Theoretical view envelope

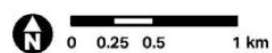


Figure 6-28 Area of theoretical view of the proposal



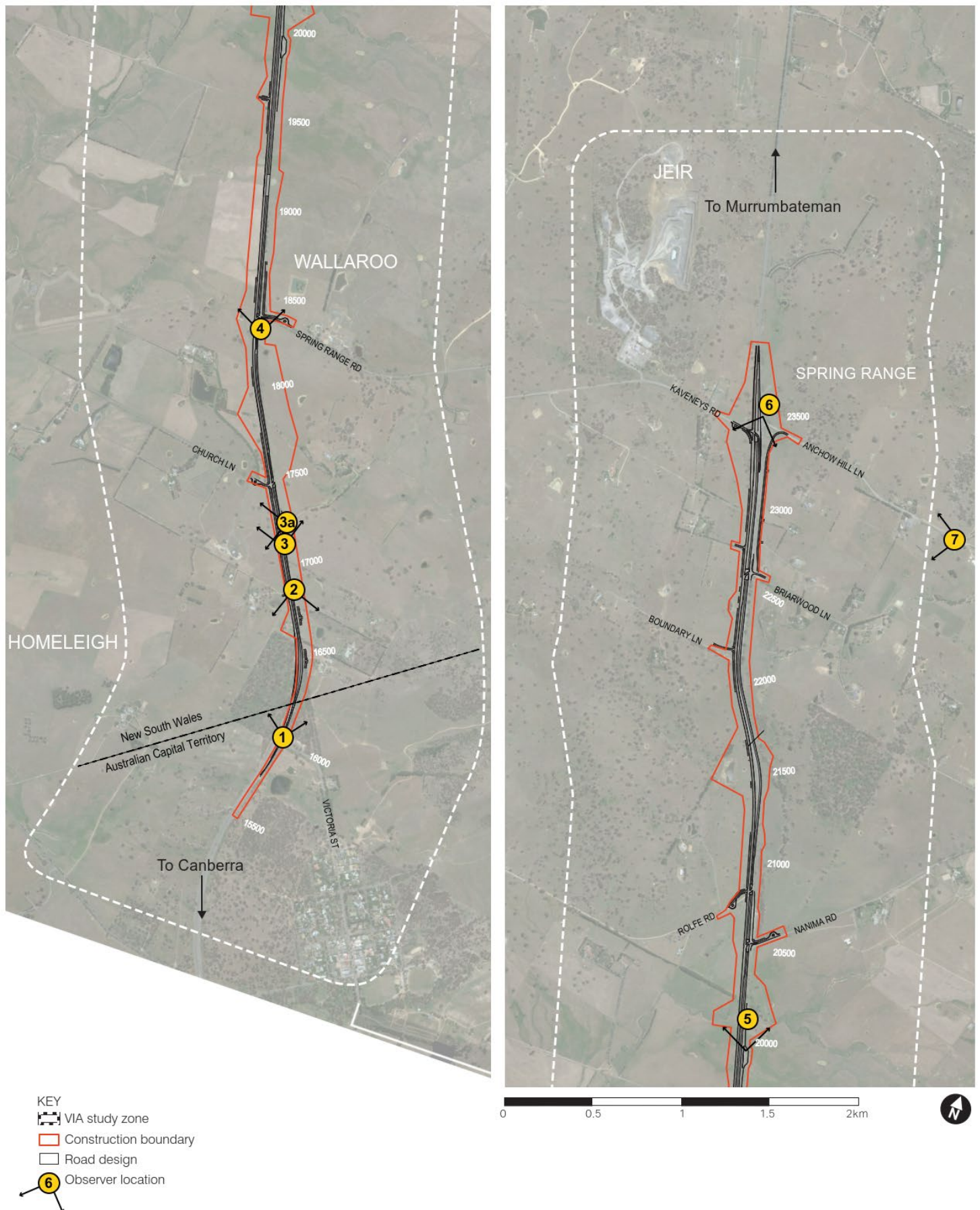


Figure 6-29 Representatives viewpoints selected to assess visual impact of the proposal

## 6.8.3 Potential impact

### Operation

#### Landscape character impact assessment

The key findings of the landscape character impact assessment during the operation stage is summarised in Table 6-45.

The impact on landscape character during the operation of the proposal was moderate for both LCZ 2 and LCZ 3. Impact to LCZ 2, which comprises the most common LCZ relative to the proposal, was due to the effective tripling of the width of the Barton Highway, localised variable increases in footprint at some intersections, and addition to areas of substantial grade separation between the dual carriageways with associated wide and tall batters between, and extensive areas of 2H:1V cuttings comprising uncharacteristic landform elements. LCZ 3 which comprises a contrasting landscape element relative to the surrounding rolling hills within which it is set, is of high visual quality, and would be subject to the loss of a substantial, distinctive cultural shelterbelt planting of mature pines north of Spring Range Road. Landscape character impacts for LCZ 1 and LCZ 4 ranged of Low to Low-Moderate.

The recommended tree management strategy and mitigation measures would serve to minimise the impact on landscape character.

Table 6-45 Landscape character impact assessment during operation

Landscape character zone	Sensitivity/ Magnitude of change	Anticipated change	Impact
LCZ 1: Woodland	Sensitivity: Low  Magnitude: Low	Loss of a band of woodland up to 50 m wide through the Hall TSR at the NSW/ACT border  Removal of an existing shady and grassed rest area, remnant woodland and Dellwood homestead including out buildings  The existing enclosed character of the road corridor would be reduced, tripling the corridor width, including a landscaped median between the two carriageways	Low
LCZ 2: Rolling hills with sporadic vegetation	Sensitivity: Moderate  Magnitude: Moderate	Tripling of the width of the Barton Highway, with locally increased footprint at intersections and some other locations  Loss of significant areas of: <ul style="list-style-type: none"> <li>Listed Box-Gum Woodland</li> <li>Box-Gum Woodland – Derived Native Grassland</li> <li>Mature ‘paddock trees’</li> </ul> The character of Barton Highway would change from that of a two lane, sealed rural road to that of an at grade four lane highway with deceleration and acceleration lanes and a new service road between Anchow Hill Lane and Briarwood Lane running closely next to the existing highway. The highway would be more visually prominent within the landscape, particularly when viewed from the surrounding higher vantage points available within the elevated, rolling terrain typical of this LCZ	Moderate
LCZ 3: Floodplain	Sensitivity: Moderate	The highway crossing the floodplain stretches over a distance of some 2.1 km, and broadly results in a tripling of the width of the	Moderate

Landscape character zone	Sensitivity/Magnitude of change	Anticipated change	Impact
	Magnitude: Moderate	<p>corridor from about 20 m to 60 m. The nature of the proposed change is relatively consistent given the minimal changes in level. All batters other than for the shallow benching of drainage structures alongside the highway, have a maximum slope of 4H:1V, providing improved integration with the adjoining (floodplain) landform than the 2H:1V cut batters associated with LCZ 2.</p> <p>Removal of a row of mature shelterbelt pines alongside the highway from Spring Range Road stretching north over 220 m would broadly halve the (discontinuous) length of this remnant cultural planting feature, in particular removing a continuous 160 m length of the row. These pine trees are considered to have important cultural value as they influence the local character of the landscape, with various mature stands and rows of conifer tree species present within the view corridor of the project.</p> <p>Overall, the project would facilitate a highly consistent landscape over the length of the LCZ. There would be potential improvement of the view over the floodplain for motorists due to the increased elevation of the new carriageway relative to that of the existing carriageway with the floodplain.</p>	
LCZ 4: Cultural planting	Sensitivity: Moderate  Magnitude: Low	<p>The key changes to this LCZ comprise:</p> <ul style="list-style-type: none"> <li>• Addition of a new service road between Anchow Hill Lane and Briarwood Lane resulting in the removal of three private accesses onto Barton Highway, and the potential retention of a residual pine tree boundary planting and driveway avenue between the highway and the service road</li> <li>• Loss of a small stands of remnant endemic tree species along the western edge of the existing highway</li> </ul> <p>The service road has the potential to moderately disrupt a key view from the crest at Tallawong Close when travelling south. This view encompasses the Briarwood Lane rural residential hamlet in the foreground, and looks beyond to a wooded high point of Spring Range Road in the middle ground at a distance of about 4.5 km, and the visual catchment boundary of the One Tree Hill range (LCZ 1: Woodland) in the background at a distance of about 6.5 km.</p>	Low-Moderate

### Visual impact assessment

The key findings of the visual impact assessment during the operation phase is presented in Table 6-46. The proposal would have a moderate impact on receivers at the heavy vehicle enforcement bay and residences near Anchow Hill Lane. The visual impact was moderate-high at Dellwood homestead, Wattle Park Uniting Church (viewpoint 3), Spring Range Road and Anchow Hill Lane intersection during operation.

The visual impact from Wattle Park Uniting Church (Viewpoint 3a) was high due to the sensitivity of the receptors within the visually enclosed grounds being high given the landmark heritage and visual qualities of the church, which is regularly used by church parishioners, and who would experience views towards the highway when congregating before and after services, and during special occasions, eg weddings. The



magnitude of change is high given the change in outlook/degree of contrast in the view arising from the removal of the screening row of pine trees along the highway frontage.

The LCVIA has informed the design and the proposal has been designed in line with the *Barton Highway Urban Design Framework* (Roads and Maritime, 2018) which provides strategic design guidance and direction for developing and achieving a well-integrated design outcome of consistent quality. The recommended tree management strategy and mitigation measures would be considered in detailed design to minimise the visual impact during the operation of the proposal. Where practical the detailed design would take into consideration the panoramic view across Gooromon Ponds floodplain from both carriageways.

Table 6-46 Operational visual impact assessment

No	Visual receiver	Sensitivity/ Magnitude of change	Anticipated change in view	Impact
1	Victoria Street, ACT	Sensitivity: Moderate  Magnitude: Moderate	<ul style="list-style-type: none"> <li>Removal of a strip of woodland vegetation fringing the highway to accommodate the new northbound carriageway. At the NSW/ACT border the road corridor would be widened by about 28 m, and from about 300 m north of the viewpoint, the highway would be widened by about 50 m to the west</li> <li>The vegetated median strip would continue northwards</li> <li>The northbound carriageway would be at a higher grade to existing ground level to the west, with a batter supporting the road surface</li> <li>Views northwards along the highway (ie the view seen along the proposal, limited by fringing trees) would increase from the existing 400 m to about 600 m, as the woodland on the western verge is cleared</li> <li>Road users heading north would be shifted westwards, travelling along a new northbound carriageway</li> <li>New safety barriers</li> <li>Removal of the heavy vehicle rest area at the NSW/ACT border</li> </ul>	Moderate
2	Dellwood homestead	Sensitivity: Moderate  Magnitude: High	<ul style="list-style-type: none"> <li>The highway corridor would be widened to the west by about 25 m, resulting in a wider, more visually dominant highway corridor in the landscape</li> <li>The new northbound carriageway would be raised above the existing ground level to the west with a batter (about 10 m wide) resulting in the entire road corridor appearing about 35 m wider</li> <li>Dellwood homestead, outbuildings and associated landscaping would be removed</li> <li>A new landscaped median strip would be seen separating the two carriageways</li> <li>The row of deciduous trees on the western verge would be removed, opening up views to the west from the highway</li> <li>There would be new safety barriers, determined at detailed design phase</li> </ul>	Moderate-High

No	Visual receiver	Sensitivity/ Magnitude of change	Anticipated change in view	Impact
3	Wattle Park Uniting Church	Sensitivity: Moderate  Magnitude: High	<ul style="list-style-type: none"> <li>The highway corridor would be widened to the west, resulting in a wider, more visually dominant highway corridor in the landscape. The road surface would increase by about 23 m west of the existing road surface, and the entire highway corridor (including battering and drainage infrastructure) would increase by about 40 m</li> <li>Road users heading north along the road would be shifted westwards, travelling along a new, northbound carriageway. This would move passing traffic closer to the existing high voltage electrical stanchions. The road level would be below the surrounding ground level, potentially screening the extent of the view to the west from the northbound carriageway</li> <li>Northbound traffic would see about 18 m of additional infrastructure to the west of the road surface, including drainage infrastructure and battering up to the surrounding ground level</li> <li>Some large paddock trees and roadside vegetation would be removed</li> <li>Some boundary trees at Wattle Park Uniting Church would be removed</li> <li>A new landscaped median strip would be seen separating the two carriageways</li> <li>There would be new safety barriers, determined at detailed design phase</li> </ul>	Moderate-High
3a	Wattle Park Uniting Church	Sensitivity: High  Magnitude: High	<ul style="list-style-type: none"> <li>The view to the Barton Highway would be opened up, with the removal of screening vegetation along the western property boundary of the church</li> <li>The highway corridor would be widened to the west by about 40 m, resulting in a wider, more dominant highway corridor in the landscape. This highway widening would include drainage infrastructure and battering to mitigate the level change between the road surface and the ground level to the west</li> <li>A new entry to the church property would be seen from within the grounds</li> <li>A new landscaped median strip would be seen separating the two carriageways</li> <li>There would be new safety barriers, determined at detailed design phase</li> </ul>	High

No	Visual receiver	Sensitivity/ Magnitude of change	Anticipated change in view	Impact
4	Spring Range Road	Sensitivity: Moderate  Magnitude: High	<ul style="list-style-type: none"> <li>The highway corridor would be widened to the west by about 50 m (including battering and drainage infrastructure) resulting in a more dominant feature in the landscape. The road surface would increase by about 30 m west of the existing road surface</li> <li>Northbound road users would be shifted westwards and would see new drainage infrastructure and battering down to the surrounding ground level and a new landscaped median strip separating the carriageways</li> <li>A significant number of the conifers would be removed on the north eastern corner of the intersection with Spring Range Road and heading north along the highway to accommodate drainage infrastructure</li> <li>The gravel u-turn facilities would be removed and a new u-turn facilities installed along Spring Range Road</li> <li>A new bus stop would be installed, which would be seen as a new element in the landscape travelling north moments before passing Spring Range Road</li> <li>There would be new safety barriers, determined at detailed design phase</li> </ul>	Moderate-High
5	Heavy vehicle enforcement bay, Gooromon Ponds	Sensitivity: Moderate  Magnitude: Moderate	<ul style="list-style-type: none"> <li>The highway corridor would be widened to the west by about 55 m (including battering and drainage infrastructure) resulting in a more dominant feature in the landscape. The road surface would increase by about 35 m at the viewpoint and by about 55 m at the crossing point of Gooromon Ponds</li> <li>Northbound road users would be shifted westwards, travelling along a new carriageway</li> <li>A new landscaped median strip would be seen separating the two carriageways</li> <li>A number of willow trees growing within Gooromon Ponds would be removed on the western side of the highway to accommodate the road widening. The first couple of (easternmost) poplars on the boundary planting to the west may also need to be removed</li> <li>There would be new safety barriers, determined at detailed design phase</li> <li>The new bus stop and u-turn facilities at Nanima Road would most likely be obscured by the existing vegetation</li> </ul>	Moderate



No	Visual receiver	Sensitivity/ Magnitude of change	Anticipated change in view	Impact
6	Anchow Hill Lane intersection	Sensitivity: Moderate  Magnitude: High	<ul style="list-style-type: none"> <li>• The highway corridor would be widened to the west, resulting in a wider, more dominant highway corridor in the landscape</li> <li>• A new service road would be seen running parallel with the highway between Anchow Hill Lane and Briarwood Lane</li> <li>• A new, large landscaped median strip would be seen separating the two carriageways</li> <li>• A significant number of paddock trees would be removed on the western side of the highway. Some trees would be removed on the eastern side of the highway to accommodate the changes to Anchow Hill Lane</li> <li>• A new bus stop would be installed</li> <li>• There would be new safety barriers, determined at detailed design phase</li> </ul>	Moderate-High
7	Homes on Anchow Hill Lane	Sensitivity: Moderate  Magnitude: Moderate	<ul style="list-style-type: none"> <li>• Sections of new northbound carriageway and associated cut batters between the carriageways, and along the western edge of northbound carriageway would be visible</li> <li>• Sections of service road between Anchow Hill Lane and Briarwood Lane would be visible</li> </ul>	Moderate

### ***Photomontages***

Photomontages provide a visual representation of the proposal and anticipated views of the surrounding landscape which would allow a realistic comparison with existing views. Photomontages were prepared to gain a visual appraisal of the proposal at the following selected key viewpoints along Barton Highway and are presented together with the existing views for comparison:

- Dellwood homestead which would be demolished (see Figure 6-30 and Figure 6-31)
- Wattle Park Uniting Church (see Figure 6-32 and Figure 6-33)
- Anchow Hill Lane intersection which would be closed (Figure 6-34 and Figure 6-35)

It is important to note that the photomontages are conceptual visualisations of the reference design and the materials and finishing shown are indicative, and would be finalised during detailed design.



Figure 6-30 The existing view to Dellwood homestead from Viewpoint 2



Figure 6-31 Photomontage showing the proposed view along the Barton Highway from Viewpoint 2





Figure 6-32 The existing view to Wattle Park Uniting Church from Viewpoint 3



Figure 6-33 Photomontage showing the proposed view to Wattle Park Uniting Church from Viewpoint 3





Figure 6-34 The existing view southbound along the highway from the Anchow Hill Lane intersection



Figure 6-35 Photomontage showing the existing Anchow Hill Lane intersection that would be removed and a new service road provided to the east of the highway

## 6.8.4 Safeguards and management measures

The recommended safeguards and management measures to minimise landscape character and visual impact during construction and operation of the proposal are outlined in Table 6-47.

Table 6-47 Landscape character and visual impact safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	Locally endemic species (both ephemeral and persisting) will be used in response to the local community the road passes through along the proposal	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
Landscape character and visual impact	Minimise the use of traffic barriers, while meeting safety objectives, as per the existing situation to maintain a seamless visual connectivity with the landscape	Roads and Maritime / Contractor	Detailed design / pre-construction/ construction	Additional safeguard
Landscape character and visual impact	Limit planting within LCZ 2: Floodplain to understory species from the Box-Gum Woodland – Derived Native Grassland community, preserving panoramic views across the floodplain. In certain areas exotic species may be appropriate in response to local landscape character	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
Landscape character and visual impact	Where safety barriers are required within LCZ 2, wire rope safety barriers will be considered to preserve the views	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
Existing trees	Where existing trees will be retained within the construction boundary or within close proximity of the work, an arborist will be engaged to determine construction setbacks and any other requirements necessary to maintain the health of the trees	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
Wattle Park Uniting Church	New landscape treatment will consider the heritage value of cultural plantings around the church. Noise mitigation and fencing will be visually integrated into the entry setting, with replacement plantings to comprise a mix of exotic coniferous species, as the existing condition	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard

## 6.9 Property and land use

This chapter assesses property and land use impact, which is a key environmental issue for the proposal. Environmental management measures are identified to minimise impact. The environmental assessment of socio-economic impact is addressed in Section 6.10.

### 6.9.1 Methodology

The impact of the proposal on property and land use has been considered through a high-level qualitative assessment referencing the *Yass Valley LEP 2013*, land ownership details, the proposed reference design and property acquisition requirements.

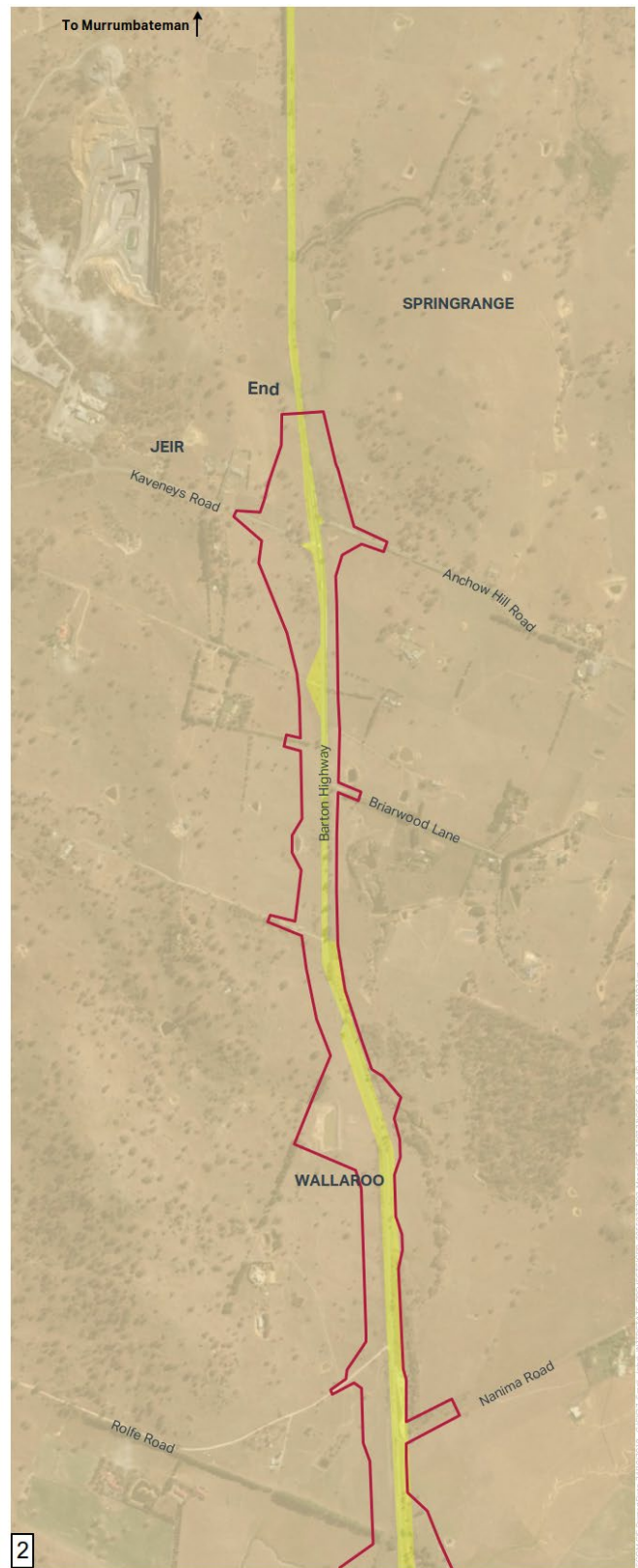
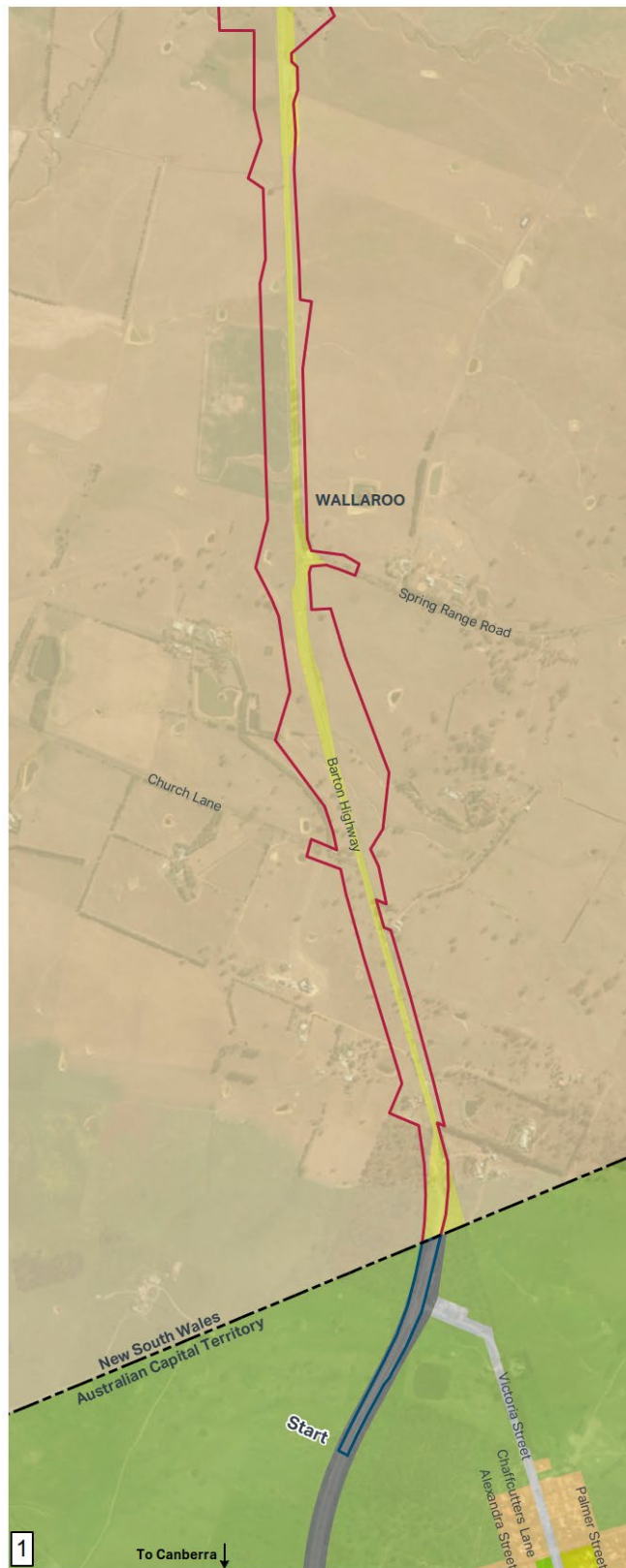
### 6.9.2 Existing environment

The proposal is located in a predominantly rural area with large use of agricultural land for activities such as sheep grazing, cropping, viticulture, dairy, wool and egg production. There are a number of residential properties within the construction boundary and the Wattle Park Uniting Church near the NSW/ACT border to the east of the existing highway.

As discussed in Section 4.1.2, the *Yass Valley LEP 2013* identifies the various land use zoning within the construction boundary. The land use zones within the construction boundary are SP2 Infrastructure and RU1 Primary Production and are shown on Figure 6-36.

As part of the proposal, but subject to a separate planning and approvals process, a 700 m tie-in section would be provided from the NSW/ACT border south to the existing dual carriageway in Hall, ACT. The impact assessment for this section of the proposal is documented separately.





#### LAND ZONING

##### KEY

- NSW/ACT boundary
- ACT section of proposal
- Construction boundary

##### NSW (Yass Valley LEP)

- RU1 Primary production
- SP2 Infrastructure

##### ACT (Territory Plan/National Capital Plan)

- CF Community facilities
- DES Designated
- NUZ3 Hills, ridges and buffer areas
- R21 Suburban
- TS21 Transport
- PRZ1 Urban open space



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Figure 6-36 Land zoning



## 6.9.3 Potential impact

### **Construction**

Long term impact on property and land use would occur from the commencement of construction. This would include the reductions in the size of available agricultural and residential land, and changes to property accesses. The immediate but long term impact of the proposal have been considered as impact associated with the operation stage of the proposal and are discussed below.

During construction, temporary impact to property and land use would occur as a result of:

- Ancillary facilities, such as stockpile sites and temporary construction compounds
- Utility relocations
- Construction of temporary sediment basins
- Disruptions or changes to local roads and property accesses.

Ancillary facilities, if located outside the property acquisition area, would result in a temporary change in land use during construction. The majority of potential ancillary facilities are located on agricultural land and are primarily located outside of the road reserve. In the event that land would be required that is not owned by Roads and Maritime, discussions would be held with the affected property owners about leasing the required land in the short-term during the construction phase of the proposal.

The final number and locations of temporary sediment basins would be determined during detailed design. Should temporary sediment basins be required that are not located within the construction boundary assessed within this REF, then further assessment and leasing arrangements would be required.

The proposal would also require the alteration and/or temporary disruption to property accesses to accommodate the construction of the proposal. This is discussed in detail in Section 6.1.

The adjustment and realignment of major service utilities would also be carried out during construction. This has been discussed in Section 3.5 and the impact assessed in Section 6.12.

### **Operation**

#### ***Property acquisition***

The proposal would require adjustments to the boundary of the existing highway corridor, including the construction of a new northbound carriageway from the NSW/ACT border towards Murrumbateman on the western side of the existing highway. About 86 hectares of land currently outside the existing road corridor would be included in the road reserve, consisting of:

- 80.31 hectares of rural residential properties
- 0.24 hectares of the Wattle Park Uniting Church
- 5.12 hectares of Crown Land (including the Hall TSR and Bedulluck TSR).

This land, referred to as directly affected land, would be acquired permanently for the proposal. Acquired land would be rezoned from RU1 Primary Production to SP2 Infrastructure for road purposes under the *Yass Valley LEP 2013*.

Land directly affected by the proposal would be acquired before commencement of construction, involving:

- Partial acquisitions where only part of a property would fall within the construction boundary
- Full acquisitions, where the majority of a lot would be impacted.

For properties that are subject to partial acquisitions, there would be residual portions of land remaining (herein referred to as residual land). In some cases, Roads and Maritime may also acquire the entire property where the partial acquisition may make a property unviable for its original use.

A total of 33 lots would be directly impacted by the proposal (see 3.6). The extent of property impact would be refined and confirmed during detailed design in consultation with the property owners. Property acquisition would be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime, 2014a) and the *Land Acquisition (Just Terms Compensation) Act 1999*. Other impact associated with partial property acquisition/adjustment include the need to relocate property boundary fencing, roadside vegetation and landscaped areas. Property adjustment plans would be developed in consultation with the affected property owners.

Part of the Hall TSR and Bedulluck TSR which are crown land would be acquired for the proposal in accordance to *Crown Lands Act 1989*. Mitigation measures for biodiversity would be considered to minimise impacts on native habitat and TEC within these properties (See Section 6.3.4).

### *Changes in property access*

Access to properties next to the Barton Highway would be affected by the proposal, and in most cases, accesses would require permanent relocation or closure to cater for the new northbound carriageway. The proposal would include modifying intersections to improve road user safety at the following locations:

- Church Lane
- Spring Range Road
- Nanima Road
- Rolfe Road
- Boundary Lane
- Briarwood Lane
- Kaveney's Road
- property access at CH16450
- property access at CH16820
- property access at CH16700
- property access at CH19600
- property access at CH22750

Direct access to the highway from Tallawong Close, Anchow Hill Lane and property access at CH21850, CH22810, CH22900 and CH23200 would be removed to improve road safety with access maintained through existing and proposed local access routes.

## 6.9.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impact to property and land use are outlined in Table 6-48.

Table 6-48 Property and land use safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property acquisition	Property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2014a), the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> (NSW) and the land acquisition reforms announced by the NSW government in 2016.	Roads and Maritime	Pre-construction	Additional safeguard
Property acquisition	Property acquisition of Crown Land will be carried out in accordance with the <i>Crown Lands Act 1989</i>	Roads and Maritime	Pre-construction	Additional safeguard

Other safeguards and management measures that would address socio-economic impact are identified in Section 6.10.4.

## 6.10 Socio-economic

A Socio-Economic Impact Assessment was carried out for the proposal (AECOM, 2018f). The socio-economic assessment is provided in Appendix L and the findings are summarised below.

### 6.10.1 Methodology

The socio-economic assessment addresses the requirements of the *Environmental Impact Assessment Practice Note – Socio-economic Assessment* (EIA N05) (Roads and Maritime 2013d) and the Roads and Maritime draft methodology for assessing the significance of socio-economic impact for a moderate level assessment. It has used quantitative and qualitative data as well as consultation with key stakeholders to inform the identification of potential impact and mitigation measures in a range of areas including:

- Amenity and community wellbeing
- Access and connectivity
- Economy
- Community identity, values and aspirations
- Property acquisition.

In the context of the socio-economic assessment, the study area includes the construction boundary, as well as the broader region within five km of the construction boundary and continuing north along the Barton Highway to Murrumbateman and ending at Yass.

The socio-economic study area lies within the Yass Valley LGA which comprises of the town of Yass and the villages of Binaong, Bookham, Bowning, Gundaroo, Murrumbateman, Sutton and Wee Jasper. The townships most likely to be affected by the proposal, and therefore remain the focus of this assessment are Murrumbateman and Yass, both of which are major population centres of the Yass Valley LGA that rely on the Barton Highway, as a transport link.

### 6.10.2 Existing environment

#### **Population and demography**

The Yass Valley LGA has experienced steady growth in its population between 2011 and 2016 and has a young age profile with higher proportions of residents aged 14 years or younger relative to the NSW State average. The Yass Valley LGA has a Socio-Economic Index for Areas score above 1,000 indicating that the area is advantaged compared to the Australian average, with a higher median household income and a higher proportion of high income households compared with the NSW State average. The most common employment source is public administration and safety. The population is heavily dependent on private motor vehicles for transport with only 1.5 per cent of residents within the Yass Valley LGA travelling to work using public transport.

#### **Social infrastructure**

The proposal is located within a rural area with limited social infrastructure facilities located within or directly next to the construction boundary. Wattle Park Uniting Church is the most noteworthy located directly next

to the construction boundary at CH17250. Social infrastructure located to the north of the proposal in Murrumbateman and Yass is shown in Figure 6-37.

Residents within the construction boundary are required to travel to the north or south along the Barton Highway to meet their socio-economic needs and for access to a wider range of facilities and infrastructure. For example, in Murrumbateman, there is an early childhood centre and a preschool but there are no primary or high schools, so the area is reliant on the larger regional centres including Yass and Canberra for these services. Similarly, for emergency services, the Murrumbateman Rural Fire Brigade is located within the vicinity of the proposal, however for police services, residents are required to travel to Yass or Canberra via the Barton Highway as there are no alternative routes to reach these destinations from the construction boundary.

### ***Local business***

The construction boundary contains a mix of agricultural businesses with land along the route of the Barton Highway being used mainly for grazing and cropping. There are no local businesses located directly within the construction boundary, however the following have been identified within the local vicinity:

- The Dogotel & Purrrfect Cattery (located off Church Lane, to the west of the construction boundary)
- Poacher's Pantry (located off Nanima Road, to the east of the construction boundary)
- Boral Quarry (located off Kaveney's Road, to the west of the construction boundary).

Within the broader vicinity, there are many businesses that rely on the Barton Highway (including the section within the construction boundary) for access for employees and customers. The majority of these businesses are located to the north of the construction boundary in Murrumbateman and Yass. Types of local business include:

- Wineries, such as Barton Estate Wines and Kerralee Wines, located on the properties along Barton Highway and in Murrumbateman and Yass
- Agistment and stud farms, such as Capricorn Park Stud
- Shops and cafes
- Petrol stations
- Accommodation including motels and inns.

Many businesses also rely on the Barton Highway, including the section within the construction boundary, for through access connecting the ACT to the southwest region of NSW.

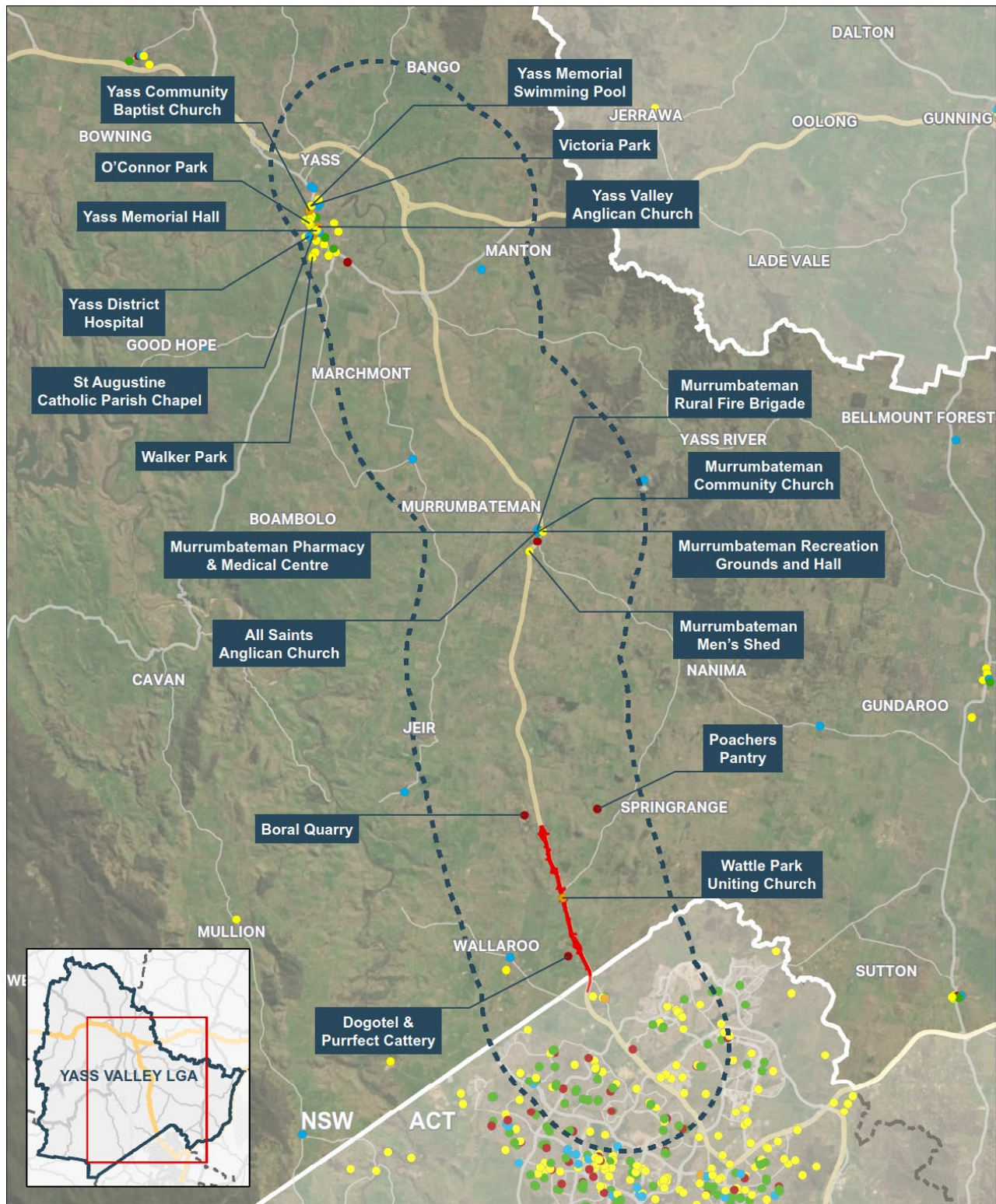
### ***Access and connectivity***

There are currently nine property access roads along the Barton Highway within the construction boundary at CH16450, CH16700, CH16820, CH19600, CH22750, CH21850, CH22810, CH22900 and CH23200. The main form of transportation for property owners and residents within the proposal area is via private vehicles along the Barton Highway.

There are six bus stops along the length of the proposal with only a limited number of commuter bus service that run between Yass and Canberra.

Pedestrian access along the Barton Highway is not available, however it is possible to cycle along the Barton Highway along the limited shoulders.





SOCIAL INFRASTRUCTURE WITHIN THE STUDY AREA

**AECOM**



Legend

- Health, emergency and aged care
- Education
- Sport and recreation
- Cultural
- Business
- ▬ Socio-economic study area
- ▬ Construction boundary

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Figure 6-37 Social infrastructure within the vicinity of the proposal

### **Community values, identity and aspirations**

Yass Valley identifies as a rural community which enjoys country living with access to city benefits due to its close proximity to Canberra. Community values and aspirations of the Yass Valley LGA, as identified in the *Yass Valley Council Community Strategic Plan 2013-2030*, include:

- Natural environment – clean, healthy and abundant with assets
- Local economy – diverse with convenient access to a variety of local industrial and retail businesses with strong local support for agri-business. Local industries (including wineries and tourism) are healthy and sustainable
- Community and culture – the area is safe and the community is friendly and welcoming with a strong sense of community through a range of active and supportive community groups. There is a strong sense of local history and the local Aboriginal community is very involved in community life
- Recreation and open space – there is a wide variety of local clubs and sporting facilities including local recreation options within proximity to local waterways, coastal areas, national parks and the snow
- Rural and urban development – large land parcels create a rural atmosphere and sense of open space within close proximity to the city. Wide streets and no high rise development create a friendly and welcoming town/village centre
- Local infrastructure and services – infrastructure is well maintained with good access to transport options connecting local area with Canberra, Sydney and Melbourne. Communities are supported by good education, medical and aged care services and facilities.

### **Community consultation**

Key issues raised by stakeholders during recent consultation carried out for the proposal are detailed in Table 5-1 and include matters relating to the proposal design, cycling pathway, impact on biodiversity, noise and visual impact, construction timeframes, construction impact, property acquisition and poor driver behaviour. Overall there was support from the local community for the proposal and they have been waiting for it to be implemented for a long time.

## **6.10.3 Potential impact**

### **Pre-construction**

As noted in Section 3.6, the proposal would require the partial or total acquisition of a number of properties. Property adjustment plans would be developed during detailed design in consultation with the property owners.

All acquisition required for the proposal would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), the Land Acquisition Information Guide (NSW government 2014) and the land acquisition reforms announced by the NSW government in 2016.

Details of property acquisition would be confirmed during detailed design of the proposal. Consultation has been carried out with directly affected residents and property owners about potential impact and the property acquisition process and opportunities. Roads and Maritime would continue to consult with affected property owners.

### **Construction**

#### **Demographics**

The proposal is not expected to have direct impact on the demographic profile of the study area. Workers not from the Yass Valley LGA may temporarily take residence in the area, influencing the local demographics in the short term but the changes are not considered to be significant.

### *Amenity and community wellbeing*

Construction of the proposal may temporarily impact the local amenity of the area, primarily through minor increases in noise and air emissions, additional traffic on local roads and visual amenity impact. Amenity impact would be minor, short-term and highly localised.

A noise and vibration assessment carried out for the proposal (see Section 6.2) found that depending on the proposed hours of construction, some residences along the Barton Highway may be exposed to noise impact during construction. Noise and vibration impact would be minimised through implementation of standard management measures for the duration of the construction period.

The proposal would result in a temporarily altered visual environment as a result of construction work and the use of temporary ancillary facilities (see Section 6.8.3). The impact is likely to be limited to visual receivers nearby to the construction boundary, including residences either side of the proposal and the Wattle Park Uniting Church to the east of the construction boundary. Visual impact would mainly arise near to construction work sites and at temporary ancillary facilities. There would also be an increase in construction traffic along key transport routes.

Impact to local air quality is likely to be minor and would be influenced by the extent and nature of the work being carried out and the local weather conditions (eg dust generation can be exacerbated during dry and windy conditions, particularly on hot days). Impact to local air quality would be minimised through implementation of standard management measures for the duration of the construction period (see Section 6.12.2).

### *Access and connectivity*

Construction of the proposal has the potential to result in local traffic impact from the establishment of traffic management measures, transportation of materials to site by heavy vehicle and physical alterations to local roads. Travel times and level of service would not reduce significantly from current conditions as much of the construction work would occur offline away from the existing highway.

### *Economic impact*

Potential impact, both positive and negative, of the construction of the proposal on the local economy are anticipated to include:

- An increase in business turnover and employment due to construction
- An increase in construction workforce and employment
- Changes to amenity of local business (ie The Dogotel & Purrfect Cattery, Poacher's Pantry and Boral Quarry) located in the vicinity of the construction boundary
- Temporary minor delays to freight transport between southern NSW and the ACT
- Temporary loss of productive agricultural land and/or impact to farm dams affecting productivity.

### *Impact to community identity, values and aspirations*

Potential impact of the proposal to community identity, values and aspirations during construction are:

- Decreased access as a result of increased congestion. Yass Valley LGA identifies as a community that enjoys a peaceful rural lifestyle with easy access to city amenities. There is potential that temporary changes in the highway during various construction stages may result in increased congestion which may limit access to residences, businesses and social infrastructure
- Decreased perceived level of safety (noting that the safety of the highway would not significantly change during construction until the new northbound carriageway is open to traffic).



## **Operation**

### *Demographics*

The proposal is not expected to have a direct impact on the demographic profile of the study area. However, increased road capacity and improved traffic flows and road user safety may influence residential growth in the region by making the region a more attractive place to live.

### *Acquisition of property and changes to land use*

A total of 32 properties would be subject to partial acquisition as part of the proposal, of which 24 are rural residential properties. All properties subject to partial acquisition would be zoned for road purposes. Partial acquisition would typically result in acquisition of a strip of land next to the existing road reserve. One property would be subject to full acquisition.

The Yass Valley LGA is predominantly rural with large use of agricultural land for activities such as sheep grazing, cropping, viticulture, dairy, wool and egg production. Of the 32 properties subject to partial acquisition, 24 are classified as having agricultural uses.

Boral Quarry is the only property used for business purposes that would be impacted by partial acquisition and would result in acquisition of a strip of land next to the existing highway, on the eastern side of the property.

One property (over two blocks of land) containing social infrastructure is subject to partial acquisition as part of the proposal. It contains the Wattle Park Uniting Church and is to be zoned for road purposes. Partial acquisition would result in acquisition of a strip of land next to the existing road reserve on the western side of the property to allow for a decelerating lane and for drainage work. The church itself and the items which make up part of the listing would not be impacted, however on the western boundary of the property a number of pine trees are to be removed for safety reasons (see Section 6.5).

### *Amenity and community wellbeing*

Day time noise levels are predicted not to exceed the day time noise criteria at residential receivers located on either side of the proposal. The changes in noise levels have been modelled to be less than two decibels which is typically considered unnoticeable and not considered significant. There would be exceedances at one non-residential receiver the Wattle Park Uniting Church (and the associated Sunday School building) located east of the construction boundary. This property which is eligible for the consideration of feasible and reasonable noise mitigation measures even though the proposal would reduce highway noise at this location. Operational night time noise impact as a result of the proposal are considered to be negligible as no changes of greater than two decibels have been identified within the residential receivers. Further detail on the assessment of noise and vibration is provided in Appendix E and summarised in Section 6.2.

Operation of the proposal would result in changes to landscape character and visual amenity due to the operation of the new northbound carriageway, new landscaping and other urban design features. A *Landscape Character and Visual Impact Assessment* (AECOM, 2018e) has been carried out for the proposal (Appendix K) which found low to moderate impacts on the LCZs identified in the vicinity of the construction boundary. The visual impact on sensitive receptors was rated as moderate or moderate-high for all locations except from the Wattle Park Uniting Church which was rated as high (see Section 6.8).

Impact to amenity and wellbeing are likely to be offset by the improved traffic flows and enhanced safety as a result of the proposal.



### *Access and connectivity*

The proposal would improve the level of service and safety of the highway within the construction boundary as described in Appendix D and summarised in Section 6.1. Once open to traffic the proposal would provide two lanes of traffic in each direction providing opportunities for road users to overtake slow moving vehicles without needing to cross into the path of oncoming traffic. The proposal would also provide an alternative route should one of the carriageways require planned or unplanned maintenance or during a traffic incident. There would be some increases to travel times from local roads and private properties accessing the highway as a number of the intersections would be restricted to left-in left-out for improved road user safety.

### *Economic impact*

As part of the broader Barton Highway Upgrade, the proposal contributes to the overall economic benefits of the Barton Highway Upgrade including:

- Increased quality of service as a result of safer road conditions and reduced travel times
- Improved freight and efficiency costs
- Employment connectivity.

### *Impact to community identity, values and aspirations*

The proposal would strengthen the community identities of the Yass Valley LGA including providing eased congestion and decreased travel times on the Barton Highway providing safe and easy access to city amenities.

Upon completion of the proposal, this section of the Barton Highway would be safer for road users as it would be duplicated and would ultimately provide wider lanes, shoulders, clear zones, better delineation and overall adequate overtaking opportunities for moving people and freight.

## 6.10.4 Safeguards and management measures

The recommended safeguards and management measures to minimise socio-economic impact are outlined in Table 6-49.

Table 6-49 Socio-economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	<p>A CP will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> <li>• Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions</li> <li>• Contact name and number for complaints.</li> </ul> <p>The CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008)</p>	Contactor	Detailed design / pre-construction	Standard safeguard
Socio-economic	All complaints are to be recorded on a complaints register and attended to promptly	Contactor	Construction	Standard safeguard
Socio-economic	Contact details for a 24-hour construction response line, proposal info line and email address will be provided for ongoing stakeholder contact throughout the design and construction phase	Roads and Maritime	Detailed design / pre-construction/ construction	Additional safeguard
Economic	Goods and services will be purchased locally helping to ensure the local community benefits from the construction of the proposal as best practicable	Contractor	Pre-construction and construction	Additional safeguard

Other safeguards and management measures that would address property and land use impact are identified in Section 6.9.4.

## 6.11 Resource use and waste

Roads and Maritime is committed to ensuring the responsible management of unavoidable waste and promotes the reuse of such waste in accordance with the resource management hierarchy principles outlined in the *WARR Act*. These resource management hierarchy principles, in order of priority are:

- Avoidance of unnecessary resource consumption in operations, maintenance, construction and management
- Resource recovery (including reuse, reprocessing, recycling and energy recovery)
- Disposal.

By adopting the above principles, Roads and Maritime aims to efficiently reduce resource use, reduce costs, and reduce environmental harm in accordance with the principles of ecologically sustainable development, as outlined in Section 8.2.

The performance criteria for this proposal would include the quantity of waste minimised, reused and recycled to the maximum extent possible and ecologically sustainable development considerations in procurement. Roads and Maritime waste recovery targets are summarised in Table 6-50. Waste generated from the proposal would be managed to achieve these targets.

Table 6-50 Roads and Maritime waste recovery targets

Waste type	Roads and Maritime target
Virgin excavated natural material/fill	95%
Concrete	90%
Asphalt	90%

Source: Roads and Maritime Annual Report 2017-18

### 6.11.1 Potential impact

#### **Resource use**

The proposal would require a range of resources including:

- An estimated net import of 20,000 cubic metres of fill material, although the proposal has been designed to balance cut and fill (see Section 3.3.5)
- Materials required for road pavements including road base, asphalt, aggregate, paint and sealing, etc
- Materials required for construction of cross drainage, culverts and general work such as cement, aggregate, sand, etc
- Materials required for safety barriers, street furniture, fencing, and bus stops with accessible shelters
- Fuel, lubricating oil and other resources required for operation of construction plant and vehicles
- Construction chemicals such as epoxy, paints, sealants, cleaning chemicals and other chemicals
- Water required for construction.

Based on the reference design there would be a need to import about 20,000 cubic metres of fill material. Virgin excavated natural material (VENM) and excavated natural material (ENM) that meets engineering requirements would be reused within the construction boundary as best practicable. There would also be

about 15,000 cubic metres of top soil generated from site stripping work that would be reused for topsoiling of batters within the construction boundary (see Section 3.3.5).

The use of resources for the proposal would increase the local demand of materials but is not anticipated to result in resources becoming scarce locally. The required fill materials would be sourced from Roads and Maritime registered local suppliers.

The quantities of materials required for the proposal would be refined during the detailed design taking into consideration the waste management hierarchy, in avoidance, recovery and reuse or disposal as well as the ecologically sustainable development principles set out in the *Environmental Impact Assessment - Practice Note: Ecologically Sustainable Development* (EIA-N02) (Roads and Maritime 2014e) and Roads and Maritime *Environmental Sustainability Strategy 2015-2019*.

### **Waste management**

Road construction activities typically generate various types of waste, some of which can be reused and recycled within the construction boundary or off-site. Waste streams expected from construction of the proposal include:

- VENM or ENM that does not meet engineering specifications and cannot be reused within the construction boundary as fill or for landscaping
- Biomass waste from vegetation clearing, which can be reused for mulching and landscaping work
- Packaging waste from materials delivered to construct the proposal including wooden pallets, crates, cartons, plastics materials and other packaging materials
- Debris from cleaning culverts and drainage along the existing Barton Highway
- Wastes from line marking work such as oils, paints and other materials
- Excess construction materials such as aggregate, sand and/or off-cuts from construction of safety railings or fencing
- Cables, electrical wires, conduits and piles from utility relocation and protection work as well as installation of street lighting
- Discarded street furniture from converting the existing Barton Highway into the dual carriageway southbound lanes
- Asphalt waste from road surfacing and/or resurfacing work as well as from removal of temporary access roads
- Wastes generated from maintenance of construction plant and equipment such as used oil, filters and wastes from cleaning, repairing and maintenance
- Waste from the demolition of Dellwood homestead (likely to contain asbestos containing materials)
- Contaminated material from spillage and/or clean-up of oil, fuel and other chemicals
- Potential contaminated material uncovered during construction (see Section 6.6.3)
- Office wastes from compounds such as paper, cardboard, printer toners and other waste
- Food and beverage packaging and containers generated by personnel on site
- Sewage from temporary toilets on site.

The largest quantity of waste to be generated would be VENM and ENM that does not meet engineering specifications. Where possible these materials would be re-used on site. Topsoil would also be stripped and stored for later re-use on site for use in landscaping.



The demolition of Dellwood homestead would be carried out in accordance with the requirements specified in Sections 6.4.4 and 6.5.4. The tanning vat and possibly other elements of the structure should be salvaged under the supervision of a Heritage Specialist and a Section 140 permit is required from DPIE before excavation within this property. If suspected asbestos containing material or contaminated soil is discovered during the demolition, the mitigation and management measures recommended in Section 6.11.2 will be implemented.

Some construction waste would be typically stockpiled within the construction compounds and disposed of upon completion of construction work. Waste skips would be provided at construction compound areas and waste would be removed regularly, recycled, reused or disposed of at an appropriately licensed waste facility. Using prefabricated modular construction components such as pre-cast culverts would reduce generation of waste on site.

Green waste would be chipped and reused as mulch for erosion and sediment control, and landscaping on site. Noxious weeds would be separated from native green waste and disposed at an appropriately licensed disposal facility.

Potential impact of construction waste includes:

- Generation of high volumes of waste on-site being sent to landfill due to improper classification, inadequate collection and disposal
- Contamination of soil, surface water and groundwater if not properly managed
- Inappropriate disposal of green waste may block drainage channels, increase bushfire risk and harbour pests
- Amenity impact including odour, worksites being unsightly and increase in vermin if waste is not effectively collected, stored and disposed.

Waste generated from the proposal during construction is not anticipated to cause adverse impact if managed in accordance with recommended mitigation and management measures, NSW EPA and Roads and Maritime guidelines.

### **Hazardous materials**

Hazardous materials commonly used for road construction work include fuels, lubricants, paints, epoxy, sealants, cleaning chemical, cement and other chemicals. These materials would be typically stored at the construction compounds and may be used throughout the construction boundary. Spillage or leakage of these materials during delivery, storage, handling or disposal could cause soil contamination and pollution of surface water or shallow groundwater. This risk would be managed by provision of adequate secondary containment for fuel and chemical storage areas, engaging trained suppliers that have spill management procedures in place and establishing storage, handling and spill response procedures in the CEMP. All hazardous waste would be managed in compliance with NSW EPA guidelines and disposed at appropriately licensed facilities.

### **Operation**

During operation of the highway there would be minimal generation of waste which would be generally similar to that being currently generated. Potential impact during operation would be from litter from road users including at the heavy vehicle enforcement bay and relocated bus stops, spillage of materials including hazardous materials from accidents and waste from maintenance activities. The proposal would have a negligible impact on resource use and waste management during operation.

## 6.11.2 Safeguards and management measures

The proposed safeguards and management measures for resource use and waste are outlined in Table 6-51.

Table 6-51 Waste and resource use safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Waste	<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"> <li>Measures to avoid and minimise waste associated with the project</li> <li>Classification of wastes and management options (re-use, recycle, stockpile, disposal)</li> <li>Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions</li> <li>Procedures for storage, transport and disposal</li> <li>Monitoring, record keeping and reporting</li> </ul> <p>The WMP will be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014d) and relevant Roads and Maritime Waste Fact Sheets</p>	Contactor	Detailed design / pre-construction	Section 4.11 of QA G36 <i>Environment Protection</i>
Waste	<p>When tree removal cannot be avoided, usable timber shall be salvaged as best practicable. Other biomass shall be chipped and mulched on site for erosion and sediment control, and landscaping.</p> <p>If vegetation is to be mulched and transported off site for beneficial reuse, it is to be assessed for the presence of weeds, pest, and other disease and a Mulch Management Plan prepared in accordance with the <i>Roads and Maritime Technical Procedure: Mulch Management</i></p>	Contactor	Construction	Standard safeguard
Waste	<p>Bulk project waste (eg fill) sent to a site not owned by Roads and Maritime (excluding EPA licensed landfills and resource recovery facilities) is to have prior formal written approval from the landowner, in accordance with <i>Environmental Direction No. 20 – Legal Off-site Disposal of Roads and Maritime Services Waste</i>. This includes waste</p>	Contactor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	transported for reuse, recycling, disposal or stockpiling			
Waste	<p>Waste is not to be burnt on site.</p> <p>There is to be no disposal or re-use of construction waste on to other land.</p> <p>Waste material, other than vegetation and tree mulch, is not to be left on site once the work have been completed.</p> <p>Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.</p> <p>Good housekeeping will be maintained at construction sites throughout the construction phase. Waste will be collected, segregated, stored and recycled as best practicable or disposed at an appropriately licensed facility on a regular basis</p> <p>All waste will be managed in accordance with the <i>POEO Act</i> and classified in accordance with the NSW EPA Waste Classification Guidelines 2014 methods and specifications</p>	Contactor	Construction	Standard safeguard
Sewage	Appropriate portable toilets with either pump out facilities or sewer connections will be provided for site personnel and sewage will be disposed of appropriately and in accordance with relevant legislation	Contactor	Construction	Additional safeguard
Construction waste	A post-construction land assessment will be carried out of land that was used for ancillary construction purposes (compounds, storage, parking, etc.) to determine the suitability for hand-back to the landowner	Contactor	Construction	Additional safeguard
Resource use	<p>Resource management hierarchy principles are to be followed:</p> <ul style="list-style-type: none"> <li>• Avoid unnecessary resource consumption as a priority</li> <li>• Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery)</li> <li>• Disposal is carried out as a last resort</li> </ul> <p>(in accordance with the <i>WARR Act</i>)</p>	Contactor	Construction	Additional safeguard
Resource use	Procurement will adhere to Roads and Maritime <i>Environmental Sustainability Strategy 2015-2019</i> and use materials, products and services which are cost and performance effective. Materials and services shall be	Contactor	Detailed design / pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	sourced from Roads and Maritime registered local suppliers as best practicable			
Contaminated land – assessment of imported VENM or ENM	Before the importation of VENM or ENM, source sites will be identified and assessed against the definition of VENM in the NSW EPA (2014) <i>Waste Classification Guidelines</i> and <i>POEO Act</i> and ENM against the <i>Excavated Natural Material Order 2014</i>	Contractor	Construction	Additional safeguard
Spoil waste management and transport	<p>Spoil to be removed from the site which has been assessed as not suitable for reuse or cannot be reused will be classified in accordance with NSW EPA (2014) <i>Waste Classification Guidelines</i>. The spoil will be transported to an appropriate waste disposal facility licensed to receive such waste. Approval will be obtained from the respective landfill facility before transport and will require an estimate of the likely volume of waste to be disposed</p> <p>The following material handling requirements will be implemented for trucks transporting materials off-site:</p> <ul style="list-style-type: none"> <li>• A licensed transporter will be used to transport material to an appropriately licensed facility</li> <li>• All truck loads will be filled to the correct level and not over filled</li> <li>• Trucks carrying waste materials will be covered before exiting the work site and will remain covered until authorised to unload at the destination (licensed waste facility)</li> <li>• Trucks will be fitted with seals to ensure that the movement of potentially saturated materials is carried out appropriately. The integrity of the seals will be inspected and tested before the start of each day's haulage work</li> <li>• In the event that materials are tracked or spilt outside of the construction zone, soil will be immediately cleaned up in a way that prevents contamination of land, the stormwater or waterways</li> </ul> <p>All truckloads and landfill waste tickets/dockets will be tracked and a register completed to reconcile and check spoil has been lawfully disposed</p>	Contractor	Construction	Additional safeguard
Existing condition of	Before land being used for ancillary construction purposes (compounds, storage,	Contractor	Pre-construction	Additional safeguard



Impact	Environmental safeguards	Responsibility	Timing	Reference
ancillary sites	parking, etc), a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes		/ detailed design	
Asbestos management	<p>An Asbestos Management Plan (AMP) will be developed for areas known to contain asbestos containing material (ACM) (from pre-construction investigations), areas suspected of containing ACM and to address unexpected finds of ACM during construction. Specifically, protocols should be stipulated for separation, monitoring, validation and clearance of asbestos</p> <p>The AMP and associated Standard Work Procedures should satisfy the requirements of the Safe Work Australia Asbestos Codes of Practice and Guidance Notes:</p> <ul style="list-style-type: none"> <li>• <i>Code of Practice: How to Manage and Control Asbestos in the Workplace</i></li> <li>• <i>Code of Practice: How to Safely Remove Asbestos</i></li> <li>• <i>Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre</i>, 2<sup>nd</sup> Edition [NOHSC: 3003 (2005)]</li> </ul>	Contractor	Construction	Additional safeguard
Asbestos management	Identified ACM will be segregated, managed and disposed of as Special Waste and transported and disposed in accordance with <i>Protection of the Environment Operations (Waste) Regulation 2014</i> . Where more than 100 kg of asbestos waste or more than 10 square metres of asbestos sheeting is transported, the NSW EPA online tool WasteLocate will be used	Contractor	Construction	Additional safeguard

## 6.12 Other impact

### 6.12.1 Existing environment and potential impact

Factor	Existing environment	Potential impact
Air quality and climate change	<p>Based on the existing land uses surrounding the proposal, the existing air quality is considered to be characteristic of a rural environment</p> <p>A search of the National Pollutant Inventory carried out on 24 October 2019 for the 2017 to 2018 reporting period identified nineteen air polluting substances from one source (Boral Quarry) within the Yass Valley LGA</p> <p>Existing sources of air pollution in the vicinity of the construction boundary include:</p> <ul style="list-style-type: none"> <li>Exhaust emissions from vehicles currently using the Barton Highway including nitrogen oxides (NO<sub>x</sub>), sulphur oxides (SO<sub>x</sub>), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), particulate matter (PM<sub>10</sub>) and deposited dust</li> <li>Potential emissions from Boral Quarry located about one km from the highway.</li> </ul> <p>Sensitive receivers of air quality impact include:</p> <ul style="list-style-type: none"> <li>Local residences in the vicinity of the highway</li> <li>Wattle Park Uniting Church located nearby to the highway</li> <li>Road users, including those waiting at bus stops and vehicles stopped at the heavy vehicle enforcement bay</li> </ul> <p>The main current source of greenhouse gasses, which cause climate change, within the construction boundary is carbon dioxide emissions from vehicles using the highway</p>	<p>Key air quality impacts that have the potential to occur during construction and operation would be impact associated with:</p> <ul style="list-style-type: none"> <li>Fugitive dust from exposed work sites during construction where there is active earthwork, vehicle movement or exposed stockpiles causing nuisance to nearby residences and road users</li> <li>Air emissions from construction machinery, plant and motor vehicles of NO<sub>x</sub>, SO<sub>x</sub>, CO, CO<sub>2</sub>, particulate matter (PM<sub>10</sub>) and deposited dust causing a reduction in local air quality</li> <li>Amenity impacts such as dust and smoke plumes from construction sites being visible</li> <li>Amenity impact of increased dust settling on roofs, parked vehicles, window sills, etc.</li> <li>Odour from improperly managed sewage at temporary construction compounds</li> <li>Reduced air quality due to local residences next to the highway due to increased vehicle emissions and dust</li> <li>Climate change causing extreme weather events that cause local floods and increased risk of bushfire</li> </ul>

Factor	Existing environment	Potential impact
Utilities	<p>There are high voltage power lines and fibre optic telecommunication cables within the construction boundary which would be impacted by the proposal. A utility investigation was carried out in 2018 for the proposal and the location of utilities within the construction boundary is shown in Figure 3-10 and described in Section 2.2.6.</p> <p>These include:</p> <ul style="list-style-type: none"> <li>• Overhead high voltage power lines (132 kV and 66 kV) running transversely across the construction boundary (not impacted by the proposal)</li> <li>• Overhead high voltage power lines (22 kV) running parallel to the proposal which would be relocated as a result of the proposal</li> <li>• Underground fibre optic cables which would require relocation</li> </ul> <p>Asset owners of these utilities have been contacted with consultation continuing during detailed design and construction to determine specific requirements/mitigation measures for working next to this asset</p>	<p>Key impact to utilities that have the potential to occur during construction and operation include:</p> <ul style="list-style-type: none"> <li>• Temporary disruption of services during utility work as part of the proposal. Utilities within the construction boundary would be relocated and protected before commencement of major earthwork</li> <li>• Adjustment of overhead or underground utilities would cause minor disruption to existing traffic on Barton Highway or intersections as well as pose a risk to public safety</li> <li>• Accidental damage of utilities during construction causing outages and disruption to local services</li> </ul> <p>Utilities relocation work may give rise to the following impacts:</p> <ul style="list-style-type: none"> <li>• Erosion and sedimentation from cable laying and installation of new electrical poles</li> <li>• Visual impact from the realigned overhead power lines</li> <li>• Temporary traffic impact during the work</li> <li>• Waste electrical wires and poles that can be reused or recycled</li> </ul>
Hazards and risk management	<p>Existing hazards and risks associated with operation of this section of Barton Highway are mainly associated with road user safety and vehicle crashes associated with the design safety issues described in Chapter 2.</p> <p>A review of the Yass Valley Council LGA bush fire prone areas map (2014) showed that the majority of the proposal was not within a bush fire prone area based on the vegetation categories mapped. There are a limited number of vegetation patches which are identified as having a potential bushfire risk within or next to the construction boundary. These are located north of Nanima Road, near to Mountain View. ACTmapi</p>	<p>Most operational impact associated with the proposal are positive and would reduce hazards and risks. The proposal would increase the safety for road users</p> <p>Key hazards during construction and operation include:</p> <ul style="list-style-type: none"> <li>• Potential contamination of soil, surface water, shallow groundwater or terrestrial habitats within and next to the construction boundary from spillage of fuel and chemicals</li> </ul>

Factor	Existing environment	Potential impact
	<p>(ACT Government, 2019) identifies the Hall TSR area near the NSW/ACT border as being within a bushfire prone area. Overall the bushfire and grass fire risk for the construction boundary is considered low</p>	<p>during delivery, storage and handling in construction (Section 6.6)</p> <ul style="list-style-type: none"> <li>• Safety risk due to road crashes for construction workers, road users and local residents</li> <li>• Safety risk when carrying out relocation of HV power lines</li> <li>• Worker exposure to hazardous substances (eg asbestos)</li> <li>• Bushfire posing a threat to human life and injury, property damage, farmland, natural habitats and threatened wildlife</li> </ul>



## 6.12.2 Safeguards and management measures

Recommended safeguards and management measures to minimise other impact are outlined in Table 6-52.

Table 6-52 Other impact safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	<p>An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• Potential sources of air pollution</li> <li>• Air quality management objectives consistent with any relevant published EPA and/or DPIE guidelines</li> <li>• Mitigation and suppression measures to be implemented</li> <li>• Methods to manage work during strong winds or other adverse weather conditions</li> <li>• A progressive rehabilitation strategy for exposed surfaces</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.4 of QA G36 <i>Environment Protection</i>
Air quality	Stockpiles or areas that may generate dust will be managed to suppress dust emissions in accordance with the Roads and Maritime <i>Stockpile Site Management Guideline</i> (EMS-TG-10)	Contractor	Construction	Standard safeguard
Utilities	<p>Before the commencement of work:</p> <ul style="list-style-type: none"> <li>• The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners</li> <li>• If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be carried out</li> </ul>	Contractor	Detailed design / pre-construction	Standard safeguard
HV relocation	<p>Relocated 22 kV overhead power lines will be designed to be:</p> <ul style="list-style-type: none"> <li>• Within the proposed Roads and Maritime road reserve boundary (including land to be acquired for the proposal) with a minimum of 7.5 m clearance from the edge of the road reserve, unless otherwise agreed with the appropriate energy provider</li> <li>• Developed in accordance with the guidelines and codes of practice recommended by the appropriate</li> </ul>	Contractor	Detailed design / pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	energy provider, unless otherwise agreed by the appropriate energy provider			
Hazard s and risk manag ement	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• Details of hazards and risks associated with the activity</li> <li>• Measures to be implemented during construction to minimise these risks</li> <li>• Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials</li> <li>• A monitoring program to assess performance in managing the identified risks</li> <li>• Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations</li> </ul> <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant <i>Safe Work Australia Codes of Practice</i>, and EPA or DPIE (ie formerly Office of Environment and Heritage) publications</p>	Contractor	Detailed design / pre-construction	Standard safeguard
Hazard s and risk manag ement	Emergency contacts will be kept in an easily accessible location on vehicles, plant and the site office. All workers will be advised of these contact details and procedures	Contractor	Construction	Standard safeguard

## 6.13 Cumulative impact

Cumulative impact occur when two or more projects are carried out concurrently and nearby to one another. The impact may be caused by both construction and operational activities and can result in a greater impact to the surrounding area than would be expected if each project was carried out in isolation.

### 6.13.1 Existing or potential projects

#### **ACT section of the proposal**

As part of the Barton Highway Upgrade, but subject to a separate planning and approvals process, a 700 m tie-in section would be provided from the NSW/ACT border south to the existing dual carriageway in Hall, ACT. The impact assessment for this section of modification is documented separately as part of a work

approval to be determined by the NCA. Pending planning approvals, this tie-in section of the proposal would be carried out concurrently with the NSW section of the proposal and likely by the same contractor.

Table 6-53 lists this development and identifies potential impact.

### ***Barton Highway Upgrade***

The proposal is part of a broader program of work to upgrade the Barton Highway. The Barton Highway Upgrade is shown in Figure 6-38 and comprises four main packages of work as described in Section 1.2. The Barton Highway Upgrade has been designed to complement each other and to make the best use of the available funding to improve the safety performance of the Barton Highway.

Construction associated with the safety works scope has started. The safety works work includes: improving clear zones such as installing a new safety barrier and tree removal), improving bus stop locations, installing intelligent Transport Systems, providing delineation and signage (upgrading linemarking), improving access for vulnerable road users (cyclists, pedestrians) in Murrumbateman village and upgrading intersections. However, it is also likely that construction of the proposal may occur as the safety works are being completed. There is a potential for cumulative impact as a result of physical work being carried out at locations on the Barton Highway at the same time as construction associated with the proposal. Table 6-53 lists these developments and identifies potential impact of these projects.

While development of other sections of the Barton Highway Upgrade progress, which would complete the duplication from NSW/ACT border to Murrumbateman, it is not likely that construction of this proposal would occur at the same time. These cumulative impacts from this proposal and from the future duplication would be assessed and managed as part of the Barton Highway Upgrade: Future Duplication from completed section: Review of Environmental Factors.

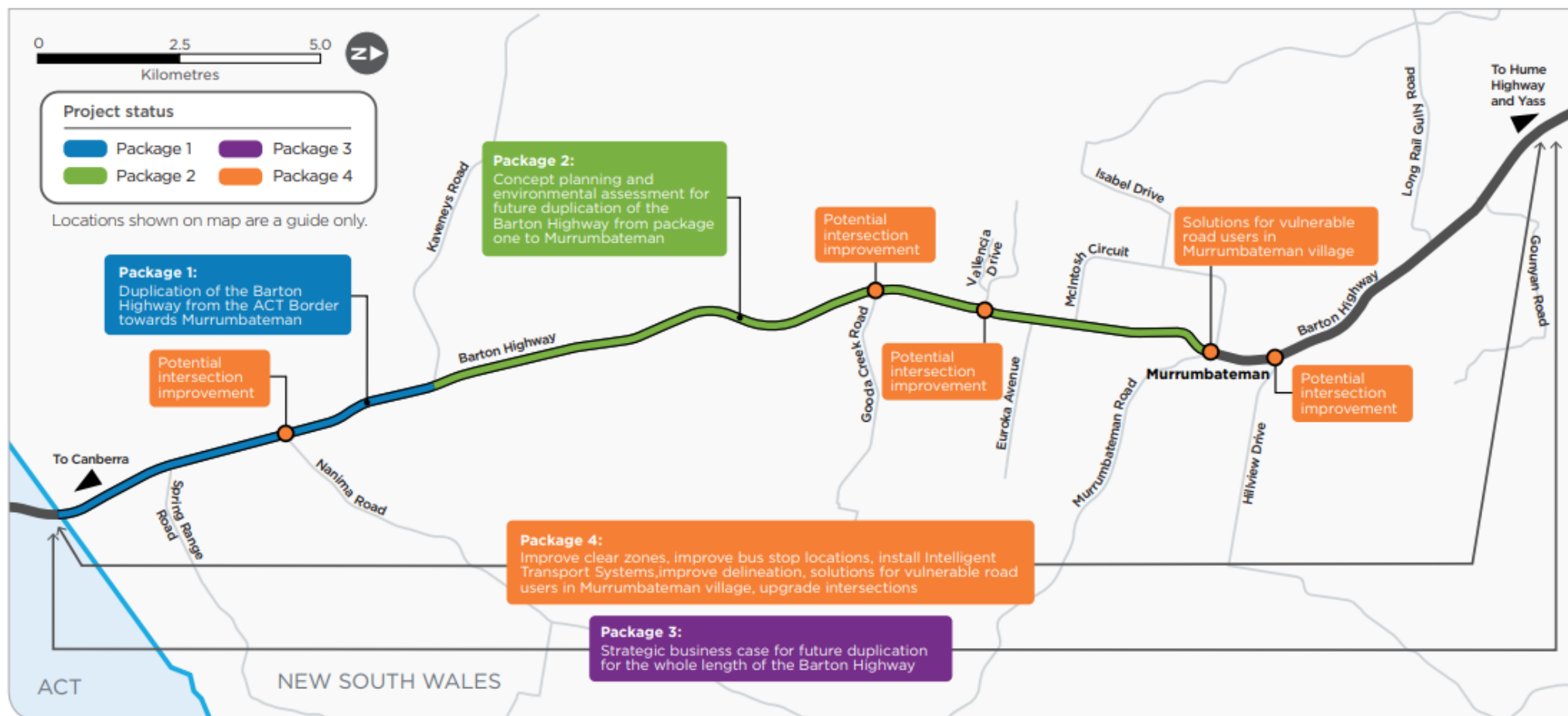


Figure 6-38 Barton Highway Upgrade program of work



## Other projects and developments

A review of the current proposed and approved developments listed for the Yass Valley LGA on the NSW Department of Planning and Environment Major Projects website, the Yass Valley Council website and the ACT Government Development Application finder in ACTmapi identified a number of major developments that may be relevant to the proposal to assess cumulative impact on the community. Table 6-53 lists these developments and identifies potential impact of the proposal.

Table 6-53 Review of major projects

Project	Construction impact	Operational impact
<p>Barton Highway Upgrade ACT section:</p> <ul style="list-style-type: none"> <li>700 m section tie in section tie-in from the NSW/ACT border to the existing dual carriageway in Hall, ACT</li> <li>Construction is subject to ACT approvals</li> <li>Currently in reference design stage</li> <li>Expected to be constructed concurrently with this proposal</li> </ul>	<p>Construction impact of the Package one ACT section may include:</p> <ul style="list-style-type: none"> <li>Clearing of about 0.3 ha of EEC Box-Gum Woodland (Commonwealth and ACT listed)</li> <li>Increased traffic congestion potentially affecting streets in Hall including Victoria Street during standard construction hours</li> <li>Amenity impact (including noise and vibration and visual impact) for residents living in Hall</li> <li>Benefits to the local economy through the supply of goods and services from the local region</li> </ul>	<p>Impact to EEC Box-Gum Woodland (Commonwealth and ACT listed) would be offset as part of the overall proposal offsets (Section 6.3).</p> <p>Operational impact of the Package one ACT section may include:</p> <ul style="list-style-type: none"> <li>Safe transition from the existing dual carriageway in Hall ACT to the north onto the newly duplicated Barton Highway in NSW</li> <li>Eased congestion/improved traffic flows</li> </ul>
<p>Barton Highway Safety Works:</p> <ul style="list-style-type: none"> <li>Improve clear zones (safety barrier installation), improve bus stop locations, install Intelligent Transport Systems, improve delineation, solutions for vulnerable road users in Murrumbateman village, potential intersection improvements at Nanima Road, Gooda Creek Road, Vallencia Drive and Hillview Drive</li> <li>Safety Works started construction in November 2017(with the safety barrier installation) with the rest of the works currently underway</li> </ul>	<p>Construction impact of Safety Works may include:</p> <ul style="list-style-type: none"> <li>Increased traffic congestion for residents within the construction boundary travelling from Yass and Murrumbateman to Canberra with enforcement of traffic management measures</li> <li>Amenity impact (including access and connectivity, noise and vibration and visual impact) for residents living near intersections to be improved</li> <li>Benefits to the local economy through the supply of goods and services from Murrumbateman/Yass</li> </ul>	<p>Operational impact of Safety Works may include:</p> <ul style="list-style-type: none"> <li>Safer road conditions</li> <li>Eased congestion/improved traffic flows</li> </ul>

Project	Construction impact	Operational impact
<b>Springdale Solar Farm:</b> <ul style="list-style-type: none"> <li>120 megawatt solar farm over 190 hectares in size</li> <li>Located in Sutton about 15 km east of the construction boundary</li> <li>Greenfield site</li> <li>An Environmental Impact Statement has been conducted and a referral submitted to Department of Environment and Energy. Construction has yet to start</li> </ul>	Construction impact of the Springdale Solar Farm may include: <ul style="list-style-type: none"> <li>Noise levels exceeding noise management levels at four receivers in Sutton</li> <li>Increased heavy and light vehicle movement along the Federal Highway for delivery of goods</li> </ul>	Operational impact of the Springdale Solar Farm may include: <ul style="list-style-type: none"> <li>Impact to biodiversity including the Golden Sun Moth, Box-Gum Woodland and Natural Temperate Grassland</li> <li>Impact to Aboriginal heritage</li> <li>Visual impact to 11 residences and road users of Tallagandra Lane</li> </ul>
<b>Gravel Road Re-sheeting Program, Urban Roads Reseal Program, Rural Reseal Program, Rural Roads Rehabilitation Program</b> <ul style="list-style-type: none"> <li>Details of these programs are unknown, including exact locations within the Yass Valley LGA</li> <li>Scheduled to begin 2018/2019 and ongoing</li> </ul>	Construction impact of these programs may include: <ul style="list-style-type: none"> <li>Increased traffic congestion for residents within the study area travelling from Yass and Murrumbateman to Canberra with enforcement of traffic management measures</li> <li>Amenity impact (including access and connectivity, noise and vibration and visual impact) for residents living within close proximity of the roads to be re-sheeted/resealed</li> </ul>	Operational impact of these programs may include: <ul style="list-style-type: none"> <li>Safer road conditions</li> <li>Eased congestion/improved traffic flows</li> </ul>

## 6.13.2 Potential impact

### Construction

Cumulative impact could occur during construction as a result of the proposal and other developments in the locality being carried out concurrently. However, this would be temporary and environmental safeguards and management measures would be implemented as appropriate.

The key cumulative impact during construction could include:

- Increased construction vehicle traffic on local roads causing congestion and delays
- Cumulative noise impact associated with multiple construction work sites
- Temporary changes to the visual amenity of the area.

The severity of potential cumulative impact would vary between locations and would generally be dependent on the types of work being carried out, the timing and duration of the work relative to each other, the distance between the work and the receivers and the sensitivity of the receiver.

There is a likelihood that the construction periods of some of these projects would overlap. This may result in potential traffic management issues during construction. Traffic adjustments required during construction would be coordinated through the Traffic Management Centre NSW and in consultation with other developments.

When combined with other projects in the area the potential cumulative noise levels in the construction boundary may result in exceedance of the noise criteria (see Section 6.2.3) and result in reduced local amenity. During work, reasonable and feasible measures to manage noise levels in exceedance of the criteria would be carried out where practicable to minimise all noise impact. Work associated with Barton Highway Upgrade would be coordinated to manage the cumulative noise impact.

For residents and road users in the area, coinciding construction activities may also result in a lower visual amenity and air quality environment during work. There may also be a greater sensitivity to impact described in this assessment through 'construction fatigue'.

## Operation

The proposal, combined with the broader Barton Highway Upgrade, would result in cumulative benefits for the Barton Highway road corridor and to the locality through increased capacity of the road network, improved traffic flow and journey times, improved road safety, improved cyclist and pedestrian facilities.

However, cumulatively the highway upgrades may also result in localised increases in traffic noise and air pollution within the region. Noise impact would be addressed during design on a project-by-project basis to minimise impact on sensitive receivers and would be further managed through proposal-specific noise management plans. Air quality would also be addressed on a project-by-project basis.

The highway upgrades may also contribute to a loss of rural land cumulatively, however this is expected to be minor. The proposed land acquisition would also cater for future upgrades to grade separated intersections as necessary without further need for additional acquisition.

As discussed in Section 6.3, the residual unavoidable impact to Box-Gum Woodland as a result of the proposal is unlikely to be significant and therefore does not legally require offsets. However an offset strategy would be developed for Box Gum Woodland TEC in accordance to Roads and Maritime Biodiversity Offset Guidelines. While the loss of 0.3 ha of Box-Gum Woodland required for the 700 m tie-in section (from the NSW/ACT border to the existing dual carriageway in Hall, ACT) by itself does not trigger a need for biodiversity offsets, the biodiversity offset strategy created for the NSW section of Package 1 would include the impact on Box-Gum Woodland located within the ACT section of the proposal, to offset the cumulative impact of this loss.

## 6.13.3 Safeguards and management measures

The recommended safeguards and management measures to minimise cumulative impact are outlined in Table 6-54.

Table 6-54 Cumulative impact safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative construction impact	The CEMP will be revised to consider potential cumulative impact from surrounding development and construction impact activities as they become known via discussion with contractors on other projects	Contractor	Pre-construction and construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impact to biodiversity	Biodiversity offsets will be secured as per the Roads and Maritime <i>Biodiversity Offset Guidelines</i>	Roads and Maritime	Detailed design	Additional safeguard



## 7. Environmental management

This chapter describes how the proposal would be managed to reduce potential environmental impact throughout detailed design, construction and operation. A framework for managing the potential impact and a summary of site-specific environmental safeguards is provided. The licence and/or approval requirements required before construction are also listed.

### 7.1 Environmental management plans

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impact, including social impact, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a CEMP would be prepared to describe the safeguards and management measures identified. The PEMP and CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The PEMP and CEMP would be prepared before construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, South West Region, before the commencement of any on-site work. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP would be developed in accordance with the specifications set out in the QA Specification G36 – *Environmental Protection (Management System)*, QA Specification G38 – *Soil and Water Management (Soil and Water Plan)*, QA Specification G40 – *Clearing and Grubbing*, QA Specification G10 – *Traffic Management*.

## 7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF would 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 would minimise any potential adverse impact arising from the proposed work 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	Reference
GEN1	General - minimise environmental impact during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager before commencement of the activity. As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> <li>Any requirements associated with statutory approvals</li> <li>Details of how the project will implement the identified safeguards outlined in the REF</li> <li>Issue-specific environmental management plans</li> <li>Roles and responsibilities</li> <li>Communication requirements</li> <li>Induction and training requirements</li> <li>Procedures for monitoring and evaluating environmental performance, and for corrective action</li> <li>Reporting requirements and record-keeping</li> <li>Procedures for emergency and incident management</li> <li>Procedures for audit and review</li> </ul> <p>The endorsed CEMP will be implemented during the undertaking of the activity</p>	Contractor/ Roads and Maritime project manager	Pre-construction/ detailed design	Standard safeguard
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 before commencement of the activity	Contractor/ Roads and Maritime project manager	Pre-construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
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 proposal. 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"> <li>• Areas of Aboriginal and non-Aboriginal heritage sensitivity</li> <li>• Threatened species habitat</li> <li>• Adjoining residential areas requiring particular noise management measures</li> </ul>	Contractor/ Roads and Maritime project manager	Pre-construction / detailed design	Standard safeguard
GEN4	General – environmental awareness	The Roads and Maritime Project Manager will notify the Roads and Maritime Environment Manager at least five days before the commencement of the activity. The notification will include a copy of any local community notification carried out (GEN2)	Roads and Maritime project manager	Pre-construction	Additional safeguard
Traffic and access					
T1	Traffic and transport	<p>A 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> (Roads and Maritime, 2018e) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008).</p> <p>The TMP will include:</p> <ul style="list-style-type: none"> <li>• Confirmation of haulage routes</li> <li>• Measures to maintain access to local roads and properties</li> <li>• Site specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>• Measures to maintain pedestrian and cyclist access</li> <li>• Measures to maintain safe access to bus stops</li> <li>• Requirements and methods to consult and inform the local community of impact on the local road network in line with Roads and Maritime '<i>Community Engagement and Communication Manual</i>' (Roads and Maritime 2012)</li> <li>• Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads</li> <li>• A response plan for any construction traffic incident</li> </ul>	Contractor	Detailed design/ Pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>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</li> <li>Monitoring, review and amendment mechanisms</li> </ul>			
T2	Construction traffic impact	A detailed construction staging plan will be developed to maintain existing peak flow capacity	Contractor	Pre-construction	Additional safeguard
T3	Traffic and transport	Where possible, the most disruptive work (such as work that requires lane closures) will be carried out at night to minimise potential impact on the regional road network. This, combined with temporary effective traffic management, will assist in minimising impact to traffic and transport using the Barton Highway	Contractor	Construction	Additional safeguard
T4	Impact to emergency services	Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency and documented in the TMP	Contractor	Pre-construction and construction	Additional safeguard
T5	Safe access to bus services	Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community	Contractor/ Roads and Maritime	Pre-construction and construction	Additional safeguard
T6	Property access - pre-construction	Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners	Contractor/ Roads and Maritime	Pre-construction and detailed design	Additional safeguard
Noise and vibration					
N1	Noise and vibration	<p>A CNVMP will be prepared and implemented as part of the CEMP. The CNVMP will generally follow the approach in the Interim <i>Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> <li>All potential significant noise and vibration generating activities associated with the activity</li> <li>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, 2014b)</li> </ul>	Contractor	Detailed design/ pre-construction	Standard safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>A monitoring program to assess performance against relevant noise and vibration criteria</li> <li>Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures</li> <li>Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria</li> </ul>			
N2	Noise and vibration	<p>All sensitive receivers (eg church, local residents) likely to be affected will be notified at least five days before commencement of any work associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> <li>The proposal</li> <li>The construction period and construction hours</li> <li>Contact information for project management staff</li> <li>Complaint and incident reporting</li> <li>How to obtain further information</li> </ul> <p>Receivers who are expected to experience an exceedance of the construction NMLs should be consulted about the proposal before the commencement of the particular activity, with highest consideration given to those that are predicted to be most affected as a result of the work. Additional information to be provided to the receivers expected to experience an exceedance include:</p> <ul style="list-style-type: none"> <li>Programmed times and locations of construction work</li> <li>Construction noise and vibration impact predictions</li> <li>Construction noise and vibration mitigation measures being implemented on site</li> </ul> <p>Community consultation regarding construction noise and vibration will be detailed in the CP for the construction of the proposal and will include a 24 hour hotline and complaints management process</p>	Contactor	Detailed design/pre-construction	Standard safeguard
N3	Construction Noise and vibration	<p>Work to be carried out during normal work hours (ie 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any work that is performed outside normal work hours or on Sundays or public holidays must have measures in place to minimise noise impact. Approvals will be obtained from the Yass Valley Council for work outside normal working hours and the local community would be notified as specified in the CP</p>	Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N4	Construction Noise	Where possible, work outside of standard construction hours will be planned so that noisier work are carried out in the earlier part of the evening or night time	Contractor	Pre-construction/ construction	Standard safeguard
N5	Noise and vibration	Where there are complaints about noise from an identified work activity, the work activity will be reviewed, and where feasible and reasonable, action additional control measures. This may include monitoring to confirm that predicted impact are in line with levels predicted in this assessment	Contractor	Construction	Standard safeguard
N6	Site induction	All personnel working on site will receive training to ensure awareness of requirements of the CNVMP. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers (eg Wattle Park Uniting Church)	Contractor	Pre-construction/ construction	Standard safeguard
N7	Construction traffic noise	<p>The following measures will be implemented to reduce and manage noise and vibration impact related to traffic:</p> <ul style="list-style-type: none"> <li>• Heavy vehicle drivers will be advised of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (ie minimising the use of engine brakes, and no extended periods of engine idling). Vehicle routes should be reviewed and final selections should consider noise impact on noise sensitive receivers</li> <li>• Site access and egress points will be located away from residences and other sensitive land uses, where feasible and reasonable</li> <li>• Deliveries and spoil removal will be planned to avoid queuing of heavy vehicles on or around the temporary compound areas</li> <li>• Where feasible and reasonable, non-tonal reversing alarms will be used, taking into account the requirements of the Workplace Health and Safety legislation</li> </ul>	Contractor	Pre-construction/ construction	Additional safeguard
N8	Construction vibration	Measures, including allowing adequate distance that rollers and other vibration producing equipment can come to nearby buildings and/or using non vibration producing equipment and equipment maintenance will be implemented to minimise or prevent vibration impact	Contractor	Construction	Standard safeguard
N9	Construction vibration	Wherever feasible and reasonable, vibration intensive work should be limited to the least sensitive times of the day	Contractor	Pre-construction/ construction	Additional safeguard
N10	Construction vibration	If the use of vibration intensive plant cannot be avoided within the minimum working distance for cosmetic damage the following procedure will occur as a minimum:	Contractor	Pre-construction/ construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>Notification of the work to the affected residents and community</li> <li>Work will not proceed until attended vibration measurements are carried out</li> </ul> <p>If ongoing work is required, a temporary relocatable vibration monitoring system will be installed, to warn operators (via flashing light, audible alarm, short message service etc) when vibration levels are approaching the cosmetic damage objective</p>			
N11	Construction vibration	<p>Building condition inspection reports must be completed in accordance with QA Specification G36 for all heritage structures in the construction boundary (eg Wattle Park Uniting Church) and any other nearby structures or buildings at risk from vibration impact</p> <p>A follow up building condition inspection of all heritage structures in the work area will be carried out when all the construction work is complete</p>	Contractor	Pre-construction and during construction as required	Additional safeguard
N12	Construction blasting	A series of initial test blasts at reduced scale will be carried out before the commencement of full scale blasting. Airblast overpressure and vibration will be measured from test blasts to establish appropriate propagation characteristics for the size and increase the accuracy of blasting predictions. This information will be used to define maximum allowable blast sizes	Contractor	Construction - before any blasting	Additional safeguard
N13	Operational noise	Appropriate noise mitigation to minimise noise impact on the Wattle Park Uniting Church and associated Sunday School building will be determined during detailed design when more detailed information is available. Noise mitigation will be determined in consultation with Roads and Maritime, a qualified heritage specialist, a qualified landscape specialist, Yass Valley Council and the church organisation to identify the most suitable mitigation option	Contractor	Detailed design/Pre-construction	Additional safeguard
<b>Biodiversity</b>					
B1	Biodiversity	<p>A Flora and Fauna Management Plan 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"> <li>Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas</li> <li>Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008)</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>Pre-clearing survey requirements</li> <li>Procedures for unexpected threatened species finds and fauna handling</li> <li>Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013)</li> </ul> Protocols to manage weeds and pathogens			
B2	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal, especially within the Hall TSR, will be investigated during detailed design and implemented where practicable and feasible	Contractor	Detailed design / pre-construction	Standard safeguard
B3	Removal of vegetation	<p>Exclusion zones will be set up at the limit of clearing (ie the edge of the impact area) in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p> <p>Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p> <p>Vegetation and habitat removal will be carried out in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p>	Contractor	Construction	Additional safeguard
B4	Removal of threatened species habitat and habitat features	<p>Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</p> <p>Nest boxes will be installed to replace lost hollows. These shall include boxes suitable for the Superb Parrot, Brown Treecreeper and Eastern False Pipistrelle</p> <p>Hollows from hollow-bearing trees that are removed will be salvaged and re-used/installed</p> <p>Trees will be planted, shall include species with potential to develop nest hollows and provide foraging and shelter habitat including preferred nest trees for the Superb Parrot (Yellow Box, Blakely's Red Gum)</p>	Contractor	Construction	Additional safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site			
B5	Tarengo leek orchid ( <i>Prasophyllum petilum</i> )	All personnel working on site will receive training to ensure awareness of the potential for Tarengo Leek Orchid ( <i>Prasophyllum petilum</i> ) within the construction boundary. Training will include photographs of the orchid and protocols if its identified during work	Contractor	Pre-construction/ construction	Additional safeguard
B6	Golden Sun Moth ( <i>Synemon plana</i> )	About 0.43 hectares of known Golden Sun Moth ( <i>Synemon plana</i> ) habitat at Site 4 will be retained and protected within a fenced exclusion zone with a 20 m buffer area. All personnel working on site will receive training to ensure awareness regarding this no go zone. This habitat will be monitored and these requirements specified in the Flora and Fauna Management Plan and CEMP	Roads and Maritime/ Contractor	Detailed design/ Pre-construction/ construction	Additional safeguard
B7	Aquatic habitat	All new drainage structures will be designed in accordance with the requirements specified in <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge, 2003)  Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013)	Contractor	Detailed design/ construction	Additional safeguard
B8	Aquatic habitat	Specific measures to mitigate impact of the minor realignment work at Gooromon Ponds and Little Bedulluck Creek next to the highway will include: <ul style="list-style-type: none"> <li>Burying required culverts slightly, so they are slightly below the level of the creek bed, allowing for pooling in the culvert and minimising the potential for erosion within the receiving creek bed from the relatively high velocity water passing through the culvert</li> <li>Installing some baffling/rock protection within the bed/walls of the culvert to reduce flow velocity/provide fauna habitat</li> <li>Use of open, vegetated, drainage swales to provide more natural drainage channels (providing habitat and sunlight)</li> </ul>	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B9	Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)  Clearing will be Implemented in a two stage clearing process to allow fauna to disperse from habitat voluntarily and inspection of hollows by experienced ecologist/fauna spotter/catcher before and after clearing of hollow bearing trees/stags to safely remove and relocate any injured /displaced fauna	Contractor	Construction	Additional safeguard
B10	Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Construction	Additional safeguard
B11	Invasion and spread of pests	Pest species will be managed within the proposal site	Contractor	Construction	Additional safeguard
B12	Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Detailed design/pre-construction	Additional safeguard
B13	Lighting	Shading and artificial light impact to biodiversity will be minimised through detailed design. Lighting will be designed in accordance with AS 4282-1997 <i>Control of the obtrusive effects of outdoor lighting</i>	Contractor	Detailed design/pre-construction	Additional safeguard
Aboriginal heritage					
AH1	Aboriginal heritage	An AHMP will be prepared in accordance with the <i>Procedure for Aboriginal cultural heritage consultation and investigation</i> (Roads and Maritime, 2012) and <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impact on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups	Contractor	Detailed design / pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
AH2	Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015a) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where	Contractor	Detailed design / pre-construction	Section 4.9 of QA G36

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		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			<i>Environment Protection</i>
AH3	Aboriginal heritage	Any potential activities that may need to occur outside the assessed construction boundary will require an additional environmental assessment	Contractor	Detailed design / pre-construction	Additional safeguard
AH4	AHIP	An AHIP will be sought for the overall construction boundary. Collection of surface artefacts and salvage excavations will be completed before any activities (including pre-construction activities) which may harm Aboriginal objects at these locations	Roads and Maritime	Detailed design / pre-construction	Additional safeguard
AH5	Aboriginal heritage	Scarred Tree BH-ST1-18 (57-2-1115) will be conserved in-situ. The tree will be protected during construction via permanent stock-proof fencing and appropriate associated signage. All relevant staff and contractors will be made aware of the nature and location of this site as well as Roads and Maritime's legal obligations with respect to it. Details for the long-term management of the site will be included within the AHMP	Roads and maritime, Contractor	Detailed design / pre-construction/ construction/ operation	Additional safeguard
AH6	Aboriginal heritage	Cultural Ring Trees BH-PMT3-18 (Site H, 57-2-1118) and BH-PMT2-18 (Site I, 57-2-1117) will be conserved in-situ within the proposed new median area. Further design refinements during detailed design will be investigated to retain these cultural trees in consultation with RAP's. During construction the trees will be protected via permanent stock-proof fencing and appropriate associated signage with the location of the temporary fencing confirmed by a cultural values consultant and relevant Knowledge Holders. All relevant staff and contractors will be made aware of the nature and location of this site as well as Roads and Maritime's legal obligations with respect to it. The sites will be marked on all operational maps as areas of high environmental and heritage sensitivity. Provisions for the long-term management of the sites will be included within the AHMP and developed in consultation with a cultural values specialist and RAPs	Roads and maritime, Contractor	Detailed design / pre-construction/ construction/ operation	Additional safeguard
AH7	Aboriginal heritage	Management of stone artefacts will be carried out in accordance with the <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW</i> (DECCW 2010b). All stone artefacts recovered from the construction boundary as part of the test excavation program should be stored temporarily at a suitable location. After completion of the Aboriginal archaeological salvage program, artefacts from the test	Roads and Maritime	Detailed design / pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		excavation and salvage programs should be reburied on Country as soon as practicable to a location close to where they originated from, where no developmental impact is proposed. A reburial location will be determined through consultation with Roads and Maritime and RAPs			
Non-Aboriginal heritage					
H1	Non-Aboriginal heritage - General	A 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 impact to Non-Aboriginal heritage	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
H2	Non-Aboriginal heritage - General	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015a) 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	Section 4.10 of QA G36 <i>Environment Protection</i>
H3	Non-Aboriginal heritage – General	Where possible, detailed design will seek to avoid or further minimise impact to the identified heritage values within the construction boundary	Contractor	Detailed design	Additional safeguard
H4	Non-Aboriginal heritage – Wattle Park Uniting Church	The construction boundary will be temporarily fenced in the vicinity of the Wattle Park Uniting Church and grounds to ensure inadvertent damage is not done to elements of the Church outside the proposal. The Memorial Gates will be temporarily fenced with a two metre exclusion zone buffer. A pre and post construction building condition inspection will be carried out as part of the CNVMP for the Church.	Contractor	Construction	Additional safeguard
H5	Non-Aboriginal heritage – Dellwood homestead	Photographic archival recording will be prepared before Dellwood homestead is disturbed. The archival recording will adhere to the guidelines Photographic recording of heritage items using film or digital capture (NSW Heritage Office, 2006) and How to prepare archival records (NSW Heritage Office, 1998). The resulting information should be used to aid in the interpretation of heritage in the area	Contractor	Detailed design / pre-construction	Additional safeguard
H6	Non-Aboriginal heritage –	An archaeological research design and methodology will be prepared and submitted to the Heritage Council of NSW for approval under Section 140 of the <i>Heritage Act 1977</i> to investigate the archaeological potential identified. Dellwood has been	Roads and Maritime	Detailed design/Pre-construction	Additional safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
	Dellwood homestead	assessed as possibly containing archaeological deposits that could provide information on life in the area in the 1890s that is not available from the historical records or elsewhere			
H7	Non-Aboriginal heritage – Dellwood homestead	The tanning tank has been identified as a rare item. The tanning tank will be relocated if feasible to a suitable institution for preservation and interpretation. The Hall School and Museum has expressed an interest in obtaining this item. Roads and Maritime will consult with the Hall School and Museum to come to an agreement on the relocation of the tanning tank	Roads and Maritime	Detailed design/Pre-construction	Additional safeguard
Soil and water					
S1	Soil and water	<p>A SWMP will be prepared and implemented as part of the CEMP in line with Roads and Maritimes QA G38 – ‘Soil and Water Management’. 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. The SWMP will be prepared in accordance with:</p> <ul style="list-style-type: none"> <li>• The Blue Book – ‘<i>Managing Urban Stormwater: soils and construction Volume 1</i>’ (Landcom 2004) and Volume 2D (DECC 2008)</li> <li>• Technical Guideline: <i>Temporary Stormwater Drainage for Road Construction</i> (Roads and Maritime 2011b)</li> <li>• <i>Guideline for Batter Surface Stabilisation Using Vegetation</i> (Roads and Maritime, 2015b)</li> </ul> <p>The SWMP and CEMP will detail site specific measures to ensure compliance to stipulated ELP conditions</p>	Contractor	Detailed design / pre-construction	Section 2.1 of QA G38 <i>Soil and Water Management</i>
S2	Soil and water	<p>A site specific ESCP will be prepared and implemented as part of the Soil and Water Management Plan. The Plan will include 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. The ESCP will also include:</p> <ul style="list-style-type: none"> <li>• A maintenance schedule for ongoing maintenance of temporary erosion and sediment controls</li> <li>• A sediment basin management plan to guide appropriate management of runoff during construction and operation</li> </ul>	Contractor	Detailed design / Pre-construction	Section 2.2 of QA G38 <i>Soil and Water Management</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>A site specific emergency spill plan, which will include spill management measures in line with the Roads and Maritime <i>Code for Proactive for Water Management</i> (RTA 1999) and relevant NSW EPA guidelines. This plan will include measures to be implemented in the event of a spill</li> </ul>			
S3	Soil and water – soil erosion and water quality	<p>A Roads and Maritime approved soil conservationist will be engaged to provide advice on erosion and sediment control, including progressive preparation of the ESCP. The soil conservationist must regularly (at least once a month and before and after rain events) review and inspect work throughout construction and provide written recommendations on the ESCP drawings and the effectiveness of controls used.</p> <p>Controls will be implemented before topsoil removal and start of earthwork within the catchment of each structure. This includes construction of sediment basins and other water quality structures</p>	Contractor	Construction	Additional safeguard
S4	Acid sulphate soil	Soil sampling will be conducted before earthwork to confirm the presence of acid sulphate soils within the construction boundary to inform the design and CEMP	Contractor	Detailed design / Pre-construction	Additional safeguard
S5	Acid sulphate soil	Potential for actual acid sulphate soils are to be managed in accordance with the Roads and Maritime Guidelines for the <i>Management of Acid Sulphate Materials 2005</i>	Contractor	Construction	Standard safeguard
S6	Erosion and sedimentation	<p>Proactive and appropriate erosion and sediment control will be implemented, including:</p> <ul style="list-style-type: none"> <li>Sediment and erosion controls (including sediment basins), clean water diversions and culverts will be constructed and be on line before earthwork commence</li> <li>Sediment basins will be regularly serviced and maintained to comply with water quality and capacity requirements</li> <li>Vegetation clearing and stabilisation/revegetation activities will be carried out progressively to limit the time disturbed areas are exposed to erosion processes</li> <li>Site stabilisation of disturbed areas will be carried out progressively as stages are completed</li> <li>Topsoil and mulch will each be stockpiled separately for possible re-use in rehabilitation work. Mulch may also be used for erosion and sediment controls</li> </ul>	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>High risk soil erosion activities such as earthwork will not be carried out immediately before or during high rainfall or wind events</li> <li>Any material transported onto road surfaces will be swept and removed at the end of each working day</li> <li>Erosion and sediment control measures will be maintained until the work is complete and areas are stabilised</li> <li>Work areas are to be stabilised progressively during the work</li> </ul>			
S7	Erosion and sedimentation	The maintenance of established stockpile sites is to be in accordance with the Roads and Maritime <i>Stockpile Site Management Guideline</i> (EMS-TG-10)	Contractor	Construction	Standard safeguard
S8	Contaminated land management plan	<p>A CLMP will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Roads and Maritime, 2013a) and implemented as part of the CEMP. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>Identification of potentially contamination land through monitoring: <ul style="list-style-type: none"> <li>For discolouration or staining of soil</li> <li>Bare soil patches both on-site, and off-site adjacent to site boundary</li> <li>Visible signs of plant stress</li> <li>Present of drums or other waste material</li> <li>Presence of stockpiles or fill material</li> <li>Odours.</li> </ul> </li> <li>Carrying out further contamination assessment where necessary and advising on the need for remediation or other action. This includes further investigation of any unexpected contamination finds.</li> <li>Diversion of surface runoff away from the contaminated land.</li> <li>Management of any surface runoff contaminated by exposure to the contaminated land</li> <li>Assessment of any requirement to notify relevant Authorities, including the EPA</li> <li>Management of any remediation and subsequent validation, including any certification required</li> <li>Review and updating the plan</li> </ul>	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
S9	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
S10	Contaminated land - assessment of excavation areas	<p>Soil characterisation will be carried out before construction in areas where excavation of soil is required to:</p> <ul style="list-style-type: none"> <li>Assess the presence of contamination and risks posed to construction workers and the environment, so that appropriate controls can be adopted during construction</li> <li>Chemically classify the soil in situ, for off-site disposal to licensed landfill in accordance with the NSW EPA (2014) <i>Waste Classification Guidelines or applicable Resource Recovery</i> exemption order or assess for re-use within the construction boundary</li> <li>A Sampling, Analysis and Quality Plan (SAQP) will be prepared for soil investigation/material characterisation in accordance with the <i>National Environment Protection (Assessment of Site Contamination) Measure 2013</i>. The SAQP will detail: <ul style="list-style-type: none"> <li>Data quality objectives and data quality indicators</li> <li>Justification of the number, density and sampling locations based on the potential for contamination, excavation extent and quantities requiring off-site disposal</li> <li>Analytical suite and schedule, including contaminants of concern identified in this contamination impact assessment</li> <li>Assessment criteria for on-site reuse for the land use and waste classification</li> <li>Sampling and laboratory methodologies, field and laboratory quality assurance and control</li> </ul> </li> </ul> <p>Documentation will be prepared with reference to the Roads and Traffic Authority of NSW (RTA) 2005, <i>Contaminated Land Management Guideline</i>, April 2005, Roads and Traffic Authority of NSW (RTA), Sydney, Australia</p>	Contractor	Detailed design / Pre-construction	Additional safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
S11	Asbestos management	Asbestos removal must be carried out in accordance with <i>Working with Asbestos: Guide 2008</i> published by WorkCover Australia	Contractor	Construction	Standard safeguard
Hydrology and drainage					
W1	Water	MUSIC modelling will be carried out during detailed design to demonstrate that the proposed swales (or alternative water quality treatment measures) achieve the project objectives	Contractor	Detailed design	Additional safeguard
W2	Water	Where feasible, farm dams will be retained and protected. Landholders will be consulted with regards to any farm dams that could potentially be disturbed	Contractor	Detailed design / Pre-construction	Additional safeguard
W3	Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers)	Contractor	Detailed design / Pre-construction	Section 4.3 of QA G36 <i>Environment Protection</i>
W4	Flooding impact and flow diversions	<p>Design drainage structures to ensure that the natural flow of floodwaters and existing flow paths, flow volumes, flow rates and flow velocities will be maintained post-construction where possible</p> <p>Further detailed hydrologic and/or hydraulic modelling will be carried out as appropriate to confirm flow and flooding impact as required during design development</p> <p>The flooding impact of temporary work, including construction staging that requires temporary departure from the design, as well as road surfacing work will be assessed</p> <p>The impact of future climate change and potential blockage of hydraulic structures on flooding conditions will be considered</p> <p>Maintain documentation that will demonstrate flooding and final flooding impact have been appropriately considered in detailed design</p>	Contractor	Detailed design / Pre-construction	Additional safeguard
W5	Flood impact on traffic	Consult with Council and SES on potential road closure and traffic management measures to divert traffic from the existing highway during flood events	Roads and Maritime	Detailed design / Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
W6	Water	<p>All fuels, chemicals, and liquids will be stored in an impervious bunded area at least 50 m away from any rivers, creeks or any areas of concentrated water flow, flooded or poorly drained areas and slopes above 10 per cent</p> <p>Refuelling of plant and planned maintenance of machinery and plant will be carried out 50 m away from waterways and drainage lines</p> <p>Vehicles and plant will be properly maintained and regularly inspected for fluid leaks</p> <p>Dirty water will be managed on site to avoid release into drainage lines and/or waterways</p> <p>Potable water will be used for wash down</p> <p>Containment material will be used to capture/filter water used in vehicle wash-downs</p> <p>Vehicle and plant wash downs and/or concrete truck washouts will be carried out within a designated bunded area with an impervious surface or will be carried out off site</p> <p>Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) of waterways will be carried out on a regular basis to identify any potential spills or deficient erosion and sediment controls. Inspection records will be kept</p> <p>Emergency spill kits will be kept on site at all times</p> <p>All staff will be inducted about incident and emergency procedures and made aware of the locations of emergency spill kits</p> <p>Should a spill occur during construction, the emergency response plan will be implemented, and the Roads and Maritime senior regional environmental officer contacted. The EPA will also be notified as per Part 5.7 of the <i>POEO Act</i></p>	Contractor	Construction	Standard safeguard
Landscape character and visual impact					
LV1	Landscape character and visual impact	Locally endemic species (both ephemeral and persisting) will be used in response to the local community the road passes through along the proposal	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
LV2	Landscape character and visual impact	Minimise the use of traffic barriers, while meeting safety objectives, as per the existing situation to maintain a seamless visual connectivity with the landscape	Roads and Maritime / Contractor	Detailed design / pre-construction/ construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
LV3	Landscape character and visual impact	Limit planting within LCZ 2: Floodplain to understorey species from the Box-Gum Woodland – Derived Native Grassland community, preserving panoramic views across the floodplain. In certain areas exotic species may be appropriate in response to local landscape character	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
LV4	Landscape character and visual impact	Where safety barriers are required within LCZ 2, wire rope safety barriers will be considered to preserve the views	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
LV5	Existing trees	Where existing trees would be retained within the construction boundary or within close proximity of the work, an arborist will be engaged to determine construction setbacks and any other requirements necessary to maintain the health of the trees	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
LV6	Wattle Park Uniting Church	New landscape treatment will consider the heritage value of cultural plantings around the church. Noise mitigation and fencing will be visually integrated into the entry setting, with replacement plantings to comprise a mix of exotic coniferous species, as the existing condition	Roads and Maritime / Contractor	Detailed design / pre-construction	Additional safeguard
Property and land use					
P1	Property acquisition	Property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2014a), the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> (NSW) and the land acquisition reforms announced by the NSW government in 2016 (NSW government, 2016)	Roads and Maritime	Pre-construction	Additional safeguard
P2	Property acquisition	Property acquisition of Crown Land will be carried out in accordance with the <i>Crown Lands Act 1989</i>	Roads and Maritime project manager	Pre-construction and construction	Additional safeguard
Socio-economic					
SE1	Socio-economic	<p>A CP will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> <li>• Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions</li> <li>• Contact name and number for complaints</li> </ul>	Contactor	Detailed design / pre-construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008)			
SE2	Socio-economic	All complaints are to be recorded on a complaints register and attended to promptly	Contactor	Construction	Standard safeguard
SE3	Socio-economic	Contact details for a 24-hour construction response line, proposal info line and email address will be provided for ongoing stakeholder contact throughout the design and construction phase	Roads and Maritime	Detailed design / pre-construction/ construction	Additional safeguard
SE4	Economic	Goods and services will be purchased locally helping to ensure the local community benefits from the construction of the proposal as best practicable	Contractor	Pre-construction and construction	Additional safeguard
Waste and resources					
/	Waste	<p>A 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"> <li>Measures to avoid and minimise waste associated with the project</li> <li>Classification of wastes and management options (re-use, recycle, stockpile, disposal)</li> <li>Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions</li> <li>Procedures for storage, transport and disposal</li> <li>Monitoring, record keeping and reporting</li> </ul> <p>The WMP will be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014d) and relevant Roads and Maritime Waste Fact Sheets</p>	Contactor	Detailed design / pre-construction	Section 4.11 of QA G36 <i>Environment Protection</i>
WR2	Waste	<p>When tree removal cannot be avoided, usable timber shall be salvaged as best practicable. Other biomass shall be chipped and mulched on site for erosion and sediment control, and landscaping.</p> <p>If vegetation is to be mulched and transported off site for beneficial reuse, it is to be assessed for the presence of weeds, pest, and other disease and a Mulch</p>	Contactor	Construction	Standard safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Management Plan prepared in accordance with the <i>Roads and Maritime Technical Procedure: Mulch Management</i>			
WR3	Waste	Bulk project waste (eg fill) sent to a site not owned by Roads and Maritime (excluding EPA licensed landfills and resource recovery facilities) is to have prior formal written approval from the landowner, in accordance with <i>Environmental Direction No. 20 – Legal Off-site Disposal of Roads and Maritime Services Waste</i> . This includes waste transported for reuse, recycling, disposal or stockpiling	Contactor	Construction	Standard safeguard
WR4	Waste	<p>Waste is not to be burnt on site.</p> <p>There is to be no disposal or re-use of construction waste on to other land.</p> <p>Waste material, other than vegetation and tree mulch, is not to be left on site once the work have been completed.</p> <p>Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.</p> <p>Good housekeeping will be maintained at construction sites throughout the construction phase. Waste will be collected, segregated, stored and recycled as best practicable or disposed at an appropriately licensed facility on a regular basis</p> <p>All waste will be managed in accordance with the <i>POEO Act</i> and classified in accordance with the <i>NSW EPA Waste Classification Guidelines 2014</i> methods and specifications</p>	Contactor	Construction	Standard safeguard
WR5	Sewage	Appropriate portable toilets with either pump out facilities or sewer connections will be provided for site personnel and sewage will be disposed of appropriately and in accordance with relevant legislation	Contactor	Construction	Additional safeguard
WR6	Construction waste	A post-construction land assessment will be carried out of land that was used for ancillary construction purposes (compounds, storage, parking, etc.) to determine the suitability for hand-back to the landowner	Contactor	Construction	Additional safeguard
WR7	Resource use	<p>Resource management hierarchy principles are to be followed:</p> <ul style="list-style-type: none"> <li>Avoid unnecessary resource consumption as a priority</li> </ul>	Contactor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery)</li> <li>Disposal is carried out as a last resort (in accordance with the <i>WARR Act</i>)</li> </ul>			
WR8	Resource use	Procurement will adhere to Roads and Maritime <i>Environmental Sustainability Strategy 2015-2019</i> and use materials, products and services which are cost and performance effective. Materials and services shall be sourced from Roads and Maritime registered local suppliers as best practicable	Contactors	Detailed design / pre-construction	Additional safeguard
WR9	Contaminated land – assessment of imported VENM or ENM	Before the importation of VENM or ENM, source sites will be identified and assessed against the definition of VENM in the <i>NSW EPA Waste Classification Guidelines 2014</i> and <i>POEO Act</i> and ENM against the <i>Excavated Natural Material Order 2014</i>	Contractor	Construction	Additional safeguard
WR10	Spoil waste management and transport	<p>Spoil to be removed from the site which has been assessed as not suitable for reuse or cannot be reused will be classified in accordance with <i>NSW EPA Waste Classification Guidelines 2014</i>. The spoil will be transported to an appropriate waste disposal facility licensed to receive such waste. Approval will be obtained from the respective landfill facility before transport and will require an estimate of the likely volume of waste to be disposed</p> <p>The following material handling requirements will be implemented for trucks transporting materials off-site:</p> <ul style="list-style-type: none"> <li>A licensed transporter will be used to transport material to an appropriately licensed facility</li> <li>All truck loads will be filled to the correct level and not over filled</li> <li>Trucks carrying waste materials will be covered before exiting the work site and will remain covered until authorised to unload at the destination (licensed waste facility)</li> <li>Trucks will be fitted with seals to ensure that the movement of potentially saturated materials is carried out appropriately. The integrity of the seals will be inspected and tested before the start of each day's haulage work</li> </ul>	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>In the event that materials are tracked or spilt outside of the construction zone, soil will be immediately cleaned up in a way that prevents contamination of land, the stormwater or waterways</li> <li>All truckloads and landfill waste tickets/dockets will be tracked and a register completed to reconcile and check spoil has been lawfully disposed</li> </ul>			
WR11	Existing condition of ancillary sites	Before land being used for ancillary construction purposes (compounds, storage, parking, etc), a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes	Contractor	Pre-construction / detailed design	Additional safeguard
WR12	Asbestos management	<p>An AMP will be developed for areas known to contain ACM (from pre-construction investigations), areas suspected of containing ACM and to address unexpected finds of ACM during construction. Specifically, protocols should be stipulated for separation, monitoring, validation and clearance of asbestos</p> <p>The AMP and associated Standard Work Procedures should satisfy the requirements of the Safe Work Australia Asbestos Codes of Practice and Guidance Notes:</p> <ul style="list-style-type: none"> <li><i>Code of Practice: How to Manage and Control Asbestos in the Workplace</i></li> <li><i>Code of Practice: How to Safely Remove Asbestos</i></li> <li><i>Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre</i>, 2<sup>nd</sup> Edition [NOHSC: 3003 (2005)]</li> </ul>	Contractor	Construction	Additional safeguard
WR13	Asbestos management	<p>An Occupational Hygienist (Hygienist) will be on-site for the duration of the excavation work where ACM has been identified from pre-construction or where unexpected finds of ACM are encountered. The Hygienist will:</p> <ul style="list-style-type: none"> <li>Carry out air monitoring for asbestos during excavation</li> <li>Provide on-site visual inspection, identification of asbestos impacted material and clearance of non-asbestos impacted surfaces</li> <li>Supervise work to ensure compliance with the AMP and NSW regulatory requirements for asbestos containing material management and disposal</li> </ul> <p>In the event that friable asbestos is detected, a suitably licensed Asbestos Removal Contractor (licensed to carry out friable asbestos (Class A) removal) will be required to carry out and oversee all the asbestos removal and disposal work outlined in the AMP</p>	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		All persons performing the work will be required to carry out a suitable risk assessment and develop a Safe Work Method Statement for all of their work activities before starting work in ACM impacted areas			
Air quality					
A1	Air quality	<p>An AQMP will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• Potential sources of air pollution</li> <li>• Air quality management objectives consistent with any relevant published EPA and/or DPIE guidelines</li> <li>• Mitigation and suppression measures to be implemented</li> <li>• Methods to manage work during strong winds or other adverse weather conditions</li> <li>• A progressive rehabilitation strategy for exposed surfaces</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.4 of QA G36 <i>Environment Protection</i>
A2	Air quality	Stockpiles or areas that may generate dust will be managed to suppress dust emissions in accordance with the Roads and Maritime <i>Stockpile Site Management Guideline</i> (EMS-TG-10)	Contractor	Construction	Standard safeguard
Utilities					
U1	Utilities	<p>Before the commencement of work:</p> <ul style="list-style-type: none"> <li>• The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners</li> <li>• If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be carried out</li> </ul>	Contractor	Detailed design / pre-construction	Standard safeguard
U2	HV relocation	<p>Relocated 22 kV overhead power lines will be designed to be:</p> <ul style="list-style-type: none"> <li>• Within the proposed RMS road reserve boundary (including land to be acquired for the proposal) with a minimum of 7.5 m clearance from the edge of the road reserve, unless otherwise agreed with the appropriate energy provider</li> </ul>	Contractor	Detailed design / pre-construction	Additional safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>Developed in accordance with the guidelines and codes of practice recommended by the appropriate energy provider, unless otherwise agreed by the appropriate energy provider</li> </ul>			
Hazards and risk					
R1	Hazards and risk management	<p>A HRMP will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>Details of hazards and risks associated with the activity</li> <li>Measures to be implemented during construction to minimise these risks</li> <li>Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials</li> <li>A monitoring program to assess performance in managing the identified risks</li> <li>Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations</li> </ul> <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant <i>Safe Work Australia Codes of Practice</i>, and EPA or DPIE (ie includes former Office of Environment and Heritage) publications</p>	Contractor	Detailed design / pre-construction	Standard safeguard
R2	Hazards and risk management	Emergency contacts will be kept in an easily accessible location on vehicles, plant and the site office. All workers will be advised of these contact details and procedures	Contractor	Construction	Standard safeguard
Cumulative impact					
CU1	Cumulative construction impact	The CEMP will be revised to consider potential cumulative impact from surrounding development and construction impact activities as they become known via discussion with contractors on other projects	Contractor	Pre-construction and construction	Additional safeguard
CU2	Cumulative impact to biodiversity	Biodiversity offsets will be secured as per the Roads and Maritime <i>Guideline for Biodiversity Offsets</i> (November 2016)	Roads and Maritime	Detailed design	Additional safeguard

## 7.3 Licensing and approvals

Licenses and approvals needed for the proposal are summarised in Table 7-2.

Table 7-2 Summary of licenses and approvals required

Instrument	Requirement	Timing
<i>Protection of the Environment Operations Act 1997</i> (s43)	EPL from the EPA for the following scheduled activities: <ul style="list-style-type: none"> <li>Road construction which results in the existence of four lanes and is more than 5 km (in a non-metropolitan area)</li> </ul>	Before start of the activity
<i>Fisheries Management Act 1994</i> (s199)	Notification to the Minister before any dredging or reclamation work.  The proposal involves installation of culverts at waterways and construction of box culverts at Gooromon Ponds and Little Bedulluck Creek	A minimum of 28 days before the start of work
<i>Fisheries Management Act 1994</i> (s219)	Permit to obstruct passage of fish (temporary or permanent) from the Minister  The proposal involves construction of box culverts at Gooromon Ponds and Little Bedulluck Creek which are key fish habitats (Type 2/3, Class 2/3)	Before start of the activity
<i>Heritage Act 1977</i> (s139)	Excavation permit from the DPIE  The proposal would require archaeological investigation of Dellwood homestead	Before start of ground disturbance work
<i>National Parks and Wildlife Act 1974</i> (s90)	Aboriginal heritage impact permit from the DPIE  The proposal involves carrying out work that could impact Aboriginal items	Before start of the activity
<i>Water Management Act 2000</i> (s91B)	Water supply work approval from DPIE  An approval would be required if dewatering of groundwater needs to be carried out for construction work	Before start of the activity
<i>Crown Lands Act 1989</i> (s6)	Licence to occupy areas of Crown land  The proposal would involve carrying out work at the following Crown lands: <ul style="list-style-type: none"> <li>Travelling Stock Reserves: Hall TSR at the NSW/ACT border and Bedulluck TSR north of Nanima Road to the east of Barton Highway</li> <li>Crown roads: Boundary Lane, Rolfe Road, Church Lane, Anchow Hill Lane and Barton Highway from Spring Range Road southbound towards to the NSW/ACT border</li> </ul>	Before start of the activity

## 8. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impact, 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 ESD as defined in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

### 8.1 Justification

#### 8.1.1 Social factors

The major benefits of the proposal include providing improved safety, reducing travel times and increasing the level of service to cater for current and future traffic requirements between Yass and Canberra. These benefits outweigh the negative impact which would occur as a result of property acquisition and through changes in access. Overall the proposal would significantly improve safety along this section of the Barton Highway. The proposal would facilitate regional freight transport and improve travel times for commuters travelling between Yass and Canberra. The relocation of bus stops to safer locations and u-turn facilities would improve public safety while the wider road shoulders provided would make it safer for cyclists. The 'do nothing' option would not improve road safety which would continue to decline with the projected increase in traffic volumes in the future due to population growth in Yass and Murrumbateman.

Environmental factors have been considered early in project design and the new northbound carriageway has been aligned along the western side of the existing highway to minimise impact to the Wattle Park Uniting Church which is a heritage item listed in the *Yass Valley LEP 2013*. However in doing so, the direct impact to Dellwood homestead could not be avoided as the alignment passes through the property. Mitigation and management measures have been recommended to minimise social impact.

Two culturally significant Aboriginal Ring Trees identified via the CVR would be retained within the proposed new median of the highway. Further design refinements during detailed design will be investigated to retain these cultural trees in consultation with RAP's.

Improved safety is the key social benefit to road users on a stretch of the highway that has a poor safety record when compared to other comparable highways. This factor is the main driver for the proposal and received positive feedback from the local community during the stakeholder consultation carried out as part of this REF.

#### 8.1.2 Biophysical factors

The reference design has minimised the impact to threatened species habitat and ecological communities where possible. By aligning the new northbound carriageway to the west of the existing highway the ecological communities along Little Bedulluck Creek have been largely avoided. The proposal passes through the Hall TSR which has Commonwealth and State listed Box-Gum Woodland on both sides of the existing highway. The highway has to be widened at this location to cater for the new northbound carriageway and so impact to Box-Gum Woodland is unavoidable. The proposal would result in the loss of 2.23 hectares of *EPBC Act* listed CEEC Box-Gum Woodland. Suitable offsets have been determined in accordance with the Roads and Maritime *Guideline for Biodiversity Offsets* and would be provided.

The crossings of waterways along the alignment particularly at Gooromon Ponds and Little Bedulluck Creek have been designed to safeguard aquatic ecology and riparian habitats as best practical.

Overall the potential impact of the proposal on biodiversity has been assessed in detail and mitigation and management measures have been recommended to minimise the impact. Where impact is unavoidable, offsets would be provided.

### 8.1.3 Economic factors

During construction the proposal would create employment and demand for local goods and services within the Yass Valley LGA and ACT which would boost the local economy.

On opening, the proposal would improve freight transport between Canberra, southern NSW and Melbourne which would support economic development in the region. The proposal would also minimise potential future disruption to haulage of goods as it has been designed to meet the 100 year ARI flood immunity level and would provide alternative connectivity during planned and unplanned maintenance.

The proposal would make it safer and faster for commuters to travel between settlements in the north (Yass and Murrumbateman) and to and from the ACT. This would make areas to the north of ACT such as Murrumbateman and Yass more amenable to residential development.

The improved travel times and safety as a result of the proposal would also encourage residents within Canberra to frequent the tourist attractions in the Yass Valley LGA which would boost the economy in the long term.

Overall the economic benefits of the proposal would justify the cost of building the highway. The economic benefits of the proposal would support future staged development of other packages of the Barton Highway as outlined in the *Barton Highway Improvement Strategy 2017*.

### 8.1.4 Public interest

Based on feedback obtained from the public throughout the REF, there was an overall positive response to the proposal which has been in the pipeline for a considerable period. Generally the public, particularly those in the vicinity of the proposal, have been eagerly waiting its construction and opening.

## 8.2 Objects of the EP&A Act

This section assesses the proposal against the requirements stipulated in Section 1.3 of the *EP&A Act*.

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources	The proposal would benefit the community by improving the safety, level of service and travel times along the Barton Highway which has a high crash rate in comparison to other comparable NSW roads. The safeguards recommended in this REF would mitigate potential environmental impact and conserve resources as best practicable
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	Roads and Maritime has carried out environmental assessments early in the project life cycle where economic, environmental and social matters have been taken into account in project planning, design and assessment. Mitigation and management measures have been recommended for the proposal to minimise environmental impact



Object	Comment
1.3(c) To promote the orderly and economic use and development of land	The proposal has been designed to minimise land acquisition as best practicable. The improved connectivity between Yass and the ACT brought about by the proposal would support existing economic activities and development of land to the north of ACT
1.3(d) To promote the delivery and maintenance of affordable housing	Not relevant to the project
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats	The proposal has minimised impact on threatened and other species of native animals and plants, ecological communities and their habitats as best practical. However as the alignment passes through the Hall TSR which contains Box-Gum Woodland on both sides of the highway, 8.90 hectares of Box-Gum Woodland would be impacted to widen the road corridor. Suitable offsets would be provided for the impacted threatened species habitats and ecological communities in accordance with the <i>Roads and Maritime Guideline for Biodiversity Offsets</i> (November 2016)
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal has been designed to avoid the Wattle Park Uniting Church which is a heritage item listed on the <i>Yass Valley LEP 2013</i> (#1124). The detailed heritage assessment carried out concluded that the proposal would not have a significant impact on the heritage values of the church. The proposal would also be designed to avoid two culturally significant Aboriginal Ring trees identified within the construction boundary via the CVR conducted. Mitigation and management measures have been proposed in the REF to safeguard the built and cultural heritage in the vicinity of the construction boundary
1.3(g) To promote good design and amenity of the built environment.	The LCVIA assessed the impact of the proposal taking into consideration the <i>Barton Highway Urban Design Framework</i> . A project specific Landscape Strategy has been developed and mitigation and management measures have been incorporated into the proposal design to ensure the design it is line with the <i>Barton Highway Urban Design Framework</i>
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants	Not relevant to the proposal
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State	This REF for the proposal covers the stretch of Barton Highway within NSW. A separate environmental assessment has been carried out concurrently for the 700 m section for tie-in within the ACT, which would be submitted to the authorities for a separate Works Approval. The

Object	Comment
	cumulative impact of the proposal has been addressed in this REF
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment	<p>During the REF, Roads and Maritime placed pop-up stalls in Murrumbateman and Yass to proactively obtain feedback and inputs from the local community regarding the proposal. Roads and Maritime also established a website and dedicated hotline for the public to provide feedback on the proposal.</p> <p>A number of RAPs/RAOs were directly involved in the ACHAR which has informed project design. This REF has addressed the comments received from the local community</p>

## 8.2.1 The precautionary principle

Schedule 2 of the *EP&A Regulation 2000* states ‘*The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*

- i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
- ii. an assessment of the risk-weighted consequences of various options’.*

The precautionary principle has been applied to the proposal by carrying out environmental assessment concurrently with the various stages of the project development to advise the design. This included conducting the preliminary environmental investigation at the feasibility stage, the preliminary environmental investigation update during the strategic design stage and this REF during the reference design stage. Environmental constraints were considered in selecting the alignment of the new northbound carriageway to the west of the existing Barton Highway which provided the following positive environmental outcomes:

- The proposal alignment has effectively avoided the Wattle Park Uniting Church which is a heritage item listed in the *Yass Valley LEP 2013* and would not result in significant impact on its heritage values
- Land acquisition for the proposal also caters for potential future upgrades of intersections into grade separated interchanges without requiring future acquisition or realignment of the highway. This prevents further development within the proposed road corridor and its associated potential future environmental impact
- The majority of the proposal would be constructed off-line which would cause minimal safety risk and traffic disruption to current users of the Barton Highway which would remain in service during construction. When the new northbound carriageway is completed traffic would be switched to the new carriageway to allow safety upgrades to be carried out off-line on the southbound carriageway. This approach would allow the work to be expedited with minimal risk and disruption to road users
- The proposal has catered for climate resilience and has been designed to meet the 100 year ARI flood immunity level. Flood modelling conducted for the 500 year ARI flood event informed the project design.

## 8.2.2 Intergenerational equity

Schedule 2 of the *EP&A Regulation 2000* defines intergenerational equity as “*the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations*”.

The proposal alignment has effectively avoided the Wattle Park Uniting Church allowing it to continue to be used by the present and future generation while maintaining its heritage values. The proposal design would also avoid impact to two Aboriginal culturally significant Ring Trees in the vicinity if the NSW/ACT border thereby maintaining its cultural values for the future generation. A key benefit of the proposal is the improvement in road safety along a stretch of highway that experiences a higher crash rate than other comparable roads in NSW. It is also forms the first package of a series of safety upgrades that would further improve the safety of Barton Highway for future road users.

The proposal would unavoidably potentially impact Box-Gum Woodland which is an EPBC listed EEC when passing through the Hall TSR which has woodland on both sides of the highway. The impact on biodiversity would be offset in accordance with the *Roads and Maritime Guideline for Biodiversity Offsets* (November 2016) which would serve to safeguard this EEC for the benefit of future generations.

## 8.2.3 Conservation of biological diversity and ecological integrity

Schedule 2 of the *EP&A Regulation 2000* requires the “*conservation of biological diversity and ecological integrity be a fundamental consideration*”,

The proposal has been designed to minimise impact on threatened species and communities. However, the proposal passes through the Hall TSR which contains EPBC listed Box-Gum Woodland that would be impacted as a result. As the proposal involves the widening of the corridor to provide a new northbound carriageway, this impact could not be avoided. A total 2.23 hectares of EPBC listed CEEC *White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland* would be impacted for which offsets would be provided.

Roads and Maritime is committed to providing offsets for the cumulative impact of the proposal. About 0.24 hectares of occupied Golden Sun Moth habitat within the construction boundary will be an exclusion zone and fenced off with a 20 m buffer to safeguard the habitat. The waterway crossings at Gooromon Ponds and Little Bedulluck Creek has been designed to safeguard aquatic ecology and riparian habitats.

## 8.2.4 Improved valuation, pricing and incentive mechanisms

Schedule 2 of the *EP&A Regulation 2000* requires the “*that environmental factors should be included in the valuation of assets and services, such as:*

- i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
- ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
- iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

Roads and Maritime has developed the proposal with the aim to get the maximum length of new northbound carriageway while carrying out limited work on the existing highway, which provides the maximum length of upgraded highway as cost effectively as possible and within the allocated budget. The

proposal has also targeted the stretch of the Barton Highway that experiences the highest crash rates, thereby minimise the losses brought about by crashes.

Land acquisition for the proposal has been carried out considering potential future upgrades of intersections into grade separated intersections without requiring any further acquisitions or realignment of the highway. This approach safeguards against future inflation as well as minimising community impact.

Roads and Maritime has adopted the approach to minimise the adverse impact of the proposal by considering environmental factors early in proposal design and managing the potential environmental impact of the proposal through carefully designed safeguards in this REF and providing financial resources for their implementation. Roads and Maritime is committed to providing offsets for the potential negative impact on Box-Gum Woodland which provides monetary compensation of protection and maintenance of biodiversity.

## 8.3 Conclusion

The proposed duplication of about eight km of the Barton Highway from about 700 m south of the NSW/ACT border towards Murrumbateman, about 300 m north of Kaveney's Road, is subject to assessment under Division 5.1 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*, biodiversity stewardship sites under the *BC Act*, wilderness areas, areas of outstanding value, impact on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impact to matters of national environmental significance listed under the Federal *EPBC Act*.

A number of potential environmental impacts from the proposal have been avoided or reduced during the reference design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impact on traffic (connectivity and access), biodiversity, Aboriginal heritage and Non-Aboriginal heritage items. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impact. The proposal would also improve safety, improve driving conditions, and reduce travel times. On balance the proposal is considered justified and the following conclusions are made.

### **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 Division 5.2 of the *EP&A Act*. A BDAR or SIS is not required. The proposal is subject to assessment under Division 5.1 of the *EP&A Act*. Consent from Council is not required.

### **Significance of impact under Australian legislation**

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *EPBC Act*. A referral to the Australian Department of the Environment and Energy 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.

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I have examined this review of environmental factors and accept it on behalf of Roads and Maritime.

Amy Evans  
Environment Officer  
Roads and Maritime South West Region  
Date: 26 November 2019

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## Terms and acronyms

Term/Acronym	Description
AAR	Aboriginal Archaeological Report
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACM	Asbestos Containing Materials
ACT	Australian Capital Territory
AFG	Aboriginal Focus Group
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AHMP	Aboriginal Heritage Management Plan
AMP	Asbestos Management Plan
ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	Air Quality Management Plan
ARI	Average Recurrence Interval The long-term average number of years between the occurrences of a flood as big as or larger than the selected event. For example, floods with a discharge as great as or greater than the 20 year ARI flood event would occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event. The Annual Exceedance Probability (AEP) is the preferred notation for the frequency or magnitude of flood events
ASC NEPM 2013	<i>National Environment Protection (Assessment of Site Contamination) Measure 2013</i>
AS/NZS	Australian and New Zealand Standards
ASS	Acid sulphate soil
BAR	Biodiversity Assessment Report
BDAR	Biodiversity Development Assessment Report
<i>BC Act</i>	<i>Biodiversity Conservation Act 2016 (NSW)</i>
bgl	Below ground level
Box–Gum Woodland	Commonwealth, State and Territory listed <i>White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland</i>
CEEC	Critically endangered ecological community
CEMP	Construction environmental management plan

Term/Acronym	Description
CLM Act	<i>Contaminated Land Management Act 1997</i>
CLMP	Contaminated Land Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CP	Communication Plan
Construction boundary	<p>The construction boundary is the area that would be directly impacted to build the project/ proposal. The construction boundary represents the assessed footprint for construction of the project. It allows space to construct the road form, fencing, ancillary facilities, and temporary and permanent sedimentation basins.</p> <p>Note: For this REF the construction boundary extends for about 8 km from about 700 m south of the NSW/ACT border for about 300 m north of Kaveney's Road (CH23800). All the specialist studies (Appendices A-E, G-I) with the exception of the Biodiversity Assessment (Appendix F) and the Preliminary Site Investigation (Appendix I), covered the construction boundary but extended further north to about 1.6 km north of Kaveney's Road as per the initial 2018 reference design. The Biodiversity Assessment covered the construction boundary whereas the Preliminary Site Investigation covered Packages 1 and 2.</p>
CVR	Cultural Values Report
dB(A)	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A)
DPIE	NSW Department of Planning, Industry and Environment
DPI	NSW Department of Primary Industries
DUAP	NSW Department of Urban Affairs and Planning
ECRTN	Environment Criteria for Road Traffic Noise
EEC	Endangered ecological community
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENM	Excavated natural material
EPA	Environmental Protection Authority
EPA&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
EPL	Environmental Protection Licence



Term/Acrronym	Description
EPSDD	Environment, Planning and Sustainable Development Directorate
ESCP	Erosion and Sediment Control Plan
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
FFMP	Flora and Fauna Management Plan
Flood model	TUFLOW and XP-RAFTS models used to characterise existing flooding conditions, as well as to assess potential flooding impact
<i>FM Act</i>	<i>Fisheries Management Act 1994 (NSW)</i>
GSM	Golden Sun Moth
<i>Heritage Act</i>	<i>Heritage Act 1977 (NSW)</i>
HRMP	Hazard and Risk Management Plan
Hz	Frequency – The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound
IBRA	Interim Biogeographic Regionalisation for Australia
ICNG	Interim Construction Noise Guideline
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
KTP	Key threatening process
kV	Kilovolt – a unit of electric potential
LA1, LA10, LA90, and Laeq	LA1, LA10 and LA90 levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The LA1 is indicative of maximum noise levels due to individual noise events. The LA90 is considered to be the background noise level. The Laeq is the energy averaged sound level over the measurement period. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound
<i>Land Acquisition Act</i>	<i>Land Acquisition (Just Terms Compensation) Act 1991</i>
LCVIA	Landscape Character and Visual Impact Assessment
LCZ	Landscape Character Zone
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the <i>EP&amp;A Act</i> .
L <sub>eq</sub>	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy
LGA	Local government area
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>

Term/Acronym	Description
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NAHMP	Non-Aboriginal Heritage Management Plan
<i>NC Act</i>	<i>Nature Conservation Act 2014 (ACT)</i>
NCA	Noise catchment area
NML	Noise management level
NOHSC	National Occupational Health and Safety Commission
NPfl	Noise Policy for Industry, Environment Protection Authority (EPA), 2017
<i>NPW Act</i>	<i>National Parks and Wildlife Act 1974 (NSW)</i>
NSW	New South Wales
OEH	Office of Environment and Heritage (Currently under Department of Planning, Industry and Environment (DPIE))
<i>P&amp;LM Act</i>	<i>Planning and Land Management Act 1988 (ACT)</i>
PAD	Potential archaeological deposit
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PCT	Plant Community Type (as per the DPIE Vegetation Information System Classification Database)
PDF	Portable Document Format
PEI	Preliminary environmental investigation
PEMP	Project Environmental Management Plan
PFAS	Per- and Poly-Fluoroalkyl Substances
<i>POEO Act</i>	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
RAP	Registered Aboriginal Parties (within NSW)
RAO	Registered Aboriginal Organisations (within ACT)
RBL	Rating background level. The overall background level for each day, evening and night period for the entire length of noise monitoring.
RCBC	Reinforced concrete box culvert
RCP	Reinforced concrete pipe
REF	Review of Environmental Factors
<i>Roads Act</i>	<i>Roads Act 1993 (NSW)</i>

Term/Acronym	Description
RNP	Environment Protection Authority's NSW Road Noise Policy
RTA	Roads and Traffic Authority
SAQP	Sampling, Analysis and Quality Plan
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act
SES	State Emergency Services
SIS	Species Impact Statement
SISD	Safe intersection sight distance
SoHI	Statement of Heritage Impact
Study area	The area that is subject to site surveys and is assessed for a particular environmental issue. The study area encompasses the project/proposal, the area that may indirectly be impacted and any area needed to be investigated to give context to the potential impact. Note: Each specialist report assessed will need to be identify a study area appropriate to the specialist field.
SWMP	Soil and Water Management Plan
TEC	Threatened ecological community
TMP	Traffic Management Plan
TSR	Travelling Stock Reserve
UNESCO	United Nations Educational, Scientific and Cultural Organization
VDV	Vibration Dose Values
VENM	Virgin excavated natural material
<i>WARR Act</i>	<i>Waste Avoidance and Resource Recovery Act 2001 (NSW)</i>
<i>WM Act</i>	<i>Water Management Act 2000 (NSW)</i>
WMP	Waste Management Plan