Great Western Highway East – Katoomba to Blackheath

Review of Environmental Factors

Transport for NSW | April 2022

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Acknowledgement of Country

Transport for NSW acknowledges the Dharug people, the traditional custodians of the land on which the Great Western Highway East – Katoomba to Blackheath is proposed.

We pay our respects to their Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

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Prepared by Aurecon Australasia in association with Mott MacDonald and Transport for NSW
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Approval and authorisation

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Accepted on behalf of Transport for NSW by:	Pete Styles Project Development Manager - Great Western Highway Upgrade Program Infrastructure & Place
Signed:	
Dated:	28/04/2022

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Executive summary

The proposal

Transport for NSW (Transport) is proposing to widen the Great Western Highway, between Rowan Lane, Katoomba and Tennyson Road, Blackheath from one to two lanes in each direction (the proposal). The proposal is part of the Great Western Highway Upgrade Program which aims to provide a safer, more efficient connection between the Central West region of New South Wales (NSW), the Blue Mountains and Sydney.

Key features of the proposal would include:

- widening of the Great Western Highway to provide a four-lane divided carriageway in two sections:
  - between Rowan Lane, Katoomba and Bellevue Crescent, Medlow Bath (about 3.5 kilometres)
  - between Station Street, Medlow Bath and Tennyson Road, Blackheath (about 1.8 kilometres)
- new concrete twin bridges (about 400 metres long) over the valley from Pulpit Hill near Explorers Road
- upgrades to intersections at Nellies Glen Road, Explorers Road and Foy Avenue
- re-use of redundant sections of the existing highway pavement for new truck stopping areas, local service roads and maintenance areas
- consolidation and improvement of the Pulpit Hill heritage interpretation area on Nellies Glen Road, including improved visitor parking
- adjustment of bus stops on the highway at Bonnie Doon Reserve, Explorers Road and Foy Avenue to provide set down and pick up locations for buses
- installation of 11 water quality basins including biofiltration and on-site detention
- upgrade and enhancement of existing sections and providing new active transport connections along the Great Western Highway, which would form part of the broader Great Blue Mountains Trail to improve active transport connectivity between Katoomba and Blackheath
- common construction activities and ancillary work, including:
  - relocation of rail infrastructure, maintenance areas, access roads and utilities (including electrical, gas, water and telecommunications)
  - work on associated rail infrastructure including adjustments to power connections and rail corridor fencing
  - civil earthworks, retaining walls, drainage work, water quality controls and tie in work to adjoining sections of the highway
  - new national park, railway, fire trail and utility authority maintenance access tracks to connect with other corridors
  - final roadworks including pavement, kerb and gutters, signs, landscaping lighting and line marking
  - new intelligent transport systems including, but not limited to, closed-circuit television, variable-message signs and variable speed limit signs
  - establishment of temporary ancillary facilities to support construction, including compound sites, site offices, stockpile and laydown locations, temporary access tracks, water quality devices and concrete batching plants.

Need for the proposal

The proposal is consistent with key strategic objectives within a number of State Government strategies and plans including:

- Premier's Priorities
- Future Transport Strategy 2056
- State Infrastructure Strategy 2018-2038: Building Momentum
- Regional NSW Services and Infrastructure Plan.

The proposal forms part of the broader upgrade of the Great Western Highway between Katoomba and Lithgow. The proposal, as part of the broader upgrade is needed to provide a safer and more efficient link between Central West NSW and the Sydney Motorway network.

Without the proposal, the highway between Katoomba and Blackheath would continue to be constrained resulting in suboptimal traffic movement along the corridor and impacts to the local communities in the Blue Mountains, particularly in Katoomba, Medlow Bath and Blackheath. In particular, without the proposal, the highway would continue to experience:

- slow travel speeds with limited overtaking opportunities and steep gradients (more than double the recommended maximum level)
- delays of up to 80 minutes in peak times and hours if there is an incident
- reduce freight efficiency by limiting access for safer and more sustainable high productivity vehicles
- limited access during incidents and natural disasters
- higher than state average crash rates, and
- socio economic amenity impacts for local communities with high through traffic volumes and congestion.

Proposal objectives

The proposal objectives are tied to the overall objectives of the Great Western Highway Upgrade Program. The program objectives and the proposal response to those objectives are detailed in the following table.

Theme	Great Western Highway Upgrade Program objective	Great Western Highway East – Katoomba to Blackheath proposal response
1. Economic development, productivity and recovery	Improve ability to drive regional economic development and freight productivity	Providing a four-lane divided carriageway with dedicated turn lanes to improve freight productivity and reduce congestion.
2. Resilience and future proofing	Provide a dependable and adaptable transport network that enables continuity of transport and essential services	Make network provisions for emergency services and provide safe continuous access to transport services.
3. Network performance	Improve transport network efficiency	Provide suitable capacity to reduce congestion during peak periods and to support overtaking of slower vehicles.
4. Safety	Reduce actual and perceived safety risks	Separate traffic flows and user groups, upgrading intersections, provide shoulders, improve alignment and remove roadside hazards along the corridor.
5. Movement, place and amenity	Maintain and enhance local amenity and character, and protect environmental and cultural assets	Improve local traffic connectivity along and across the corridor. Provide facilities to encourage active transport as part of the Great Blue Mountains Trail. Preserve, consolidate and interpret cultural heritage through sensitive urban design along the highway, including both Aboriginal and non-Aboriginal heritage themes.

The proposal would meet these objectives by the provision on increased capacity on the highway.

Options considered

Since the 1950's, Transport has considered duplication and alignment of the Great Western Highway to improve the crossing of the Blue Mountains.

In 2009, planning and investigations for the duplication of the Great Western Highway for the corridor between Mount Victoria and Lithgow were undertaken to inform the Local Environmental Plan (LEP) corridor reservation.

In June 2018, the NSW Government committed to investigating the feasibility of extending the duplication of the Great Western Highway from north of Katoomba to Forty Bends. In late 2018 and 2019, a corridor route option analysis was undertaken for the length of highway.

The corridor was split into four zones to appropriately capture potential options for the localities. Due to the constraints between Katoomba and Medlow Bath, the only option was to consider a duplication generally along the alignment of the existing highway. This included straightening the alignment by bridging across the valley north of Explorers Road. Between Medlow Bath and Blackheath, there were two corridor route options: a new alignment that passed to the west of the Main Western Rail Line (along Station Street) or realigning and widening the existing alignment. The preferred corridor route was to realign and widen the existing alignment as it would maximise the use of existing road pavement and reduce impacts on heritage items.

Once the preferred corridor route had been selected, strategic and concept design was undertaken to further minimise environmental impacts and improve the constructability of the designs. The strategic design identified two separate options for the Katoomba to Medlow Bath section, focusing around the bridges required west of Explorers Road:

- Option A: A new carriageway to cater for westbound traffic, with the existing highway catering for eastbound traffic.
- Option B: Upgrade the existing alignment with one curved twin bridge to the west of Explorers Road.

Option B was selected for the Katoomba to Medlow Bath section as Option A did not meet the program objectives, as using the existing highway alignment did not resolve known constraints and safety issues.

Between Medlow Bath and Blackheath, an alternative alignment near Coachhouse Lane was progressed. This option was further developed based on community feedback, as it shifted the alignment more into the rail corridor to avoid impacts to Coachhouse Lane and private properties in the area.

Through the concept design phase, a number of different design refinements were undertaken to improve the constructability of the strategic designs including changes to the alignment around Pulpit Hill and the bridges to the north of Explorers Road.

The preferred design for the proposal has been defined through strategic and concept design development, involvement of stakeholders attending workshops, and included a range of refinements to minimise impacts and improve constructability. The preferred design:

- provides a four-lane dual carriageway through the sections of Katoomba to Medlow Bath, and Medlow Bath to Blackheath suitable for a posted speed of 80 kilometres per hour
- follows an alignment that is constructable alongside highway traffic to maintain existing highway operation during construction
- provides upgraded intersections at Nellies Glen Road, Explorers Road and Foy Avenue
- makes best use of redundant highway sections for maintenance, local access and for truck stopping areas for load checking
- avoids impacts on properties in Coachhouse Lane
- provides for improvement to water quality along the proposal while also providing suitable access to maintain and manage assets along the corridor
- provides opportunities to enhance locations with heritage value through interpretation and urban design features
- makes best use of the landscape to provide connections between villages that integrate with the surrounding natural landscape
- construction of the bridge structures identified to be incrementally launched to minimise direct environmental impacts under the bridge structure and reduce construction logistics.

Statutory and planning framework

Chapter two of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State.

Section 2.108 of the Transport and Infrastructure SEPP 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 on behalf of Transport, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

Part of the proposal area is currently located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) as part of the Blue Mountains National Park. Development within national park estate cannot proceed by virtue of Section 2.108 of the Transport and Infrastructure SEPP until the land is revoked from the national park estate via an Act of Parliament. This revocation process is currently ongoing.

Community and stakeholder consultation

The NSW Government began planning for the Great Western Highway upgrade between Katoomba and Lithgow in 2019. Since then, Transport has involved the community during the development of the Great Western Highway Upgrade Program through a range of community consultation activities. For the Great Western Highway East – Katoomba to Blackheath this has included community feedback periods for the strategic design, community updates and doorknocking activities to inform the community of the upgrade.

Consultation has also been undertaken with a range of government and community stakeholders through the development of the concept design. In particular, issues such as heritage, water quality and National Park revocation have been discussed. Aboriginal heritage stakeholders have also been consulted in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.

Environmental impacts

Surface water and groundwater

During construction, there would be a need to prevent surface water quality impacts from sediment laden runoff or accidental leaks and spills. In addition, the proposal may result in localised interception of groundwater which could impact on the groundwater quality. Construction sediment control basins have been designed to minimise impacts to water quality from the proposal. A Soil and Water Management Plan (SWMP) would be implemented during construction and include the requirement for several erosion and sediment control measures to be maintained during construction. Soil and erosion controls would be especially important around the Blue Mountains Swamp Threatened Ecological Community (TEC) (Plant Community Type [PCT] 1078) within the proposal area. Near the new twin bridges, surface water flow off the bridge structure during construction would also be managed by explicit intervention measures to avoid uncontrolled site water falling onto the PCT.

During operation, the increased impervious surface area of the upgraded Great Western Highway would result in increased stormwater runoff volume, frequency and rate and associated increases in pollutant loading to receiving waterways. The drainage design of the proposal includes several Gross Pollutant Traps, water quality basins and swales to retain and treat stormwater runoff before release into the surrounding environment. Water quality modelling carried out for the proposal identified that these treatments would result in a net beneficial effect on water quality compared to the existing scenario.

Biodiversity

There is limited cleared space for widening the Great Western Highway along the existing corridor. As such, the proposal would involve the removal of up to 47.56 hectares of native vegetation, including:

- up to 46.8 hectares of vegetation identified as plant community type (PCT 1248) Sydney Peppermint – Silvertop Ash
- up to 0.76 hectares of vegetation identified as plant community type (PCT 967) Narrow-leaved Peppermint – Silvertop Ash.

The design has avoided direct impact to the Blue Mountains Swamp TEC (PCT 1078) near the twin bridges in the Katoomba to Medlow Bath section. This is a TEC listed under the BC Act and EPBC Act. However, there may be indirect impacts to 0.12 hectares of the swamp.

The proposal would result in an increased road crossing distance (from about 30 metres to about 100 metres in some locations). This would reduce connectivity across the widened Great Western Highway and increase the risk of injury and mortality to local fauna.

Assessments of significance have been carried out for threatened species which were identified with potential to occur within the proposal area. These assessments found that the vegetation removal associated with the proposal would not have a significant impact on threatened biota. Significant impacts would be avoided through the implementation of mitigation measures, including the implementation of a Flora and Fauna Management Plan.

During the detailed design and construction stages, work would be undertaken to minimise, as far as practicable, the area of vegetation removal. However, biodiversity offsets have been identified and would offset the resultant vegetation removal.

Non-Aboriginal heritage

The proposal would result in direct impacts on four local heritage items listed on the *Blue Mountains Local Environment Plan 2015* within the Katoomba to Medlow Bath section. These are: Pulpit Hill and Environs; Stone Arrangements; Explorer's Tree and Environs; and Bonnie Doon Reserve. While the proposed design has been refined to minimise impacts to these heritage items by following the existing alignment as much as possible, impacts would occur during construction. This would be due to the widening of the existing road corridor through the curtilages of these heritage items. While the Explorer's Tree and Environs heritage item sits entirely within the proposed road corridor, the tree was removed in February 2021 due to safety concerns. As such, the proposal would have a partial impact on the item. The proposal would not impact on the 'heritage fabric' of the other heritage items subject to direct impacts.

The proposal has been designed to complement the heritage significance of the proposal area by creating spaces for interpretation and community access. These design features include the retention and expansion of the existing heritage interpretation area at Pulpit Hill and the provision of improved active transport trails. These features would be further developed as part of the Great Western Highway Upgrade Program heritage interpretation strategy.

Landscape character and visual impact

The proposal would result in visual impacts to motorists, recreational walkers and cyclists during construction due to clearance of vegetation, excavations and earthworks and the presence of construction areas and ancillary facilities. Residents that overlook construction sites would experience the greatest visual impacts from the proposal. There would be major visual impacts experienced at residences on Explorers Road, especially those down the valley due to their proximity to the construction of the twin bridges. Visual impacts would also be noticeable for residents on Rowan Lane, Katoomba; Foy Avenue, Delmonte Avenue, Coachhouse Lane and Station Street, Medlow Bath. There are no anticipated residual landscape or visual impacts resulting from the construction phase of the proposal as contractors would be required to rehabilitate all work sites.

The proposal would result in landscape character and visual impacts due to widening of the road corridor and removal of vegetation. This would have the greatest impact in areas which are currently highly vegetated including near Pulpit Hill in the Katoomba to Medlow Bath section and along the Medlow Bath to Blackheath section where the proposal removes vegetation that is currently part of the Blue Mountains National Park. However, an urban design and landscape strategy has been developed for the proposal to maintain the existing character of the local area. The strategy has informed the design of elements including the proposed twin bridges, retaining walls, exposed cut, fill embankments, bicycle and pedestrian connections and replanting/ landscaping.

Noise and vibration

During construction, exceedances of the noise management levels are predicted near the proposal. During standard working hours, most residences are not predicted to be 'highly noise affected'. However, where work occurs near Foy Avenue and Coachhouse Lane, Medlow Bath, nine residences are predicted to be 'highly noise affected'. The highest noise levels are only likely to occur for relatively short periods when construction work is near the residences.

For work outside standard hours, exceedances are predicted throughout the proposal area. Impacts would be greatest during the night-time period for work near Medlow Bath. The main potential source of vibration during construction would be excavation of hard rock. The assessment found that some receivers would be within the minimum working distance for cosmetic damage and/or the human comfort minimum working distance during the worst-case vibration scenario. Noise and vibration impacts during construction would be minimised and managed as far as feasible and reasonable in accordance with the Construction Noise and Vibration Guideline (Transport, 2016a).

During operation, noise levels are predicted to increase for some sensitive receivers along the Great Western Highway as the highway would move closer. The operational noise modelling show that 31 residential receivers would experience an exceedance of the adopted operational noise criteria. This is expected to apply to receivers closer to the Great Western Highway along the Katoomba to Medlow Bath section, and receivers at the eastern end of the Medlow Bath to Blackheath section.

A range of noise mitigation measures including low noise pavement and at-property treatments would be considered further by Transport during detailed design for properties where noise levels would exceed the adopted criteria.

Traffic and transport

The construction of the proposal would be staged so that the new carriageway for each section would be constructed offline and result in little or no impact to existing traffic. Once completed, the main highway traffic would be diverted onto the new carriageways in a contraflow operation, resulting in minimal impacts to traffic during the construction of the second carriageway for each section. As some work may be carried out immediately adjacent to the highway, there may be the need to reduce the speed limit in localised sections along the highway during work for the safety of workers. This could result in some short-term localised traffic delays.

Within the Katoomba to Medlow Bath section, construction of the westbound carriageway would result in the temporary closure of the Great Blue Mountains Trail between Katoomba and Medlow Bath. This would be reconstructed and reopened upon completion of this carriageway. Construction would also impact local roads through the staged temporary closure of Nellies Glen Road and Explorers Road. Temporary access to properties along these roads would be provided. Construction would also result in temporary relocation of bus stops along this section.

During operation, the proposal would result in benefits to traffic and transport including:

- improved existing performance and safety and reduced congestion by:
  - improving operation of key intersections (Nellies Glen Road, Explorers Road and Foy Avenue) along the Katoomba to Medlow Bath section
  - improving traffic flow along the Medlow Bath to Blackheath section

- improved pedestrian and cyclist infrastructure through:
  - the upgrade and realignment of parts of the Great Blue Mountains Trail within the Katoomba to Medlow Bath section
  - the establishment of a new active transport trail to the east of the Great Western Highway between Medlow Bath and Blackheath.

The proposal would result in permanent changes to traffic conditions at Nellies Glen Road and Explorers Road, Katoomba, and Foy Avenue, Medlow Bath.

Explorers Road would no longer connect to the highway, instead connecting to the service road which would provide access eastbound to the highway. The Explorers Road intersection would only allow a right-in and right-out (to Katoomba) traffic movement.

Nellies Glen Road would be shifted further east to improve driver sight lines of traffic on the highway and allow for the retention and improvement of the existing Pulpit Hill heritage interpretation area. The left-out movement at Nellies Glen Road which was removed by Blue Mountains City Council in 2021 due to safety concerns would be reinstated, making the intersection left-in left-out only. If Pulpit Hill residents need to travel to Medlow Bath, access to the highway would be via Nellies Glen Road.

At Foy Avenue, the intersection would become a left-in, left-out and right-in only. The right turn out of Foy Avenue onto the Great Western Highway eastbound would not be permitted. To travel towards Katoomba, residents would need to travel north to Bellevue Crescent to turn around at the U-turn bay provided by the Great Western Highway Upgrade – Medlow Bath.

By widening the Great Western Highway from one to two lanes in each direction, the proposal would improve reliability of access for the local and regional communities and emergency services currently using the highway. It would also improve the resilience of the highway during emergencies such as traffic incidents and bushfires.

Justification and conclusion

Without the proposal, the highway between Katoomba and Blackheath would continue to be constrained resulting in restrictive traffic movement along the corridor continuing to impact on the local communities in the Blue Mountains, particularly in Katoomba, Medlow Bath and Blackheath.

In particular, the proposal would meet the proposal objectives and would realise the following benefits:

- increased road capacity from one lane either direction to two lanes either direction to improve travel speeds and reduce delays during peak times
- improved safety for all road users including pedestrians and cyclists
- improved access in terms of traffic incidents or other emergency incidents or natural disasters.
- upgrading to latest road specifications could allow for improved freight access including use by higher productivity vehicles.
- improved travel efficiency would result in improved amenity for local communities and improved access for the local community.

While there would be some environmental impacts from the proposal, they have been avoided or minimised wherever possible through design and the use of site-specific environmental safeguards to be implemented during detailed design and construction. The beneficial effects of improving safety and freight efficiency are considered to outweigh the adverse impacts and risks associated with the REF proposal.

In conjunction with the broader Great Western Highway Upgrade Program, the proposal would improve transport link for freight, commuters, travellers and tourists between the Central West and the east coast cities including Sydney, Newcastle and Wollongong. It would better connect local communities in the Blue Mountains to jobs, health care, education and other services both within townships and in neighbouring regional cities and strategic centres. Completion of upgrades to the last section of the Great Western Highway (between Sydney and Lithgow) would also result in improved:

- resilience and emergency management conditions
- connectivity for all road users along and across the corridor
- active transport links
- consistency of travel conditions
- network efficiency and freight productivity
- safety for all road users
- quality of surface water run off to the surrounding environment
- local amenity through heritage interpretation.

Display of the review of environmental factors

This REF is on display for comment between 15 May and 19 June 2022. You can access the documents in the following ways:

Internet

The documents are available as pdf files on the Transport for NSW website at ***nswroads.work/gwheastconsult***.

Printed copies

Hard copies of the REF will also be available for viewing between 15 May and 19 June 2022 at:

- Blaxland Library
  - 33 Hope St, Blaxland NSW 2774
  - Hours of operation: 10am to 5:30pm Monday to Friday and 9am to 4pm Saturday
- Blue Mountains City Council – Katoomba Council Headquarters
  - 2-6 Civic Place, Katoomba NSW 2780
  - Hours of operation: Monday to Friday 9am–4pm
- Glenbrook Customer Service Counter (Glenbrook Visitor Information Centre)
  - Hamment Place, Glenbrook NSW 2773
  - Hours of operation: 8:30am to 3pm Monday to Friday
- Katoomba Library
  - Blue Mountains Cultural Centre, 30 Parke St, Katoomba 2780
  - Hours of operation: 10am to 5pm Monday to Friday, 10am to 4pm Saturday and 12 noon to 4pm Sunday.

An online version of the REF will also be available throughout the display via our virtual consultation room at ***nswroads.work/gwheastconsult***.

Copies by request

Printed and electronic copies are available by contacting Elisabeth Sacco on 1800 953 777 or email ***gwhd@transport.nsw.gov.au***.

Staffed displays

Date	Location and time
Monday, 23 May 2022	Online general session – 6:30pm – 8pm
Wednesday, 25 May 2022	Aboriginal stakeholder engagement session – 4:30pm – 6pm General face to face session – 6pm – 8pm Seminar Room, Katoomba Cultural Centre, 30-32 Parke Street Katoomba
Tuesday, 31 May 2022	Specialised online session – biodiversity & water quality 6:30pm – 8pm
Saturday, 4 June 2022	Face to face session – 10am – 12pm Blackheath Neighbourhood Centre, 41 Gardiner Cres, Blackheath
Monday, 6 June 2022	Specialised online session – localised access/construction & completion 6:30pm – 8pm
Thursday, 9 June 2022	Online general session – 6:30pm – 8pm

How can I make a submission?

To have your input formally considered, and receive a response in the Submissions Report, use our online submission form at ***nswroads.work/gwheastconsult***.

To send in a printed submission via post, write to:

Great Western Highway Upgrade Program

Katoomba to Blackheath Upgrade REF & Concept Design

PO Box 334, Parkes NSW 2870

Submissions must be received by midnight 19 June 2022. Submissions will be managed in accordance with the Transport for NSW Privacy Statement which can be found here https://www.transport.nsw.gov.au/privacy-statement or by contacting 1800 953 777 for a copy.

What happens next?

Transport for NSW will collate and consider the submissions received during public display of the REF.

After this consideration, Transport for NSW will determine whether or not the proposal should proceed as proposed and will inform the community and stakeholders of this decision. The REF for this proposal and the Great Western Highway Upgrade – Medlow Bath REF will be considered and determined at the same time to capture all potential impacts of the Great Western Highway upgrade between Katoomba and Blackheath.

If the proposal is determined to proceed, Transport for NSW will continue to consult with the community and stakeholders prior to and during construction.

Contents

Tables

Figures

Appendices

1. Introduction

1.1 Proposal identification

Transport for NSW (Transport) is proposing to widen the Great Western Highway, between Rowan Lane, Katoomba and Tennyson Road, Blackheath from one to two lanes in each direction (the proposal) (refer to Figure 1-1). The proposal is part of the Great Western Highway Upgrade Program which aims to provide a safer, more efficient connection between the Central West region of New South Wales (NSW), the Blue Mountains and Sydney.

The proposal consists of two sections:

- Katoomba to Medlow Bath – about 3.5 kilometres of highway between Rowan Lane at Katoomba and Bellevue Crescent at Medlow Bath
- Medlow Bath to Blackheath – about 1.8 kilometres of highway between Station Street, Medlow Bath and Tennyson Road, Blackheath.

The Great Western Highway Upgrade – Medlow Bath (between Bellevue Crescent and Station Street) (Medlow Bath Upgrade) has been assessed in a separate REF (Transport, 2021d). This project occurs between the two sections of this proposal.

1.1.1 Proposal background

The Federal and NSW Governments are investing more than $4.5 billion towards the Great Western Highway Upgrade Program which proposes to upgrade the remaining 34 kilometres of the Great Western Highway to four-lane divided highway between Katoomba and Lithgow.

The Great Western Highway Upgrade Program would reduce congestion, deliver safer, more efficient and reliable journeys for those travelling in, around and through the Blue Mountains, and better connect communities in the Central West. This proposal would contribute to the overall objectives of the Great Western Highway Upgrade Program.

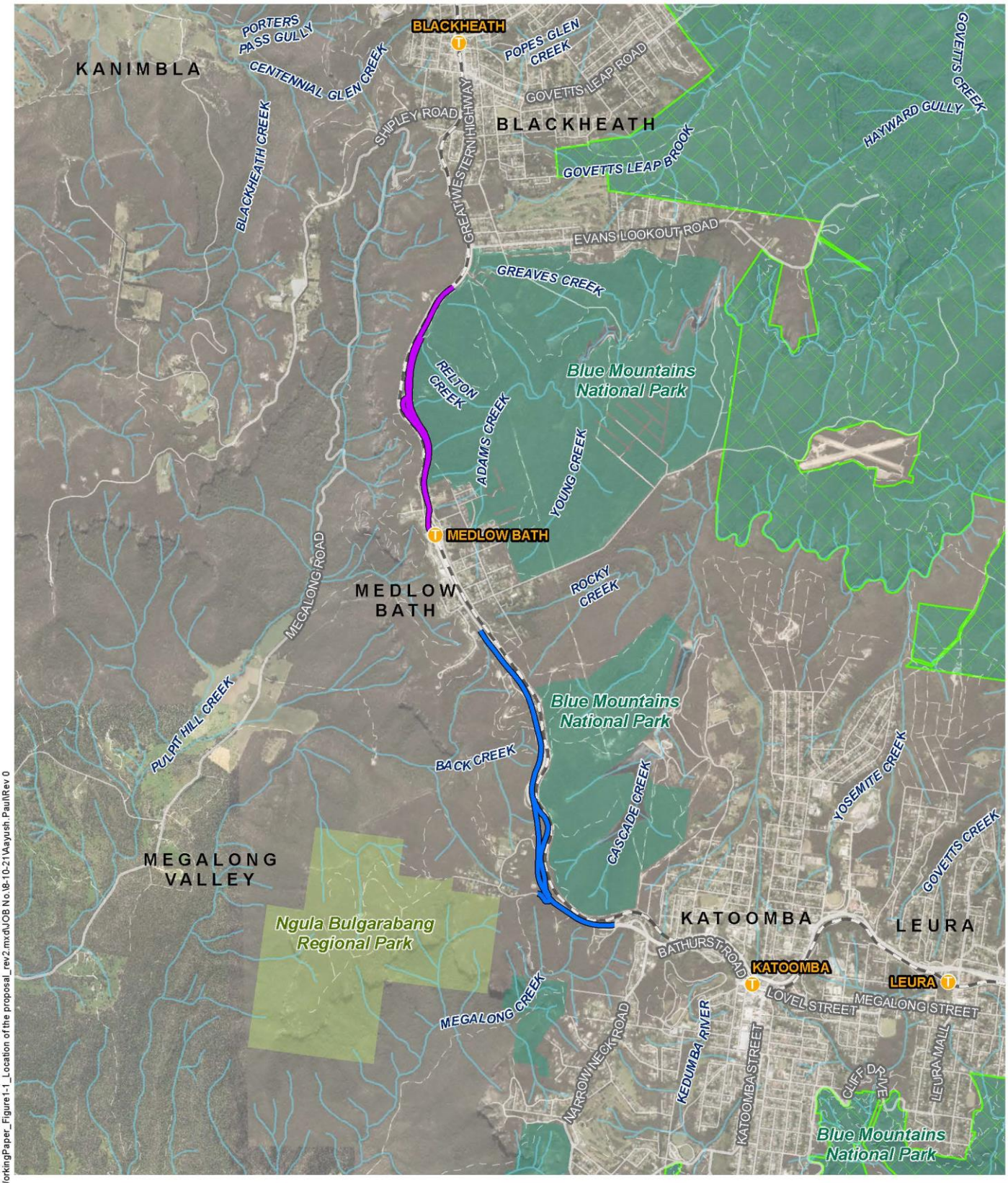
The proposal is referenced as the ‘East’ project within the Great Western Highway Upgrade Program.

1.1.2 Proposal location and setting

The proposal is located within the Blue Mountains local government area (LGA) (refer to Figure 1-1).

The proposal is along or adjacent to the existing Great Western Highway between Katoomba and Blackheath, maximising the use of the existing road corridor as it runs along the ridgeline between the Megalong Valley and the Blue Mountains National Park. The road corridor connects the existing towns of Katoomba, Medlow Bath and Blackheath.

The Katoomba to Medlow Bath section is bounded by vegetated private or Council owned property to the west and the Main Western railway corridor to the east. The Medlow Bath to Blackheath section is bounded by the Main Western railway corridor to the west and the Blue Mountains National Park to the east. The section of National Park immediately adjacent to the Medlow Bath to Blackheath section is not part of the Greater Blue Mountains World Heritage Area.



Katoomba to Medlow Bath section

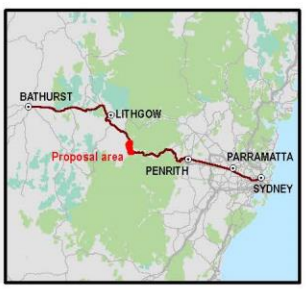
Medlow Bath to Blackheath section

Main Western Railway

Greater Blue Mountains World Heritage Area

Blue Mountains National Park

Ngula Bulgarabang Regional Park



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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 1-1: Location of the proposal

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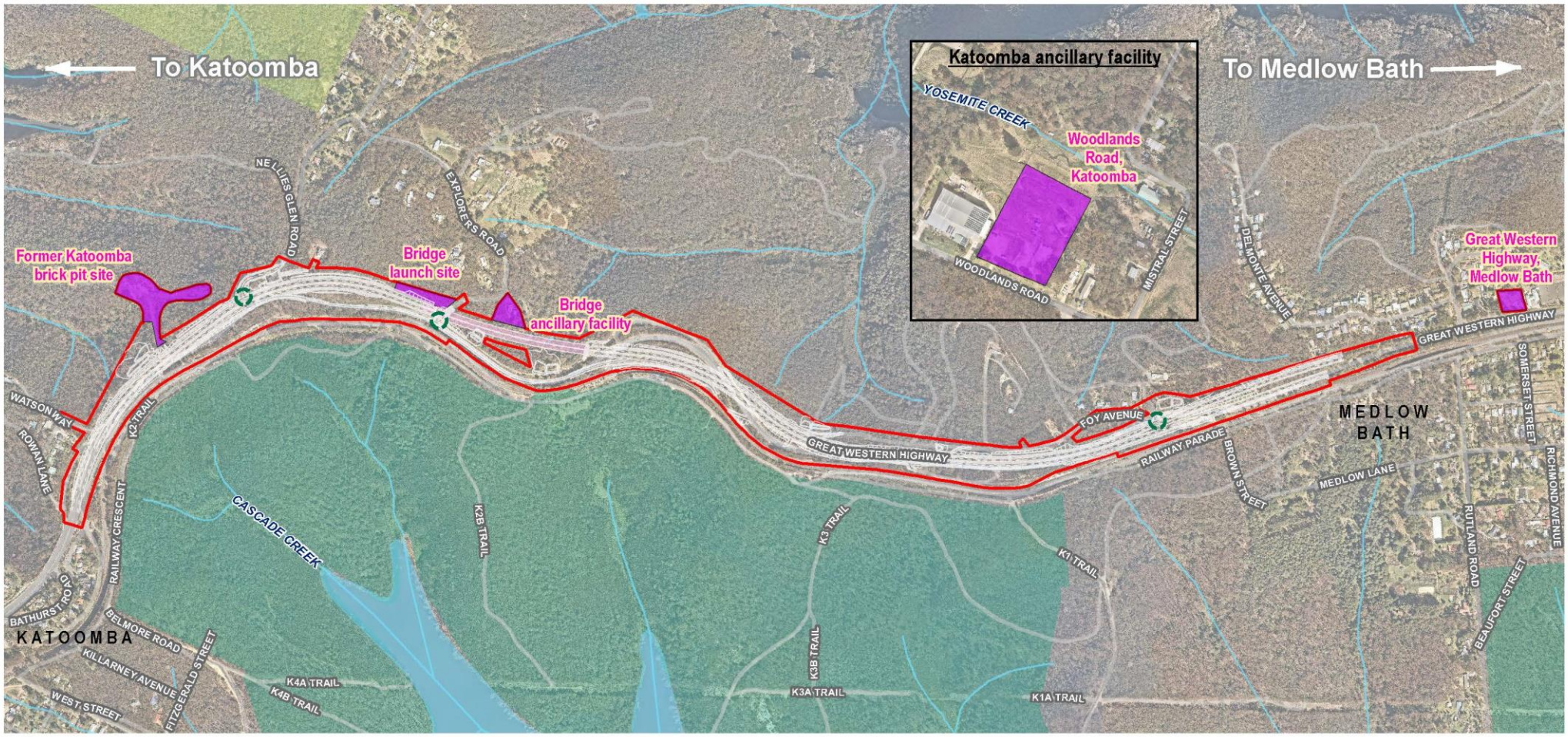
1.1.3 Proposal overview

Key features of the proposal would include:

- widening of the Great Western Highway to provide a four-lane divided carriageway in two sections:
  - between Rowan Lane, Katoomba and Bellevue Crescent, Medlow Bath (about 3.5 kilometres)
  - between Station Street, Medlow Bath and Tennyson Road, Blackheath (about 1.8 kilometres)
- new concrete twin bridges (about 400 metres long) over the valley from Pulpit Hill near Explorers Road
- upgrades to intersections at Nellies Glen Road, Explorers Road and Foy Avenue
- re-use of redundant sections of the existing highway pavement for new truck stopping areas, local service roads and maintenance areas
- consolidation and improvement of the Pulpit Hill heritage interpretation area on Nellies Glen Road, including improved visitor parking
- adjustment of bus stops on the highway at Bonnie Doon Reserve, Explorers Road and Foy Avenue to provide set down and pick up locations for buses
- installation of 11 water quality basins including biofiltration and on-site detention
- upgrade and enhancement of existing sections and providing new active transport connections along the Great Western Highway, which would form part of the broader Great Blue Mountains Trail to improve active transport connectivity between Katoomba and Blackheath
- construction activities and ancillary work common to both sections, including:
  - relocation of rail infrastructure, maintenance areas, access roads and utilities (including electrical, gas, water and telecommunications)
  - work on associated rail infrastructure including adjustments to power connections and rail corridor fencing
  - civil earthworks, retaining walls, drainage work, water quality controls and tie in work to adjoining sections of the highway
  - new national park, railway, fire trail and utility authority maintenance access tracks to connect with other corridors
  - final roadworks including pavement, kerb and gutters, signs, landscaping lighting and line marking
  - new intelligent transport systems including, but not limited to, closed-circuit television, variable-message signs and variable speed limit signs
  - establishment of temporary ancillary facilities to support construction, including compound sites, site offices, stockpile and laydown locations, temporary access tracks, water quality devices and concrete batching plants.

An overview of the proposal is shown in Figure 1-2a-b, with further detail provided in Chapter 3.



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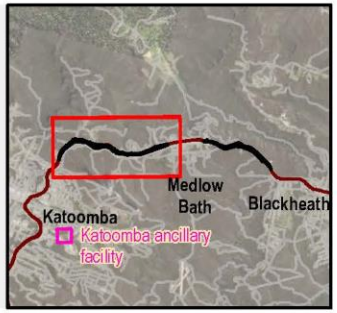
- The design
- Proposal area
- Proposed ancillary facilities
- Bridge
- Blue Mountains National Park
- Ngula Bulgarabang Regional Park
- Proposed intersection upgrades



Source: Aurecon, Mott MacDonald, LPI, Nearmap

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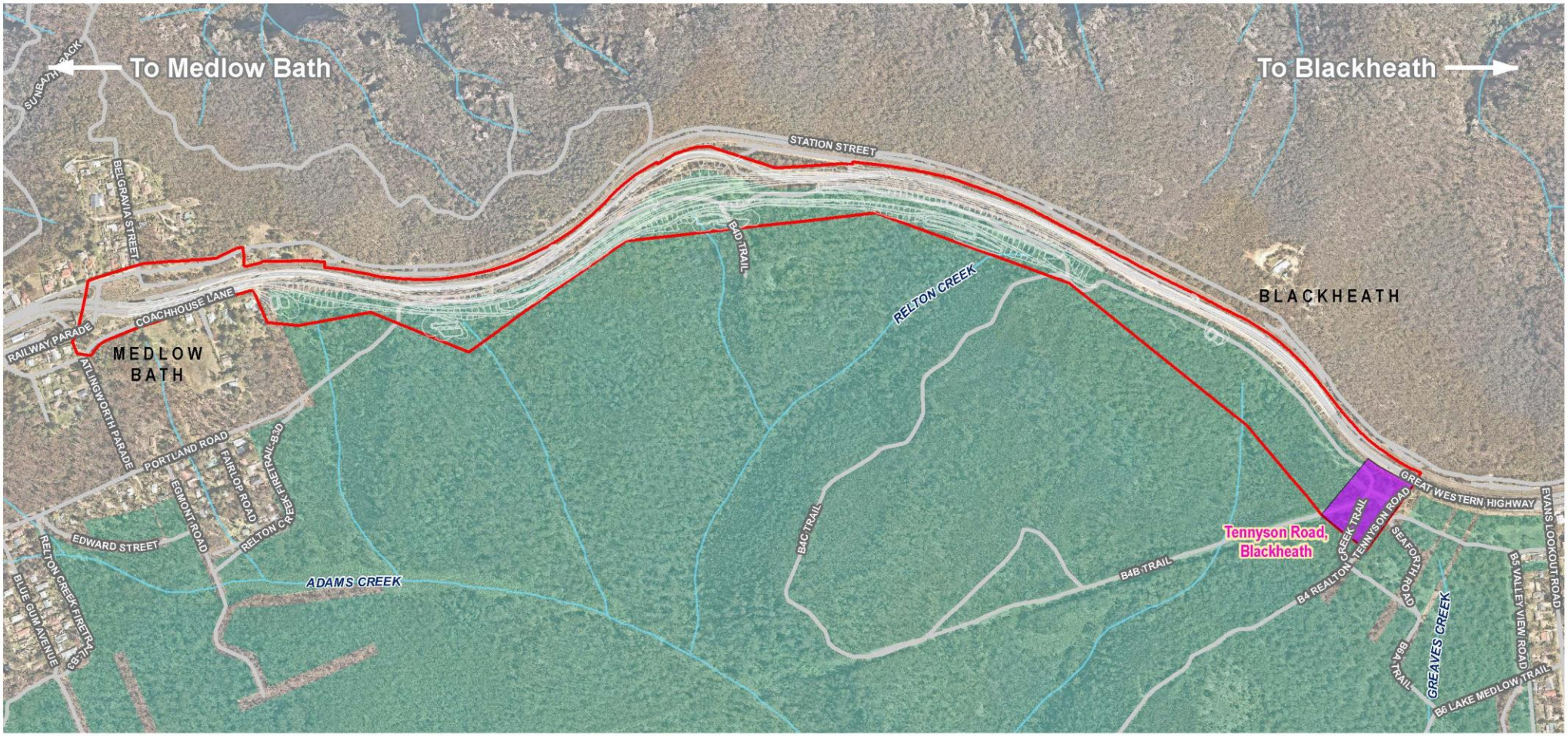
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 1-2a: The proposal - Katoomba to Medlow Bath section



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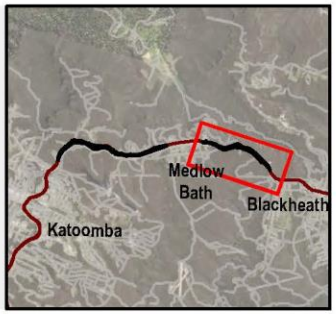
- The design
- Proposal area
- Proposed ancillary facilities
- Blue Mountains National Park



Source: Aurecon, Mott MacDonald, LPI, Nearmap

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0 100 200m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 1-2b: The proposal - Medlow Bath to Blackheath section

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Aurecon Australasia in association with Mott MacDonald on behalf of Transport. This REF assesses the Great Western Highway East – Katoomba to Blackheath (Katoomba to Blackheath Upgrade).

For the purposes of these works, Transport is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of Section 171 of the Environmental Planning and Assessment Regulation 2021, 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), *Roads and Related Facilities EIS Guideline* (DUAP, 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

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

- Section 5.5 of the EP&A Act, including that Transport examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity
- the strategic assessment approval granted by the Federal Australian Government under the EPBC Act in September 2015, with respect to the impacts of Transport's road activities on nationally listed threatened species, ecological communities and migratory species.

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 and Public Spaces under Division 5.2 of the EP&A Act
- the significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- 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 the environment of Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of Agriculture, Water and the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

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

The proposal form part of the broader upgrade of the Great Western Highway between Katoomba and Lithgow. The proposal, as part of the broader upgrade is needed to provide a safer and more efficient link between Central West NSW and the Sydney Motorway network.

The Great Western Highway (route A22) is a 201-kilometre-long state highway in NSW connecting Bathurst with Sydney. It is the primary road network link connecting the Central West NSW to Sydney for freight, tourist and general traffic. It also serves an important access function to the local communities along the highway. The Great Western Highway has been upgraded to dual carriageway standard from the Sydney motorway network to the northern outskirts of Katoomba. Transport for NSW are now investigating upgrading the Great Western Highway between Katoomba and Lithgow, being the Great Western Highway Upgrade Program.

The highway's topography and existing two lane carriageway design results in the following constraints:

- reduces freight efficiency by limiting access for safer and more sustainable high productivity vehicles
- limits access during incidents and natural disasters
- slows travel speeds with limited overtaking opportunities and steep gradients (more than double the recommended maximum level)
- causes delays of up to 80 minutes in peak times and hours if there is an incident
- has higher than state average crash rates, and
- impairs amenity for local communities with high through traffic volumes and congestion.

The Katoomba to Blackheath section of the Great Western Highway is an important local transport link, connecting the Medlow Bath community with Katoomba and Blackheath communities and further afield. It connects local communities to jobs, health care, education and other services both within townships and in neighbouring regional cities and strategic centres. The Great Western Highway also provides access from within the proposal study area to the Greater Sydney region and accommodates travel for visitors and tourists to the region. The highway also facilities the movement of freight both inbound for local consumption and outbound to Sydney, interstate and to the international port terminals.

2.1.1 Strategic planning and policy documents

The proposal has been reviewed against, and is found to be consistent with, relevant strategic plans as summarised in the following sections.

NSW Premier's and State priorities

The New South Wales Government has committed to achieve 12 Premier's priorities and 18 state priorities to grow the economy, deliver infrastructure, protect the vulnerable, and improve health, education and public services across NSW.

The proposal supports and is relevant to the following Premier's priority:

- Building infrastructure - Key infrastructure projects to be delivered on time and on budget across NSW.

The proposal supports and is relevant to the following state priorities:

- Improving road travel reliability - 90 per cent of peak travel on key road routes is on time
- A safe transport system for every customer with the aim for zero deaths or serious injuries on the network by 2056.

The *Premier's Priorities* (NSW Government, 2021) recognises that key infrastructure projects immensely benefit the local economy through sustainable urban connections and land use planning. The proposal would increase capacity that would reduce travel time and improve road safety by improving traffic flow between Katoomba and Blackheath. Together with other safety upgrades in the Great Western Highway corridor, the proposal would provide the same benefits to the highway between Katoomba and Lithgow. Therefore, the proposal supporting the relevant Premier's and state priorities.

Future Transport Strategy 2056

The *NSW Future Transport Strategy 2056* (Transport, 2018b) outlines a clear framework to address transport challenges in NSW over the next 40 years. It integrates planning for roads, freight and all other modes of transport and sets out initiatives, solutions and actions to meet NSW transport challenges. Transport is identified as an enabler of economic and social activity and contributes to long term economic, social and environmental outcomes.

Future Transport 2056 outlines six state-wide outcomes to guide investment, policy and reform and service provision. They provide a framework for planning and investment aimed at harnessing rapid change and innovation to support a modern, innovative transport network.

The proposal directly aligns with the following state-wide outcomes:

- A strong economy – The transport system powers NSW's future $1.3 trillion economy and enables economic activity across the state. The proposal supports this outcome enabling growth in economic activity, including the movement of freight
- Safety and performance – Every customer enjoys safe travel across a high performing, efficient network. The proposal supports this outcome through the separation of carriageways and the implementation of contemporary design standards.

By upgrading the highway to current design standards, the proposal would support the following regional NSW transport customer outcomes:

- supporting centres with appropriate transport services and infrastructure. The proposal would support the access between Sydney and the Central West of NSW, including the various towns and urban centres along the alignment.
- the appropriate movement and place balance is established enabling people and goods to move efficiently through the network whilst ensuring local access and vibrant places. The proposal would provide an opportunity, through options selection and the design development process, to balance the movement function of the Great Western Highway with the place functions of the various towns and urban centres along the alignment.
- economic development is enabled by regional transport services and infrastructure.
- a safe transport system for every customer with the aim for zero deaths or serious injuries on the network by 2056. The proposal would improve safety via the separation of carriageways and the implementation of contemporary design standards.
- customers enjoy improved connectivity, integrated services and better use of capacity.

Future Transport Strategy 2056 identifies future directions for road customers including the provision of better road connections, an expanded network of bus lanes, and safer roads, particularly during extreme weather events. The proposal would meet these directions by improving road capacity, reinstating bus

stops on the highway at Bonnie Doon Reserve, Explorers Road and Foy Avenue and reinstatement of parts of the active transport paths or creation of new active transport trails.

Infrastructure Priority List (Australian Infrastructure Plan)

The *Infrastructure Priority List* (Infrastructure Australia, 2021) sets out the investment opportunities that can deliver nationally significant benefits to Australia. It directs Australia's governments to the projects and initiatives that will deliver world-class infrastructure services to all Australians across the energy, telecommunications, water, waste, social and transport sectors. Great Western Highway improvements: Katoomba to Lithgow is identified in both the 2020 and 2021 Infrastructure Priority Lists.

Great Western Highway improvements: Katoomba to Lithgow is categorised as national connectivity project with the problem timeframe being in the 'near term' (0-5 years). Delivery of the proposal is therefore of national significance.

State Infrastructure Strategy 2018 – 2038: Building Momentum

The *State Infrastructure Strategy* (Infrastructure NSW, 2018) is a 20-year investment plan prepared by Infrastructure NSW. The State Infrastructure Strategy assesses infrastructure problems and solutions and provides recommendations to grow the state economy, enhance productivity and improve living standards.

The strategic objective in the *State Infrastructure Strategy* relating to transport is to ensure the transport system creates opportunities for people and businesses to access the services and support they need. As Greater Sydney will need to cater for an additional 1.7 million people, this strategy acknowledges that a comprehensive review of the existing transport infrastructure is needed, including reference to the need to modernise the city's motorways, and upgrade strategically important corridors to ensure efficient movement of freight.

The proposal would assist in addressing the following key challenges and opportunities identified in this strategy document:

- addressing capacity constraints
- improving productivity
- shaping our regions and cities
- improving road safety
- embracing technological changes
- resilience and climate change
- leveraging health benefits.

Regional NSW Services and Infrastructure Plan

The *Regional NSW Services and Infrastructure Plan* (Transport, 2018c) is the NSW Government's blueprint for transport in regional NSW from now until 2056. It sets out the big trends, issues, services and infrastructure needs which are now, or will soon shape transport in regional NSW.

The vision for regional NSW is a safe, efficient and reliable network of transport services and infrastructure. This is in recognition of the vital role of regional cities as hubs for services, employment and social interaction for their surrounding communities.

The regional customer outcomes in the *Regional NSW Services and Infrastructure Plan* are the same as those in *NSW Future Transport Strategy 2056*, as discussed above.

The plan includes the following future projects that are directly relevant to the proposal:

- 0 to 10 years for investigation – Great Dividing Range long term solution study
- 0 to 10 years for investigation – Great Dividing Range long term solution corridor preservation
- 20 years plus initiative – Delivery of Great Dividing Range long term solution – Delivery of solution to improve freight connectivity across the Great Dividing Range in order to connect inland areas to Sydney/Wollongong/Newcastle.

Tourism and Transport Plan

The *Tourism and Transport Plan* (Transport, 2018e) is a companion document to the *NSW Future Transport Strategy 2056* (Transport, 2018b) that recognises the connection between transport and tourism and identifies the potential to support and enhance existing tourism as well as create new economic development opportunities.

The plan includes the following four customer outcomes:

- Customer Outcome 1: Enhancing the visitor experience
- Customer Outcome 2: Greater access to more of NSW
- Customer Outcome 3: Making transport the attraction
- Customer Outcome 4: A seamless experience.

By improving transport infrastructure on the main route to the Central West region, the proposal aligns with Customer Outcome 2. There may also be opportunities to contribute to Customer Outcomes 1 and 3 as the design process continues, particularly through the interpretation of heritage values along the proposal.

NSW Design Policy (Better Placed)

The *NSW Design Policy (Better Placed)* (Government Architect NSW, 2017) informs seven design objectives for the New South Wales built environment:

- Better fit: contextual, local and of its place
- Better performance: sustainable, adaptable and durable
- Better for community: inclusive, connected and diverse
- Better for people: safe, comfortable and liveable
- Better working: functional, efficient and fit for purpose
- Better value: creating and adding value
- Better look and feel: engaging, inviting and attractive

These are all relevant considerations for the proposal. The proposal will modify the built environment and has considered the importance of design quality on the function, integration and contribution of places and spaces to users, inhabitants and audiences they support or attract.

Central West and Orana Regional Plan 2036

The *Central West and Orana Regional Plan 2036* (NSW Department of Planning, Industry and Environment, 2017) provides an overarching framework to guide detailed land use plans, developments and infrastructure funding decisions for the region.

The plan provides a number of goals to drive the framework. Those relevant are under Goal 3: Quality freight, transport and infrastructure networks:

- Direction 18: Improve freight connections to markets and global gateways
- Direction 19: Enhance road and rail freight links.

The proposal, in increasing the capacity of the highway between Katoomba and Blackheath is consistent with these directions by improving general and freight traffic efficiency.

Western City District Plan

The *Western City District Plan* (Greater Sydney Commission, 2018) is a 20-year plan to manage growth and achieve the 40-year vision of the Greater Sydney Region Plan. The aim of this plan is to coordinate and align the planning that will shape the future of Greater Sydney and make it more liveable, productive and sustainable.

The proposal aligns with Planning Priority W1 of the *Western City District Plan* which is planning for a city supported by infrastructure. The proposal would therefore be consistent with the direction of the Western City District Plan as it is a transport infrastructure project that aligns with forecast growth and demonstrates adaptation of existing infrastructure to meet future needs.

NSW Road Safety Strategy 2012-2021

The *NSW Road Safety Strategy 2012-2021* (Transport, 2012) sets the direction for road safety in NSW. This strategy is underpinned by the safe system approach to improving road safety. This takes a holistic view of the road transport system and interactions among the key components of that system – the road user, the roads and roadsides, the vehicle and travel speeds.

The proposal would provide the opportunity to reduce crashes and help achieve the targets set by the strategy by improving road safety, upgrading intersections, improving pedestrian and cyclist facilities and increasing capacity to reduce congestion.

Road Safety Plan 2021

The *Road Safety Plan 2021* (Transport, 2018d) outlines how the NSW Government will work towards the State Priority Target of reducing fatalities by 30 per cent by the end of 2021 compared to average annual fatalities over 2008–2010. It also aligns the Towards Zero vision with NSW Future Transport Strategy 2056, which aims to have a NSW transport network with zero trauma by 2056.

The proposal is consistent with the directions set out in Road Safety Plan 2021 because it would provide a better standard of road with improved safety through the separation of carriageways and the implementation of contemporary design standards.

NSW Freight and Ports Strategy 2013

The *NSW Freight and Ports Strategy* (Transport, 2013b) targets specific challenges associated with the forecast doubling of the NSW freight task by 2031. It recognises that providing a network that minimises congestion will support economic growth and productivity and encourage regional development. In this context the strategy identifies the need to develop and maintain capacity for freight on the road network.

Objectives of the *NSW Freight and Ports Strategy* relevant to the proposal include:

- delivery of a freight network that efficiently supports the projected growth of the NSW economy
- balancing freight needs with those of the broader community and the environment
- actions and tasks of the strategy and task actions relevant to the proposal include:
  - Action 2B – Develop and maintain capacity for freight on the road network
  - Task 2B-2 – Prioritise road infrastructure investments
- Action 3B – Manage congestion, noise and emission impacts of freight transport

- Task 3B-1 – Recognise costs of congestion.

The proposal is considered consistent with the objectives, actions and tasks referenced above. As discussed in Section 2.1, the proposal would help address growth in freight demand and would reduce congestion and enhance safety for all road users. Without the proposal, congestion on this section of highway would worsen and freight would continue to be constrained (particularly due to the highway only being able to cater for General Access heavy vehicles).

NSW Freight and Ports Plan 2018-2023

The *NSW Freight and Ports Plan* (Transport, 2018a) is aligned with the NSW Future Transport Strategy 2056 and has the aim of providing a network to move goods in an efficient, safe and environmentally sustainable manner, providing successful outcomes for communities and industry.

The proposal directly supports the following plan objectives:

- Objective 1 Economic growth – Providing confidence and certainty that encourages continued investment in the freight industry to support economic growth
- Objective 2 Efficiency, connectivity and access – Improving the efficiency of existing infrastructure and ensuring greater connectivity and access along key freight routes
- Objective 3 Capacity - Maximising infrastructure investment and increasing
- infrastructure and land use capacity to accommodate growth
- Objective 4 Creating a safe freight supply chain, involving safe networks, safe transport, safe speeds and safe people – Creating a safe freight supply chain, involving safe networks, safe transport, safe speeds and safe people
- Objective 5 Sustainability - Developing a sustainable supply chain that delivers benefits to our environment and continued operations into the future.

The plan also includes the goal to deliver new infrastructure to increase road freight capacity and improve safety. To address this goal several projects and initiatives for investigation were identified. This includes capacity enhancement crossing the Blue Mountains including the duplication of the Great Western Highway from Katoomba to Forty Bends.

Blue Mountains Local Strategic Planning Statement

Blue Mountains 2040: Living Sustainably Local Strategic Planning Statement (Blue Mountains City Council, 2020) is the long-term land use plan aimed at ensuring the Blue Mountains local government area can respond in a locally appropriate way, to the challenges and opportunities for the future. This Local Strategic Planning Statement is required by legislation to identify the basis for strategic planning in the area, having regard for social, economic and environmental matters.

The Local Planning Statement aligns with, and responds to, the key directions of the Blue Mountains Community Strategic Plan 2035. The Local Planning Statement includes nine local planning priorities within three themes: Sustainability, Liveability and Productivity. Key infrastructure priorities are embedded within each of these themes.

Local planning priority nine is the most relevant to this proposal, which focuses on improving local transport connections and accessibility.

This planning priority identifies the need to obtain local benefit and protect the World Heritage setting as part of the upgrades to the Great Western Highway. It is recognised that highway improvements have improved freight movements and brought associated productivity benefits for NSW, however, the impacts on the local environment and local traffic movement have been adverse. The proposal is identified as having potential to compound environmental issues by further prioritising regional freight movement. The

statement notes that Council would continue to advocate for the best outcome for the local area in any decisions affecting the Blue Mountains and for alternatives to regional road freight (Action 9.1). Council would also advocate for the preservation of local values and amenity (Action 9.3) and improved local connections and improved safety and accessibility (Action 9.4).

The issue of congestion points on the Great Western Highway and local linkages that affect the safe and effective movement of traffic is also highlighted. The statement notes that Council would advocate for the upgrade of key intersections with the aim of decreasing congestion and improving road function (Action 9.5).

This planning priority also indicates that improved local connections along the Great Western Highway should facilitate the mobility of residents and visitors in the Blue Mountain area. This would aid evacuation during emergencies and improve day-to-day local movements (Action 9.9). Council would also prioritise opportunities to fund and construct the Great Blue Mountains Trail to provide shared linkages between communities in the Blue Mountains (Action 9.12).

The proposal would improve local transport connections and meet the objectives of Actions 9.1, 9.3, 9.4, 9.5, 9.9 and 9.12 through:

- the provision of an upgraded active transport trail between Katoomba and Blackheath
- improved intersections of Nellies Glen Road, Explorers Road and Foy Avenue with the Great Western Highway (refer to Section 3.2.3)
- improved safety and reliability for motorists travelling along the Great Western Highway via the separation of carriageways and the implementation of contemporary design standards.

Blue Mountains Community Strategic Plan 2035

Blue Mountains Community Strategic Plan 2035 (Blue Mountains City Council, 2017) identifies the Blue Mountains community's main priorities and aspirations for the future and plans strategies for achieving these goals.

The proposal directly supports multiple strategies identified in this plan, including:

- 5.2a – Improve the safety, amenity and linkages for the local road network
- 5.2b – Complete the upgrade and widening of the Great Western Highway west of Katoomba so that it delivers improved safety, accessibility, and amenity
- 5.2c – Develop transport links between towns and villages for vehicles (including emergency vehicles), cyclists and pedestrians other than the Great Western Highway
- 5.4a – Provide safe and accessible active transport networks that will improve connectivity and encourage increased confidence in walking and cycling.

The proposal would meet these strategies through:

- the widening of the Great Western Highway from one to two lanes in each direction in two sections:
  - between Rowan Lane, Katoomba and Bellevue Crescent, Medlow Bath (about 3.5 kilometres)
  - between Station Street, Medlow Bath and Tennyson Road, Blackheath (about 1.8 kilometres)
- improved safety and reliability for motorists travelling along the Great Western Highway via the separation of carriageways and the implementation of contemporary design standards
- improved safety due to intersection upgrades at Nellies Glen Road, Explorers Road and Foy Avenue
- improved reliability of emergency services access due to the widening of the highway, widened shoulders and ability for contraflow to operate on the new second, separated carriageway if one carriageway is required to close due to an incident
- the provision of an upgraded active transport trail between Katoomba and Blackheath, which would form part of the broader Great Blue Mountains Trail.

2.2 Limitations of existing infrastructure

The key limitations on the existing highway between Katoomba and Medlow Bath and Medlow Bath to Blackheath relate to limited capacity and safety. The highway is only two lanes (one lane in either direction) with traffic volumes regularly exceeding the capacity of the highway. In addition, congestion leads to flow on safety and accessibility issues.

The Great Western Highway is a key transport route across and along the Great Dividing Range for all vehicles, including emergency and essential services, local and through rail customers, tourists and freight. The Great Western Highway between Katoomba and Blackheath has a higher average traffic volume than other duplicated interregional highways surrounding Greater Sydney. Average weekday traffic volumes were about 23,000 vehicles between Katoomba and Medlow Bath and 21,000 vehicles between Medlow Bath and Blackheath (March 2020). Heavy vehicles along these sections of highway account for around 22 per cent of the average annual daily traffic volume.

Due to the one lane either direction, limited overtaking opportunities and lack of alternative roads, traffic incidents along the highway can result in long traffic delays. The existing infrastructure is already restrained in its capacity to accommodate the existing vehicle moments, with traffic peaks and congestion a common occurrence at current merge points on the highway. Congestion is especially restrictive during weekends, where there is an increase in tourist and visitor traffic on top of day to day travel volumes; special event and the school holiday periods. This congestion results in increased travel times and a steady stream of traffic along the highway that anecdotally, reduces the opportunity for local residents venturing out for local trips. Congestion also results in delays for emergency services to get to the site of incidents and well as other incidents in the areas such as bushfires restricted traffic flows due to congestion, limited overtaking opportunities and steep gradients.

The two-lane two-way Great Western Highway in the proposal area generally has a level of service (LOS) D, which means the highway is approaching capacity. This is mostly due to inadequate lane capacity, lower than average travel speed, substandard road geometry, lower posted speed limits and traffic composition as the key contributing factors. It is expected that level of service would further deteriorate during event type peaks (such as in holiday periods).

The current performance of the corridor constrains local and inter regional traffic, including between Sydney and proposed new freight infrastructure (and associated land use changes) in the Central West such as the Parkes National Logistics Hub and the Inland Rail Program. At present, the Great Western Highway is the only major regional freight connection into Sydney currently limited to General Access heavy vehicles, including 19 metre B-doubles and 20 metre Performance Based Standards (PBS) vehicles. This is a major limitation for the current and ongoing functionality of this highway as modern, Higher Productivity Vehicles can carry more freight in one load than General Access heavy vehicles. The amount of freight on the Great Western Highway is expected to continue to grow regardless of the proposal but allowing modern Higher Productivity Vehicles could reduce articulated truck trips on the highway by at least 15 per cent.

Even without the proposal, private vehicle and freight traffic movements along the corridor are expected to increase. Between 2018 and 2026, it is predicted that daily car volumes would increase by 19 per cent along the Katoomba to Medlow Bath section and 17 per cent along the Medlow Bath to Blackheath section. This increase in traffic would result in a worsening of the existing performance of the Great Western Highway unless it is upgraded.

There are sections of the highway, particularly at intersection locations where there is substandard alignment, grades and visibility that result in a high crash rate.

In particular, the Nellies Glen Road intersection has a substandard alignment. Previously, vehicles turning left from Nellies Glen Road onto the Great Western Highway needed to be careful due to the limited visibility of oncoming highway traffic as well as the wide turning circle required to enter the highway westbound. However, Blue Mountains City Council removed this movement in 2021. These deficiencies are

highlighted by the crash data, which shows that there have been a number of crashes over the past 12 years including serious injury crashes at the Nellies Glen Road intersection. The upgrade would reinstate the left-out movement (so the intersection would be left-in left-out only).

Crash data along the Katoomba to Medlow Bath section of highway over the 12-year period to 2021 identified:

- thirty-seven crashes
- one fatal crash due to an opposite head-on collision
- six serious injury crashes, at Nellies Glen Road intersection, west of Explorers Road and near Bellevue Crescent
- eleven moderate injury crashes
- four minor/other injury crashes
- fifteen non-casualty towaway crashes
- one uncategorised crash.

The spatial grouping of crashes suggests that most accidents occur between Nellies Glen Road and to the west of Explorers Road. Most of these accidents are head on collisions with a small number of rear end and run off bend crashes.

Crash data along the Medlow Bath to Blackheath section of highway over the 12-year period to 2021 identified:

- sixty-five crashes
- one fatal crash due to an opposite head-on collision
- seven serious injury crashes
- twenty-nine moderate injury crashes
- nil minor/other injury crashes
- twenty-nine non-casualty towaway crashes.

Within the Medlow Bath to Blackheath section, most accidents occurred about one kilometre west of the Great Western Highway / Railway Parade intersection in Medlow Bath.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

As part of a staged upgrade program, the proposal aims to deliver outcomes consistent with the Great Western Highway Upgrade Program objectives, for the Katoomba and Blackheath locality.

Table 2-1 summarises how the proposal would address the overall objectives of the Great Western Highway Upgrade Program.

Table 2-1: Proposal response to Great Western Highway Upgrade Program objectives

Theme	Great Western Highway Upgrade Program objective	Katoomba to Blackheath Upgrade proposal response
1. Economic development, productivity and recovery	Improve ability to drive regional economic development and freight productivity	Providing a four-lane divided carriageway with dedicated turn lanes to improve freight productivity and reduce congestion.
2. Resilience and future proofing	Provide a dependable and adaptable transport network that enables continuity of transport and essential services	Make network provisions for emergency services and provide safe continuous access to transport services.
3. Network performance	Improve transport network efficiency	Provide suitable capacity to reduce congestion during peak periods and to support overtaking of slower vehicles.
4. Safety	Reduce actual and perceived safety risks	Separate traffic flows and user groups, upgrading intersections, provide shoulders, improve alignment and remove roadside hazards along the corridor.
5. Movement, place and amenity	Maintain and enhance local amenity and character, and protect environmental and cultural assets	Improve local traffic connectivity along and across the corridor. Provide facilities to encourage active transport as part of the Great Blue Mountains Trail. Preserve, consolidate and interpret cultural heritage through sensitive urban design along the highway, including both Aboriginal and non-Aboriginal heritage themes.

2.3.2 Development criteria

The design development criteria for the proposal include:

- maintain the functional operation of the highway to traffic and users during construction
- provide four lane dual carriageway separated by median between Katoomba and Lithgow, with a design speed generally 90 kilometres per hour
- provide facilities for active transport users appropriately linked to other trails of the area
- adjust, maintain, relocate or reinstate property access to all private properties along the highway frontage
- adopt water quality control measures to improve the management of stormwater out flows into the Sydney drinking water catchment through the Blackheath Special Catchment Area
- no impact to the Greater Blue Mountains World Heritage Area.

2.3.3 Urban design objectives

The urban design vision adopted for the proposal is:

- reinforce the journey sequence of bushland and village
- evoke a sense of its history and heritage
- provide views and a clear sense of orientation for users
- create a road design that integrates urban design and engineering
- establish active transport links between towns and connections to key points along the journey.

To achieve this vision, the urban design objectives for the proposal are to:

- develop an integrated design that fits with the existing high visual qualities, ecology and character of areas between townships in the Blue Mountains setting
- minimise impacts to the integrity of heritage sites, significant trees and cultural values of the community within the proposal
- enhance local and regional connectivity incorporating key principles of NSW Government's 'Practitioner's Guide to Movement and Place, 2020'
- provide a memorable journey experience that positively contributes to the identity of the area
- consider approaches consistent with the Transport '*Reconciliation Action Plan'* & '*Designing with Country'* discussion paper, GANSW 2020.

2.4 Alternatives and options considered

This section summarises the options that were considered for the proposal and documents the justification of why the preferred option was chosen.

To define and select the preferred option for an upgrade of the Great Western Highway between Katoomba and Blackheath the section passed through a series of option analyses, including:

- historic route development – past decisions and projects that defined the preferred corridor
- corridor route alignment and strategic design development – the 2019 corridor route options and 2020 strategic design refinement and display as part of the Great Western Highway Upgrade Program
- concept design development and environmental planning approval – outlined in this REF.

2.4.1 Historic route development

The Great Western Highway between Katoomba and Blackheath has straddled the ridgetop terrain between forested private property and the railway line since the 1813 crossing of this part of the Blue Mountains by Blaxland, Lawson and Wentworth. The road corridor between Katoomba and Blackheath was first formally constructed as Cox's Road in 1814 – 1815. Through the 19th century, the road corridor was developed with bridges and retaining walls and the 1887 Plan of the Village of Katoomba shows the Great Western Highway alignment in its modern location.

Bypassing Katoomba, Medlow Bath and Blackheath further to the east would shift the alignment onto difficult and steep, undulating terrain and pass entirely through the Blue Mountains National Park and impact sensitive water catchment areas. Bypassing to the west would move the highway off the escarpment, into the Megalong Valley. Historic corridor development did not consider tunnel options, so the existing route remained favoured from the establishment to the present day. The existing road corridor in the proposal area has served movement of people and goods over the mountains for about 200 years.

An option to pass through Medlow Bath on the east was considered in the 1950s using a Eumemmering Street alignment and quickly ruled out a few years later due to impacts on the residential village area.

Since the 1950s, different corridor options have been considered between Katoomba and Blackheath through Medlow Bath. However, due to the terrain constraints, corridor options from Katoomba to Medlow Bath have focussed on the existing corridor, with land reserved for future widening in most locations. There is an exception between Medlow Bath and Blackheath, where land was reserved along Station Street, should future widening favour an alignment along the Megalong Valley escarpment into Blackheath.

However, in 2002, the bridge over the railway at Medlow Bath confirmed that the upgrade of the highway to four-lanes would cross over the railway at Medlow Bath. This in turn reinforced that the upgrade would occur along the existing highway corridor between Katoomba and Blackheath.

In 2009, planning and investigations for the duplication of the Great Western Highway for the corridor between Mount Victoria and Lithgow were undertaken to inform the Local Environmental Plan (LEP) corridor reservation.

In June 2018, the NSW Government committed to investigating the feasibility of extending the duplication of the Great Western Highway from north of Katoomba to Forty Bends. In late 2018 and 2019, a corridor route option analysis was undertaken for the length of highway.

2.4.2 2019 corridor route options

Methodology for selection of the preferred corridor route

In August 2018, the corridor route options development for the upgrade began. To develop the corridor route options, corridor environmental and engineering constraints were considered during the corridor route options identification process. These constraints included:

- steep topography, the existing Main Western Railway and the proximity of the Blue Mountains National Park and Blue Mountains World Heritage Area
- requirement for major horizontal alignment improvements between Katoomba and Medlow Bath to achieve the nominated design speed of 90 kilometres per hour
- need for substantial cuts and high retaining walls between Katoomba and Medlow Bath
- need to ensure continued traffic flow during construction, which would require construction staging and complex traffic switches on some parts of the alignment
- interaction with the rail corridor in the southern and northern parts of Blackheath
- opportunity to improve urban amenity (and protect heritage values) within Blackheath with a bypass of the main township which sits to the east of the railway
- presence of underground and above ground public utilities, particularly through Blackheath
- need for tunnels, bridges and deep fills for alignments to the west of Blackheath and associated challenges for construction access
- need to implement water quality controls within a constrained corridor to ensure a neutral or beneficial effect on water quality within drinking water catchments.

In addition, a range of option / project design requirements were adopted to assist in providing corridor route options of a consistent design across the upgrade. The required features of the corridor route options included:

- four lane dual carriageway separated by a median
- design speed generally 90 kilometres per hour and posted speed limit 80 kilometres per hour
- 3.5 metre travel lanes and wide 2.5 metre shoulders between Blue Mountains villages (for better road safety and provision for cyclists)
- connection with existing four lane sections built at Katoomba in the 1990s
- design alignment and pavement to allow potential future improvement to freight productivity (including 26 metre and 30 metre B-doubles
- adequate heavy vehicle rest stop facilities consistent with a finalised corridor strategy or plan when confirmed
- safe, accessible heavy vehicle enforcement infrastructure
- desired one in 20-year flood immunity
- potential active transport infrastructure (to be investigated through development of an Urban Design Framework).

Once corridor route options were identified, a value management workshop (VM workshop) for the proposal was held on 14 November 2018. The workshop was attended by a cross section of (the then) Roads and

Maritime personnel supported by consultants with extensive experience in project development and options investigation processes for major road projects.

The intent of the VM workshop was to identify a ranking of the corridor route options to provide context to the community, and the selection of the proposed corridor route option would only occur after feedback from the community had been received.

Between Katoomba and Medlow Bath and Medlow Bath and Blackheath, there were minimal options that could be generated due to the environmental and engineering constraints.

Identified corridor route options

The corridor route options between Katoomba and Mount Victoria were divided into four zones due to the nature of the options considered (refer to Figure 2-1):

A. Katoomba to Medlow Bath

B. Medlow Bath to Blackheath

C. Blackheath Bypass

D. Blackheath Bypass to Browntown Oval (Mount Victoria)

The relevant zones for this proposal (Katoomba to Medlow Bath and Medlow Bath to Blackheath) are Zone A and Zone B and so only these zones are discussed in the following sections. Table 2-2 discusses the corridor route option zones. It should be noted that part of Zone A also captured the Medlow Bath upgrade.

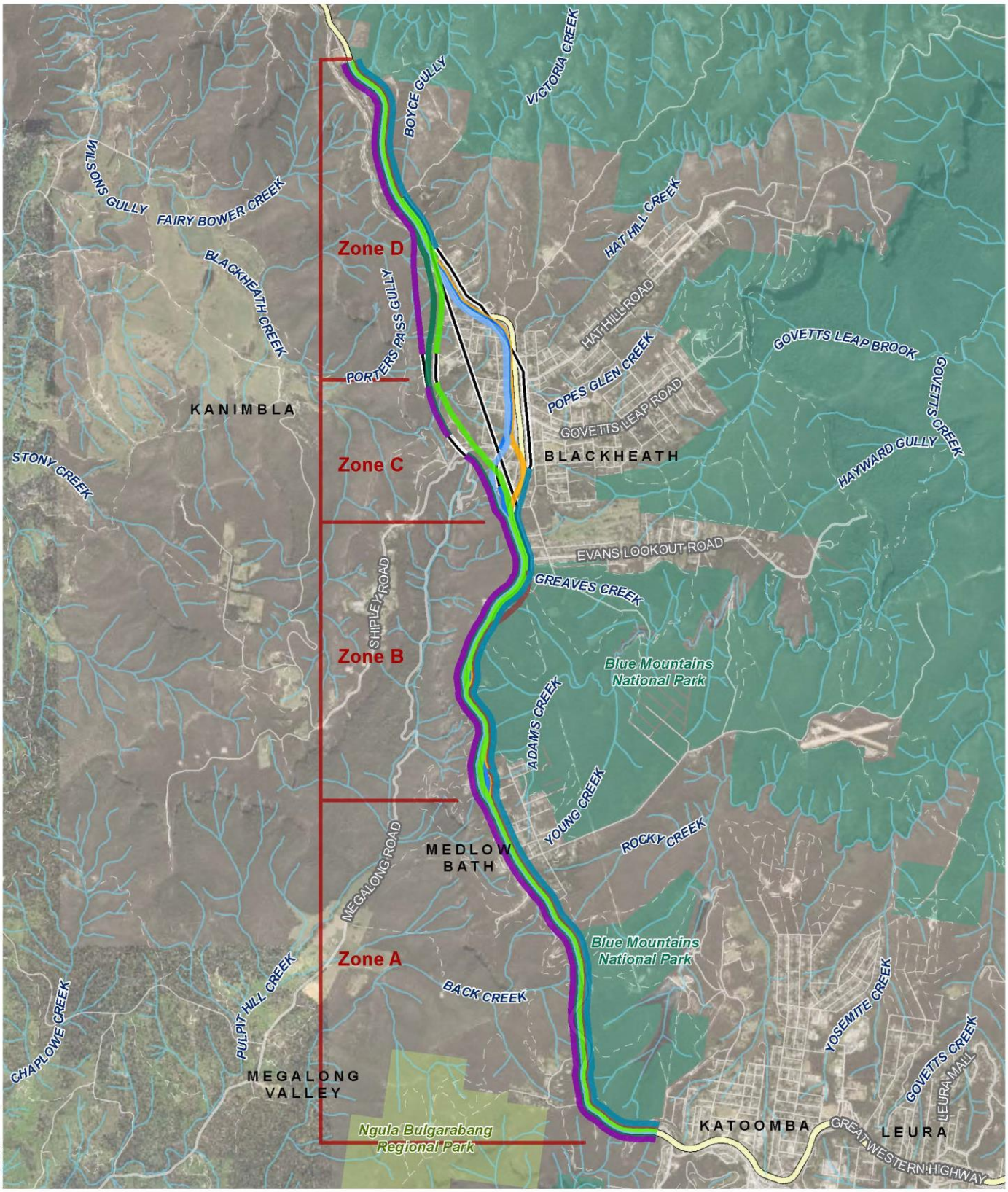
Table 2-2: Corridor route option zones

Zone	Existing scenario	Constraints	Options considered
Zone A – Katoomba to Medlow Bath (4.7 kilometres on existing alignment)	The eastern two thirds of the road corridor within Zone A comprises one westbound overtaking lane but few other overtaking opportunities. The western third of the alignment passes through Medlow Bath village.	• Main Western railway line to the east of the highway • Upper Cascade Creek Dam located to the east of the Main Western railway line • Near Medlow Bath, the terrain falls sharply to the west into the Megalong Valley • The highway crosses the Main Western line at the northern extent of the zone	The constraints indicate new alignments are not practicable and led to an approach that would focus on widening and upgrading the current highway alignment. As such, the main corridor route option considered was for the realignment and upgrade of the existing highway to a four-lane divided carriageway to achieve an 80 km/h posted speed outside Medlow Bath.
Zone B – Medlow Bath to Blackheath (3.2 kilometres)	This zone contains one eastbound overtaking lane to the east of Blackheath and few other overtaking opportunities.	• Main Western railway line to the west of the highway • Alignments to the west of the railway are further constrained in Medlow Bath by residential and commercial developments and the need to retain property access • There are also severe topographical constraints with the land sloping down towards the escarpment that joins to Pulpit Hill Creek and the Megalong Valley • The remainder of a western alignment lies within native vegetation with Blue	The corridor route options considered in Zone B were: • realign and upgrade the existing alignment to achieve 80 kilometres per hour posted speed outside Medlow Bath and widen the alignment to provide a four-lane divided carriageway (refer to Options 1A, 1B, 3A, 3B, 4A, 4B on Figure 2-1). • new four lane carriageway west of the

Zone	Existing scenario	Constraints	Options considered
		Mountain Swamps threatened ecological community (BC Act and EPBC Act listed) affected • Alignments to the east are constrained by residential development in Medlow Bath and Blackheath • Construction of alignments to the east would be complicated by the need to work adjacent to 'live' highway traffic.	existing road corridor and rail line, including extensive retaining walls (refer to Options 2A, 2B, 2C on Figure 2-1).

By keeping the Great Western Highway on the existing alignment on the ridgeline through Zone A and Zone B, environmental impact was reduced while still providing opportunities to support and enhance the character of the surrounding area.

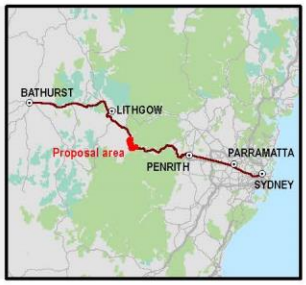
All corridor route options would reduce travel time, improve safety and reduce vehicle operating costs. Options were found to have varying advantages and disadvantages with reference to construction, property, visual and environmental considerations.



Great Western Highway

Corridor route options

- 1A
- 1B
- 2A
- 2B
- 2C
- 3A
- 3B
- 4A
- 4B
- Tunnels
- Blue Mountains National Park
- Ngula Bulgarabang Regional Park



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Great Western Highway East **Review of Environmental Factors**

Projection: GDA2020 MGA Zone 56

FIGURE 2-1: 2019 Corridor route options zones

Preferred corridor

In Zone A, due to the constraints, all corridor route options followed the same alignment and there were no options to choose between. As such, the preferred corridor route was to realign and upgrade the alignment to achieve 90 kilometres per hour design speed (80 kilometres per hour posted speed) outside Medlow Bath and widen the full length to provide a four-lane divided carriageway. This included straightening up the alignment including bridging across the valley north of Explorers Road.

For Zone B, there were two corridor route options: one that passed to the west of the Main Western Rail Line and would be a new highway alignment or realigning and widening the existing alignment. The assessment of these options is summarised in Table 2-3.

Table 2-3: Corridor route option assessment – Zone B

Corridor route option	Assessment
All options	• Traffic impacts during construction
Options to the west of the existing highway	• Greater impact on the State Heritage Register listed Medlow Bath Railway Station Group than other corridor route options • Reduced traffic impacts during construction
Options along the existing alignment	• Some impact to the Blue Mountains National Park • Opportunity to maximise the use of the existing road pavement and corridor

As such, the preferred corridor route was to realign and upgrade the alignment to achieve 90 kilometres per hour design speed (80 kilometres per hour posted speed) outside Medlow Bath and widen the full length to provide a four-lane divided carriageway.

2.4.3 2020 strategic design

Once the preferred corridor route was confirmed, Transport developed strategic design options to consider the design of the upgrade between Katoomba and Medlow Bath.

The strategic design sought to develop designs within the chosen corridor that would minimise impacts while being constructable. The main area of changes during strategic design focussed on the cutting at Pulpit Hill and bridges across the valleys of Explorers Road leading to Mount Mark.

The strategic design sought to improve constructability of the Pulpit Hill cutting and Explorers Road valley by providing for construction widths that would not restrict the daily operation of the highway. The alignment was also pulled closer to the rail corridor after the Explorers Road valley to realign the climb up the surrounds of Mount Mark to Foy Avenue. This realignment successfully removed bridges previously required to span this valley.

A number of different designs were developed during this stage (refer to Table 2-4). These options are different to those discussed in Section 2.4.2.

Table 2-4: 2020 Strategic design options for the proposal

Option	Description
Katoomba to Medlow Bath	
Option A	**New westbound carriageway with eastbound traffic on existing carriageway** • The existing carriageway would be converted to be eastbound only, with a new westbound carriageway constructed adjacent to the existing highway. Where required, existing curves would be realigned. • The eastern limit of work connects into the existing section of dual carriageway on the Great Western Highway at Rowan Lane then climbs to the intersection with Nellies Glen Road. • Nellies Glen Road intersection is provided as left in/left out, including left turn deceleration lane. • Explorers Road intersection would connect only to the existing highway (becoming the eastern carriageway), with a right turn deceleration lane on the Great Western Highway. With the left in/left out intersection at Nellies Glen Road and the right turn intersection at Explorers Road, the design provides full access to residential area of Pulpit Hill. • On the approaches to and from Medlow Bath, the posted speed is reduced to 60 kilometres per hour. • The western limit of work for this section is 100 metres south of Bellevue Crescent, Medlow Bath. • No separate bus facilities would be provided. • Existing off-road active transport trails would be maintained.
Option B	**Upgrade existing alignment with one curved twin bridge** • The southern limit of work connects into the existing section of dual carriageway on the Great Western Highway at Rowan Lane then climbs to the intersection with Nellies Glen Road. • The eastern section of the alignment has one major curved bridge. • Nellies Glen Road intersection is provided as left in/left out, including left turn deceleration lane. • Explorers Road intersection removes the right turn bay on the Great Western Highway for southbound access to Explorers Road. However, access would be provided to eastbound traffic, via a service road along the existing highway alignment. With the left in/left out intersection at Nellies Glen Road and the right turn intersection at Explorers Road, provides full access to residential area of Pulpit Hill. • A curved bridge structure would span across the valley west of Explorers Road, commencing just east of Explorers Road and connecting back to the highway about 450 metres to the west. • On the approaches to and from Medlow Bath, the posted speed is reduced to 60 kilometres per hour. • The western limit of work for this section is 100 metres south of Bellevue Crescent, Medlow Bath. • No separate bus facilities would be provided. • Existing off-road active transport trails would be maintained.
Medlow Bath to Blackheath	
Option A	**Alternate alignment at Coachhouse Lane** • The eastern limit of work for this option is the westbound departure of existing traffic control signalised intersection with Station Street and Railway Parade. • Where possible, the alignment is vertically similar to the existing road corridor. • There would be no impacts to rail infrastructure. • The alignment at Coachhouse Lane would impact on private property. However, new access to properties on Coachhouse Lane would be provided. • On the approaches to and from Medlow Bath, the posted speed limit would be reduced from 80 kilometres per hour to 60 kilometres per hour. • The existing right turn lane into Station Street and left turn lane for southbound traffic into Railway Parade is maintained. • There would be no active transport trails or bus facilities provided.

Option	Description
Option B	**Alternate alignment at Coachhouse Lane** • Option B was a variation to Option A for the Medlow Bath to Blackheath section which was developed considering feedback from the community. The differences with Option A were: – existing alignment and property accesses at Coachhouse Lane are retained – the alignment at the southern end encroaches into the rail corridor, impacting on the existing Medlow Bath West Sectioning Hut, requiring a retaining wall and potentially reducing the width of maintenance access adjacent to the live rail lines. This option takes advantage of Transport (Sydney Trains) relocating the existing Medlow Bath West Sectioning Hut under a separate planning approval as it has reached its end of life.

The strategic designs recommended to progress to concept design stage were:

- Katoomba to Medlow Bath Option B
- Medlow Bath to Blackheath Option B.

Option B was selected for the Katoomba to Medlow Bath section as Option A did not meet the objectives of the proposal and used existing highway alignment with known constraints and safety issues. Option B was selected for the Medlow Bath to Blackheath section as it was considered to provide similar traffic benefits to Option A while minimising impacts to existing properties along Coachhouse Lane.

2.4.4 2021 concept design refinements

The concept design proposed in this REF was developed based on the strategic designs undertaken in 2020. The concept designs were undertaken to provide further design and constructability information to obtain planning approval. The concept designs have further refined the strategic design outlined in Section 2.4.3.

A series of workshops were held to challenge the strategic design during the early phase of concept design. This included:

- risk and constructability
- health and safety in design
- bridge optioneering
- value management.

A range of other stakeholders were also engaged through design and direct engagement initiatives to inform the designs development. Transport will continue to engage with these stakeholders in future design and construction phases. A list of stakeholders and the subject areas of engagement include:

- water quality design – Water NSW and Blue Mountains City Council water quality team
- National Parks and Wildlife Service – planning and compensatory land strategy
- heritage values – Aboriginal groups (refer to Section 5.3), Blue Mountains City Council heritage team, Blue Mountains City Council Heritage Committee and Heritage NSW
- active transport – Blue Mountains Cycling Safety Forum and Crossley Transport Planning (movement and place specialist).

The concept design refinements carried out during this process are outlined in Table 2-5.

Table 2-5: Concept design refinements

Design element	Refinements
Intersection upgrades	• Great Western Highway / Nellies Glen Road intersection was moved about 70 metres east along the westbound carriageway to provide greater driver visibility at the intersection. This also allows the existing Heritage interpretation area to be retained as far as practicable with improved carparking. • The service road from the Great Western Highway to Explorers Road intersection was widened to allow for more efficient construction staging. • The Great Western Highway / Foy Avenue intersection was modified for safer in and out movements by adding an auxiliary left turn lane in and right median turn lane in.
Heritage	• The Pulpit Hill heritage interpretation area was retained as far as practicable through the shift in the Nellies Glen Road intersection. The proposal would provide opportunities to provide a more cohesive and inclusive heritage interpretation of the broader Pulpit Hill. In addition, the proposal would include improved car parking facilities at this location. • Land owned by Deerubbin Local Aboriginal Land Council was avoided in the Medlow Bath to Blackheath section.
Bridge options	• The bridge design straightens up the alignment of the Great Western Highway, including bridging across the valley north of Explorers Road, to achieve the design speed limit. • The incrementally launched method is being considered for bridge construction to minimise the construction footprint required under the bridges and limit the need for extensive crane lifts. This would improve constructability and minimise the environmental impacts of construction of the twin bridges. • The separation between the two bridges was reduced for safety reasons due to the proposal being in an area which experiences high levels of fog.
Active transport options	• Additional upgraded active transport connections have been included between Katoomba to Medlow Bath to provide continuous upgraded active transport connections along this section. This included extension of the active transport trail to include a new connection between Rowan Lane and Nellies Glen Road and Foy Avenue and the Medlow Bath Upgrade. • The alignment of active transport trails along the Medlow Bath to Blackheath section was changed to follow the natural topography.
Split carriageway	Within the Medlow Bath to Blackheath section: • the westbound and eastbound carriageways have been separated, with a varied median width • the eastbound carriageway was lowered to remove the retaining wall along the entire carriageway • a widened median has been included to allow vegetation to be retained where possible through the section.
Rail corridor and Coachhouse Lane	While the 2020 strategic option chosen would avoid private property on Coachhouse Lane while impacting on the rail corridor, the concept design was able to: • avoid acquisition of private property on Coachhouse Lane. • minimise encroachment on the rail corridor opposite Coachhouse Lane. • minimise impact to the existing retaining wall near Coachhouse Lane. The design takes advantage of Transport (Sydney Trains) relocating the existing Medlow Bath West Sectioning Hut which has reached its end of life under a separate planning approval. In addition, along the proposal alignment, maintenance and emergency accesses to the rail corridor have been replaced where they would be impacted by the proposal.
Constructability	• The concept design follows an alignment that is constructable alongside highway traffic. During construction, one carriageway with one lane in each direction would always remain open, maintaining flow along the Great Western Highway between Katoomba and Blackheath.

Design element	Refinements
Water quality	• Six water quality basins have been added along Katoomba and Medlow Bath section and five along the Medlow Bath to Blackheath section. Accesses into drainage basins have been designed to allow for a maintenance vehicle to access bio-retention portion of drainage basins from the maintenance access track.
Heavy vehicles	• Truck stopping bays have been added on existing road pavement, near Explorers Road in the Katoomba to Medlow Bath section (eastbound) and about one kilometre north of Medlow Bath in the Medlow Bath to Blackheath section (westbound).
Tie-ins	• At the western end of the Katoomba to Medlow Bath section west of Foy Avenue, the design speed on the westbound carriageway was reduced from 90 kilometres per hour to 70 kilometres per hour to be more appropriate speed for entering a township along the highway. • Great Western Highway Blackheath to Little Hartley tie-in has been included in the road design for the Medlow Bath to Blackheath section. This has been developed to ensure the pavement constructed in the interim case also suits the final lane configuration. The stub location for the final eastbound and westbound carriageways has been provided in the design. The westbound truck stopping bay would not be operational during the interim configuration.

2.4.5 Preferred design

The preferred design for the proposal has been developed through strategic and concept design development, involvement of stakeholders through workshops, and included a range of refinements to minimise impacts and improve constructability. The preferred design:

- provides a four-lane dual carriageway through the sections of Katoomba to Medlow Bath, and Medlow Bath to Blackheath suitable for a posted speed of 80 kilometres per hour
- follows an alignment that is constructable alongside highway traffic to maintain existing highway operation during construction
- provides upgraded intersections at Nellies Glen Road, Explorers Road and Foy Avenue
- makes best use of redundant highway sections for maintenance, local access and for truck stopping areas for load checking
- avoids impacts on properties in Coachhouse Lane
- provides for improvement to water quality along the proposal while also providing suitable access to maintain and manage assets along the corridor
- provides opportunities to enhance locations with heritage value through interpretation and urban design features
- makes best use of the landscape to provide connections between villages that integrate with the surrounding natural landscape
- construction of the bridge structures identified to be incrementally launched to minimise direct environmental impacts under the bridge structure and reduce construction logistics.

3. Description of the proposal

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

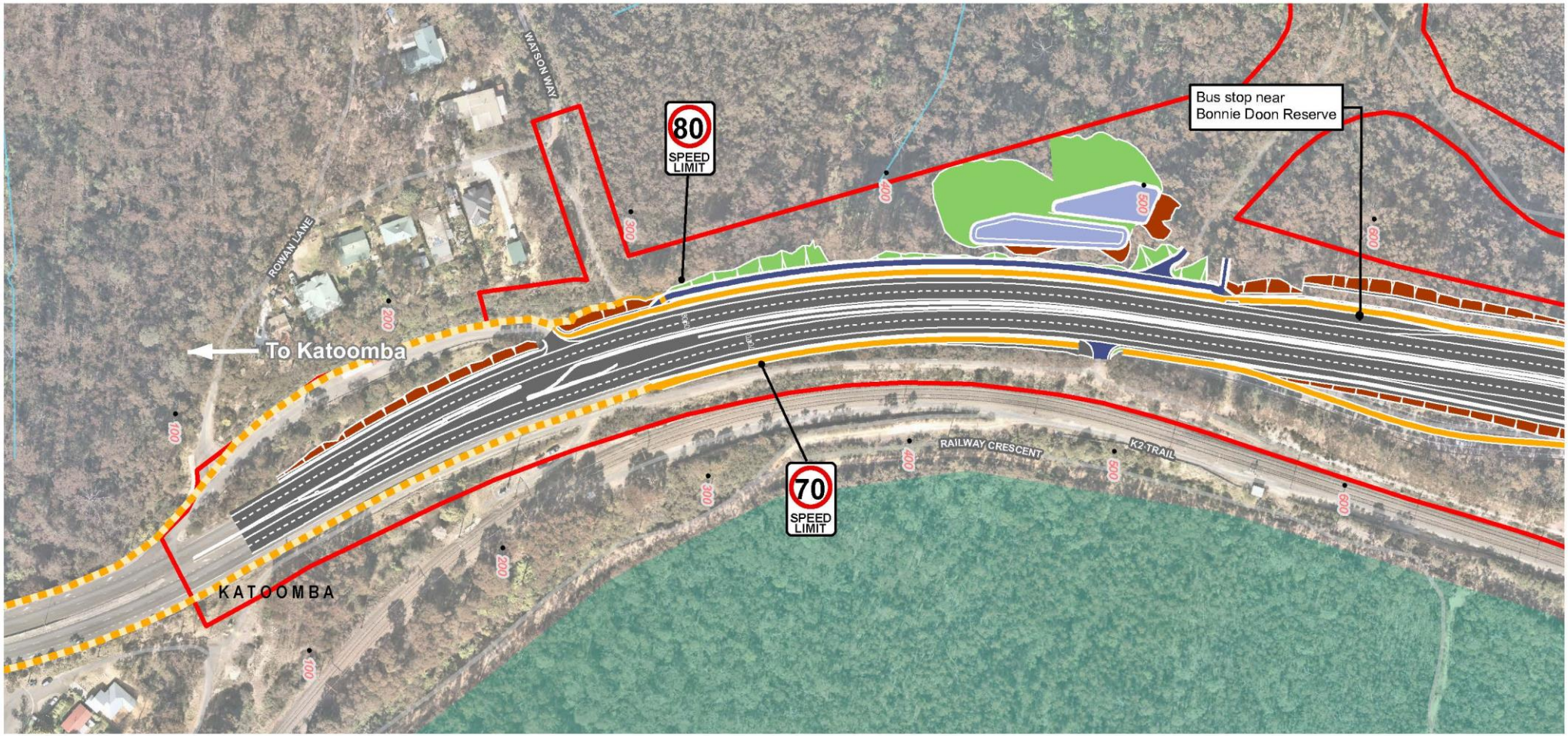
3.1 The proposal

The key features of the proposal include:

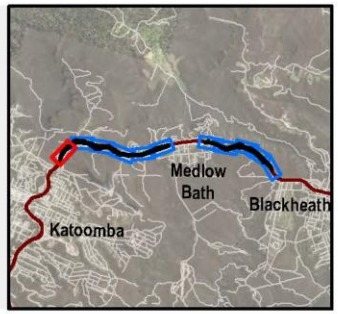
- widening of the Great Western Highway to provide a four-lane divided carriageway in two sections:
  - between Rowan Lane, Katoomba and Bellevue Crescent, Medlow Bath (about 3.5 kilometres)
  - between Station Street, Medlow Bath and Tennyson Road, Blackheath (about 1.8 kilometres)
- new concrete twin bridges (about 400 metres long) over the valley from Pulpit Hill near Explorers Road
- upgrades to intersections at Nellies Glen Road, Explorers Road and Foy Avenue
- re-use of redundant sections of the existing highway pavement for new truck stopping areas, local service roads and maintenance areas
- consolidation and improvement of the Pulpit Hill heritage interpretation area on Nellies Glen Road, including improved visitor parking
- adjustment of bus stops on the highway at Bonnie Doon Reserve, Explorers Road and Foy Avenue to provide set down and pick up locations for buses
- installation of 11 water quality basins including biofiltration and on-site detention
- upgrade and enhancement of existing sections and providing new active transport connections along the Great Western Highway, which would form part of the broader Great Blue Mountains Trail to improve active transport connectivity between Katoomba and Blackheath
- common construction activities and ancillary work, including:
  - relocation of rail infrastructure, maintenance areas, access roads and utilities (including electrical, gas, water and telecommunications)
  - work on associated rail infrastructure including adjustments to power connections and rail corridor fencing
  - civil earthworks, retaining walls, drainage work, water quality controls and tie in work to adjoining sections of the highway
  - new national park, railway, fire trail and utility authority maintenance access tracks to connect with other corridors
  - final roadworks including pavement, kerb and gutters, signs, landscaping lighting and line marking
  - new intelligent transport systems including, but not limited to, closed-circuit television, variable-message signs and variable speed limit signs
  - establishment of temporary ancillary facilities to support construction, including compound sites, site offices, stockpile and laydown locations, temporary access tracks, water quality devices and concrete batching plants.

The key features of the Katoomba to Medlow Bath section are shown in Figure 3-1a-f. The key features of the Medlow Bath to Blackheath section are shown in Figure 3-2a-e. These are described in greater detail in the remainder of the chapter.

The concept design would be further refined during detailed design to minimise environmental and social impacts and to consider community feedback to the exhibition of the REF.



Proposal area
Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Chainage



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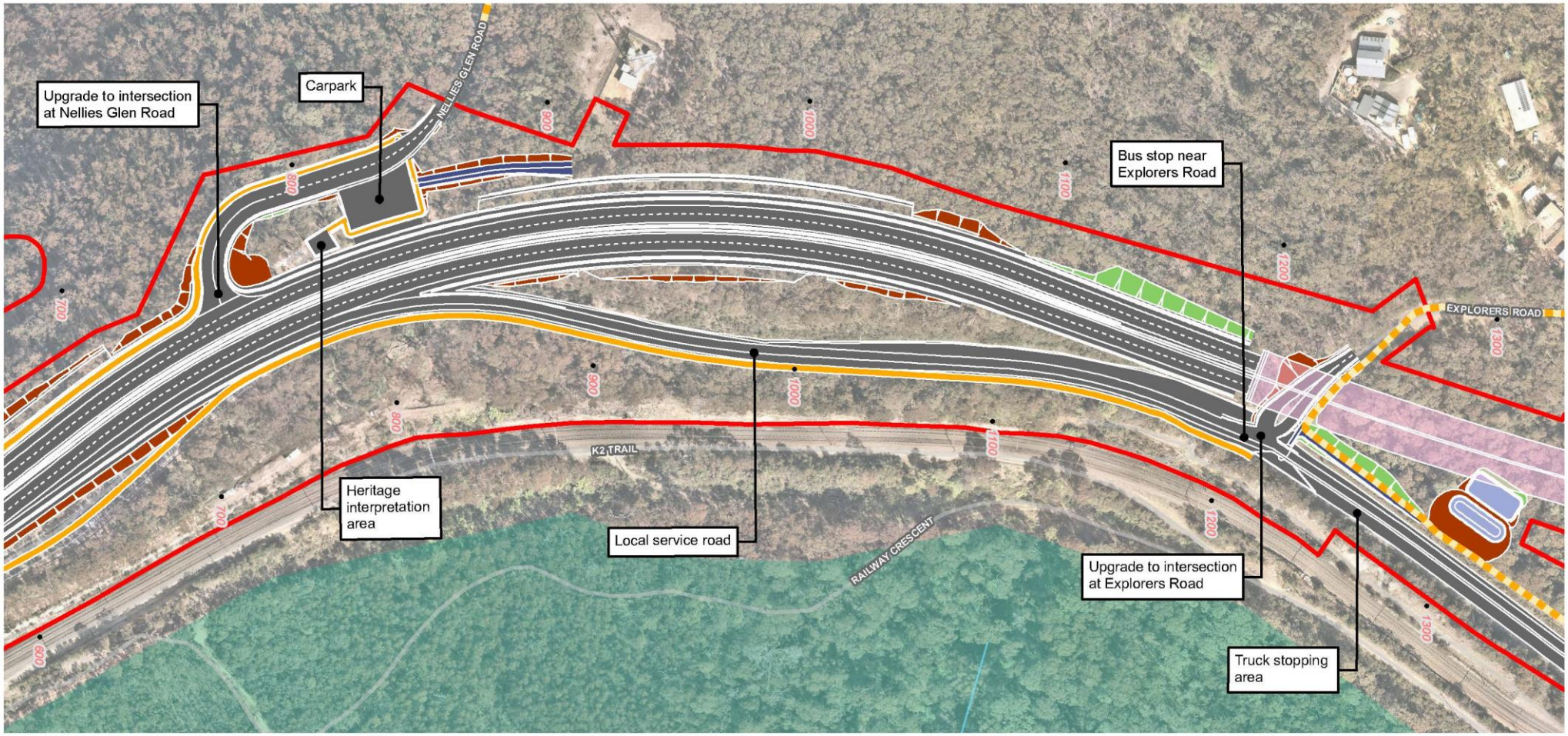
Projection: GDA2020 MGA Zone 56

FIGURE 3-1a: Key features of the proposal - Katoomba to Medlow Bath section



Proposal area
Bridge
Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Chainage

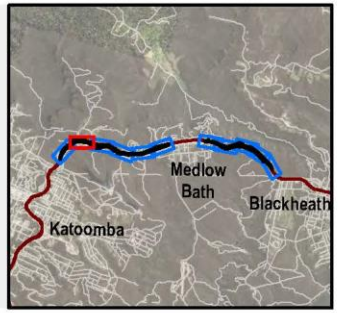


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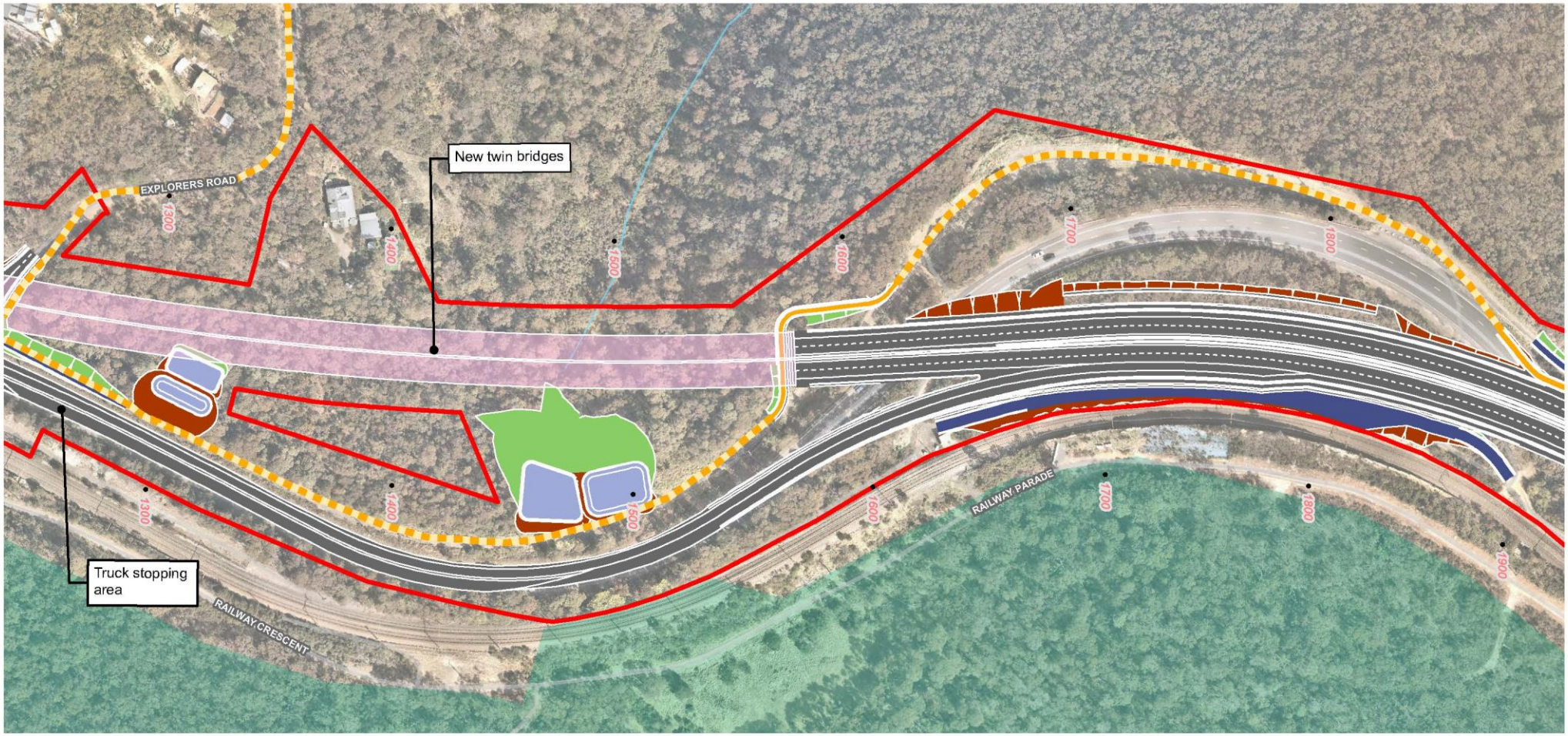
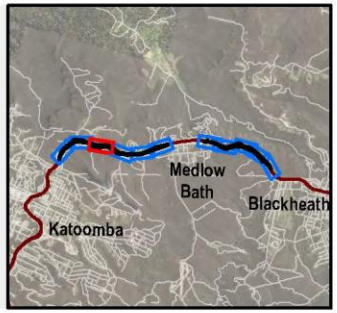
FIGURE 3-1b: Key features of the proposal - Katoomba to Medlow Bath section



Proposal area
Bridge
Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Chainage



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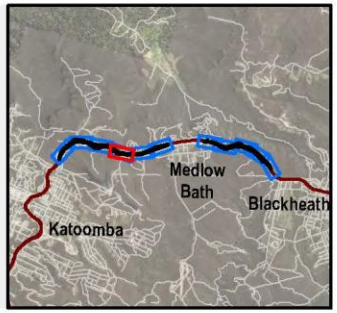
Projection: GDA2020 MGA Zone 56

FIGURE 3-1c: Key features of the proposal - Katoomba to Medlow Bath section

Proposal area
Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Chainage



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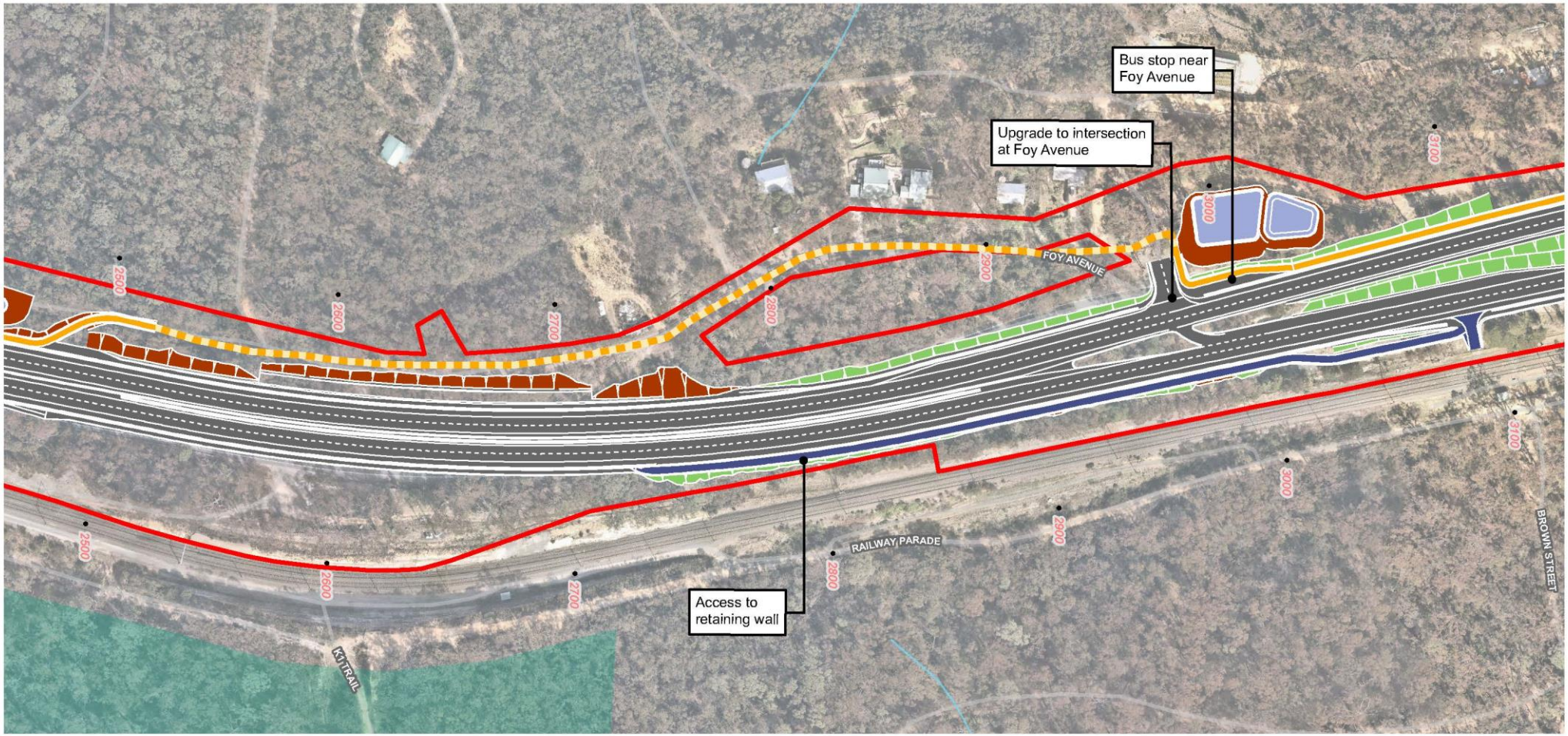
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-1d: Key features of the proposal - Katoomba to Medlow Bath section



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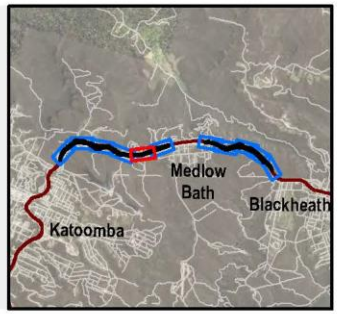
Proposal area
Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Chainage



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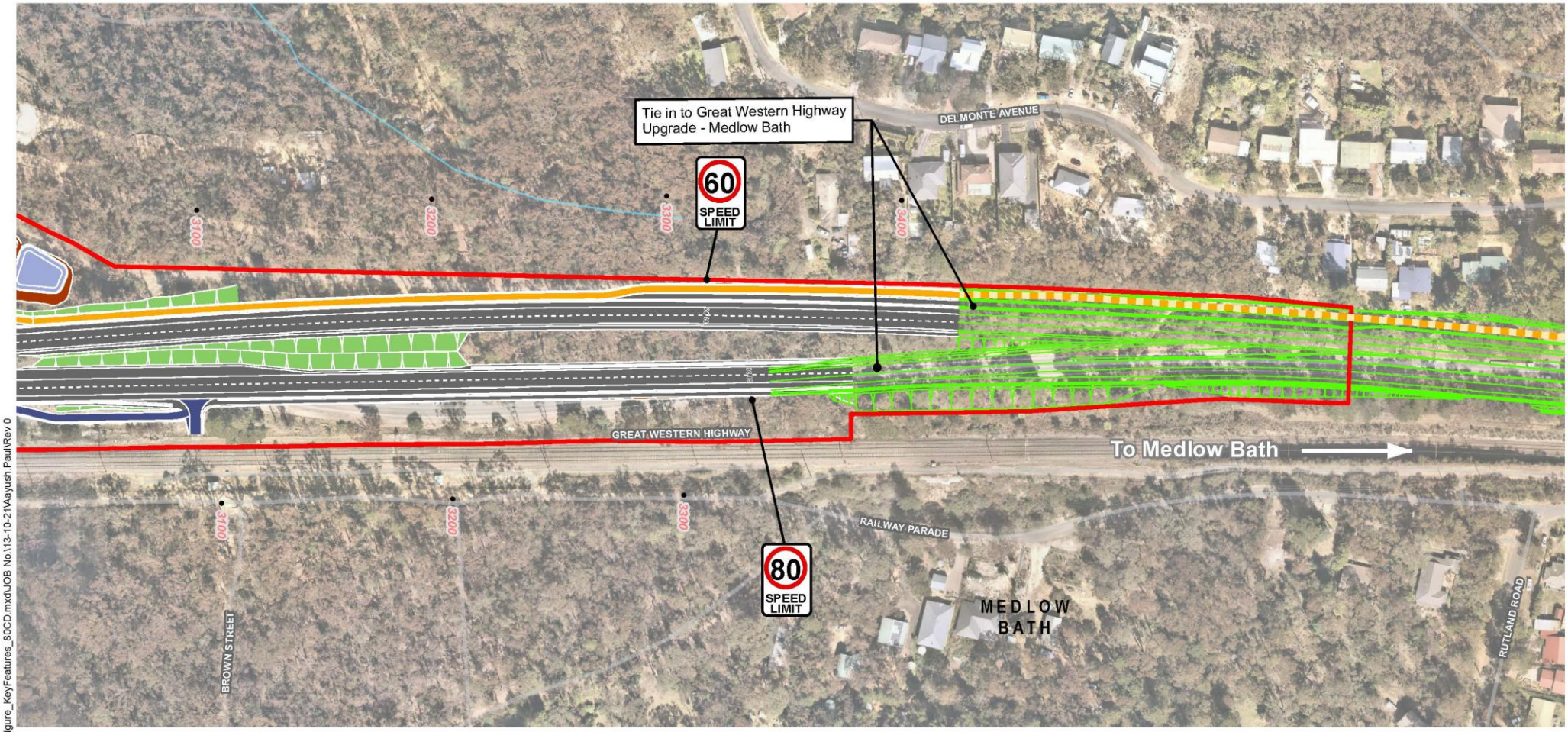
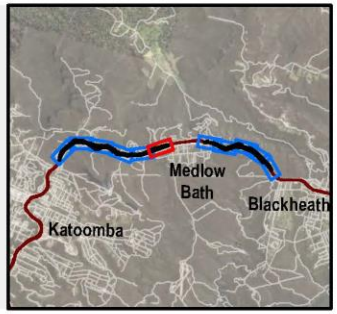
Projection: GDA2020 MGA Zone 56

FIGURE 3-1e: Key features of the proposal - Katoomba to Medlow Bath section



Proposal area
Great Western Highway Upgrade - Medlow Bath proposed design
Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Drainage basin
Chainage



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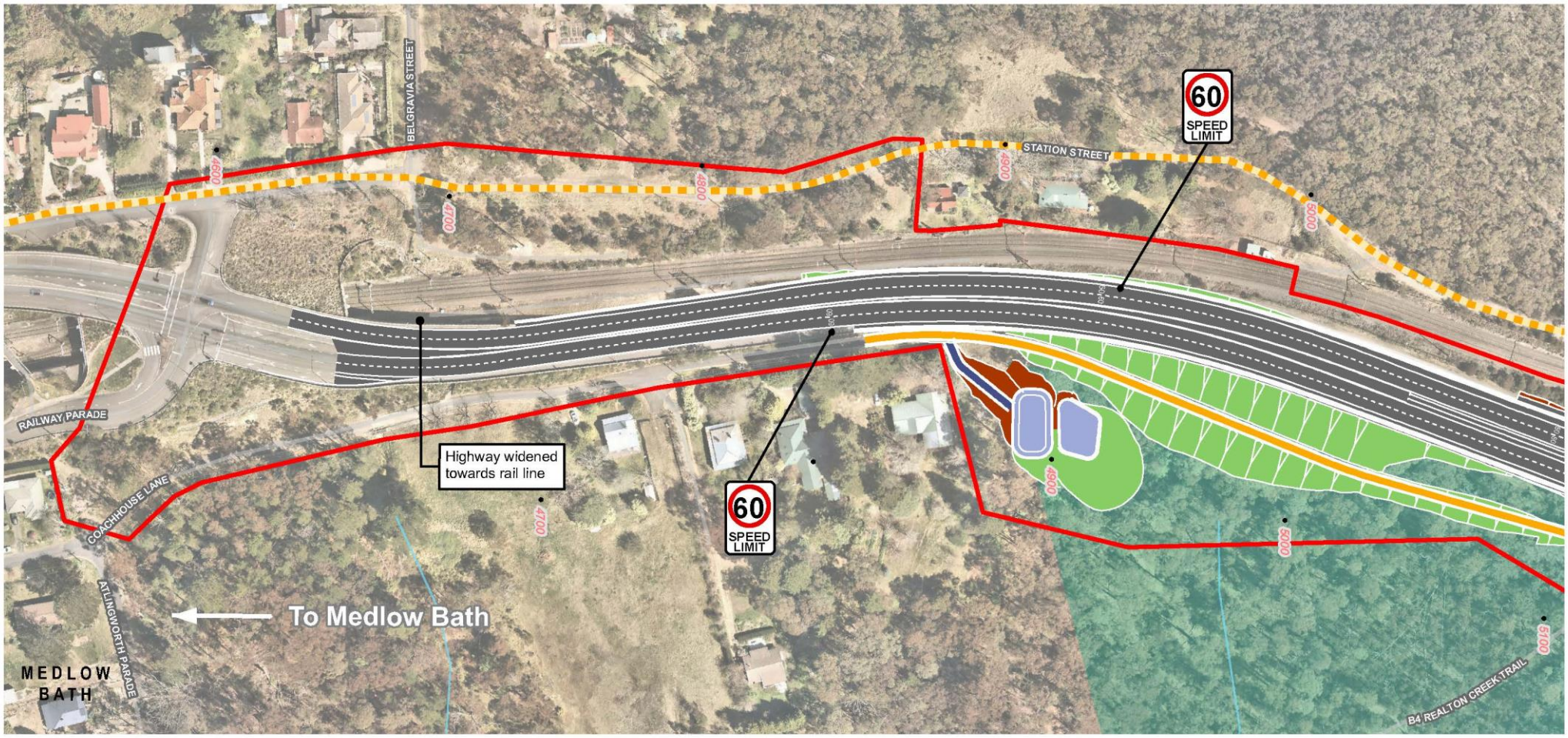
Source: Aurecon, Mott MacDonald, LPI, Nearmap

1:2,500@A4
0 25 50m

Projection: GDA2020 MGA Zone 56

FIGURE 3-1f: Key features of the proposal - Katoomba to Medlow Bath section



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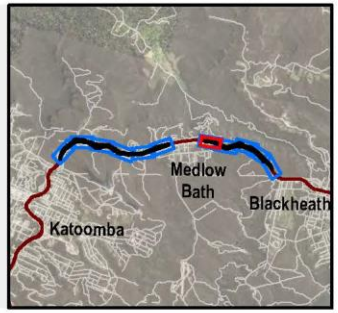
- Proposal area
- Active transport trail - existing
- Active transport trail - proposed
- Maintenance access
- Cut
- Fill
- Pavement
- Drainage basin
- Blue Mountains National Park
- Chainage



Source: Aurecon, Mott MacDonald, LPI, Nearmap

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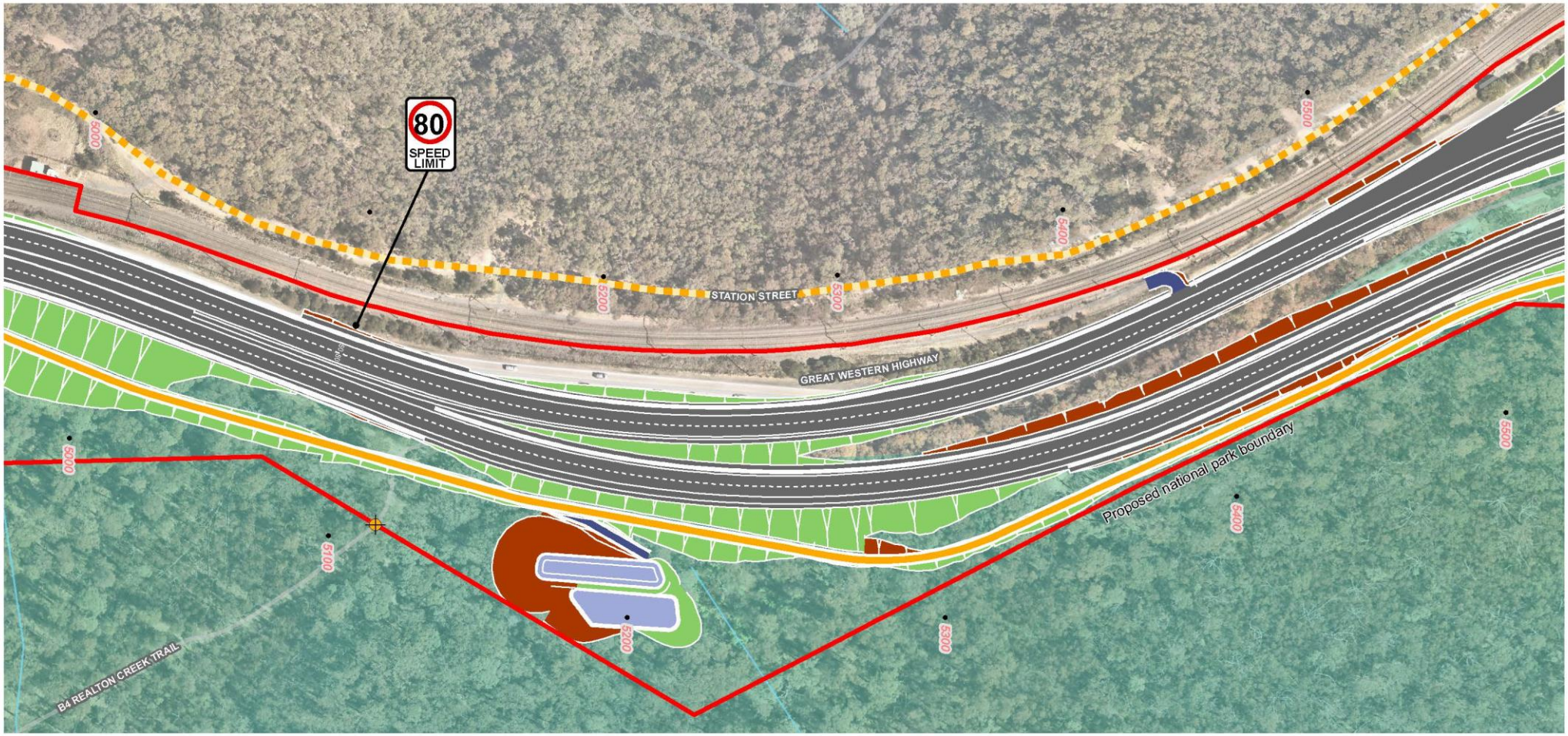
0 25 50m

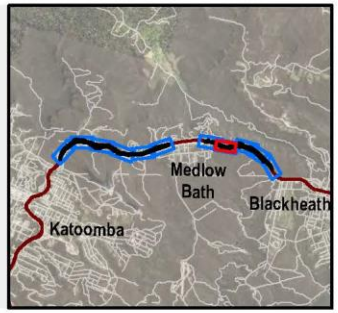
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-2a: Key features of the proposal - Medlow Bath to Blackheath section



Proposal area
Active transport trail - existing
Active transport trail - proposed
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Existing access track connection
Chainage



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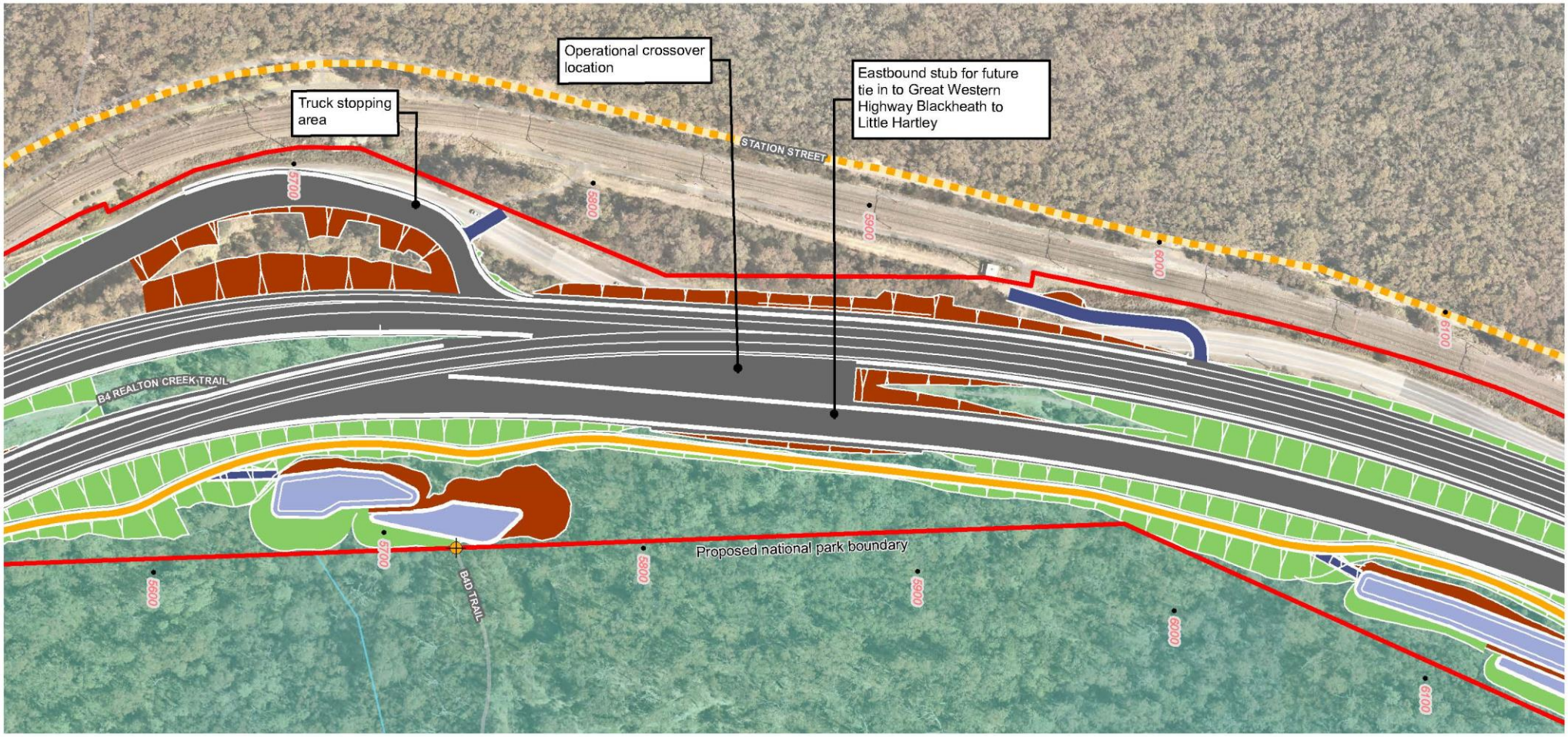
Source: Aurecon, Mott MacDonald, LPI, Nearmap

1:2,100@A4
0 25 50m

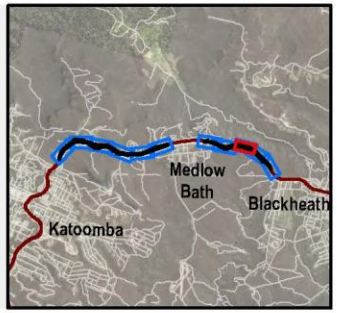
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-2b: Key features of the proposal - Medlow Bath to Blackheath section



Proposal area
Active transport trail - existing
Active transport trail - proposed
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Existing access track connection
Chainage



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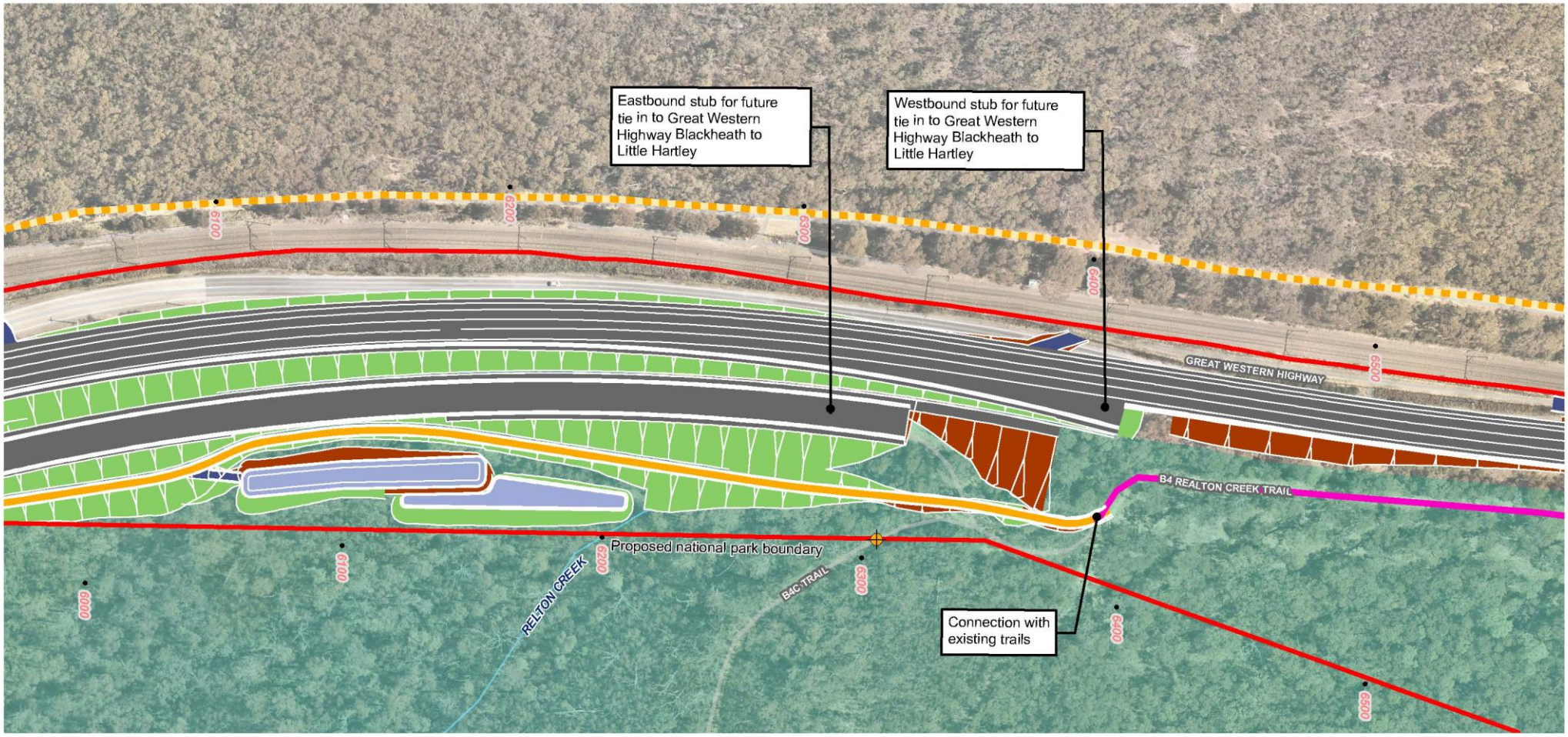
Source: Aurecon, Mott MacDonald, LPI, Nearmap

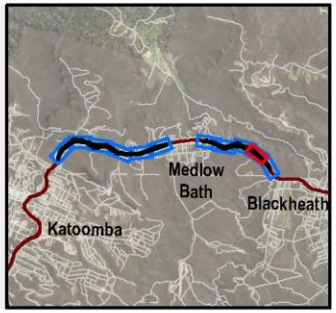
1:2,100@A4
0 25 50m

Projection: GDA2020 MGA Zone 56

FIGURE 3-2c: Key features of the proposal - Medlow Bath to Blackheath section



Proposal area
Track and path - existing
Active transport trail - existing
Active transport trail - proposed
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Existing access track connection
Chainage



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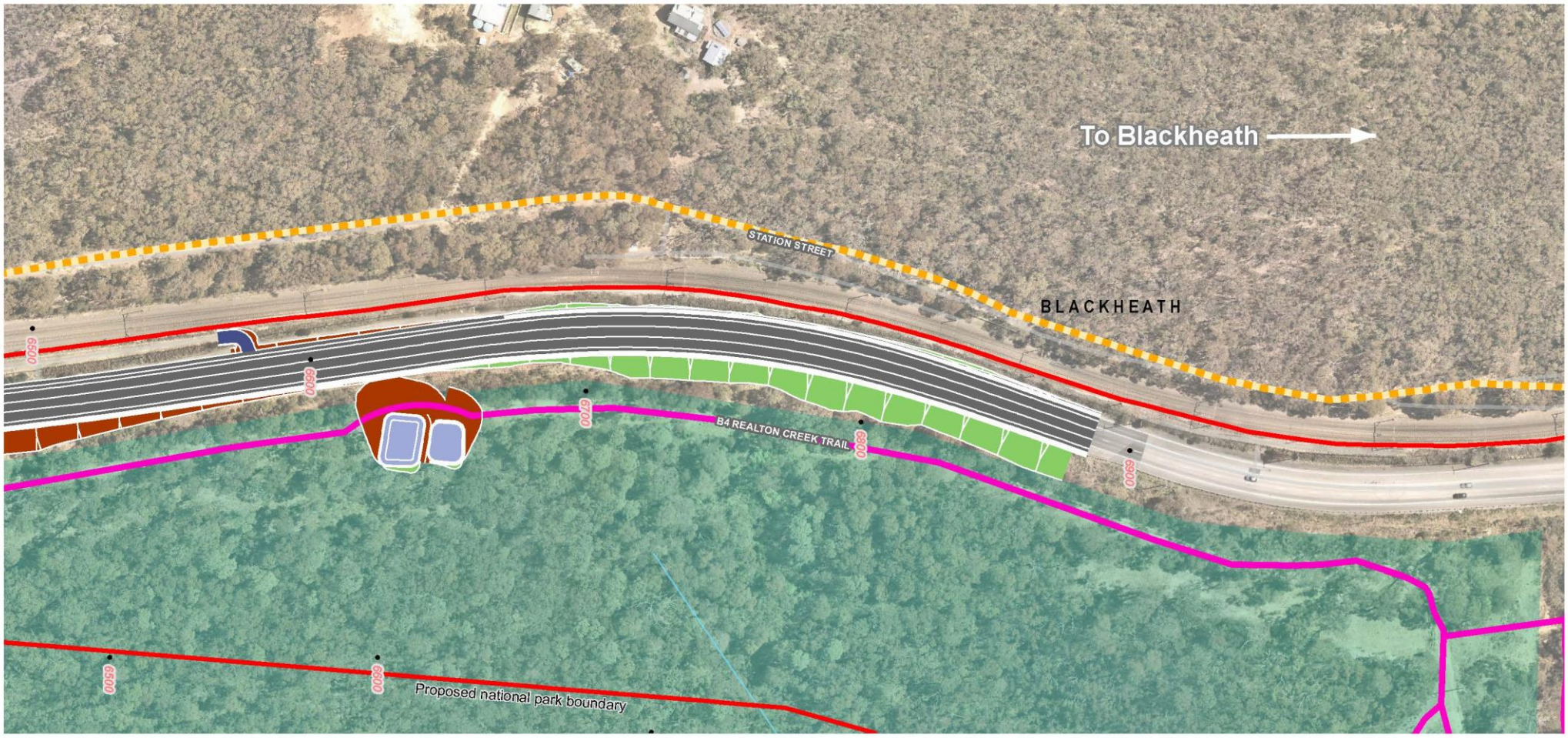
Source: Aurecon, Mott MacDonald, LPI, Nearmap

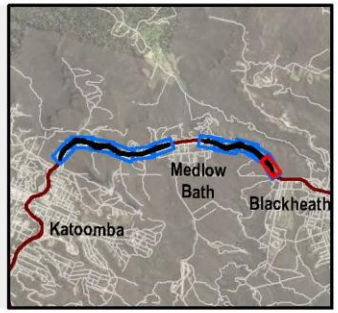
1:2,100@A4
0 25 50m

Projection: GDA2020 MGA Zone 56

FIGURE 3-2d: Key features of the proposal - Medlow Bath to Blackheath section



Proposal area
Track and path - existing
Active transport trail - existing
Maintenance access
Cut
Fill
Pavement
Drainage basin
Blue Mountains National Park
Chainage



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Source: Aurecon, Mott MacDonald, LPI, Nearmap

1:2,100@A4
0 25 50m

Projection: GDA2020 MGA Zone 56

FIGURE 3-2e: Key features of the proposal - Medlow Bath to Blackheath section

3.2 Design

A description of the Katoomba to Blackheath concept design is provided in the following sections.

3.2.1 Design criteria

The Katoomba to Blackheath concept design was prepared in accordance with the guidelines and standards in Table 3-1.

Table 3-1 Design guidelines and standards

Feature	Standards
Road design	• QA Specification PS251 • Roads and Maritime Technical Directions and Quality Alerts TD2003/RS01 • Roads and Maritime Design Guides 03.286 • Roads and Maritime Standard Drawings • Roads and Maritime Specifications R151 & QA3851 • Austroads Guides AP-G34/13 • Australian Standards
Bridge design	• QA Specification PS261 • Roads and Maritime Bridgeworks Specifications • Roads and Maritime Bridge Technical Directions (BTD's) • Roads and Maritime Standard Bridge Drawings • AS5100-2017 Bridge set • T HR EL 08012 ST - Overhead Wiring Standards for Design and Construction • AS/(NZS) 5100:2017 Series Bridge Design. • Austroads Guide to Bridge Technology: Part 8 Waterway Design - A Guide to the Hydraulic Design of Bridge – February 2018. • RMS Structural Drafting and Detailing Manual (SDDM). • Austroads Guides • The Design and Construction of Incrementally Launched Bridges – DMR – 1986. • Classification of Sandstone and Shale in Sydney Region – A Forty year Review – Pells PJN et al 2019.
Signage and road marking	• AS1742 and AS1743 • RTA Delineation Guidelines • RTA Technical Direction for Road Safety Practitioners (2003) • Roads and Maritime Guide Signposting Manual (2007) • Roads and Maritime Supplement to AS1742 Manual of uniform traffic control devices (2013)
Urban design	• QA Specification PS281 • Transport for NSW *Beyond the Pavement* (2020) • Transport for NSW Bridge Aesthetics Design Guideline (2019) • Transport for NSW Practice Note EIA-N04: Guideline for Landscape Character and Visual impact Assessment (2020) • Transport for NSW Noise Wall Design Guideline (2021) • Transport for NSW Shotcrete Design Guideline (2016) • Transport for NSW Landscape Design Guideline (2018) • Transport for NSW Water Sensitive Urban Design Guideline (2017) • Roads and Maritime Guideline for Batter Surface Stabilisation Using Vegetation (2015)

Feature	Standards
	• Transport for NSW Preliminary Environmental Investigation • Transport for NSW Great Western Highway Urban Design Framework - Katoomba to Mt Victoria (2016)

Specific design criteria have been identified for the proposal length, on approach to Medlow Bath and local roads (refer to Table 3-2).

Table 3-2: Design criteria

Design element	Great Western Highway – Katoomba to Blackheath length	Great Western Highway – Medlow Bath northern and southern approaches	Local roads
Carriageway	Dual carriageway, two lanes either direction	Dual carriageway, two lanes either direction	Two lanes, two way
Design speed (kilometres per hour)	90	70	50
Posted speed (kilometres per hour)	80	60	50
Design vehicle (check vehicle)	26 metre B-double (30 metre B-double)	26 metre B-double (30 metre B-double)	12.5 metre Single Unit Truck
Through and turning traffic lane width (metres)	3.5	3.3	Explorers Road Ramp – 3.5 All other local roads – 5
Nearside shoulder width (metres)	2.5	1.5	Explorers Road Ramp – 2.5
Offside shoulder width (metres)	1	1	Explorers Road Ramp – 0.5
Minimum verge width (metres)	2	2	N/A
Active transport trail width (metres)	3	3	N/A
Maximum vertical grade (per cent)	6	6	7.5
Batter slopes	Between 2V:3H and 1V:2H	Between 2V:3H and 1V:2H	N/A
Flood immunity	Pavement drainage pit and pipe network – 10 per cent annual exceedance probability (AEP) storm event Transverse drainage network – one per cent AEP storm event		

3.2.2 Engineering constraints

The engineering constraints considered in the design of both the Katoomba to Medlow Bath and Medlow Bath to Blackheath sections are summarised in Table 3-3.

Table 3-3: Engineering constraints

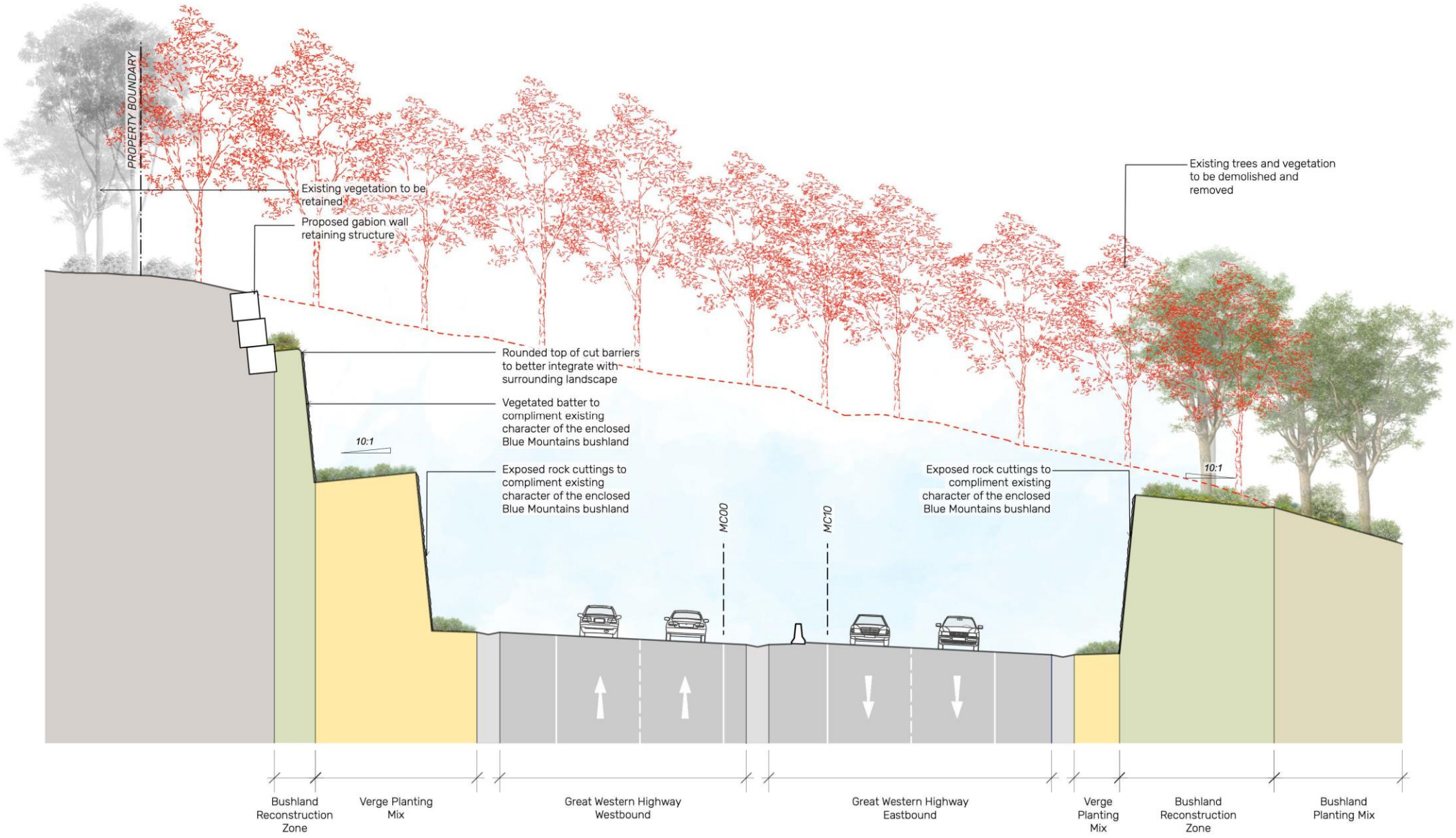
Constraint	How it has been addressed in the proposal design
Great Western Highway to remain open during construction (Katoomba to Medlow Bath, Medlow Bath to Blackheath)	As the upgraded highway would be built across or on top of the existing highway, needing to maintain trafficability of the highway during construction is important. The proposed staging of construction is outlined in Section 3.3.2. Off-line carriageways would be constructed first, while traffic remains on the existing highway. When offline carriageways are complete, traffic would be switched across so that the second carriageway can be constructed. When both carriageways are completed, traffic would be switched back to their permanent directions.
Proximity of Coachhouse Lane and the rail corridor at Medlow Bath (Medlow Bath to Blackheath)	At the eastern extent of the Medlow Bath to Blackheath section, the Great Western Highway is located in a narrow corridor between Coachhouse Lane and the rail corridor. Widening of the highway would result in impacting the rail corridor or Coachhouse Lane. To maintain local property access through Coachhouse Lane, the highway would be widened to the west, impinging on the rail corridor.
Proximity of the Main Western Railway line (Katoomba to Medlow Bath, Medlow Bath to Blackheath)	The proposal design has minimised impacts to the rail corridor and to rail assets. Immediately north of Medlow Bath, new rail corridor fencing would be installed. Access to the rail corridor would be maintained with existing gates either retained or relocated.
Steep terrain (Katoomba to Medlow Bath, Medlow Bath to Blackheath)	In several locations, the proposal design extends across valleys and cuts through existing ridges. There are several retaining walls as part of the design. The Katoomba to Medlow Bath section includes a bridge near Explorers Road, to span across the valley.

3.2.3 Major design features

Cross sections

The typical sealed carriageway for the Katoomba to Medlow Bath section in each direction would be between 10.5 and 10.9 metres wide. The verge and median areas would vary in width and include a concrete median with appropriate barriers in place. On the approach to Medlow Bath, median trees would be planted to denote the change in environment. Refer to Figure 3-3a-b for two indicative cross sections of this section.

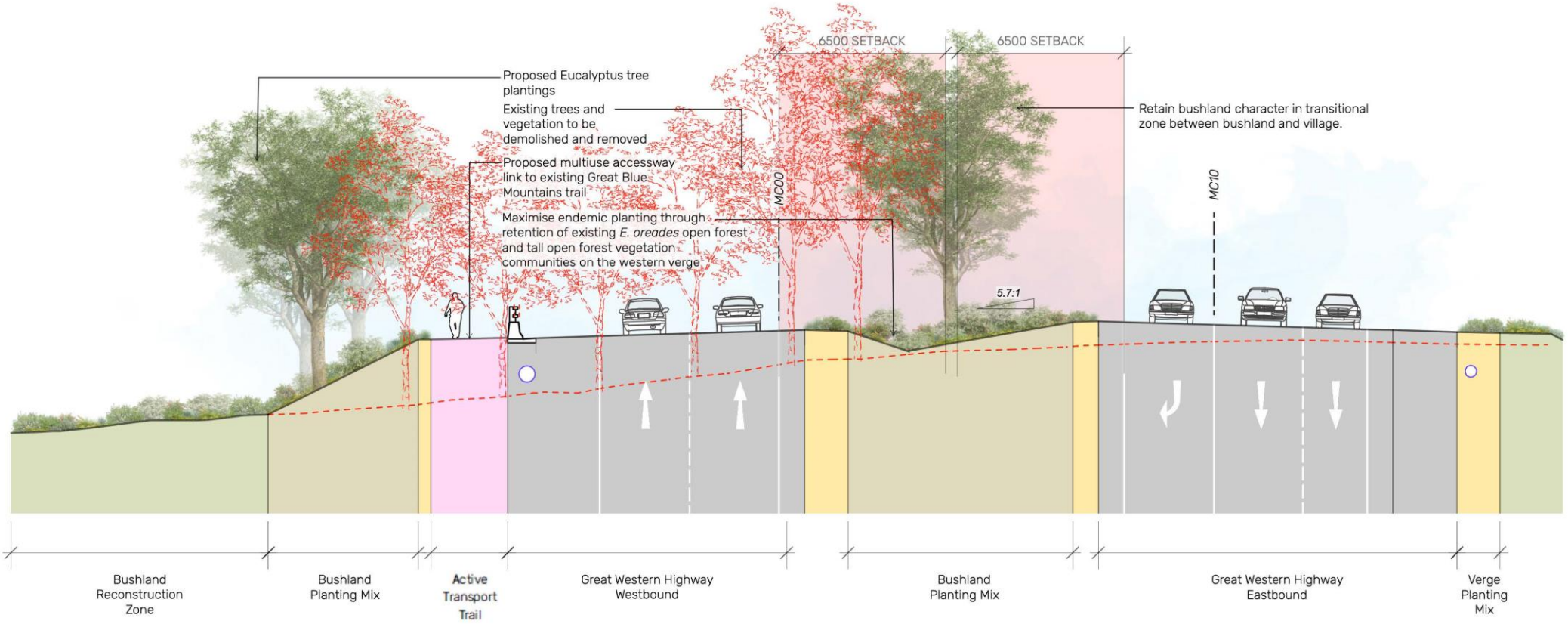
For the Medlow Bath to Blackheath section, the typical carriageway width would be between about 8.1 and 10.5 metres. The verge and median areas would vary in width, with a raised concrete median near Medlow Bath and widened medians in other areas, with appropriate barriers installed. Refer to Figure 3-4a-b for indicative cross sections of this section.



Source: SMM, 2022

NO SCALE – CH920

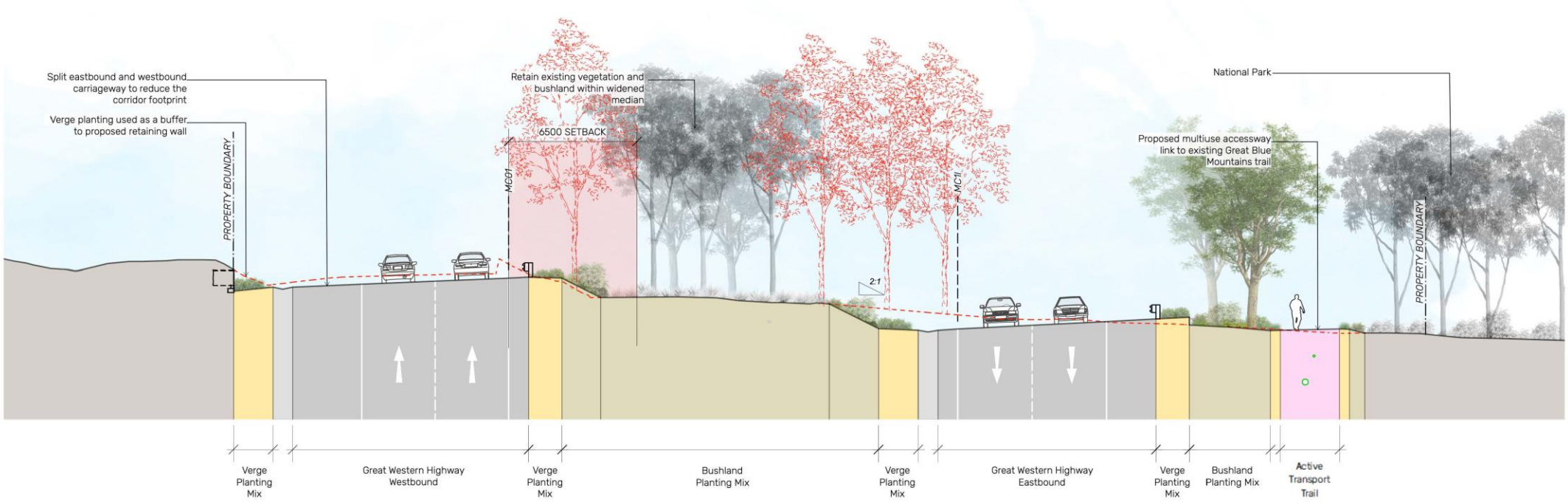
FIGURE 3-3a: Katoomba to Medlow Bath section – cut – Ch920



Source: SMM, 2022

NO SCALE – CH3100

FIGURE 3-3b: Katoomba to Medlow Bath section – fill – Ch3100

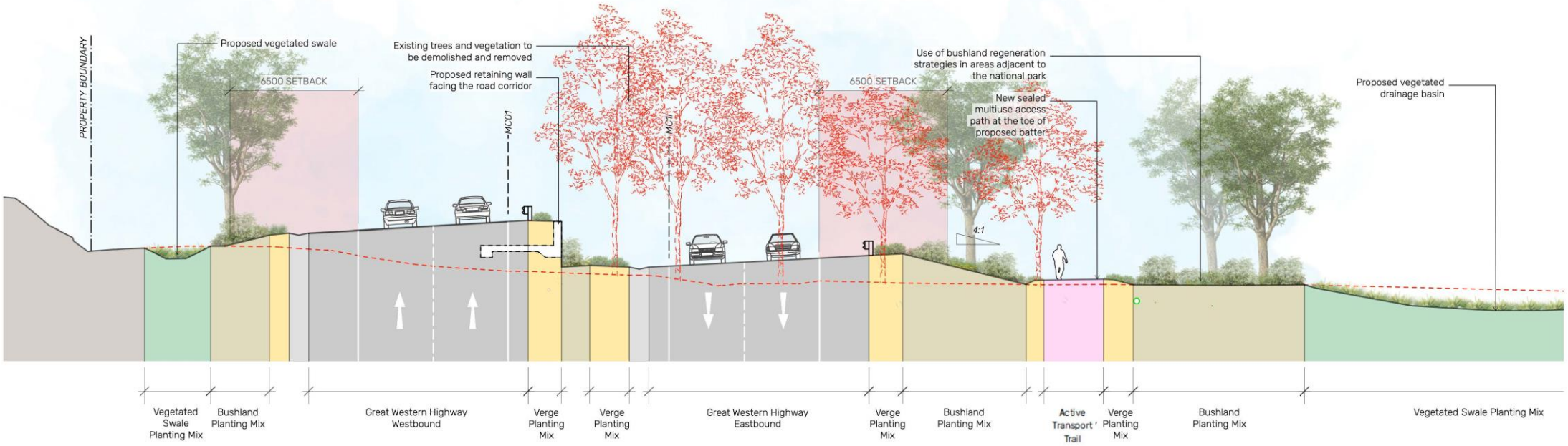


Source: SMM, 2022

NO SCALE – CH5400

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-4a: Medlow Bath to Blackheath section – cut – Ch5400



Source: SMM, 2022

NO SCALE – CH5180

FIGURE 3-4b: Medlow Bath to Blackheath section – fill – Ch5180

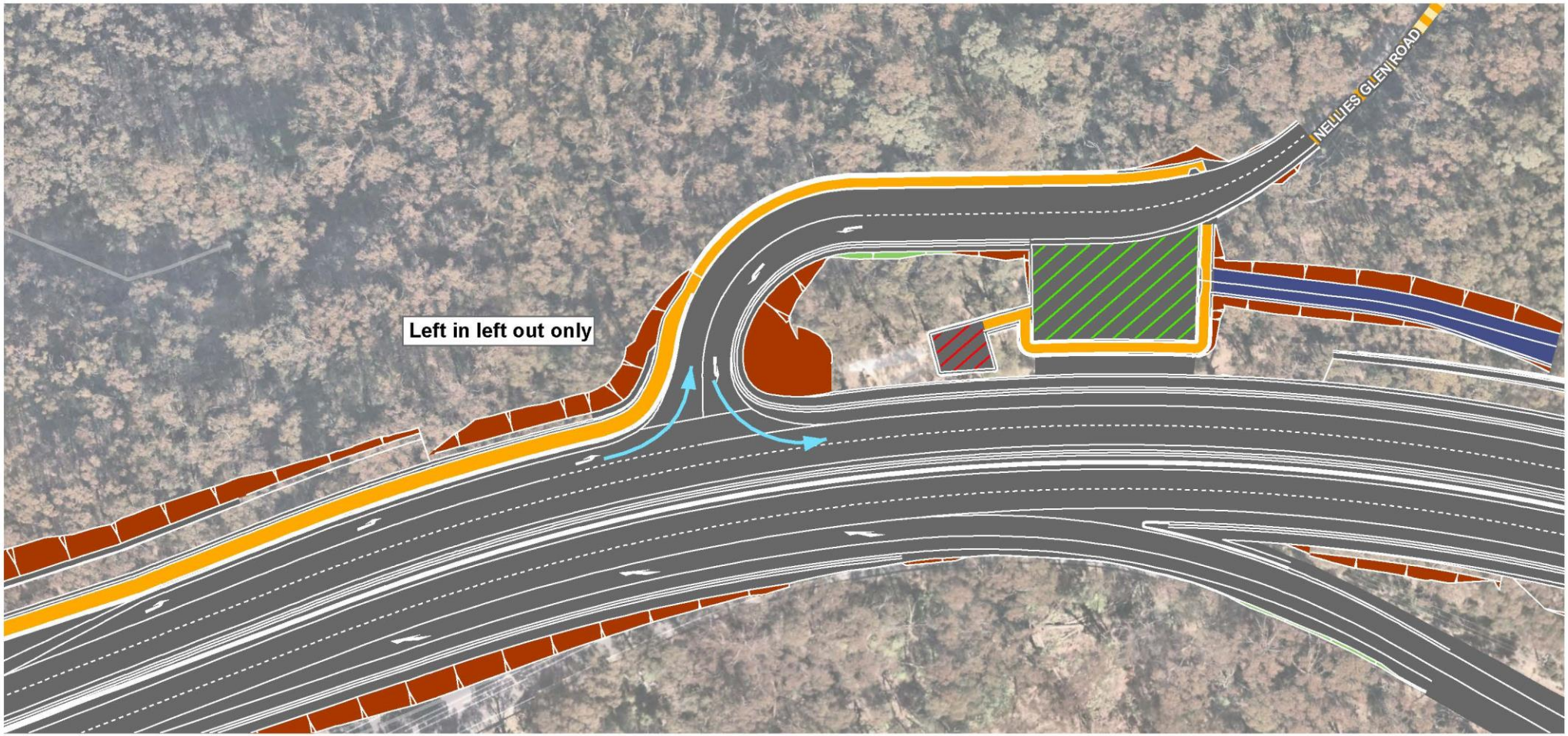
Intersection upgrades

As part of the Katoomba to Medlow Bath section, there are three local roads that connect to the Great Western Highway. These intersections would be upgraded at Nellies Glen Road, Explorers Road and Foy Avenue. These intersection upgrades are detailed in Table 3-4 and shown in Figure 3-5 to Figure 3-7.

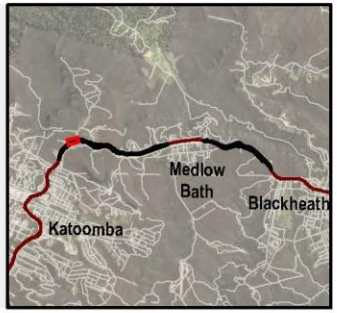
Table 3-4: Description of intersection upgrades

Intersection	Description of upgrade
Nellies Glen Road	• The intersection would be realigned further east to improve driver sight lines of traffic on the highway. • The left-out movement at Nellies Glen Road removed in 2021 due to safety concerns would be reinstated, making the intersection left-in left-out only for westbound traffic. • Access to / from the eastbound carriageway, Nellies Glen Road traffic would travel via the Explorers Road intersection.
Explorers Road	• Explorers Road would no longer connect to the Great Western Highway, as at this point, the highway would be located above on new twin bridges that would extend over Explorers Road. • Explorers Road would connect to the existing highway, which would become a service road in this location • The Explorers Road intersection would be a right in right out only intersection, with priority given to vehicles turning right out of Explorers Road. • Access to / from the westbound carriageway, Explorers Road traffic would travel via the Nellies Glen Road intersection.
Foy Avenue	• The Foy Avenue intersection with the Great Western Highway would be upgraded to provide channelised right in turn and left in left out traffic movements. • A left turn bay would be provided for highway westbound vehicles to access Foy Avenue and a channelised right turn bay for highway eastbound vehicles • Vehicles exiting the intersection would only be able to turn left, with eastbound traffic redirected to the Bellevue Crescent intersection to perform U-turns.

There are no intersections along the length of the Medlow Bath to Blackheath section.



Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Carpark
Heritage interpretation area



P:\GIS\Project-4\project511168_GWH\GWHE_REF_Fig3-5_Nellies_Glen_Road_intersection_upgrade_rev2.mxd\JOB No.\12-10-21\Aayush.Paul\Rev 0

Source: Aurecon, Mott MacDonald, LPI, Nearmap

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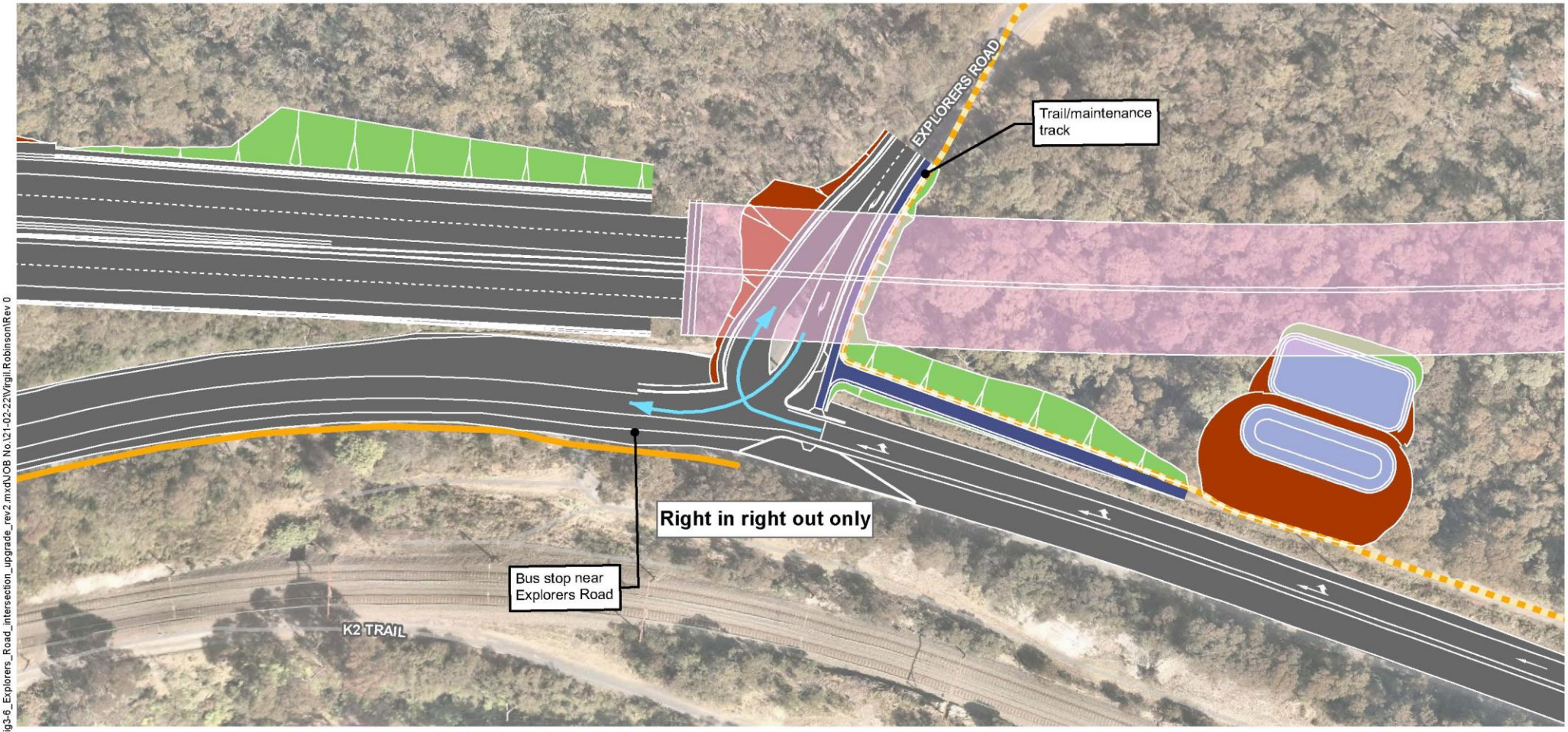
0 20 40 m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-5: Nellies Glen Road intersection upgrade



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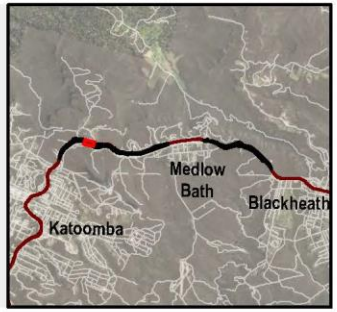
Bridge
Active transport trail - existing
Active transport trail - upgraded
Maintenance access
Cut
Fill
Pavement
Drainage basin



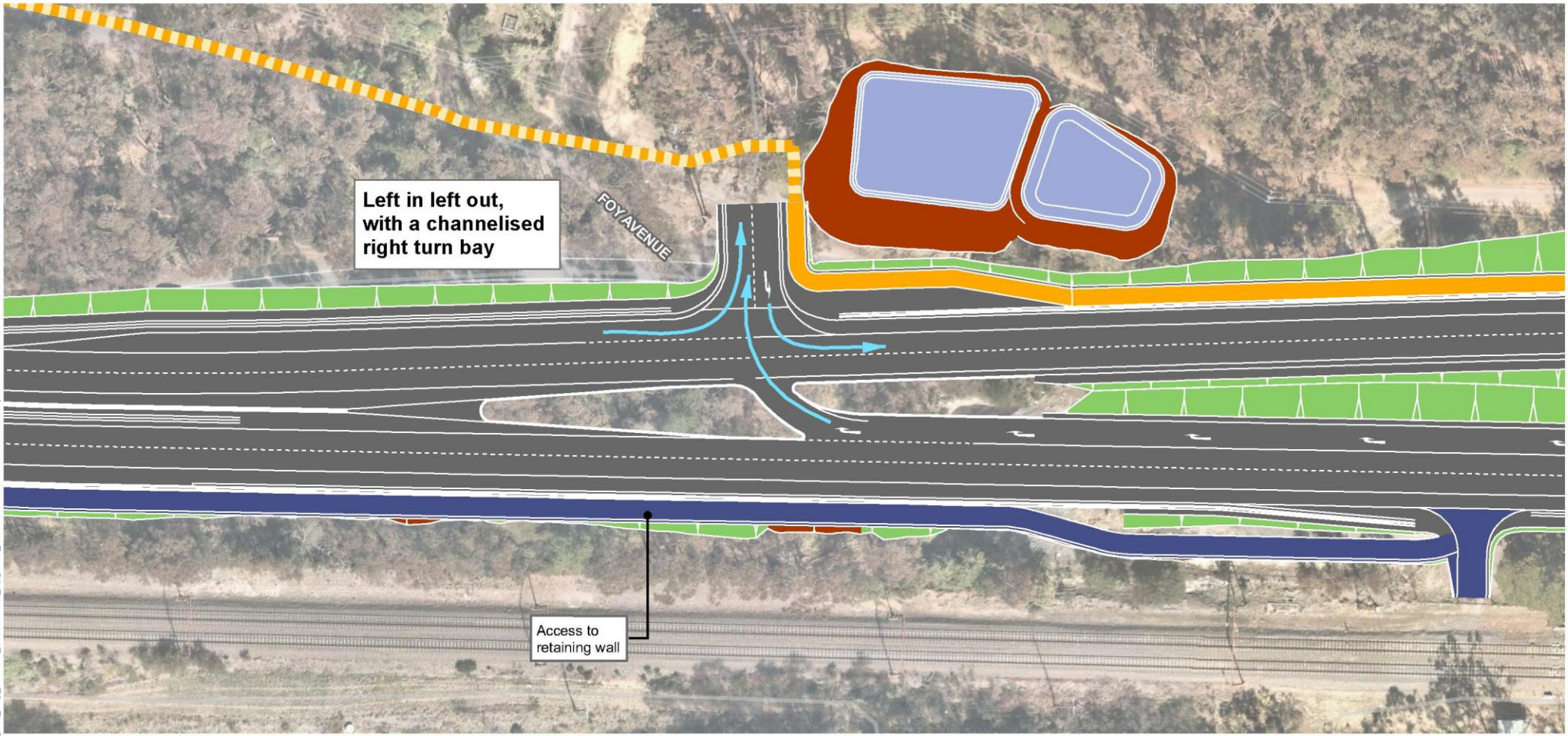
Source: Aurecon, Mott MacDonald, LPI, Nearmap

1:1,000@A4
0 15 30m

Projection: GDA2020 MGA Zone 56

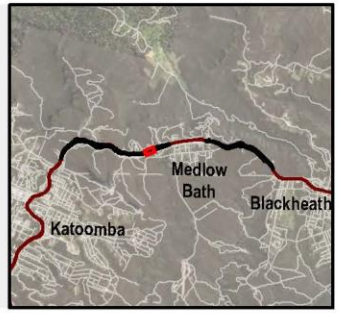
Great Western Highway East **Review of Environmental Factors**

FIGURE 3-6: Explorers Road intersection upgrade



P:\GIS\Project-4\project511168_GWH\GWHE_REF_Fig3-7_Foy_Avenue_intersection_upgrade_rev2.mxd\JOB No.\13-10-21\Aayush.Paul\Rev 0

- Active transport trail - existing
- Active transport trail - upgraded
- Maintenance access
- Cut
- Fill
- Pavement
- Drainage basin



Source: Aurecon, Mott MacDonald, LPI, Nearmap

1:1,000@A4

0 15 30m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-7: Foy Avenue intersection upgrade

Tie-ins

The Katoomba to Medlow Bath section would connect into the existing highway west of Katoomba, near Rowan Lane where the existing highway is two lanes in each direction. The western end of this section would tie-in to the Great Western Highway south of Bellevue Crescent and connect to a section of the highway that would be upgraded as part of the Medlow Bath Upgrade.

The eastern extent of Medlow Bath to Blackheath would tie into the Great Western Highway at the Station Street intersection. This section of the highway is two lanes in each direction. To the west, the section would tie-in to the existing highway near Tennyson Road. This section of the highway is two lanes eastbound and one lane westbound. As such, the separated carriageways of the section would converge together near the truck stopping bay to match the existing highway alignment and number of traffic lanes. Pavement stubs would be constructed for each of the carriageways as part of this section for a future tie-in to the Great Western Highway Blackheath to Little Hartley (Blackheath to Little Hartley Upgrade).

The crossover pavement would be maintained as an emergency crossover point for the final arrangement.

Twin bridges over Explorers Road

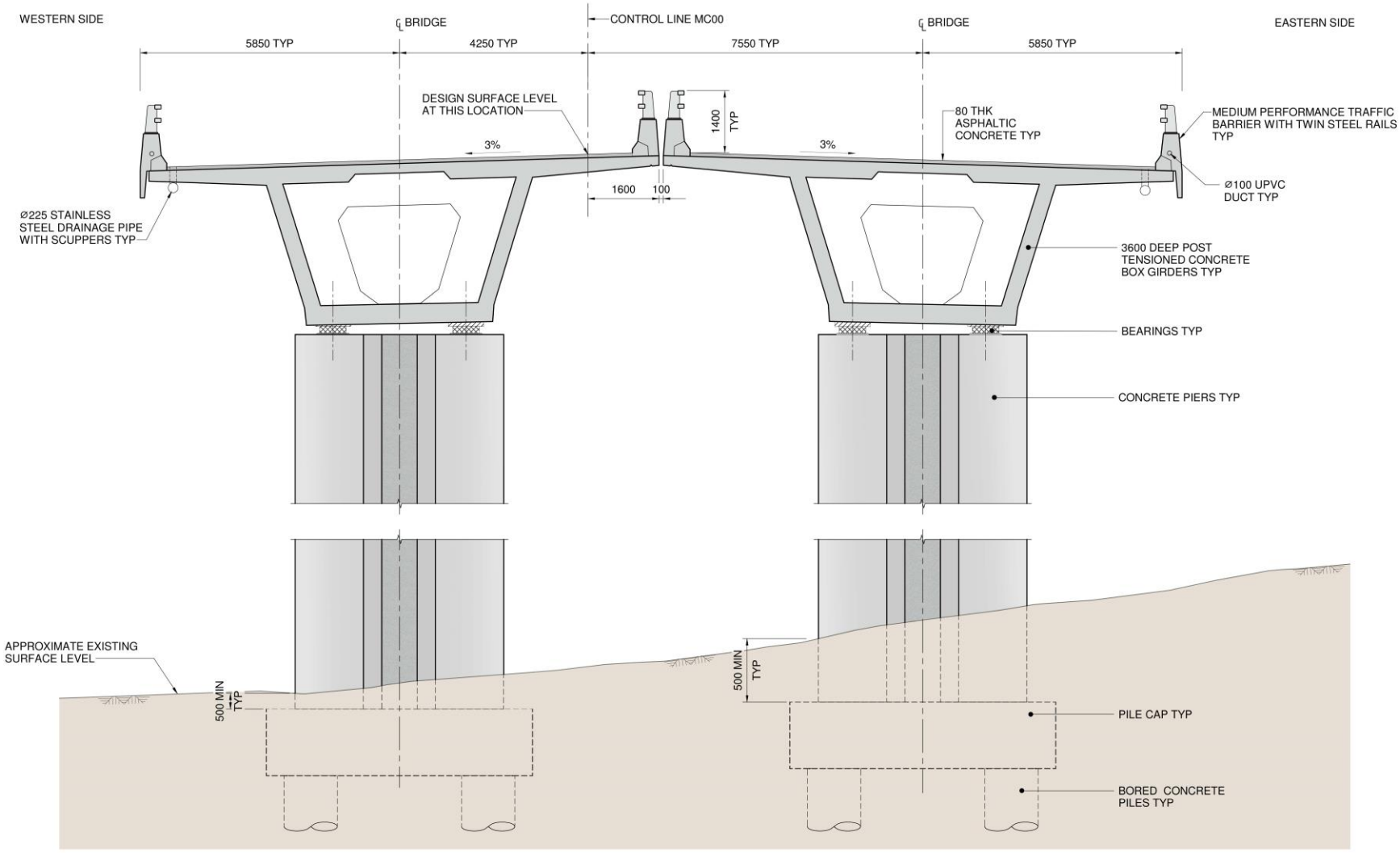
The new twin concrete bridges would span about 400 metres over the valley from Pulpit Hill near Explorers Road, Katoomba to the existing Great Western Highway. One bridge would carry eastbound traffic, while the other bridge would carry westbound traffic. Each bridge would consist of two traffic lanes and a shoulder. The road carriageway on each bridge would be about 10.5 metres wide, comprising two 3.5-metre-wide traffic lanes, a one-metre-wide inner shoulder and 2.5-metre-wide outer shoulder. A cross-section of the twin bridges is shown in Figure 3-8.

The bridge structures comprise twin 3.6 metres deep post tensioned concrete box girders constructed side by side, with a maximum spacing of 100 millimetres between each bridge for safety reasons. The maximum height of the bridge deck over ground would be about 32 metres.

The bridges would consist of nine spans with eight piers, with the maximum span length of about 55 metres. There would be four piles for each pier. The piers have been placed to avoid direct impact to an area of Blue Mountains Swamp threatened ecological community (TEC) that passes under the twin bridges. The piers have also been designed to reduce the visual bulk of the bridges in line with the urban design objectives of the proposal (refer to section 2.3.3).

Appropriate safety barriers would be constructed along both bridge structures and there would be no pedestrian access along the bridges.

Construction of the twin bridges is proposed to be via an incrementally launched method. This would involve bridge segments being pushed out from the eastern abutment near Explorers Road to the western abutment near the existing Great Western Highway. This construction technique would minimise the construction footprint required under the bridges and limit the need for extensive crane lifts. However, the construction technique may vary during detailed design or construction once a detailed construction methodology has been developed.



Source: SMM, 2022

NO SCALE

FIGURE 3-8: Typical cross section of the twin bridges

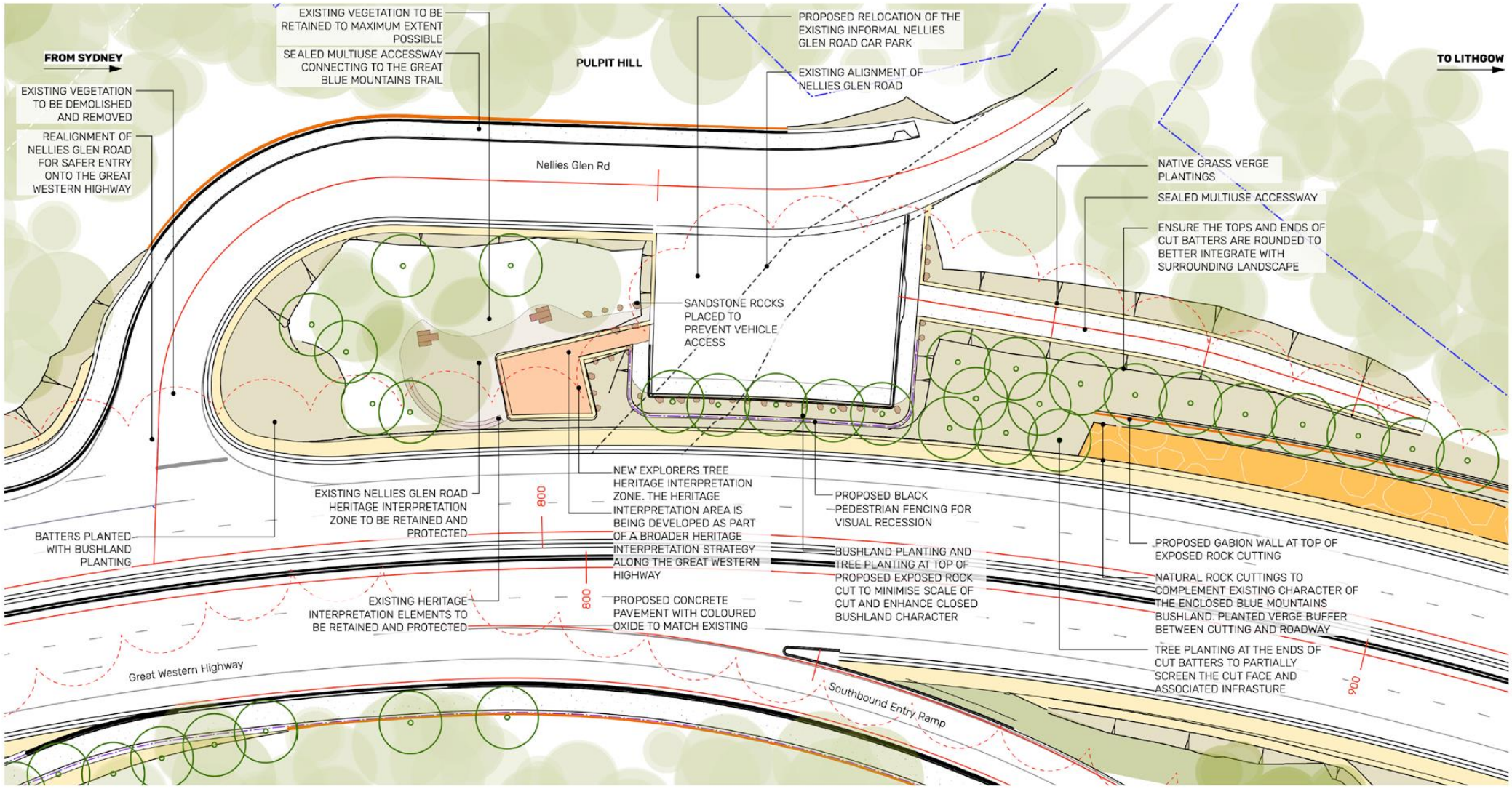
Heritage interpretation

Transport is currently engaging with specialist heritage consultants GML Heritage and Balarinji Indigenous Design and Strategy to engage stakeholders in developing a cultural interpretation strategy across the Great Western Highway Upgrade Program – Katoomba to Lithgow. This cultural interpretation strategy would look to interpret both Aboriginal and non-Aboriginal heritage along the highway alignment.

As part of the Katoomba to Medlow Bath section, an expanded and cohesive heritage interpretation area would be developed on Nellies Glen Road to display the Aboriginal and non-Aboriginal heritage of the area. The Nellies Glen Road intersection with the Great Western Highway has been shifted further east than the existing intersection. This has allowed the retention of the existing Blue Mountains City Council heritage interpretation area. The proposal would allow better connection between the disparate heritage items such as the nearby Stone arrangements (including an unmarked convict grave site). The new interpretation area would enhance and supplement the Council's existing site. It would support a broader story of the cultural significance of Pulpit Hill, not just focusing on the former Explorers Tree.

This area will incorporate improved visitor car parking and active transport trails that form part of the Great Blue Mountains Trail around Nellies Glen Road to better connect users with the interpretation area. It would not impact on the 'heritage fabric' of the site. An indicative image showing the enhanced heritage interpretation area is shown in Figure 3-9. How the enhanced heritage interpretation area would connect to the heritage items across Pulpit Hill is shown in Figure 3-10.

The heritage interpretation area would be further developed as part of the Great Western Highway Upgrade Program cultural interpretation strategy, in consultation with the Blue Mountains City Council, Heritage NSW, Aboriginal knowledge holders and the local community.



Source: SMM, 2022

NO SCALE

FIGURE 3-9: Heritage interpretation area

Existing heritage interpretation area

Bonnie Doon Reserve

Pulpit Hill and Environs

NELLIES GLEN ROAD

Possible grave

K039: Stone Arrangements

Pulpit Hill and Environs

Proposed carpark

Existing Nellies Glen Road heritage interpretation area (pictured) to be retained and enhanced

Proposed upgrade to intersection at Nellies Glen Road (to allow retention of the existing heritage interpretation area)

GREAT WESTERN HIGHWAY

K031: Explorers Tree and Environs

K2 TRAIL

The design

Photo location and direction indicator

Blue Mountains LEP 2015

Heritage items

Bonnie Doon Reserve

Pulpit Hill and Environs

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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

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0 25 50m

Projection: GDA2020 MGA Zone 56

FIGURE 3-10: Pulpit Hill heritage

Pavement

Different pavements that would be used for the proposal include:

- a full depth asphalt pavement for the main carriageway and new truck stopping bays
- bridge deck asphalt pavement for the twin bridges within the Katoomba to Medlow Bath section
- sealed granular pavements for tying into local roads, car parks and access roads, suitable for the proposed traffic loading
- concrete medians and a mix of concrete and asphalt pavement surfaces for paths.

As part of the noise assessment undertaken for the REF, one potential noise mitigation measure being considered is a low noise asphalt pavement for sections near sensitive receivers in the Katoomba to Medlow Bath section. The need for and feasibility of using low noise asphalt pavement would be confirmed during detailed design.

There are sections of pavement on the existing highway that would no longer be required for the highway alignment. These sections of pavements would either be retained for use as access trails or transport maintenance areas. If they are no longer required, the pavements would be removed and the area re-landscaped.

Truck stopping areas

The proposal would establish two new formal truck stopping areas for heavy vehicle load checking. These areas would provide areas where trucks can move off the highway to check loads and vehicles. This would address an issue that is currently experienced on the highway, where trucks pull over on the side of the highway at Foys Avenue and outside the Hydro Majestic in Medlow Bath to check their loads.

The truck stopping bays are intended as short term stop areas and would not be ‘rest areas’. There would be no ablutions or other facilities.

The truck stopping areas would be:

- one eastbound on the existing highway pavement near Explorers Road in the Katoomba to Medlow Bath section
- one westbound about one kilometre north of Medlow Bath on a section of existing highway pavement in the Medlow Bath to Blackheath section.

The truck stopping areas are shown in Figure 3-1b-c and Figure 3-2c.

Drainage and water quality

The proposal would include the following road drainage infrastructure:

- Longitudinal drains, which would run along length of the road and are designed to remove water from the road surface as quickly as possible. This would include a system of pits and pipes within the median and kerb of the road.
- Cross drainage pipes, which transfer water under the road and are generally installed along natural low points on a road to allow natural stormwater runoff from the surrounding land to drain across a road to minimise disturbance to the existing flow patterns. There would be eight cross drainage pipes within the Katoomba to Medlow Bath section but no cross drainage pipes within the Medlow Bath to Blackheath section.
- Bridge drainage system that would direct run-off from the bridge surface to pits on the northern abutment of the twin bridges that would then drain to water quality treatment basin.

- Water quality management and stormwater treatment measures that could include:
  - water quality basins
  - bio filtration systems
  - grass swales
  - scour protection at transverse culverts, longitudinal pipes and channels to prevent erosion and scour from the flow of water.

The pavement drainage pit and pipe network would be designed to achieve flood immunity for a ten per cent annual exceedance probability (AEP) flood event and the transverse drainage network would be designed to achieve flood immunity for a one per cent AEP flood event. The pavement drainage network would also incorporate overland flow routes through the proposed road pavement and landscaped areas to provide capacity in storm events.

Due to the location of the proposal within the Katoomba and Blackheath Special Catchment Areas and adjacent to the Blue Mountains National Park, it is important that the water quality treatment provides a beneficial effect on water quality. Through the concept design, Transport have held ongoing meetings with the Blue Mountains City Council and Water NSW to develop the water quality strategy for the proposal. MUSIC modelling undertaken for the proposal (refer to Section 6.1.3) show that this strategy would have a beneficial effect on water quality in the catchments.

The water quality management process is outlined in Figure 3-11. Water quality for the proposal is considered on a water runoff catchment area and each catchment would have water quality treatments such as:

- Baramy Single Vane Gross Pollutant Traps (GPTs) or approved equivalents. These are pollution control devices specifically designed to remove gross pollutants and coarse sediments from stormwater runoff.
- Bioretention systems incorporated within the onsite detention basin (OSDs). These facilitate additional nutrient removal. Sediments and attached pollutants (including nutrients, metals, and other soluble pollutants) are removed via filtration through the vegetated surface layer and filter layer below.
- Grassed line swales with check dams at the discharge point from the basins, where possible. These slow down the runoff velocity and promote infiltration to the existing low point or overland flow path.

Figure 3-12 is an example of basin outlet treatment to reduce scour, which is indicative of the treatment proposed to be implemented for the proposal. A typical cross-section of a basin is shown in Figure 3-13.

There are twelve discharge locations proposed. The locations of the proposed basins are shown in Figure 3-1a-f and Figure 3-2a-e. There would be:

- seven discharge locations within the Katoomba to Medlow Bath section. Six of these locations would have bioretention basins, and at five locations, there would be bioretention basin and OSD systems.
- five bioretention basins with OSD installed along the eastern side of the road corridor within the Medlow Bath to Blackheath section.

Transport will continue to work with Blue Mountains City Council and Water NSW on the design of the water quality devices through the detailed design. The extent of scour protection would be confirmed during detailed design.

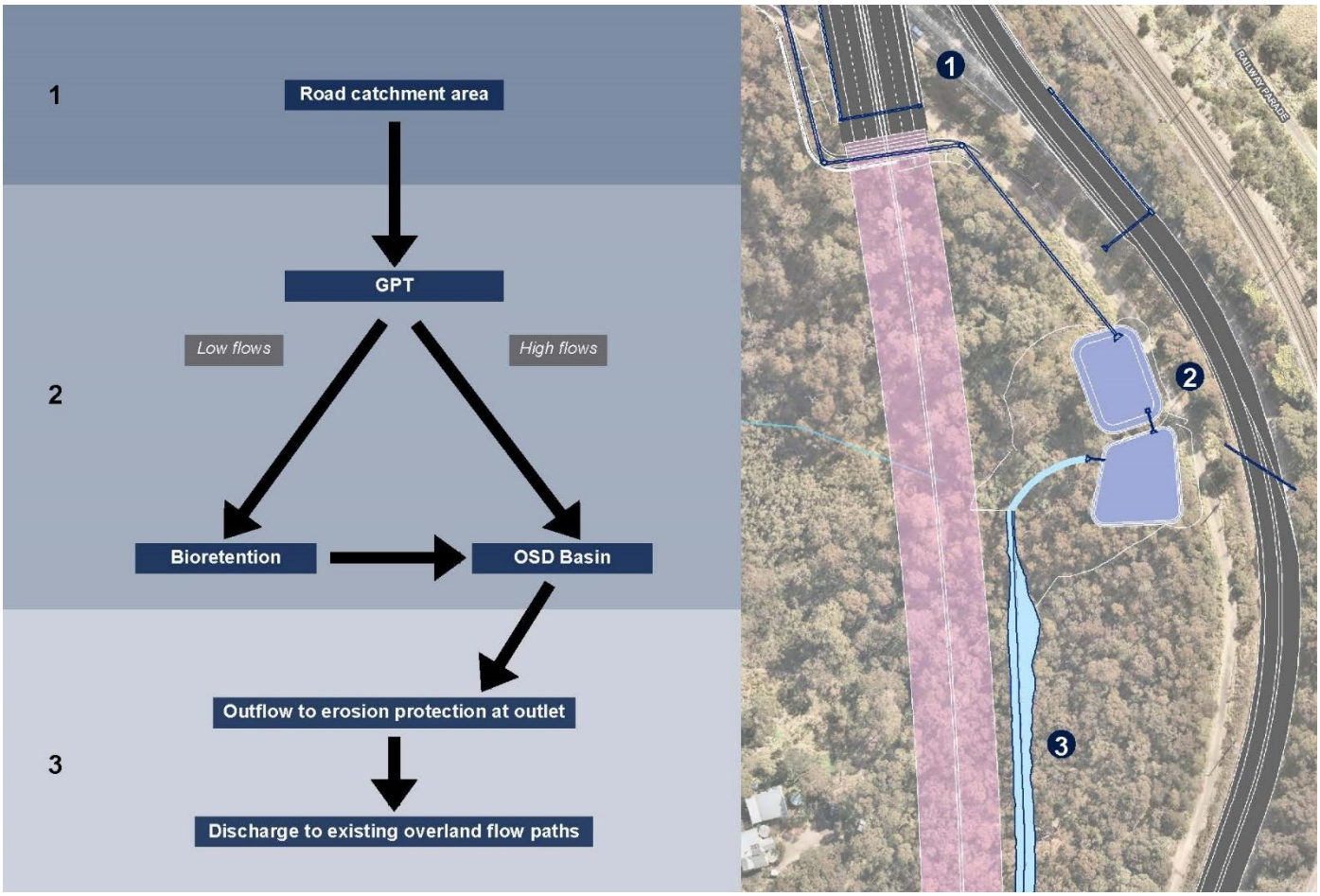
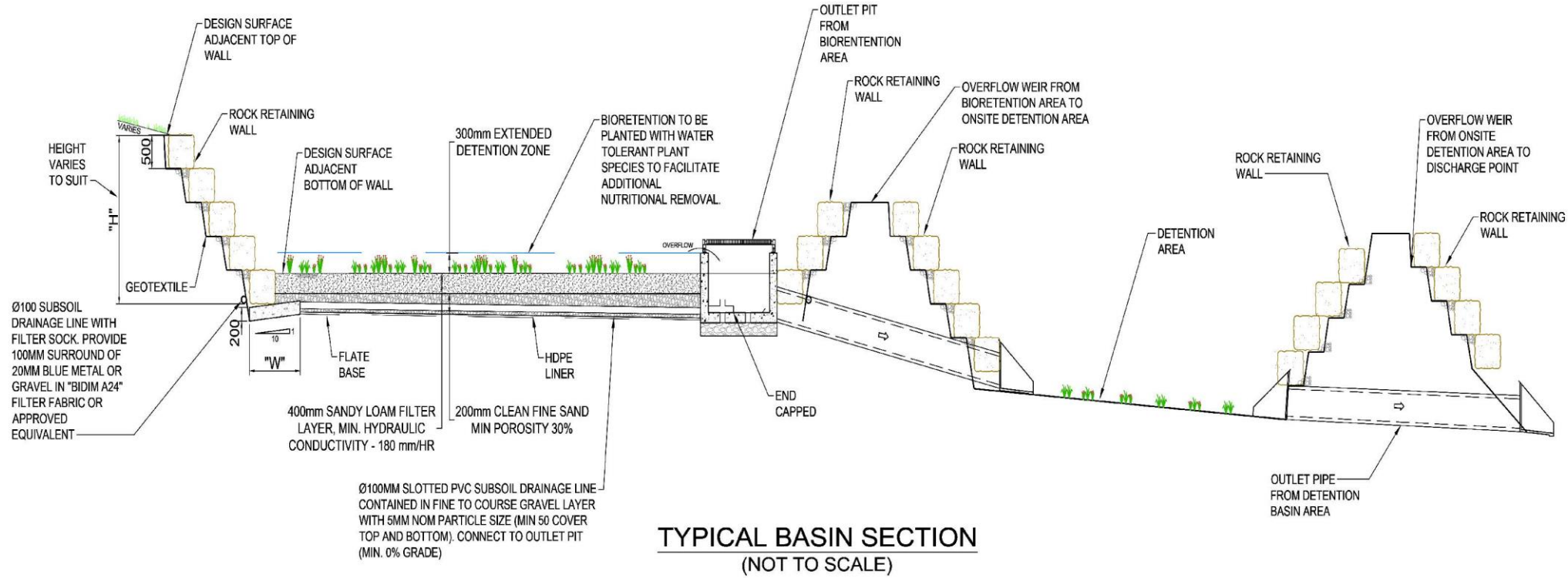


Figure 3-11: Water quality management process

Figure 3-12: Indicative treatment at basin outlet (source: Blue Mountains City Council)



TYPICAL BASIN SECTION
(NOT TO SCALE)

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Source: Aurecon

FIGURE 3-13: Typical basin cross-section

Bus facilities

There would be no changes to existing bus routes due to the proposal.

There are existing bus stops on the Great Western Highway at Bonnie Doon Reserve, Nellies Glen Road and Foy Avenue along the Katoomba to Medlow Bath section. These would be reinstated in slightly different locations to allow public and school bus services to continue to operate. This would include:

- the bus stop at Bonnie Doon Reserve would shift further west from its current location into a dedicated bus bay
- the bus stop opposite Nellies Glen Road would be relocated further north to be opposite Explorers Road on the service road
- the bus stop at Foy Avenue would remain on the western side of the intersection.

Reinstatement and installation of the bus stops would be undertaken in consultation with local bus operators.

There are no bus stops along the Medlow Bath to Blackheath section.

Active transport trail

There are many active transport trails and hiking routes that fall within or connect to the proposal area. The main one of these is the Great Blue Mountains Trail, which mostly follows the alignment of the Great Western Highway. The proposal would relocate, upgrade and connect with existing sections that make up the Great Blue Mountains Trail along the Katoomba to Medlow Bath section as well as provide a new publicly accessible trail in the Medlow Bath to Blackheath section. The sections of trail that are proposed or would be upgraded as part of the proposal as well as existing active transport links throughout the proposal area are shown in Figure 3-14a-b.

Active transport trails would also serve as a maintenance access trail to utilities, water quality basins, local streets and other walking trails in the area.

Along the Katoomba to Medlow Bath section:

- the existing active transport trail would start from the western end of Rowan Lane, Katoomba
- from Rowan Lane, a section of active transport trail would be upgraded along the Great Western Highway to Nellies Glen Road via the reinstated Bonnie Doon Reserve bus stop
- on Nellies Glen Road, the upgraded active transport trail would be able to access the heritage interpretation area via the new carpark, or continue on the existing Great Blue Mountains Trail diversion to Six Foot Track and Explorers Road
- north of the upgraded Great Western Highway / Explorers Road intersection, the existing active transport trail would be retained, with a short deviation around the western abutment of the bridges
- the existing active transport trail would continue for about 250 metres before joining a section of upgraded trail, allowing users to access the existing trail network along Foy Avenue
- west of the upgraded Great Western Highway / Foy Avenue intersection, an upgraded active transport trail, would traverse along the highway connecting into Bellevue Crescent, providing access to Medlow Bath.

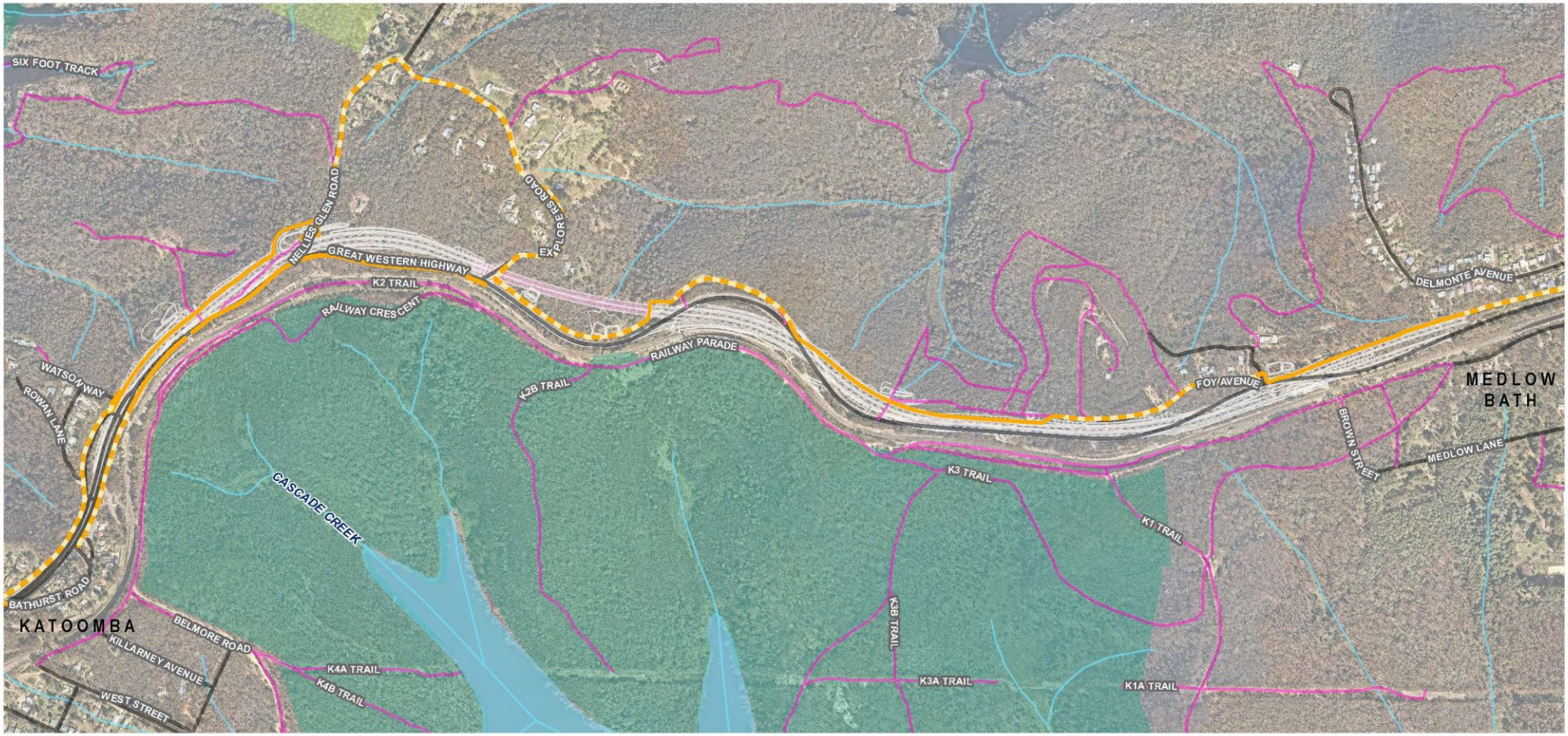
In addition, Transport are investigating further opportunities to connect a new section of active transport trail on the eastern side of the highway from Katoomba to Explorers Road. This would be between the road and rail corridors through to Explorers Road and provide improved grades for walking and cycling. Transport would continue to discuss this opportunity with stakeholders as the proposal progresses.

Along the Medlow Bath to Blackheath section:

- the proposal would provide a new length of active transport trail on the eastern side of the Great Western Highway connecting from the Medlow Bath Railway Station via Coachhouse Lane alongside the Blue Mountains National Park to Tennyson Road, Blackheath
- the future connection of the active transport trail would likely extend to Evans Lookout Road as part of the adjoining Blackheath to Little Hartley Upgrade
- this section would also serve as a maintenance access trail to utilities, water quality basins and the Blue Mountains National Park trails in the area

The proposal would not alter the existing Great Blue Mountains Trail along Station Street.

Upon completion of construction, this trail would provide uninterrupted pedestrian and cyclist access between Katoomba and Blackheath. The trail would be sealed with bitumen, asphalt or surfaced with concrete as appropriate along the length.



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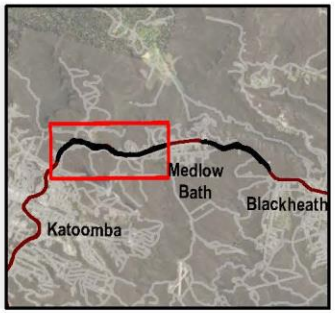
- The design
- Main road
- Track and path - existing
- Active transport trail - existing
- Active transport trail - upgraded
- Bridge
- Blue Mountains National Park
- Ngula Bulgarabang Regional Park



Source: Aurecon, Mott MacDonald, LPI, Nearmap

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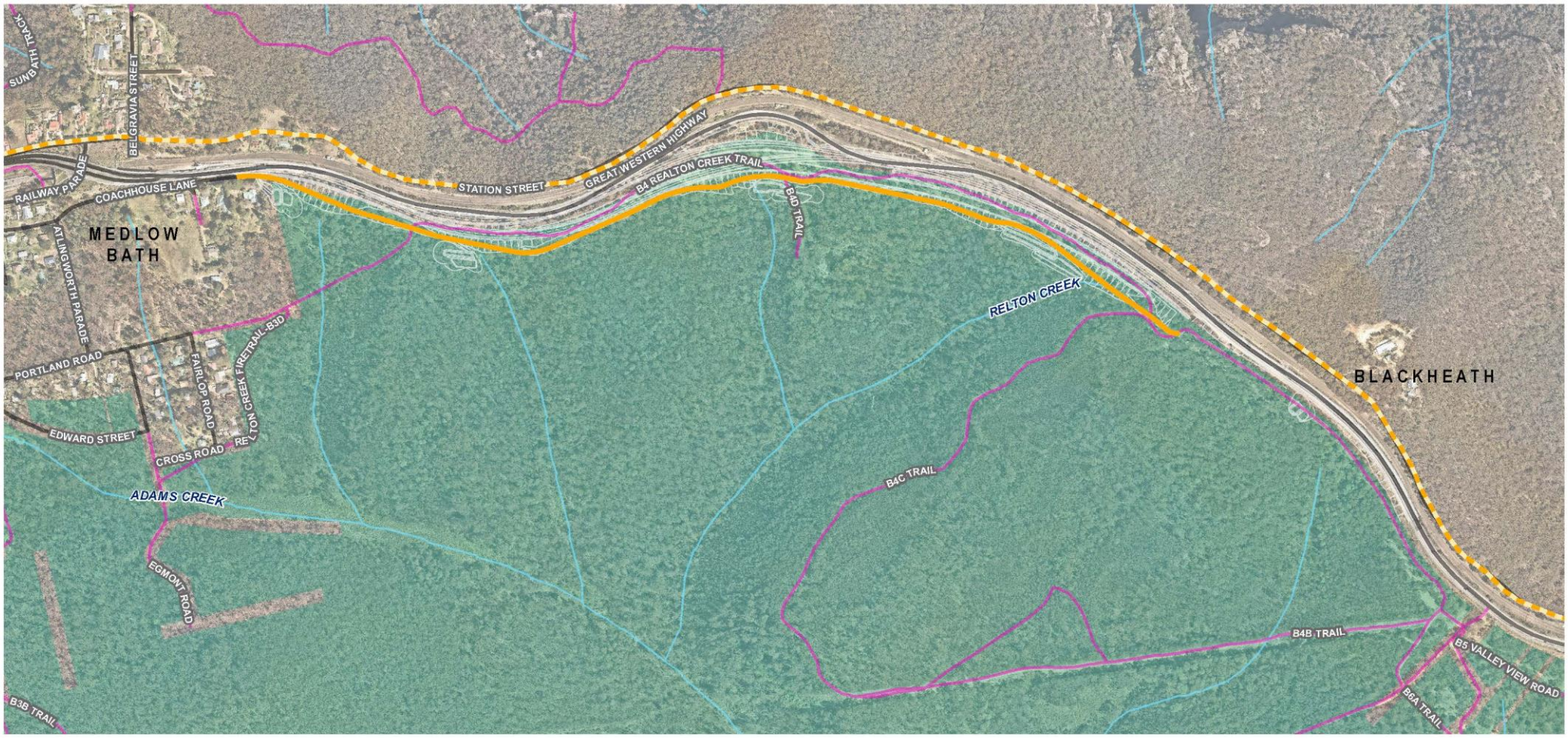
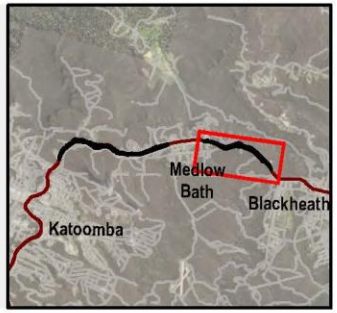
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-14a: Active transport links



The design
Main road
Track and path - existing
Active transport trail - existing
Active transport trail - upgraded
Blue Mountains National Park



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Source: Aurecon, Mott MacDonald, LPI, Nearmap

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-14b: Active transport links

Property access

Where the proposal would interrupt access to properties, all properties would be provided with restored or new permanent access arrangements. There are no privately owned residential properties with access directly onto the Great Western Highway. However, there are a number of uninhabited land holdings within the Katoomba to Medlow Bath section adjoining the highway with direct accesses that would be disrupted by the proposal. These would be reinstated in consultation with the relevant landowner.

There are a number of rail corridor access gates and access to rail infrastructure that would be re-established. Due to the separated median between the eastbound and westbound carriageways, access to the rail corridor would be left-in and left-out only from:

- the eastbound carriageway and new local service road in the Katoomba to Medlow Bath section
- the westbound carriageway in the Medlow Bath to Blackheath section.

A rail access strategy has been developed in consultation with Sydney Trains to maintain access to the rail corridor and to other rail assets.

Along the Medlow Bath to Blackheath section, the proposal would include a new trail that would be used for active transport and maintenance requirements. This trail would be within the road reserve, but would replicate an existing trail that currently is within the Blue Mountains National Park and is used for maintenance and emergency access. As such, this trail would retain this purpose and would provide access to other existing trails in the national park. This would be facilitated with gates in the national park fence line.

Some property acquisition would be required as part of the proposal, as outlined in Section 3.6.

Urban design and landscaping

An urban design and landscape strategy has been developed for the proposal from the urban design objectives and principles (refer to section 2.3.3).

The strategy includes urban design direction for elements including the proposed bridge location (Katoomba to Medlow Bath section only), retaining walls, exposed cut, fill embankments, bicycle and pedestrian connections and vegetation to be consolidated into the proposed design to maintain the existing character of the local area. The urban design and landscaping strategies implemented would be finalised during detailed design.

Refer to the Urban Design Concept, Landscape Character and Visual Impact Assessment Report attached to the REF as Appendix G for further detail.

Supporting infrastructure

The proposal would feature supporting road infrastructure, flag lighting at intersections, signage and street furniture, which would be confirmed during detailed design and likely include provision of:

- safety and median barriers, where required to protect vehicles, pedestrians and cyclists from hazards
- traffic control facilities and integrated transport systems (ITS) including traffic monitoring units, closed-circuit television cameras, variable message signage (VMS), variable speed limit signs, integrated speed and lane use signs, overheight vehicle detection and associated utilities
- guide, regulatory, tourism and warning signs for road users
- line marking along the road corridor and retroreflective raised pavement markers on all lane, edge and barrier lines
- roadside furniture, including fencing, to manage property access and allow safe use of active transport.

3.3 Construction

This section summarises the likely construction methodology, work hours, plant and equipment, and associated activities that would be used during construction of the proposal.

Construction of the proposal could commence in 2023 with early works, however the main construction is anticipated to commence from late 2024 and last for a period of about:

- 36 months for the Katoomba to Medlow Bath section
- 30 months for the Medlow Bath to Blackheath section.

3.3.1 Construction boundary

The construction boundary consists of the proposed road design as well as areas required for construction of the proposal. These include:

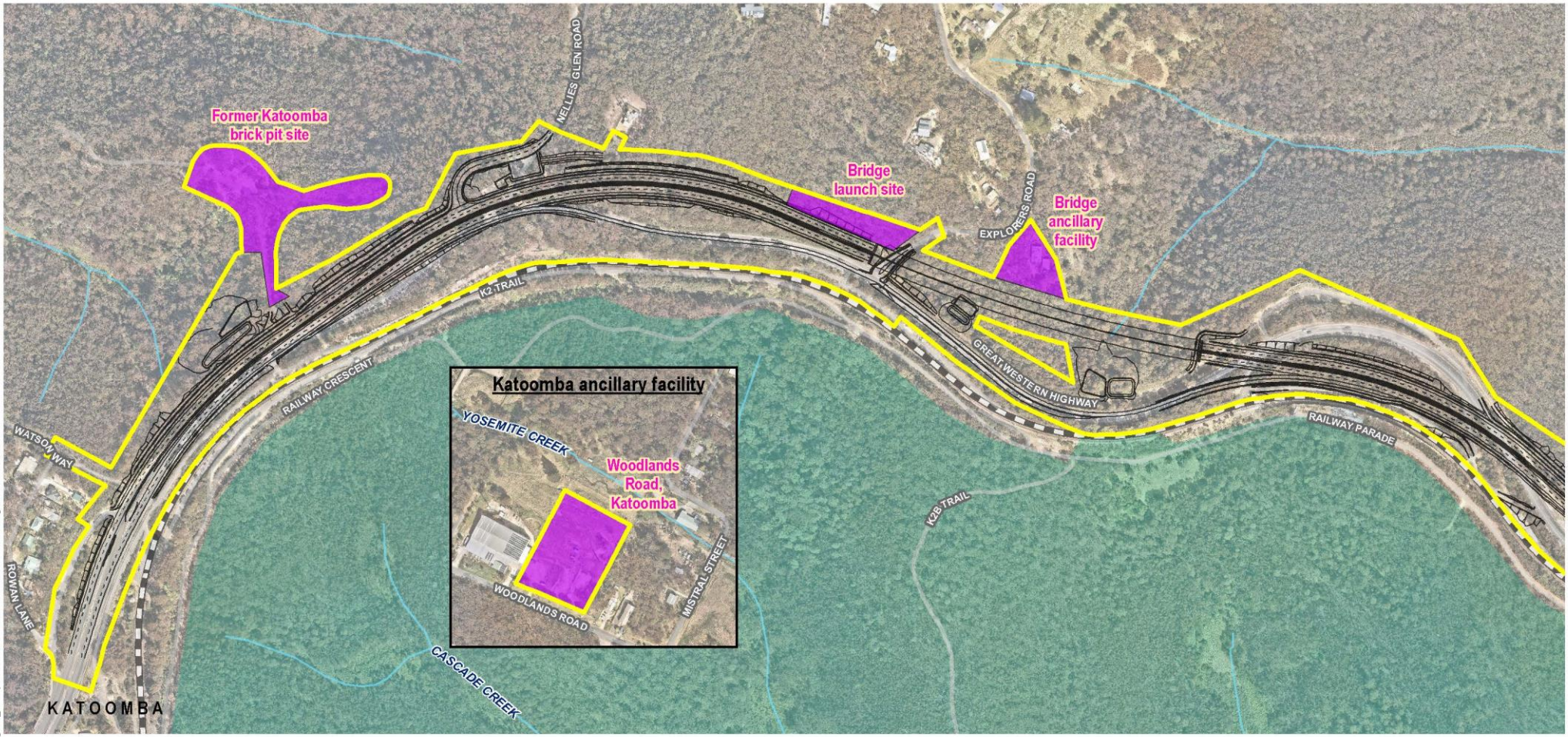
- ancillary facilities, including bridge launching sites for the Katoomba to Medlow Bath section and water quality treatment
- areas required for construction access
- typically, a 15-metre buffer around the road alignment, subject to environmental and engineering constraints.

The rail corridor was considered an engineering constraint and was avoided where possible, even if the distance was less than 15 metres.

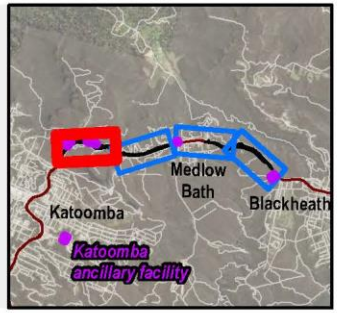
The construction boundary has been adopted as the proposal area in this REF to assess impacts of the proposal.

The proposed construction boundary is shown in Figure 3-15a-d and is indicative only. Construction work may occur anywhere within the construction boundary at the discretion of the construction contractor. It would be subject to refinement during detailed design and construction. The construction area and key construction features are detailed in the following sections.

Refer to section 3.4 for details on proposed ancillary facilities.



The design
Proposed construction boundary
Proposed ancillary facilities
Blue Mountains National Park
Main Western Railway



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Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

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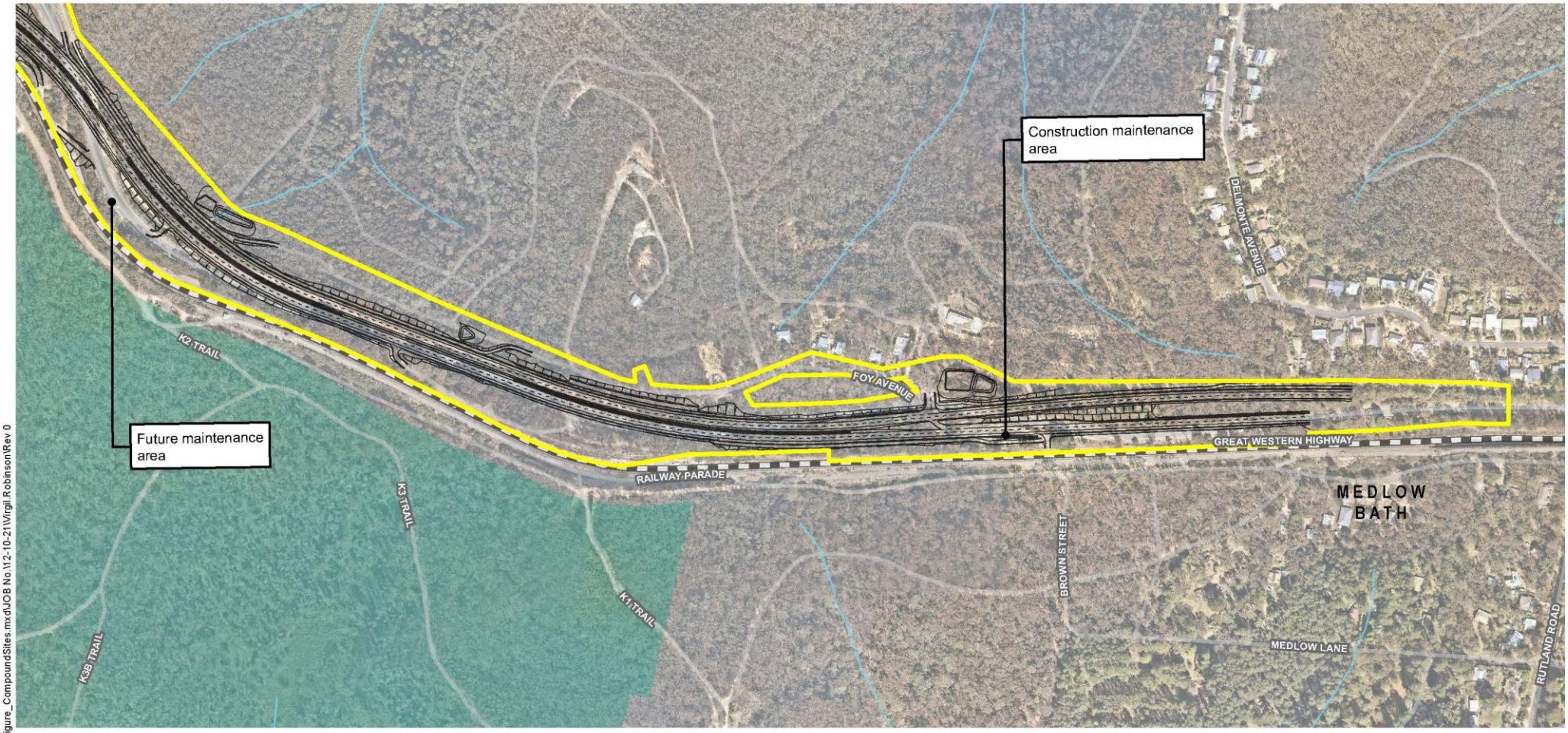
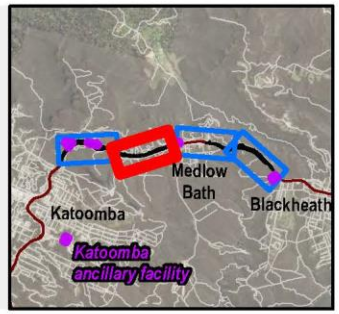
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-15a: Construction areas



The design
Proposed construction boundary
Blue Mountains National Park
Main Western Railway



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Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

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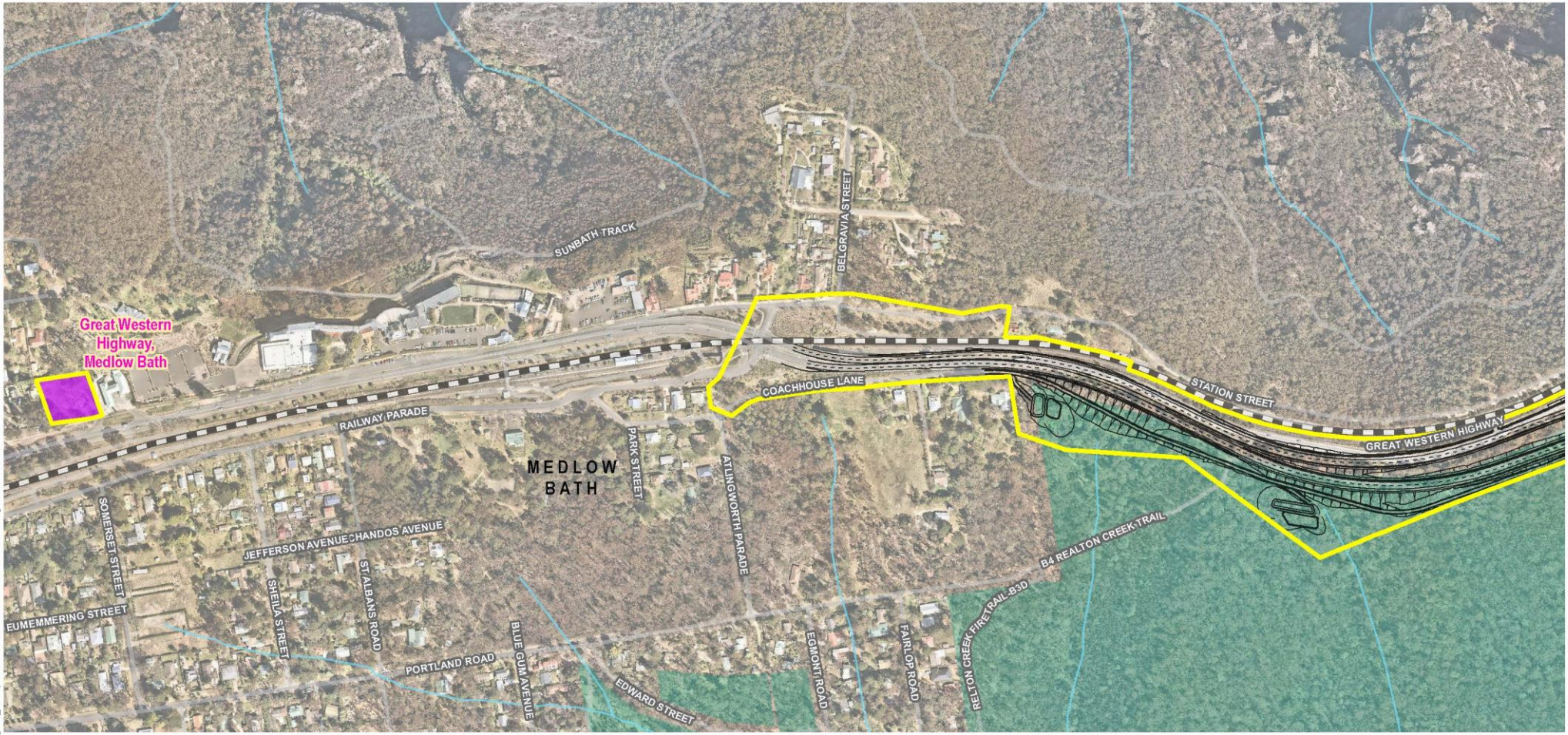
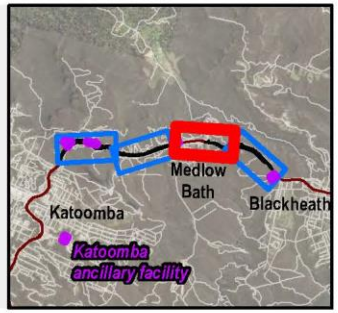
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-15b: Construction areas



The design
Proposed construction boundary
Proposed ancillary facilities
Blue Mountains National Park
Main Western Railway



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Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

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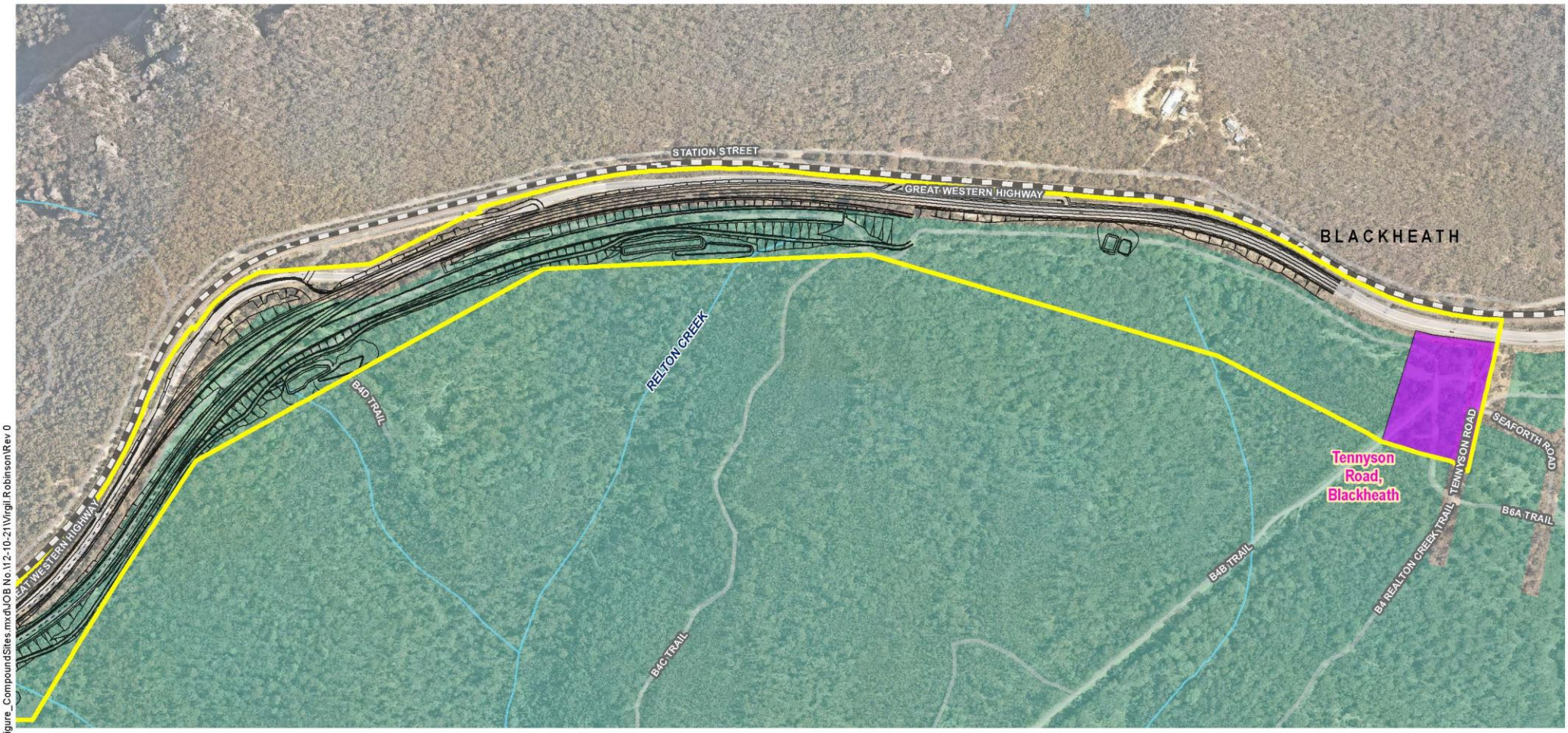
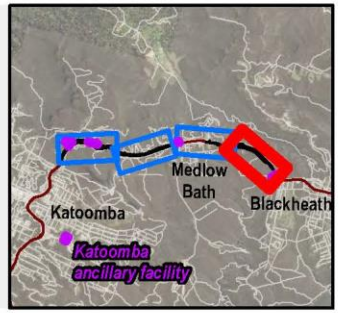
Projection: GDA2020 MGA Zone 56

FIGURE 3-15c: Construction areas



The design
Proposed construction boundary
Proposed ancillary facilities
Blue Mountains National Park
Main Western Railway



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Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-15d: Construction areas

3.3.2 Construction staging

The proposal forms part of the broader Great Western Highway Upgrade Program, which comprises a number of projects. Timing of the different projects may overlap. It is anticipated that there would be some overlap of construction activities between this proposal and the Medlow Bath Upgrade. A construction strategy is being considered across the Katoomba to Blackheath Upgrade and the Medlow Bath Upgrade to minimise construction impacts and impacts to the travelling public at Medlow Bath and across the Blue Mountains. Construction staging across the entire Great Western Highway Upgrade Program would be considered during detailed design and pre-construction to plan the construction sequencing of the projects.

The Medlow Bath Upgrade is anticipated to be the first project within the program to commence construction. Construction of the Medlow Bath Upgrade is anticipated to commence from late 2022 and is likely to still be under construction when the sections in the Katoomba to Blackheath Upgrade (this proposal) commence construction. This is staged to deliver access improvements in Medlow Bath as soon as possible. Construction of the two projects would be staged to minimise the impacts of multiple construction projects running in and around Medlow Bath at the same time.

While the sequencing of construction of the proposal has not yet been determined, the two sections of this proposal could be constructed concurrently. The design has maximised offline work to reduce impact on the Great Western Highway traffic. Early work would likely be considered across both sections for activities such as:

- utility relocations
- national park boundary establishment
- early installation of water quality devices.

3.3.3 Construction activities

The proposal is expected to involve the following general work sequence:

- site preparation
- site establishment
- utility relocations
- roadwork
- bridge and drainage work
- landscaping and finishing work.

The potential work activities for each stage are listed in Table 3-5. Construction activities would be carried out in accordance with a construction environmental management plan (CEMP) to ensure work complies with Transport's commitments and legislative requirements. Construction activities may be carried out in a staggered approach, with some overlap. Detailed work methodologies would be identified by the construction contractor. The work methodology may be modified or refined during detailed design due to engineering constraints or to minimise environmental impacts, including:

- onsite conditions identified during pre-construction activities
- ongoing refinement of the detailed design
- outcomes of community consultation, including submissions on the REF.

Construction activities would be carried out in accordance with a CEMP to ensure work complies with Transport's commitments and legislative requirements. Construction activities may be carried out in a staggered approach, with some overlap. Detailed work methodologies would be identified by the construction contractor.

Table 3-5: Potential pre-construction and construction activities

Stage	Activities	Katoomba to Medlow Bath section			Medlow Bath to Blackheath section		
		Duration (weeks)	Maximum daily deliveries (trucks)	Maximum daily workforce	Duration (weeks)	Maximum daily deliveries (trucks)	Maximum daily workforce
Site Preparation	• Clearing trees, mulching • Utility investigations • Potential removal of redundant utilities and relocation of existing ones	8	6	13	6	6	10
Site establishment	• Clearing and grubbing • Topsoil stripping • Hardstand construction • Utilities services • Material storage areas • Temporary security fencing • Temporary pedestrian fencing • Temporary access road to compound sites • Installation of water quality and sediment control measures • Temporary traffic control barriers, signage and lighting along the full length of the existing roadway in order to separate the construction site from passing traffic	6	15	35	6	15	30
Earthworks	• Embankment foundation treatments • Construction of the new fill embankments • Excavation of major cuttings	40	50	10	28	50	10
Roadwork	The work would be split into constructing the off-line carriageways first, before construction the second carriageway for each section (refer to Section 3.3.8). Road construction would include: • Removal and demolition of existing pavements • Embankment foundation treatments • Construction of the new embankment • Excavation of cuttings	40	20	75	28	14	50

Stage	Activities	Katoomba to Medlow Bath section			Medlow Bath to Blackheath section		
		Duration (weeks)	Maximum daily deliveries (trucks)	Maximum daily workforce	Duration (weeks)	Maximum daily deliveries (trucks)	Maximum daily workforce
	• Utility work typically including communications, power, gas, water and sewer (where necessary) along with ITS and TCS networks • Construction of the pavement layers including the subbase and asphalt layers • Retaining walls • Tie-ins to existing pavement at the eastern and western limits.						
Bridge work	• Bridge foundation piling, pile caps and piers, headstock and abutment construction • Casting of the twin bridges decks from a casting yard at the southern end of the bridge using stressing equipment and hydraulic jacks and sliding bearings for launching of the bridges	78	40	80	N/A – no bridge work in this section		
Drainage work	• Construction of larger transverse drainage structurers (box culverts) • Installation of drainage pit and pipe systems • Construction of the open drainage channels and permanent controls.	78	40	80	57	28	56
Finishing work	• Installation of sign structures including piling, concrete work and installation of overhead steel structure • Installation of road furniture (i.e. lighting, safety barriers and guideposts) • Pavement marking • Installation of urban design treatments and features • Landscaping work • Removal of all remaining temporary work such as traffic control barriers, ancillary facilities and lighting • Rehabilitation work will include batter protection and landscaping plus reinstatement of all disturbed areas.	8	25	40	8	19	28

3.3.4 Construction hours and duration

Proposed working hours

The standard working hours defined in the Interim Construction Noise Guideline (DECC, 2009) (ICNG) are:

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

It is acknowledged that in conjunction with the broader Great Western Highway upgrade program, there would be ongoing construction impacts to the local and regional community along the Great Western Highway for a decade or more. This would include amenity impacts, construction traffic and highway disruptions.

Extended working hours

To reduce the overall construction timeframe of the proposal to provide relief to the Blue Mountains community from a number of longer term construction projects, Transport for NSW is seeking approval for 'extended construction hours' for this proposal. This would provide additional work hours at the end of each day (Monday to Friday) and on Saturday afternoon outlining that maximum hours that could be worked. Extended construction hours would apply across the full length of the proposal and would be limited to daylight hours, with potentially shorter working periods throughout winter months. The proposed extended construction hours are:

- Monday to Friday: 6am to 7pm
- Saturday: 8am to 5pm
- Sunday and Public Holidays: no work.

Most construction work would be carried out within these proposed working hours. This would include:

- ancillary facility operation including stockpiling and general office duties
- removal and delivery of materials, plant, and equipment such as cranes
- establishment of temporary traffic management controls and facilities enabling traffic switches so that traffic flows can be maintained during construction
- earthworks, including haulage, placement, and compaction
- bridge structure works when launching the bridge deck
- piling driving and/or boring at bridges and retaining walls
- utility adjustments and relocations
- pavement and concrete finishing works.

The reasons for the proposed extension of hours, and for out-of-hours work, are presented in the following section.

Night work

Certain work may still need to occur outside these hours (known as night works) to minimise disruption to customers, pedestrians, road users and nearby sensitive receivers. Any night work would be undertaken in accordance with the Construction Noise and Vibration Guidelines (Roads and Maritime, 2016). Typically, specific work and activities that may be required to be undertaken out-of-hours would include:

- tie-in work at either end which would require some night-time work for asphalt paving to maintain safety of road users

- adjustment to line marking
- temporary safety barrier placement
- work in the rail corridor
- traffic switches and utility work to reduce inconvenience to road users, avoid traffic delays during daytime or peak traffic periods and to provide safety for construction workers working on the existing highway
- minor services adjustment
- ancillary facility operations required to support any activities which may occur out of hours
- concrete batch plant operations.

A concrete batch plant is proposed to be located at the Woodlands Road, Katoomba ancillary facility (refer to Section 3.4). To provide concrete, the batch plant would need to operate 1.5 hours before and one hour after the proposed construction work hours.

Justification for the extended working hours

Transport is investigating opportunities for longer standard construction hours for the proposal to complete the construction of the proposal sooner to allow relief from construction for the travelling public and local communities from the construction activities. In particular, this is due to the construction that would be occurring for the Great Western Highway Upgrade Program between Katoomba and Lithgow for up to nine years which would result in construction and consultation fatigue to communities along the Great Western Highway.

By extending standard working hours by two hours every day and four hours on a Saturday, this would:

- reduce the volume of traffic on the roads during peak hours due to construction staff and some construction vehicles travelling to and from the work site outside peak traffic periods
- potentially bring forward the opening date for the proposal and minimising overlapping construction timeframes for different Great Western Highway Upgrade Program projects
- cause less traffic disruption and noise and visual amenity impacts to the community, local business, motorists, pedestrians and cyclists as work would be completed earlier than currently predicted
- provide a safer road and active transport network earlier than planned.

Longer working days would result in a direct increase in productivity across the proposal, making maximum and most efficient use of existing equipment and resources. This would result in a safer work environment and a more attractive employment proposition.

The proposed extended construction working hours would be unlikely to result in significant impacts on the amenity of affected sensitive receivers. This is because of the location of the proposal in a mostly sparsely populated area. In particular, through the Medlow Bath to Blackheath section, sensitive receivers that would be impacted by amenity are located at the northern end of Medlow Bath, with no receivers located along the remaining length.

The implementation of management measures identified in Chapter 7 would make sure impacts were limited, including for sensitive receivers near Katoomba and Medlow Bath.

The proposed construction hours and consideration of the effects would be discussed with the community and potentially affected receivers before construction. The assessment of construction noise is presented in Section 6.6.4.

Consultation proposed for the extended working hours

Section 2.3 of the ICNG indicates construction activities are permissible outside of standard hours for “public infrastructure works that shorten the length of the project and are supported by the affected

community". Community consultation would be required for extended working hours in line with guidance from the ICNG. This consultation would occur during the public display of this REF.

The community consultation would include:

- Identification of receivers potentially impacted by construction activities through the construction noise assessment (refer to Section 6.6.4). Impacts would be based on predicted noise impacts from the adopted extended working hours.
- Notification of identified receivers by mail of the proposed hours, including request for comment and feedback. This would include justification for the proposed extended working hours along with the benefits the community can expect.
- Individual interviews or public meetings to address any further issues where the community or individual residents request further clarification on the proposed hours. Discussions would be sufficiently detailed to provide a general summary of the expected impacts and an explanation of how the proposed working hours relate to individual receivers.
- Provision of complaints management procedures which would be in place during the work to property owners.

While community consultation would be ongoing, feedback received during this consultation period would inform the final adopted working hours for the proposal.

3.3.5 Plant and equipment

The plant and equipment which would be used construction of both sections of the proposal includes:

- water trucks, street sweepers, road saws, rollers, road saws, trench compactors, concrete trucks, semi-trailers and spoil trucks (truck and dog)
- welding equipment, air compressors, concrete saws, generators, concrete vibrators, concrete pumps, jack hammer
- excavators (8-30 tonnes)
- asphalt pavers
- asphalting equipment
- cranes of various sizes up to 250 tonnes
- articulated dump trucks (Moxy), scrapers, excavators to 60T, D10/D11 dozers and crusher for the conveyor feed
- batch plant equipment (subject to detailed design) and related heavy machinery.

The plant and equipment which would be used only as part of the Katoomba to Medlow Bath section to construct the twin bridges includes:

- over-road conveyor for transportation of excavation material from a major cutting north of the bridge site to fill embankment on the other side of the road
- stressing and hydraulic jacking equipment required for the twin bridges construction.

3.3.6 Earthworks

A range of earthworks would be required for the proposal. This would involve fill embankments and cut embankments, shown on Figure 3-1a-f and Figure 3-2a-e. Where there are spatial or environmental constraints, retaining walls would be used to minimise the impact footprint. These would support the widened road carriageways over the steeply sloping terrain across the length of the proposal.

The Katoomba to Medlow Bath section would result in about 272,000 cubic metres of cut material, with about 124,000 cubic metres being reused in this section as fill material. Some of the cut material is

anticipated to be considered unsuitable for use in road construction and, where possible, this material would be used in landscaping mounds along the proposal.

The Medlow Bath to Blackheath section would result in about 61,000 cubic metres of cut material, all being reused in this section as fill material. However, there would still be a shortfall of material required in this section. Additional cut material (around 63,000 cubic metres) would be transported from the Katoomba to Medlow Bath section for reuse as fill.

Geotechnical investigations conducted have identified that Banks Wall Sandstone cut during construction would be suitable for use as fill in retaining walls within the Katoomba to Medlow Bath section. Further investigations would be carried out during detailed design to determine suitability for cut material to be used in retaining walls within the Medlow Bath to Blackheath section.

Surplus material that cannot be used on-site or on adjacent projects would be classified in accordance with the *NSW EPA Waste Classification Guidelines* (EPA, 2014) and disposed of at an approved materials recycling or waste disposal facility. Transport are also reviewing old quarry and mining sites in the area that may be suited to filling with excavated natural material to remediate these areas.

Details of the cuts and fills required for the proposal are outlined in Table 3-6. The final earthwork requirements and source of materials would be confirmed during detail design.

Table 3-6: Earthworks

Feature	Description	Katoomba to Medlow Bath section location	Medlow Bath to Blackheath section location
Cuts	Where the depth of excavation for the road pavement extends below the top of rock level, vertical or near vertical cut rock faces would be constructed. The residual soil/fill would typically be cut at a slope between 2V:3H and 1V:2H.	• Ch 300-370 • Ch 550-750 • Ch 830-1090 • Ch 1620-1900 (two cuts at this location) • Ch 2480-2750 (two cuts at this location) • Ch 3300-3560	• Ch 5340-5420 • Ch 5436-5485 • Ch 6370-6650
Fills	Where the new road alignment sits above the existing ground levels, built up fill retaining walls would be required. Reinforced soil wall construction would be the recommended option where possible along the proposal. Retaining walls would be up to 17 metres in height for the Katoomba to Medlow Bath section.	• Ch 325-552 • Ch 774-837 • Ch 1100-1197 (two fills at this location) • Ch 1624-1653 • Ch 1926-2200 • Ch 2777-3008 • Ch 3120-3300 • Ch 3386-3556	• Ch 4730-4830 • Ch 4820-5080 • Ch 5170-5270 (two fills at this location) • Ch 5790-6013 • Ch 6100-6234 • Ch 6140-6423

3.3.7 Source and quantity of materials

About 76,000 cubic metres of asphalt would be required for the proposal. In-situ concrete would also be required for the proposal, including for the twin bridges, Type F safety barriers, twin rail barriers, kerbs, active transport trails and the foundation for signs, VMS and ITS gantries.

Materials would be sourced from appropriately licensed commercial suppliers in nearby areas. None of the materials proposed to be used are considered to be in short supply. However, a concrete batching plant may be set up by the contractor to supply the proposal. On-site production of concrete would allow for project control over the quality, quantity and timing of concrete material for construction activities. It would also reduce the time required to transport concrete from its production to its use, which may result in a

higher quality product and reduce the number of heavy vehicles required on the wider road network. New concrete technologies would be considered in aid of avoiding acidic runoff into the surrounding environment.

Surplus material that cannot be used on-site or on adjacent projects would be classified in accordance with the *NSW EPA Waste Classification Guidelines* (EPA, 2014) and disposed of at an approved materials recycling or waste disposal facility.

The amount of water that would be required during construction is unknown at this stage. The amount would depend on material sources and methodologies applied by the contractor. Water would be obtained from the town water supply.

3.3.8 Traffic management and access

Construction traffic

Construction of the proposal would generate light and heavy vehicle movements. Vehicle movements would mainly be associated with:

- delivery of construction materials including concrete and precast structural elements
- spoil removal
- importation of fill material for earthworks
- delivery and removal of construction equipment and machinery
- workers travelling to, from and within the construction site.

Construction traffic impacts are assessed in Section 6.7.4.

Temporary traffic management and controls

The construction of the proposal would be staged to allow the Great Western Highway to remain open to traffic during construction. Construction of the off-line carriageways[1] would occur first, including the construction of the twin bridges within the Katoomba to Medlow Bath section, while traffic remains on the existing highway. Once complete, the traffic would be switched onto the new carriageways while the second carriageway for each section is completed and redundant pavement removed. The upgraded sections would then be opened to traffic.

Construction vehicles and plant would use the Great Western Highway to reach the construction sites. Most heavy vehicle access to construction sites and egress would be provided via slip lanes and/or side roads. The two local roads which would be used by heavy vehicles would be Explorers Road, Katoomba and Evans Lookout Road, Blackheath to access ancillary facilities on these roads (refer to Section 3.4).

In most cases, the construction would be undertaken away from live traffic, however, where work is required in proximity to live traffic, work zones would be created behind safety barriers where construction work can be completed safely and during standard construction working hours, to avoid the need for lane closures. During construction, when workers or construction zones are close to traffic, speed limits may be reduced during construction to:

- 60 kilometres per hour on the Great Western Highway

[1] For the Katoomba to Medlow Bath section, the off-line carriageway would be the westbound carriageway. For the Medlow Bath to Blackheath section, the off-line carriageway would be the eastbound carriageway.

- 40 kilometres per hour on side roads.

Where this is not practical (particularly during tie-in work), construction work would be undertaken out of peak traffic periods using temporary traffic management arrangements, such as night-time and weekend lane closures, and relevant traffic controls.

There are few properties with direct access to the Great Western Highway within the proposal area. These are mainly Sydney Trains property and asset accesses or to recreational areas, including the Blue Mountains National Park (within the Medlow Bath to Blackheath section). Access to these properties would be maintained throughout construction by providing temporary or escorted property access where required.

There would be temporary closure of Nellies Glen Road and Explorers Road during construction of the Katoomba to Medlow Bath section. However, these roads would not be closed concurrently and, because they are connected, access would be maintained to properties on these roads. Explorers Road would be temporarily closed once Nellies Glen Road has been upgraded. During this temporary closure, the upgraded Nellies Glen Road intersection would provide both left-in and left-out access to and from Explorers Road. Access would also be maintained to other local roads during construction.

Bus stops on Great Western Highway (at Bonnie Doon Reserve and Foy Avenue) would be temporarily relocated or closed during construction. Any proposed relocations or closures would be confirmed pre-construction in consultation with bus companies.

Part of the Great Blue Mountains Trail within the Katoomba to Medlow Bath section near Bonnie Doon Reserve and Nellies Glen Road would be temporarily closed during construction off the off-line carriageway.

Section 6.6 provides a more detailed assessment of traffic and transport impacts.

3.4 Ancillary facilities

A range of ancillary facilities would be required to support construction, including:

- site compounds that incorporate site offices, car parking, sheds, workshops and storage
- areas for the delivery and storage of bridge structural elements
- bridge launching site (Katoomba to Medlow Bath section only)
- a concrete batch plant
- areas for capturing and treating water from construction areas
- stockpile sites for materials, spoil and mulch
- demolition compound for processing components of the demolished bridge.

Six potential ancillary facilities have been identified that could be used by construction contractors. These sites were identified in areas that maximised the use of existing infrastructure, buildings and / or vacant land. These facilities are at:

- Woodlands Road, Katoomba
- Former Katoomba brick pit site
- Bridge launch site, on Explorers Road
- Bridge ancillary facility, on Explorers Road
- Great Western Highway, Medlow Bath
- Tennyson Road, Blackheath.

Initial work at these sites would be required at the start of construction, and could include vegetation clearing, installation of environmental controls, construction of hardstand areas and access roads and provision of additional or augmented utilities and services (where required).

These ancillary facilities are further described in Table 3-7 and evaluated against the ancillary facility assessment criteria in Table 3-8. The sites and surrounding environmental features are shown in Figure 3-15a-d (refer to Section 3.3.1). Sites that are not located on Transport-owned property would be acquired or leased during construction pending agreement between the landowner and Transport.

Table 3-7: Proposed ancillary facilities

Ancillary facility	Description
Woodlands Road, Katoomba	The potential uses for the Woodlands Road ancillary facility include: • a concrete batching plant • bulk material storage • construction worker parking and site offices.
Former Katoomba brick pit site	The potential uses for the former Katoomba brick pit site include: • construction worker parking • a main site office • cut spoil material management and rehabilitation. For the Stage 2 work, a secondary site would be established along the old highway for overnight parking of a construction plant plus construction worker amenities and parking facilities.
Bridge launch site, on Explorers Road	To incrementally launch the new twin bridges within the Katoomba to Medlow Bath section, a launching facility would also need to be constructed on Explorers Road. The launching facility would include: • a casting bed – including an adjustable formwork mould for casting segments, laydown area and various small plant (e.g. concrete pumps) • a launch pad – including a paved area, various supports and guides to hold the superstructure and hydraulic jacks • other minor ancillary features – including concrete truck receival area.
Bridge ancillary facility, on Explorers Road	The bridge ancillary facility would support the construction activities at the bridge launch site within the Katoomba to Medlow Bath section. The potential uses for the bridge ancillary facilities include: • construction worker parking • material storage and laydown areas • bridge engineer site offices.
Great Western Highway, Medlow Bath	The ancillary facility on the Great Western Highway in Medlow Bath would be a community information facility and office. This would cater for a small number of staff only and minimal off-street parking. The ancillary facility would be established as part of the Medlow Bath Upgrade. This facility would be reused for the purpose of this proposal. As it will have already been established and assessed as part of the Medlow Bath Upgrade, it is not assessed in Table 3-8.
Tennyson Road, Blackheath	The potential uses for the Blackheath site include: • construction worker parking • bulk material storage and laydown area • a main site office. Once constructed, the off-line eastbound and westbound stubs which are designed to connect to eventually connect to the Blackheath to Little Hartley Upgrade may be able to be used to access this ancillary facility.

Table 3-8: Ancillary facility assessment

Criteria	Woodlands Road, Katoomba	Former Katoomba brick pit site	Bridge launch site	Bridge ancillary facility	Evans Lookout Road, Blackheath
Operational during a flood event and avoid or minimise impacts to surrounding properties	Yes	Yes	Yes	Yes	Yes
More than 40 metres from a watercourse	Yes	Yes	Yes	Yes	Yes
At least 100 metres from residential dwellings	Yes	Yes	No	No	Yes
In an area of low ecological value	Yes – site cleared	Yes – however, vegetation clearance may be required for site access	Yes – however, vegetation clearance required	Yes – however, vegetation clearance restricted due to nearby Blue Mountains Swamp TEC	No – currently part of Blue Mountains National Park
In plain view of the public to deter theft and illegal dumping	Yes – the property has street frontage within an industrial area	No – set back from the Great Western Highway and secluded by existing vegetation	No – set back from Explorers Road and secluded by existing vegetation	No – set back from Explorers Road and Great Western Highway and secluded by existing vegetation	Yes – visible from the Great Western Highway
Outside the drip line of trees	Yes	Yes	No – currently vegetated	No – currently vegetated	No – currently vegetated
On relatively level ground	Yes – the part of the property identified to be used as an ancillary facility is level, however there is a steep decline at the rear of the property	Yes	Partially	Partially	Yes
Away from areas of heritage value	Yes	No – lies within Bonnie Doon Reserve (local heritage listing)	No – lies within Pulpit Hill and Environs (local heritage listing)	Yes	Yes

As outlined in Section 3.3.8, the off-line carriageways (the westbound carriageway for the Katoomba to Medlow Bath section and the eastbound carriageway for the Medlow Bath to Blackheath section) would be constructed first. Once these new carriageways are constructed, they would be used in a contraflow operation. At this time, the existing Great Western Highway road corridor would be closed to traffic for construction. During this phase of construction, there may be additional smaller ancillary facilities or storage

areas established along the existing road corridor within the proposal area for activities including parking construction plant.

Should the need for additional or alternative ancillary facilities be identified during detailed design and construction planning, the positioning of additional or alternative sites would be undertaken in consideration of the site assessment criteria outlined in Table 3-8. The construction contractor would consult with the Transport Senior Environment Officer to confirm the suitability of any additional ancillary facilities and whether any additional environmental controls or assessment are required.

3.5 Public utility adjustment

Public utility adjustments and relocations would be required for the proposal. The list of relocations and adjustments required are detailed in Table 3-9. This would include:

- electricity supply
- telecommunications
- mains water.

While some impacted utilities are located adjacent to the rail corridor in both sections, utility relocations and adjustments along the Great Western Highway would largely occur on the side of each section where the new carriageway would be built.

Other utilities identified within the proposal area would be protected during construction of the proposal. Further work during detailed design may result in changes to the required relocations and adjustments. All utility adjustments or relocations would be finalised in consultation with utility providers during detailed design.

Table 3-9: Utilities impacted by the proposal

Section	Utility type and provider	Service type	Location	Requirement
Katoomba to Medlow Bath section	Electricity supply (Endeavour Energy)	11kV overhead high voltage transmission line, including poles	Great Western Highway at: • Ch240-1240 • Ch1560-660 • Ch1900-2720 • Ch3090-3460	Relocation required
		Electrical supply to rail building	Great Western Highway, west of Explorers Road, at Ch1560	Relocation required
		Electrical supply to potential mobile tower	Eastern end of Foy Avenue, at Ch2640	Relocation required
	Telecommunications (Telstra)	Aerial coaxial cable	Great Western Highway between Rowan Lane and Nellies Glen Road	Relocation required
			Great Western Highway between Foy Avenue and Delmonte Avenue	Relocation required
		Conduit (P100)	Great Western Highway / Explorers Road intersection	Further investigations to determine whether relocation is required
Medlow Bath to Blackheath section	Electricity supply (Endeavour Energy)	11kV overhead high voltage transmission line, including poles	Great Western Highway at: • Ch4800 • Ch4880-6889	Relocation required

Section	Utility type and provider	Service type	Location	Requirement
	Electricity supply within the rail and road corridors (Transport for NSW)	Rail 11kV overhead and underground high voltage transmission network	Rail corridor near Coachhouse Lane	Relocation required
		Light columns	Great Western Highway near Coachhouse Lane	Relocation required
	Telecommunications (Telstra)	Conduit (P100)	Great Western Highway between Coachhouse Lane (Ch4850) and Ch6270	Relocation required
	Telecommunications (Optus)	Optic fibre	Western end of Coachhouse Lane	Further investigations to determine whether relocation is required
	Water (Sydney Water)	Water main (200-250)	Western end of Coachhouse Lane	Relocation required
		Water main (DN300 DICL)	Great Western Highway between Ch5150 and Ch6610	Relocation required
Both sections of the proposal	Telecommunications (Telstra)	Direct buried cable	Great Western Highway	N/A – cable is redundant
	Water (Sydney Water)	Water main (DN150 AC)	Great Western Highway	N/A – disconnected water main

3.6 Property acquisition

3.6.1 Katoomba to Medlow Bath section

The Katoomba to Medlow Bath section would require the acquisition and leasing of both public and private land, as shown in Table 3-10 and Figure 3-16a-b. Acquisition would include:

- 21 properties to be fully acquired
- 15 properties to be partially acquired.

The extent of property acquisition would be refined and confirmed during detailed design in consultation with the property owners. Property acquisition would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Property adjustment plans would be developed in consultation with the relevant property owner.

In addition, there are a number of properties that would be partially or fully leased for construction activities. These include properties that would be used as ancillary facilities. Leased land would be rehabilitated and returned to the property owner once the construction of the proposal is completed.

The Katoomba to Medlow Bath section would also require the use of public land already owned by Transport, which is shown in Figure 3-16a-b only.

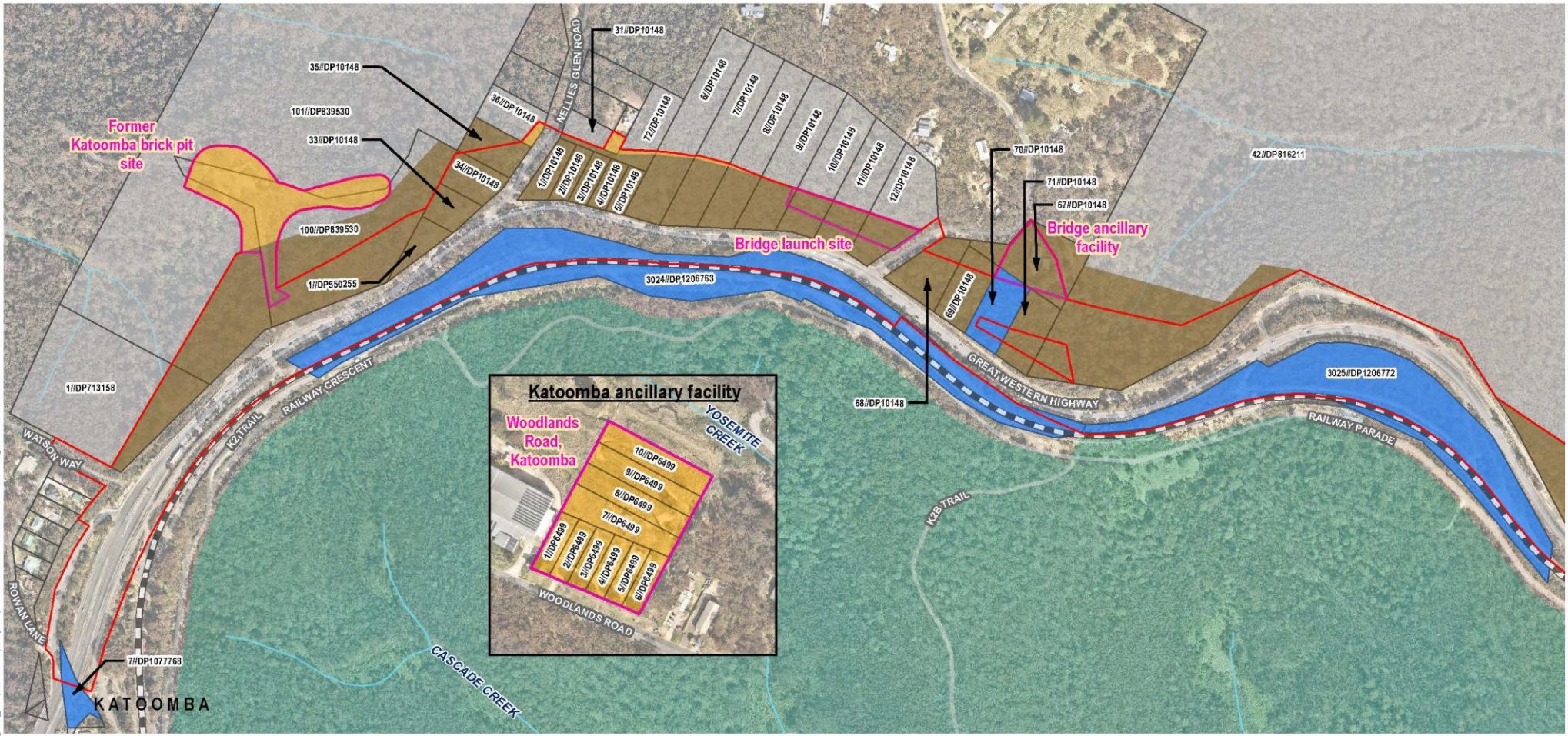
Table 3-10: Proposed property acquisition and leases – Katoomba to Medlow Bath section

Lot and DP	Total property area (square metres)	Acquisition area (square metres)	Lease area (square metres)	Type of Acquisition or lease	Current owner	Land use zone (LEP)[1]
Lot 1 DP10148	1700	1700	0	Full acquisition	Blue Mountains City Council (BMCC)	C2, SP2
Lot 2 DP10148	1250	1250	0	Full acquisition	BMCC	C2, SP2
Lot 3 DP10148	1200	1200	0	Full acquisition	BMCC	C2, SP2
Lot 4 DP10148	1100	1100	0	Full acquisition	BMCC	C2, SP2
Lot 5 DP10148	1050	1050	0	Full acquisition	BMCC	C2, SP2
Lot 6 DP10148	8750	3000	150	Partial acquisition and lease	BMCC	C2, SP2
Lot 7 DP10148	7650	2800	150	Partial acquisition and lease	BMCC	C2, SP2
Lot 8 DP10148	7000	2450	50	Partial acquisition and lease	BMCC	C2, SP2
Lot 9 DP10148	7100	2300	0	Partial acquisition and lease	BMCC	C2, SP2
Lot 10 DP10148	6250	1900	0	Partial acquisition and lease	BMCC	C2, SP2
Lot 11 DP10148	5600	1850	0	Partial acquisition	BMCC	C2, SP2
Lot 12 DP10148	6500	2200	0	Partial acquisition	BMCC	C2, C3, SP2
Lot 31 DP10148	1600	0	350	Lease	BMCC	C2, SP2
Lot 33 DP10148	1800	1800	0	Full acquisition	BMCC	C2, SP2
Lot 34 DP10148	2400	2400	0	Full acquisition	BMCC	C2, SP2
Lot 35 DP10148	2650	2650	0	Full acquisition	BMCC	C2
Lot 36 DP10148	2800	0	300	Lease	BMCC	C2
Lot 67 DP10148	5850	5850	0	Full acquisition	Private	C2, C3
Lot 68 DP10148	3550	3550	0	Full acquisition	BMCC	C3, SP2
Lot 69 DP10148	3200	3200	0	Full acquisition	Private	C3, SP2
Lot 71 DP10148	3200	3200	0	Full acquisition	Private	C2, C3, SP2
Lot 72 DP10148	3650	900	200	Partial acquisition and lease	BMCC	C2
Lot 1 DP116050	3500	0	3500	Lease	Private	IN 1
Lot 219 DP1211208	200	200	0	Full acquisition	BMCC	SP2
Lot 220 DP1211208	200	200	0	Full acquisition	BMCC	SP2
Lot 208 DP1218075	700	700	0	Full acquisition	The State of NSW	SP2
Lot 11 DP16634[2]	998	998	0	Full acquisition	Private	C4, SP2
Lot 15 DP16634[2]	996	996	0	Full acquisition	Private	C4, SP2
Lot 16 DP16634[2]	1006	91	0	Partial acquisition	Private	C4, SP2
Lot 26 DP16634[2]	1011	135	0	Partial acquisition	Private	C4, SP2
Lot 1 DP550255	1500	1500	0	Full acquisition	BMCC	C2, SP2
Lot 1 DP6499	900	0	900	Lease	Private	IN 1
Lot 2 DP6499	900	0	900	Lease	Private	IN 1
Lot 3 DP6499	900	0	900	Lease	Private	IN 1
Lot 4 DP6499	900	0	900	Lease	Private	IN 1

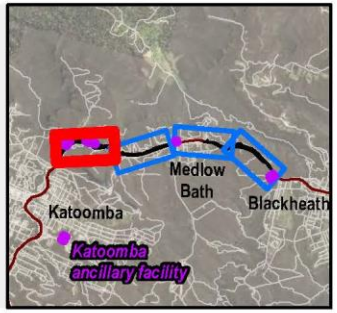
Lot and DP	Total property area (square metres)	Acquisition area (square metres)	Lease area (square metres)	Type of Acquisition or lease	Current owner	Land use zone (LEP)[1]
Lot 5 DP6499	900	0	900	Lease	Private	IN 1
Lot 6 DP6499	900	0	900	Lease	Private	IN 1
Lot 7 DP6499	2300	0	2300	Lease	Private	IN 1
Lot 8 DP6499	2050	0	2050	Lease	Private	IN 1
Lot 9 DP6499	2050	0	2050	Lease	Private	IN 1
Lot 10 DP6499	2050	0	2050	Lease	Private	IN 1
Lot 1 DP713158	20350	3700	0	Partial acquisition	BMCC	C2, C4, SP2
Lot 11 DP732317	153,000	5400	3200	Partial acquisition and lease	Private	C2, C3, SP2
Lot 13 DP732317	9300	9300	0	Full acquisition	Private	C3, SP2
Lot 178 DP751657	2000	2000	0	Full acquisition	The State of NSW	SP2, SP2
Lot 215 DP751657	1450	1450	0	Full acquisition	The State of NSW	SP2
Lot 42 DP816211	1,503,050	31,150	0	Partial acquisition	Private	C2, C3, SP2
Lot 100 DP839530	24200	15,700	5650	Partial acquisition and lease	Minister administering the EP&A Act 1979	C2, SP2
Lot 101 DP839530	123,950	7950	4650	Partial acquisition and lease	Minister administering the EP&A Act 1979	C2, SP2

Note 1: C2 Environmental Conservation; C3 Environmental Management; C4 Environmental Living; IN1 General Industrial; SP2 Infrastructure.
Note 2: Disclaimer: Property boundaries shown on Figure 3-16b for Lot 11 DP16634, Lot 15 DP16634, Lot 16 DP16634 and Lot 26 DP16634 are indicative only and are based on detailed Land Title searches. Further survey will be carried out to confirm these boundaries.

The Katoomba to Medlow Bath section is within an area covered by the Deerubbin Local Aboriginal Land Council. There are no Native Title claims on any land within this section. However, the section would require full property acquisition of Lot 215 DP751657 (1447 square metres of Crown land) which is subject to an Aboriginal land claim which has not yet been determined. Transport would continue to consult with the Deerubbin Local Aboriginal Land Council and Crown Lands during detailed design about this impact.



Proposal area
Proposed ancillary facilities
Area subject to lease
Area subject to acquisition
Transport owned land
Blue Mountains National Park
Main Western Railway



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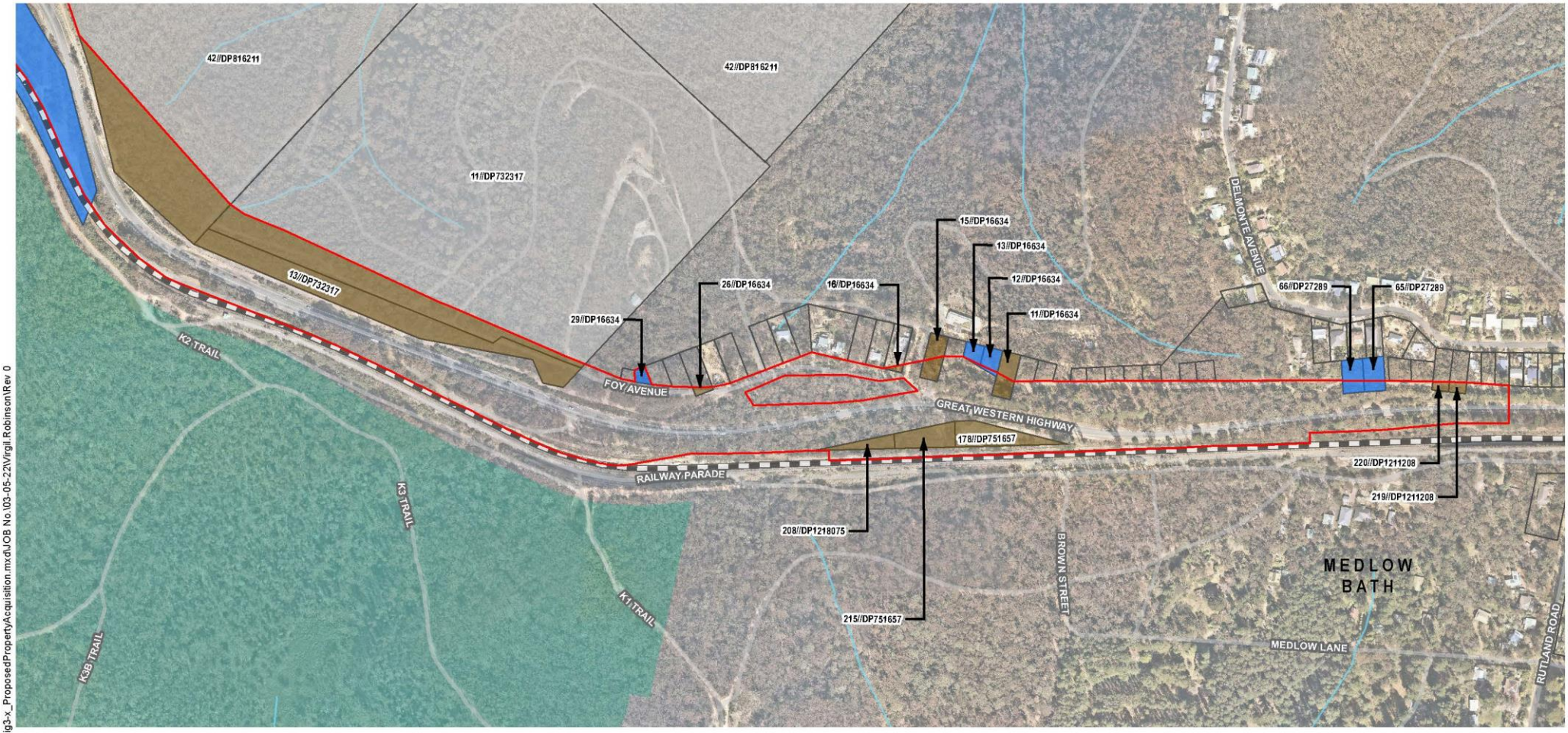
Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

1:6,250@A4
0 100 200m

Projection: GDA2020 MGA Zone 56

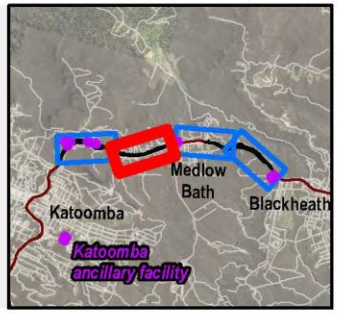
Great Western Highway East **Review of Environmental Factors**

FIGURE 3-16a: Proposed property acquisition - Katoomba to Medlow Bath section



Proposal area
Area subject to acquisition
Transport owned land
Blue Mountains National Park
Main Western Railway

Disclaimer: Property boundaries for Lot 11 DP16634, Lot 15 DP16634, Lot 16 DP16634 and Lot 26 DP16634 are indicative only and are based on detailed Land Title searches. Further survey will be carried out to confirm these boundaries.



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Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

1:6,250@A4
0 100 200m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-16b: Proposed property acquisition - Katoomba to Medlow Bath section

3.6.2 Medlow Bath to Blackheath section

The Medlow Bath to Blackheath section would require the use of public land already owned by Transport (refer to Figure 3-17a-b). As such, no further private or council-owned properties would be acquired for this section of the proposal.

In addition, there are a number of properties that would be fully leased for construction activities (refer to Table 3-11). These include properties that would be used as ancillary facilities. Leased land would be rehabilitated and returned to the property owner once the construction of the proposal is completed.

This section also includes land currently owned by the NSW Department of Planning and Environment (DPE) and managed by the National Parks and Wildlife Service (NPWS).

Transport submitted a proposal to revoke a section of national park estate in 2021 (refer to Table 3-11 and Figure 3-17a-b). The submission addresses the requirements of NPWS *Revocation, recategorisation and road adjustment policy*, including an outline of the potential impacts of the revocation. A compensation package will also be negotiated with NPWS. This revocation would transfer ownership of the land to Transport.

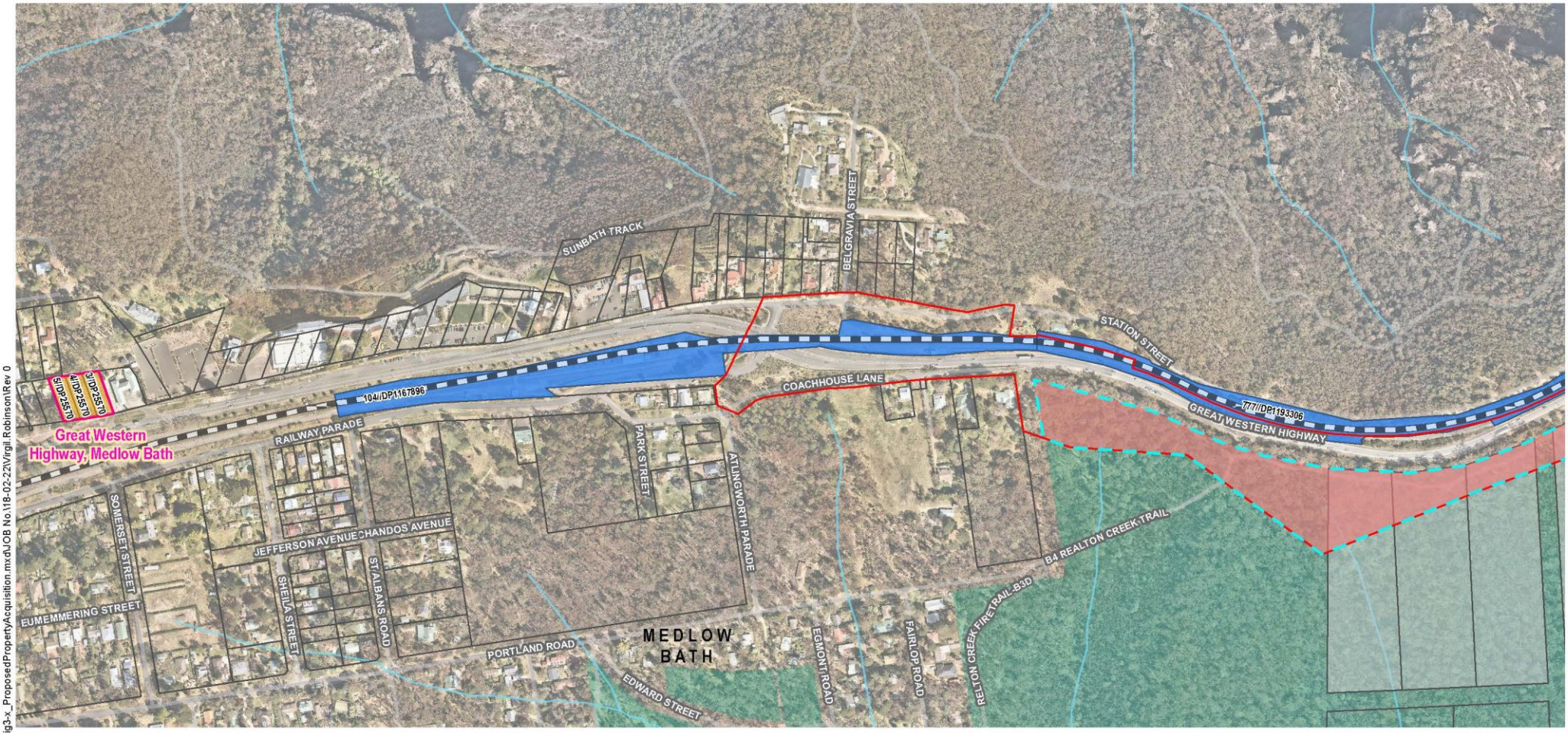
Transport intends to exclude from its determination any work requiring revocation until such time that a decision has occurred, via an Act of Parliament. Due to this process occurring concurrently to the environmental approval prepared in this REF, this land would not be acquired until after determination of the REF.

Table 3-11: Properties within proposal area – Medlow Bath to Blackheath section

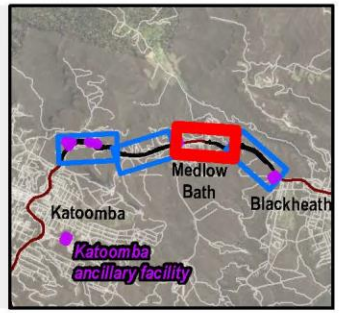
Description	Total property area (square metres)	Area within proposal area (square metres)	Acquisition type	Current owner	Land use zone (LEP)[1]
Lot 3 DP25570	900	900	Lease	Private	C4
Lot 4 DP25570	900	900	Lease	Private	C4
Lot 5 DP25570	900	900	Lease	Private	C4
Area subject to proposed Blue Mountains National Park revocation	237,500	150,550	n/a – revocation to occur prior to determination of this REF	DPE. Land is currently reserved under the *National Parks and Wildlife Act 1974*.	C1

Note 1: C1 National Parks and Nature Reserves; C4 Environmental Living.

The Medlow Bath to Blackheath section is within an area covered by the Deerubbin Local Aboriginal Land Council. There are no Native Title claims or Aboriginal claims for Crown land on any land within this section. However, it is noted that the proposal area is adjacent to a parcel of land that has a determined land claim on it. The proposal would not impact on this parcel of land.



Proposal area
Proposed ancillary facilities
Area subject to lease
Transport owned land
Proposed Blue Mountains National Park revocation - Great Western Highway Upgrade Program
Proposal area subject to proposed Blue Mountains National Park revocation
Blue Mountains National Park
Main Western Railway



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Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

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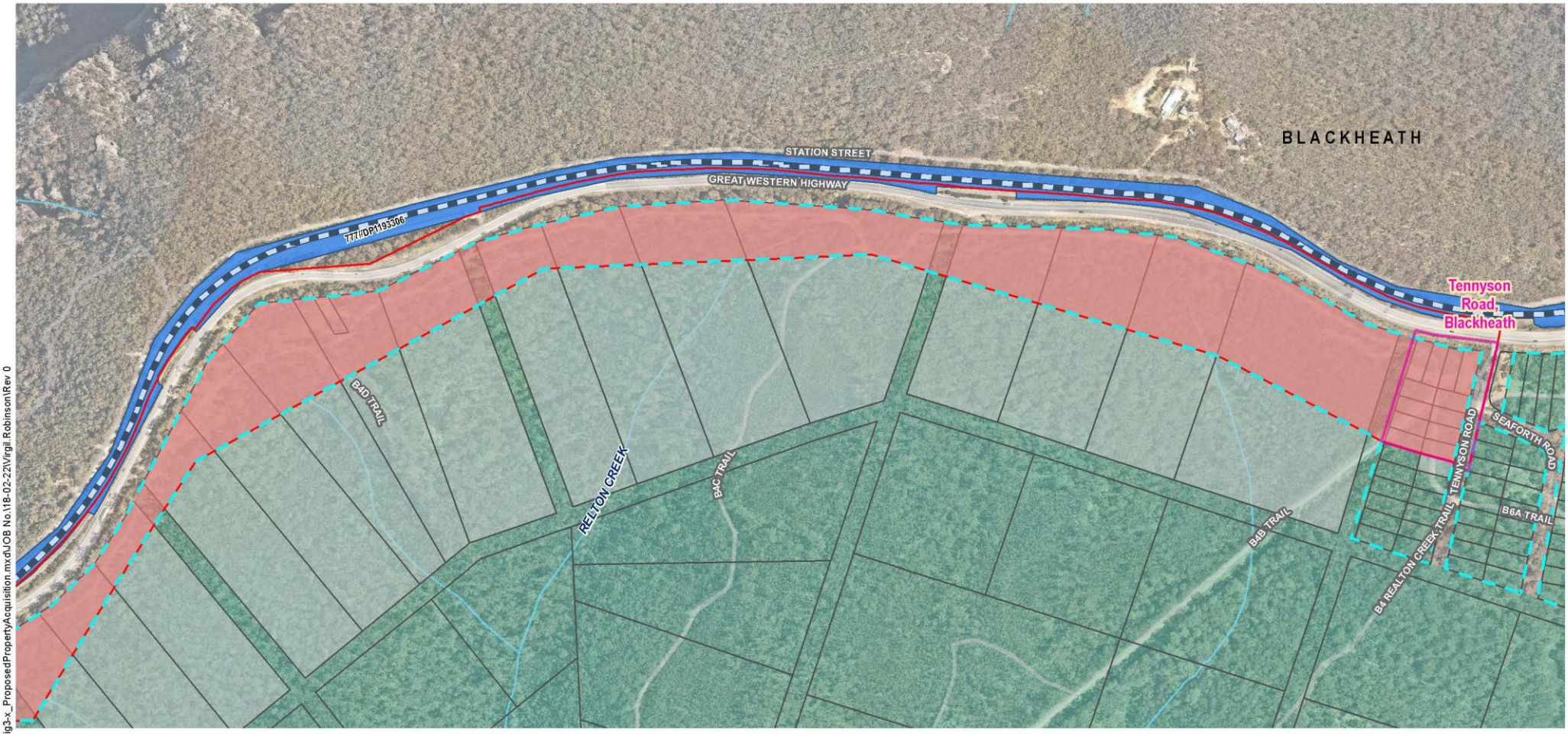
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-17a: Proposed property acquisition - Medlow Bath to Blackheath section



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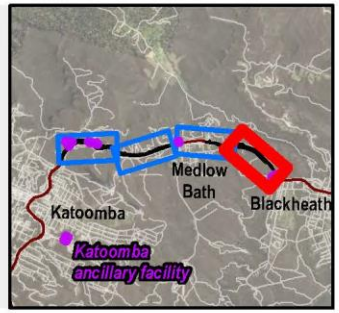
- Proposal area
- Proposed ancillary facilities
- Transport owned land
- Proposed Blue Mountains National Park revocation - Great Western Highway Upgrade Program
- Proposal area subject to proposed Blue Mountains National Park revocation
- Blue Mountains National Park
- Main Western Railway



Source: Aurecon, Mott MacDonald, LPI, DPIE, Nearmap

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 3-17b: Proposed property acquisition - Medlow Bath to Blackheath section

4. Statutory and planning framework

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

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

In March 2022, the State Environmental Planning Policies (SEPPs) were updated. The former State Environmental Planning Policy (Infrastructure) was incorporated into the State Environmental Planning Policy (Transport and Infrastructure) 2021.

Chapter two of the SEPP (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State.

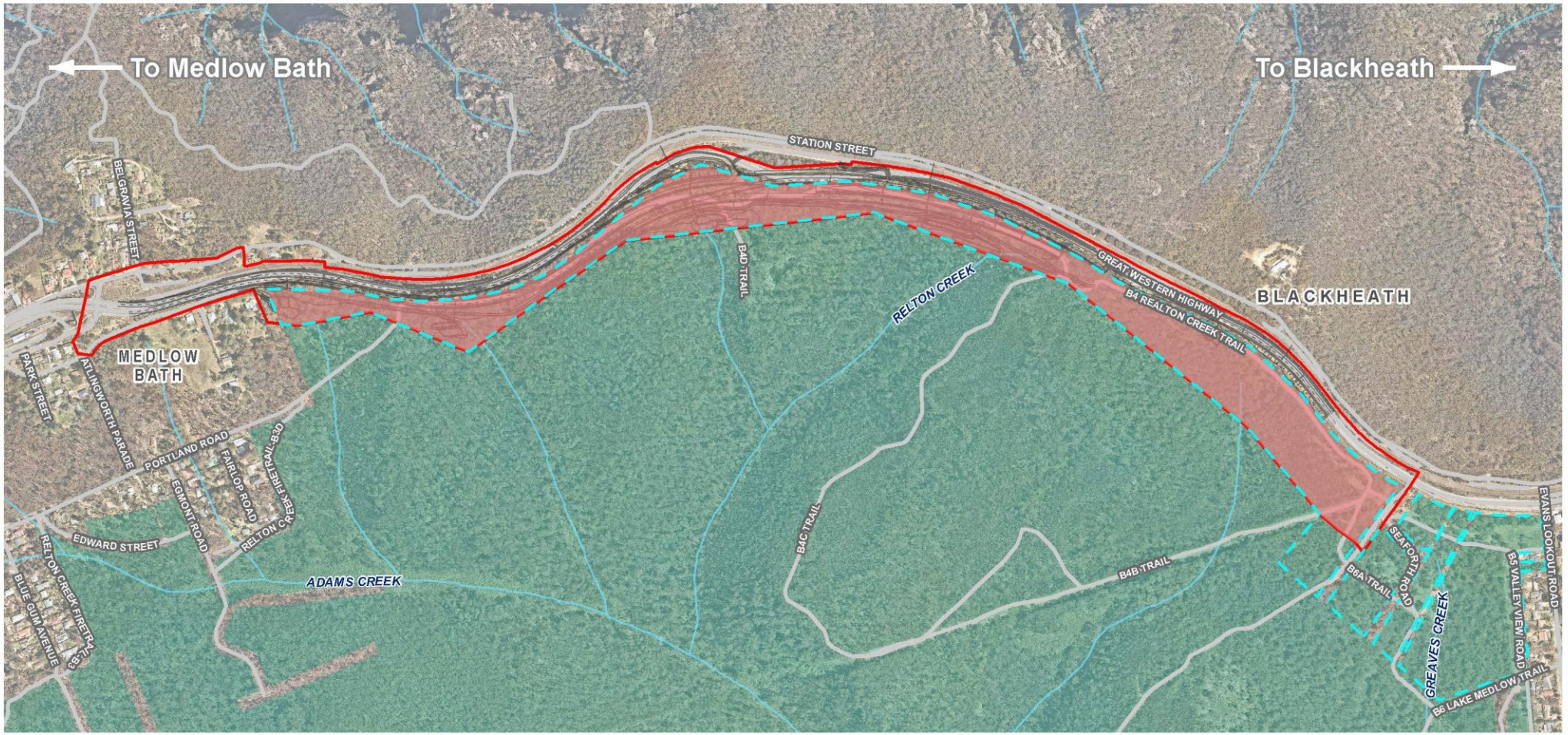
Section 2.108 of the Transport and Infrastructure SEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and road infrastructure facilities and is to be carried out on behalf of Transport, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

Part of the proposal area is currently located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) (refer to Figure 4-1). Development within national park estate cannot proceed by virtue of Section 2.108 of the Transport and Infrastructure SEPP until the land is revoked from the national park estate via an Act of Parliament. This revocation process is currently ongoing (refer to Section 4.2.3).

The proposal does not require development consent or approval under State Environmental Planning Policy (Resilience and Hazards) 2021, State Environmental Planning Policy (Planning Systems) 2021 or State Environmental Planning Policy (Precincts – Regional) 2021.

Part 2.2 of the Transport and Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by the Transport and Infrastructure SEPP (where applicable), is discussed in chapter 5 of this REF.



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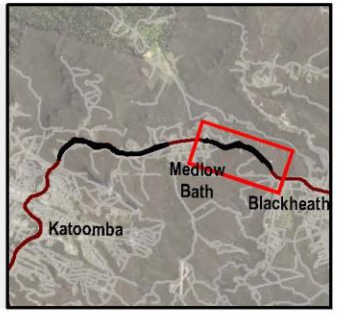
- The design
- Proposal area
- Proposed Blue Mountains National Park revocation - Great Western Highway Upgrade Program
- Proposed Blue Mountains National Park revocation boundary - Medlow Bath to Blackheath section
- Blue Mountains National Park



Source: Aurecon, Mott MacDonald, LPI, Nearmap

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 4-1: Proposed Blue Mountains National Park revocation boundary

State Environmental Planning Policy (Biodiversity and Conservation) 2021

In March 2022, the SEPPs were updated. The former State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 and State Environmental Planning Policy (Koala Habitat Protection) 2021 were incorporated into the State Environmental Planning Policy (Biodiversity and Conservation) 2021.

The SEPP (Biodiversity and Conservation) 2021 relates to biodiversity and conservation planning matters.

Koala habitat protection 2021

Chapter four of the SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. Part 4.2 of the SEPP regulates impact on koala habitats during development assessment by council.

Section 4.4 of the SEPP identifies that the proposal lies on land on which Chapter four of the SEPP is applicable (as it is within the Blue Mountains local government area (LGA)). However, the proposal does not require development consent from council as it would be assessed under Division 5.1 of the EP&A Act.

Regardless the Biodiversity Assessment Report (BAR) has been undertaken for the proposal (refer to Appendix E) and is summarised in Section 6.2. The BAR notes that koalas were surveyed and not identified within the proposal area.

Sydney drinking water catchment

Chapter eight of the SEPP relates to the use of land within the Sydney drinking water catchment. Section 8.8 of the SEPP requires consideration of whether or not an activity to which Division 5.1 of the EP&A Act applies will have a neutral or beneficial effect on water quality before carrying out the activity. A neutral or beneficial effect assessment is included in Appendix C. The assessment concludes that the proposal would have a beneficial effect on water quality.

State Environmental Planning Policy (Resilience and Hazards) 2021

In March 2022, the SEPPs were updated. The former State Environmental Planning Policy No 55—Remediation of Land was incorporated into the State Environmental Planning Policy (Resilience and Hazards) 2021.

Chapter four of the State Environmental Planning Policy (Resilience and Hazards) 2021 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment –

- by specifying when consent is required, and when it is not required, for a remediation work, and
- by specifying certain considerations that are relevant in rezoning land and in determining development applications in general and development applications for consent to carry out a remediation work in particular, and
- by requiring that a remediation work meet certain standards and notification requirements.

An assessment of soils and contaminated land has been carried out for the proposal as part of the REF (refer to Section 6.2). The investigation identified that the potential for contaminants of potential concern to be present at concentrations above applicable Tier I screening values in the proposal area is low to moderate. A Construction Environmental Management Plan will be prepared to identify safeguards and mitigation measures to be followed during construction of the proposal (refer to Section 7). A specific remediation action plan is not required for any site in the proposal area.

4.1.2 Local Environmental Plans

Blue Mountains Local Environment Plan 2015

The proposal is within the Blue Mountains LGA, which is subject to the *Blue Mountains Local Environment Plan 2015* (LEP). Local development control and land use zoning and planning in the LGA is governed under the LEP and supporting document controls plans (DCPs). As the proposal is permitted without consent under the Transport and Infrastructure SEPP (refer to Section 4.1.1), the consent requirements of the LEP do not apply to the REF. The proposal would not impact any specific provisions of the LEP which could be considered relevant to the proposal.

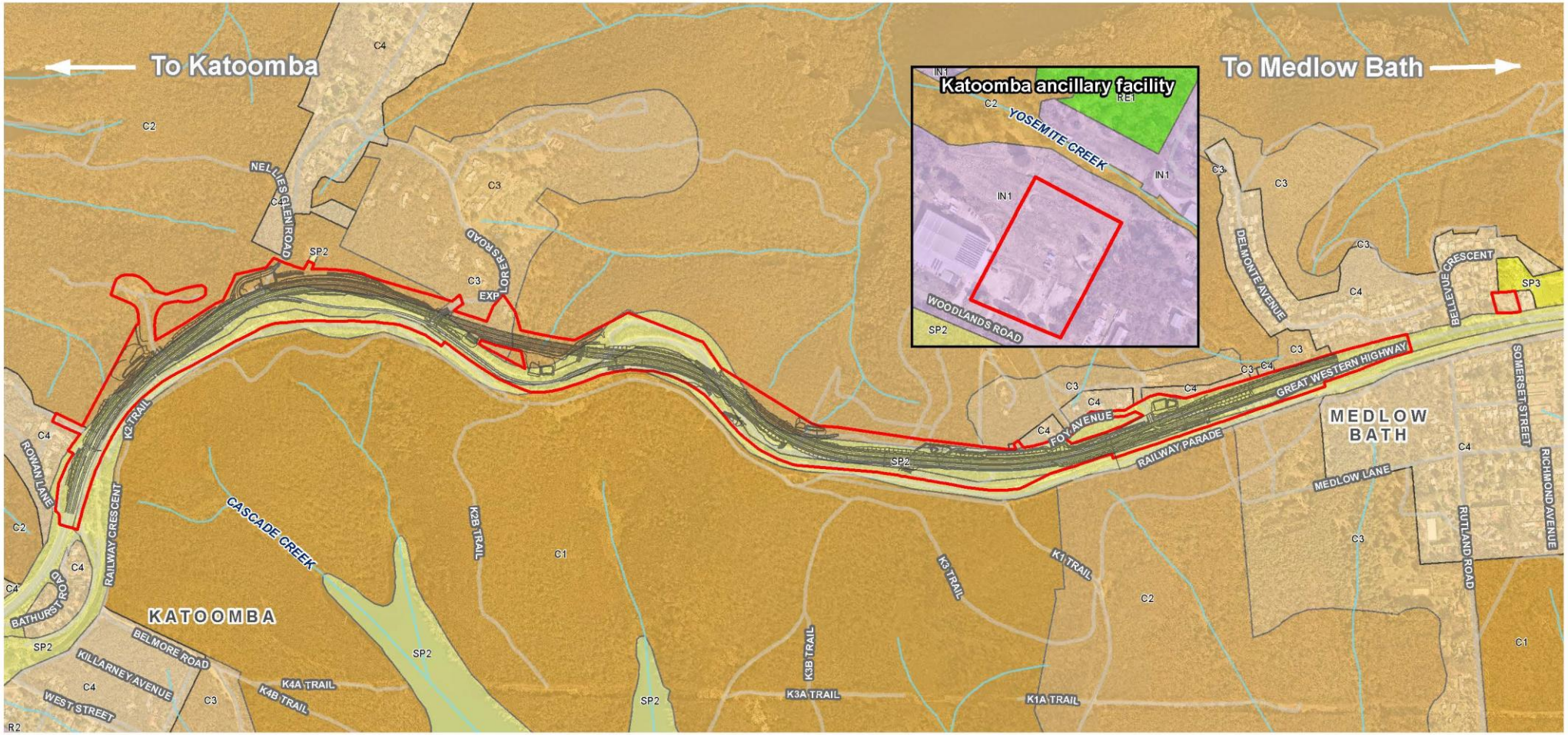
Consultation carried out for the proposal as required by the Transport and Infrastructure SEPP is discussed further in Section 5.4.

The proposal would impact on four local heritage items listed on the Blue Mountains LEP. These are Pulpit Hill and environs, Stone Arrangements, Explorer's Tree and environs and Bonnie Doon Reserve. The impacts on these local heritage items are discussed and assessed in Section 6.4.3 of this REF. Table 4-1 outlines the land use zones within the study area and the consistency of the proposal with the objectives of each zone. The land zones are mapped in Figure 4-2a-b.

Table 4-1 Consistency of proposal with LEP zones

Zone	Objectives of zone	Consistency of proposal with objectives
SP2 – Infrastructure	• To provide for infrastructure and related uses. • To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The proposal would be consistent with the zone objectives as it is major road infrastructure. Roads are permitted with consent in this land use zone.
C1 – National Parks and Nature Reserves	• To enable the management and appropriate use of land that is reserved under the NPW Act or that is acquired under Part 11 of that Act. • To enable uses authorised under the NPW Act. • To identify land that is to be reserved under the NPW Act and to protect the environmental significance of that land.	The proposal would not be consistent with the zone objectives to protect the environmental significance of land reserved under the NPW Act. Transport is separately in the process of negotiating the revocation of part of the Blue Mountains National Park which lies within the study area. The area which is proposed to be revoked would be rezoned to SP2 – Infrastructure, meaning that the proposal would be consistent with the new land zone (refer to the previous row).
C2 – Environmental Conservation	• To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. • To prevent development that could destroy, damage or otherwise have an adverse effect on those values. • To encourage land restoration works on disturbed bushland areas. • To restrict the development of private land that would be inappropriate because of physical characteristics or high bush fire hazards, but only where less restricted development is permitted elsewhere on the land due to split zoning. • To maintain biodiversity in the Blue Mountains.	While the proposal conflicts with many of the objectives of this land use zone, the selection of a preferred option considered outcomes that would minimise environmental impacts. However, roads are permitted with consent in this land use zone. The reestablishment of the Pulpit Hill heritage interpretation area on Nellies Glen Road would protect the high cultural value of this location. The installation of concrete twin bridges over the valley from Pulpit Hill near Explorers Road would minimise the amount of affected vegetation in this land zone. This REF assesses the potential impacts on environmentally sensitive areas and scenic quality and provides safeguards to minimise potential impacts.

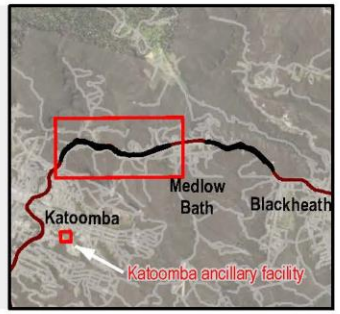
Zone	Objectives of zone	Consistency of proposal with objectives
C3 – Environmental Management	• To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values. • To provide for a limited range of development that does not have an adverse effect on those values. • To protect the natural bushland buffer between towns, to avoid ribbon development and to conserve vistas of bushland obtained from public places and the Blue Mountains National Park. • To ensure that the form and siting of buildings, colours, landscaping and building materials are appropriate for, and harmonise with, the bushland character of the area. • To encourage landscaping and regeneration of natural bushland in areas with sparse tree or canopy cover.	While the proposal conflicts with many of the objectives of this land use zone, the selection of a preferred option considered outcomes that would minimise environmental impacts. However, roads are permitted with consent in this land use zone. The installation of concrete twin bridges over the valley from Pulpit Hill near Explorers Road would minimise the amount of affected vegetation in this land zone. This REF assesses the potential impacts on environmentally sensitive areas and scenic quality and provides safeguards to minimise potential impacts.
C4 – Environmental Living	• To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values. • To ensure that residential development does not have an adverse effect on those values. • To preserve and re-establish native bushland in those areas that exhibit a predominantly bushland character, where consistent with the protection of assets from bush fire. • To ensure that the form and siting of buildings are appropriate for, and harmonise with, the bushland character of the locality.	While the proposal conflicts with many of the objectives of this land use zone, the selection of a preferred option considered outcomes that would minimise environmental impacts. However, roads are permitted with consent in this land use zone. This land use zone occupies a small part of the study area. This REF assesses the potential impacts on environmentally sensitive areas and scenic quality and provides safeguards to minimise potential impacts.



The design
Proposal area

Land zoning

- C1 National Parks and Nature Reserves
- C2 Environmental Conservation
- C3 Environmental Management
- C4 Environmental Living
- R2 Low Density Residential
- SP2 Infrastructure
- SP3 Tourist
- IN1 General Industrial
- RE1 Public Recreation



Source: Aurecon, Mott MacDonald, LPI, Nearmap

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 4-2a: Land zoning

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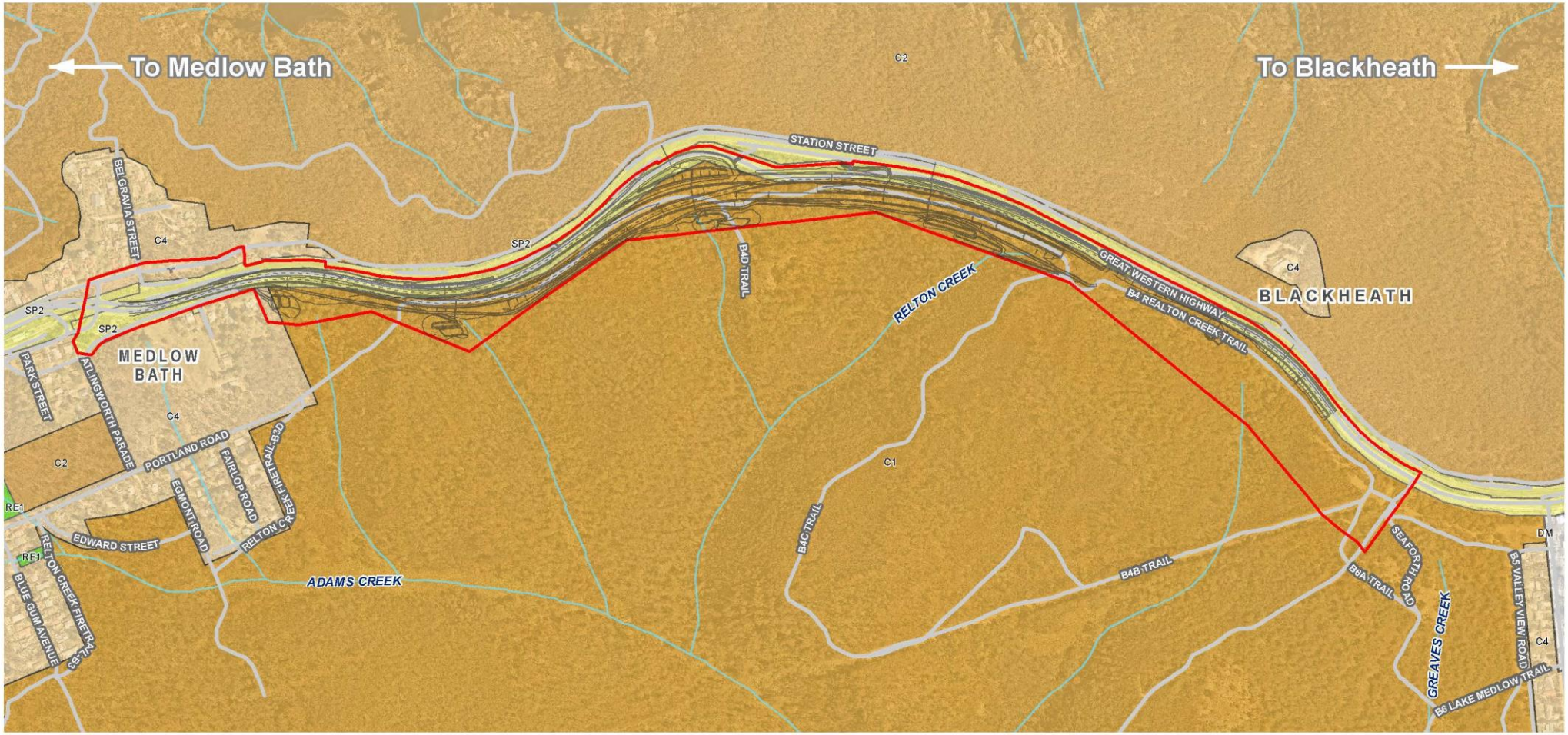

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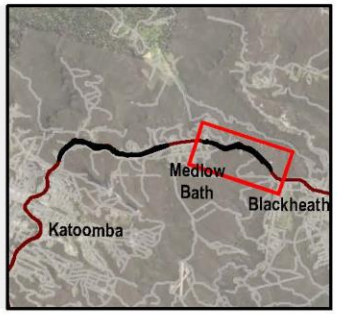
The design
Proposal area
SP2 Infrastructure
DM Deferred Matter

Land zoning

C1 National Parks and Nature Reserves
C2 Environmental Conservation
C4 Environmental Living
RE1 Public Recreation



Source: Aurecon, Mott MacDonald, LPI, Nearmap

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 4-2b: Land zoning

4.2 Other relevant NSW legislation

4.2.1 Roads Act 1993

The objects of the *Roads Act 1993* (Roads Act) are to govern the use and access to public roads, manage opening and closing of public roads as well as provide classification of roads and identify the functions of road authorities.

The Roads Act states that a road authority may carry out road work on any public road for which it is the relevant road authority and on any other land under its control (Division 1, Clause 71). If the road is not under the control of the authority undertaking the works, then consent is required. Section 138 of the Roads Act requires consent to be obtained from the appropriate road authority for the following works to:

- erect a structure or carry out a work in, on or over a public road
- dig up or disturb the surface of a public road
- remove or interfere with a structure, work or tree on a public road
- pump water into a public road from any land adjoining the road
- connect a road (whether public or private) to a classified road.

The proposal is located on both a classified road that is managed by Transport and local roads that are managed by Blue Mountains City Council. A Road Occupancy Licence would be required from the relevant roads authority by the contractor prior to work on public roads and any temporary road closures during construction of the proposal.

4.2.2 Crown Lands Management Act 2016

The Crown Land Management Act 2016 provides the legislative framework for the administration of land that is vested in the Crown in NSW. Ministerial approval is required to grant a lease, licence, permit, easement or right of way over a Crown Reserve. Part of the proposal is located on Crown Land located along the Great Western Highway.

Acquisition and leasing of Crown land would be required for the proposal. Land acquisition details are provided in Section 3.6.

Transport would require approval from the Department of Planning and Environment (DPE) for the acquisition and leasing of Crown land.

4.2.3 National Parks and Wildlife Act 1979

The NPW Act provides the basis for legal protection and management of National Parks estates and Aboriginal sites and objects in NSW. The NPW Act reserves land as historic sites to protect and conserve areas associated with a person, event or historical theme, or containing a building, place, feature or landscape of cultural significance. The purpose of the NPW Act is the conservation of:

- nature, including habitat, ecosystems, biological diversity, landforms and landscapes
- objects, places or features of cultural value within the landscape including:
  - places, objects and features of significance to Aboriginal people
  - places of social value to the people of NSW
  - places of historic, architectural or scientific significance.

As indicated in Section 4.1.1, part of the Medlow Bath to Blackheath section is on land reserved under the NPW Act being the Blue Mountains National Park. Where a new non-permissible activity or development is proposed by another party and requires the use of National Parks and Wildlife Service land, the park boundary can be re-defined to exclude the proposed development. If not, the development cannot proceed as it would encroach upon the park. For the land to be transferred to Transport under Part 11 of the NPW Act, it would need to be revoked from the gazetted park by an Act of Parliament.

Transport submitted a proposal to revoke a section of National Park estate in mid-2021. The submission addresses the requirements of NSW National Parks and Wildlife Service (NPWS) *Revocation, recategorisation and road adjustment policy*, including an outline of the potential impacts of the revocation. A compensation package will also be negotiated with NPWS.

The NPW Act sets out permits and consent requirements should Aboriginal heritage items and/or places be affected. There are no known Aboriginal heritage items located near the proposal area. An Aboriginal cultural heritage assessment was completed to inform the REF and is summarised in Section 6.8. The assessment concluded that the proposal would be unlikely to impact Aboriginal cultural heritage values and that an AHIP will not be required.

4.2.4 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is designed to protect both known heritage items (such as standing structures) and items that may not be immediately obvious (such as potential archaeological remains or 'relics'). Different parts of the Heritage Act deal with different situations and types of heritage and the Act provides a number of mechanisms by which items and places of heritage significance may be protected.

Approval under Section 57(1) is required for works to a place, building, work, relic, moveable object, precinct, or land listed on the State Heritage Register. An excavation permit is required under Section 139 to disturb or excavate any land containing or likely to contain a relic. The Statement of Heritage Impact for the proposal has identified the need for an excavation permit if direct impact to the local heritage listed 'Pulpit Hill and environs' item would occur (refer to Section 6.4). The need to apply for a permit under Section 140 of the Heritage Act due to archaeological test excavations as well as general construction work on the site will be confirmed during detailed design. However, it is anticipated that the test excavations would be able to proceed without a Section 140 permit under Section 139(4)(d) of the Heritage Act.

Section 170 of the Heritage Act requires that culturally significant items or places managed or owned by Government agencies are listed on the departmental Heritage and Conservation Register (Section 170 Register). Information on these registers has been prepared in accordance with Heritage Division guidelines.

The proposal would impact on the Greater Blue Mountains Area – Additional Values, which has been nominated for listing on the State Heritage List, but is not in itself a listed item.

Further information is provided in Section 6.4 and Appendix F.

4.2.5 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) became operational in August 2017 to replace the *Threatened Species Conservation Act 1995*. The BC Act promotes the maintenance of a healthy, productive and resilient environment. The BC Act focuses on biodiversity conservation through ecologically sustainable development.

The BC Act applies to the proposal through the requirement to avoid, minimise and offset the impacts of proposed development and land use changes on biodiversity. The proposal would consider potential impacts to biodiversity values and biodiversity and the need for any biodiversity offsets.

The biodiversity assessment report (Appendix E) carried out for this assessment is summarised in Section 6.3 and has considered ecologically endangered communities and threatened species that have a likelihood of or were found to be present in the proposal area. The assessment concluded that the proposal is not likely to significantly impact threatened species or ecological communities or their habitats. It also outlines the biodiversity offset credit liability for the proposal that has been calculated to offset the unavoidable impacts of the proposal.

4.2.6 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) aims to protect, restore and enhance the quality of the environment in NSW, reduce the risks to human health and prevent degradation to the environment. The POEO Act outlines offences relating to land, water, air and noise pollution and includes a duty to report pollution incidents.

Under the provisions of Part 5.7 of the POEO Act, Transport is required to notify the EPA if a 'pollution incident' occurs that causes or threatens 'material harm' to the environment.

Under Part 3.2 of the POEO Act, an environmental protection licence (EPL) is required for scheduled activities or scheduled development work as defined in Schedule 1.

Schedule 1, Clause 35 (road construction) is relevant to the proposal. Road construction is defined by Clause 35(1) as the construction, widening or re-routing of roads and related construction works, but does not apply to the maintenance or operation of any such road.

Road construction is considered a scheduled activity under Clause 35(3)(a)(ii) where extraction of more than 150,000 tonnes of materials is proposed over the life of the proposal. The Katoomba to Medlow Bath section is expected to require extraction of about 406,000 tonnes of material and the Medlow Bath to Blackheath section is expected to require extraction of about 91,000 tonnes of material. This would require the Katoomba to Medlow Bath section to be carried out under an EPL under Clause 35(3)(b)(iii), which would be held by the construction contractor.

4.2.7 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) covers all biosecurity risks, including pest animals, plant diseases and noxious weeds and introduces the legally enforceable concept of a General Biosecurity Duty.

As outlined in Section 6.2 of this REF, a number of invasive species are present in the proposal area.

Management measures have been recommended to manage these invasive species in accordance with the requirements of the Biosecurity Act (refer to Section 6.3.4). Appropriate biosecurity controls would be put in place for the proposed works to minimise the risk of weed transfer.

4.2.8 Land Acquisition (Just Terms Compensation) Act 1991

The *Land Acquisition (Just Terms Compensation) Act 1991* (Land Acquisition Act) applies to the acquisition of land (by agreement or compulsory process) by a public authority authorised to acquire the land by compulsory process. It provides a guarantee that, when a public authority requires the acquisition of land, the amount of compensation would not be less than the market value of the land.

The Land Acquisition Act applies to the acquisition of any land required for the proposal. Property acquisition is further discussed in Section 3.6.

4.2.9 Rural Fires Act 1997

The *Rural Fires Act 1997* (Rural Fires Act) aims to prevent, mitigate and suppress bushfires and protect persons, property, infrastructure and the environment from fire-related damage.

Part of the proposal area, especially on land currently reserved under the NPW Act as the Blue Mountains National Park, is located on Vegetation Category 1 high risk bushfire prone land. Other parts of the proposal area are located on Vegetation Category 2 low risk bushfire prone land and bushfire buffer zones. The proposal is consistent with bush fire management plans and would not constrain the objectives of protection of life, property and the environment as per the Rural Fires Act (refer to Section 6.10).

4.2.10 Aboriginal Land Rights Act 1983

Through the *Aboriginal Land Rights Act 1983* (Aboriginal Land Rights Act), vacant Crown land not lawfully used or occupied or required for an essential purpose or for residential land, is returned to Aboriginal people (and vested in Aboriginal Land Councils). In accordance with Section 42B of the Aboriginal Land Rights Act, land vested in an Aboriginal Land Council can only be acquired by Transport through an Act of Parliament.

The Katoomba to Medlow Bath section would acquire a lot owned by the Crown that is subject to an undetermined Aboriginal land claim. Part of the Medlow Bath to Blackheath section is adjacent to Aboriginal LALC owned land, but the proposal would not encroach or otherwise disturb the site.

4.2.11 Water Management Act 2000

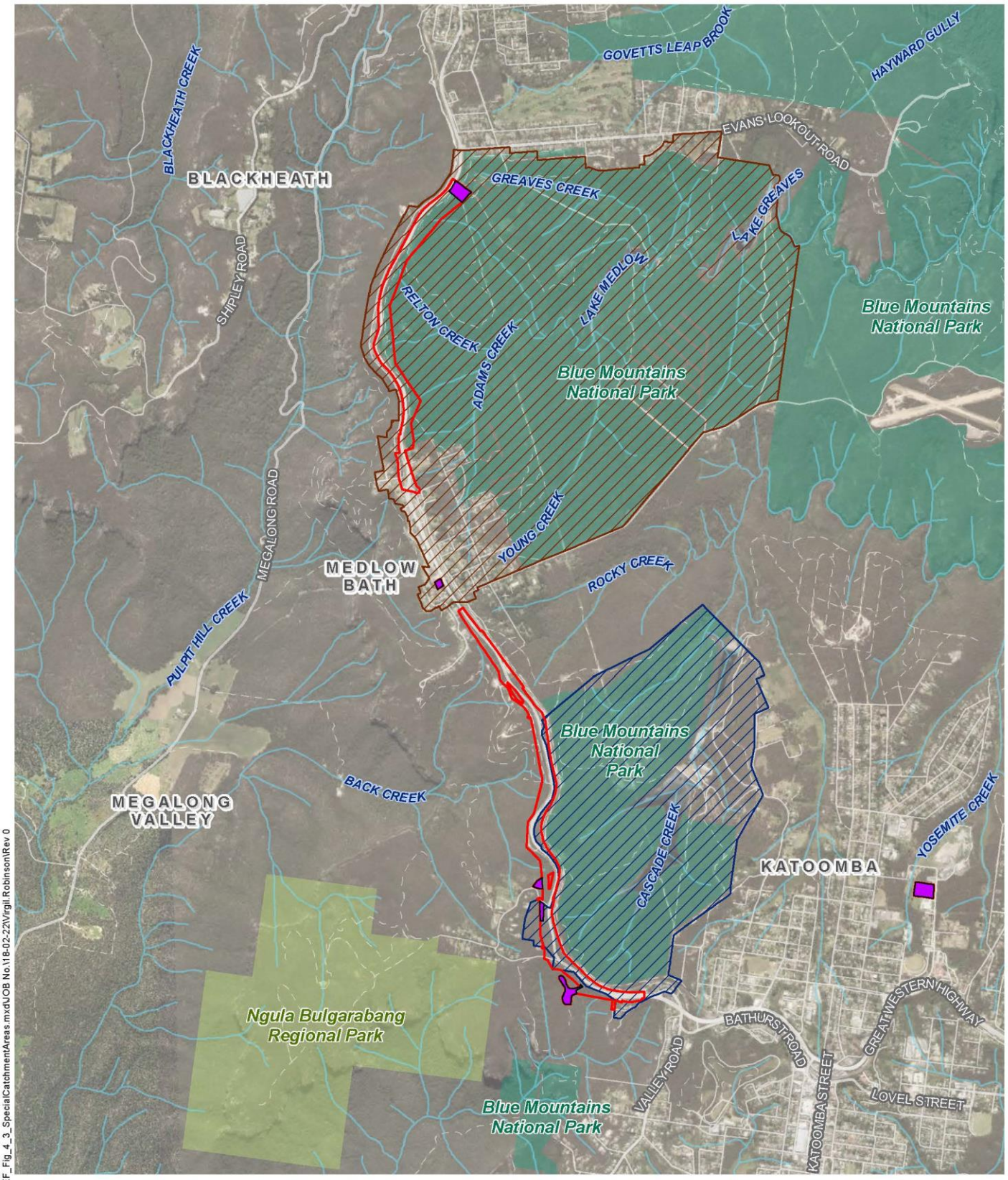
The proposal area is covered by the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 and the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources. It is subject to the provisions of the *Water Management Act 2000* (Water Management Act). The Water Management Act aims to provide for the sustainable and integrated management of the water sources of NSW.

The proposal would require management in line with the Water Management Act, with safeguards and mitigation measures identified in Section 7.2 of this REF.

4.2.12 Water NSW Act 2014

Part of the proposal area is within a declared catchment area under the *Water NSW Act 2014* (Water NSW Act) and within a declared Schedule 1 special area under the *Water NSW Regulation 2020*. The proposal passes through two Special Catchment Areas (refer to Figure 4-3), being the Katoomba special area (in the Katoomba to Medlow Bath section) and the Blackheath special area (in the Medlow Bath to Blackheath section).

Under Section 50 of the Water NSW Act, notice would need to be given to Water NSW in relation to any road upgrade proposal within the special area. Transport is in consultation with Water NSW about the proposal.



Proposal area
Blackheath Special Catchment Area
Katoomba Special Catchment Area
Proposed ancillary facilities
Blue Mountains National Park
Ngula Bulgarabang Regional Park
Watercourses

Source: Aurecon, LPI, DPIE

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 4-3: Special Catchment Areas

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4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

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

A referral 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 impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

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

Findings – matters of national environmental significance

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 Agriculture, Water and the Environment under the EPBC Act.

Findings – nationally listed biodiversity matters (where the strategic assessment applies)

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

4.3.2 Other relevant Commonwealth legislation

4.3.3 Native Title Act 1993

The *Native Title Act 1993* (Native Title Act) recognises and protects native title. The Native Title Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affective native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Native Title Act a future act includes proposed public infrastructure on land or waters that affects native title rights or interest.

A search of the Native Title Tribunal Native Title Vision website was undertaken, with no Native Title claimants identified in the proposal area.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority.

Transport has commenced a process to revoke a portion of the Blue Mountains National Park. Subject to the revocation being passed by Parliament, the proposal can proceed by virtue of Section 2.108 of Transport and Infrastructure SEPP. The proposal would be 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.

Transport for NSW is the determining authority for the proposal. This REF fulfils Transport for NSW'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.

5. Consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future.

5.1 Consultation strategy

Transport has prepared a *Community and Stakeholder Engagement Plan* (CSEP) (Transport, 2021b) for the Great Western Highway Upgrade program to guide communication and consultation activities. The CSEP is designed to provide an agreed approach to communication and engagement, employing open communication channels and clear protocols. The CSEP has been applied in the *Communications and Engagement Plan – REF East* (Transport, 2021a), which is the consultation strategy developed for this proposal.

The key communication and engagement objectives as outlined in the CSEP are to:

- ensure the Blue Mountains community, Central West community and the broader NSW community, including key stakeholders and interest groups, are aware of and involved in consultation opportunities about the proposed duplication
- provide targeted information to the community and other stakeholders, and to clearly communicate whether we are providing information or seeking feedback so that expectations are clear
- ensure the proposed concept designs are developed appropriately, incorporating and acknowledging feedback and concerns of the local community and stakeholders
- collaborate with government agencies and local councils to ensure a whole-of-government approach to managing issues and providing consistent messages.
- ensure that the communications and engagement approach and key messages align with Transport's Road Network and Corridor Planning, and Future Transport strategy
- monitor and evaluate stakeholder feedback and communication activities to review planning as required
- engage in a manner that is open and transparent, collaborative, innovative, responsive, adaptive and sustainable
- build stakeholder and community confidence in Transport and its decisions.

The CSEP outlines the relevant stakeholder groups that have been identified for the proposal, as they may have interest in or be affected by the proposal. These groups include, but are not limited to:

- the Federal Government
- the NSW Government and agencies
- local government
- emergency services
- utilities
- local residents
- local businesses
- other local community groups
- road users
- special interest/stakeholder groups
- media.

These stakeholder groups have been and will continue to be consulted on relevant aspects of the proposal using a variety of consultation methods and engagement activities.

A summary of the consultation activities carried out to date and the planned ongoing or future consultation activities is provided in the following sections.

5.2 Community involvement

The NSW Government began planning for the Great Western Highway upgrade between Katoomba and Lithgow in 2019. Since then, Transport has involved the community during the development of the Great Western Highway Upgrade Program. This REF allows community involvement in the development of the concept design for the proposal.

A summary of community consultation and engagement activities which have been undertaken for the Great Western Highway Upgrade Program are outlined in Table 5-1.

Table 5-1: Consultation and engagement activities undertaken for the Great Western Highway Upgrade Program

Activity/ consultation method	Summary
Project website	The Great Western Highway Upgrade Program – Katoomba to Lithgow website (***nswroads.work/gwhd***) provides the latest program information.
Community updates	10 community updates have been released via the Great Western Highway Upgrade Program website: • March 2022 – Katoomba, Medlow Bath and Blackheath community update • September 2021 – Little Hartley to Lithgow Upgrade community update • July 2021 – Medlow Bath Upgrade Review of Environmental Factors community update • April 2021 – Blackheath to Little Hartley long tunnel investigation community update • March 2020 – Explorers tree community update • October 2020 – Blackheath consultation community update • August 2020 – Medlow Bath consultation community update • May 2020 – community consultation report community update • February 2020 – Katoomba to Lithgow community update • November 2019 – Katoomba to Lithgow strategic consultation community update.
Project notifications	17 project notifications for work associated with the Great Western Highway Upgrade Program have been released via the program website: • April 2022 • March 2022 (four notifications) • November 2021 (two notifications) • August 2021 (three notifications) • May 2021 • April 2021 • March 2021 (two notifications) • February 2021 • January 2021 • December 2020.
Media releases	30 media releases have been distributed between March 2019 and March 2022. Copies of these media releases are available on the Great Western Highway Upgrade Program website.
Community engagement periods	Five community engagement periods have been undertaken for the Great Western Highway Upgrade Program: • Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Review of Environmental Factors, November 2021 – January 2022. • Great Western Highway Upgrade – Medlow Bath Review of Environmental Factors, July – September 2021. 340 formal submissions received. • Blackheath tunnel options consultation, October – November 2020. 2486 items of feedback received. • Medlow Bath Upgrade consultation, June – August 2020. 850 items of feedback received.

Activity/ consultation method	Summary
	• Katoomba to Lithgow strategic design consultation, November – December 2019. 1759 items of feedback received.
Blackheath Co-Design Committee	The Blackheath Co-Design Committee (BCC) was formed by Transport for NSW in March 2020, following feedback from the community. The purpose of the BCC was to involve representatives of the community in working with Transport for NSW to refine route options for Blackheath.
Toll free community enquiry number	A dedicated toll-free 1800 telephone number (1800 953 777) has been created to receive and respond to enquiries from the community and interested stakeholders on the Great Western Highway Upgrade Program.
Project email address	A dedicated email address (***gwhd@transport.nsw.gov.au***) has been created to receive and respond to enquiries from the community and interested stakeholders.
Door Knocking	Targeted door knocking was undertaken through the Explorer's Road area on 25 November 2020.

5.2.1 Summary of community consultation activities

Katoomba to Lithgow 2019 strategic design consultation

Transport carried out community consultation around the strategic design for the Great Western Highway Upgrade Program between 7 November and 16 December 2019. Community consultation and community engagement was carried out to understand community views and values so that feedback could be considered in further development of the Great Western Highway Upgrade Program's design.

The aim of this consultation period was to gather early feedback on the community on key values and priorities, as well as to address any concerns or questions they had about the whole upgrade program, before progressing to the refinement route options and features within the corridor.

The community engagement activities included:

- display of the proposed upgrade at locations including Katoomba, Oberon, Bathurst and Orange libraries
- twelve community information sessions held in Katoomba, Medlow Bath, Blackheath, Mount Victoria, Hartley and Lithgow, attended by 1045 people
- advertisements in local newspapers and on the NSW Roads Facebook page.

During the consultation period, Transport received 1759 items of feedback from members of the community, businesses and stakeholders. A summary of the key issues raised by the community during community consultation activities that are relevant to the proposal is provided in Table 5-2.

Table 5-2: Summary of issues raised by the community – Katoomba to Lithgow 2019 strategic design consultation

Issue category	Issue raised	Response / where addressed in REF
Transport should consider other options	Suggestion to increase the posted speed limit to 100 kilometres per hour.	The posted speed limit for the proposal has been developed in line with Austroads guidelines.
Environmental impacts of the proposal	Concern about impacts on cultural and historic heritage of the townships along the Great Western Highway	A Statement of Heritage Impact has been undertaken to assess the potential non-Aboriginal heritage impacts of the proposal. Refer to Section 6.4 for a summary of this assessment.
	Concern about impacts on the World Heritage Area	The Greater Blue Mountains World Heritage Area would not be directly or indirectly impacted by the proposal. While part of the Blue Mountains National Park boundary would be revoked as part of the Medlow Bath to Blackheath section, this part of the National Park does not form part of the World Heritage Area. Refer to Section 1.1.2 for details.
	Concern about noise impacts for residents living along the Great Western Highway	A noise and vibration assessment has been undertaken to assess the potential noise and vibration impacts of the proposal. Refer to Section 6.6 for a summary of this assessment.
	Concern about pollution generated by the Great Western Highway Upgrade Program along the Great Western Highway	The potential air quality impacts of the proposal are addressed in Section 6.10.
	Concern about impacts on the natural surroundings and visual aesthetics of the area, as well as recreational opportunities near the proposal area	A landscape character and visual impact assessment has been undertaken to assess the potential visual impacts of the proposal. Refer to Section 6.4 for a summary of this assessment. A socio-economic impact assessment has been undertaken to assess the impacts of the proposal on recreation and tourism. Refer to Section 6.7.5 for a summary of this assessment.
Road use	Concern about large heavy vehicles travelling along the Great Western Highway and safety of road users due to increased heavy vehicle traffic	A traffic and transport assessment has been undertaken to assess the potential traffic impacts of the proposal. The assessment found that the proposal would result in fewer heavy vehicles travelling along the Great Western Highway than without the proposal. Refer to Section 6.6 for a summary of this assessment.
	Concern about increased congestion in towns along the Great Western Highway	A traffic and transport assessment has been undertaken to assess the potential traffic impacts of the proposal. Refer to Section 6.6 for a summary of this assessment.
Property and business	Concern by potentially impacted property owners about their homes and businesses, or impact from a decline in tourism	Transport notes the concerns of impacted residents and business owners and reaffirms that the proposal is designed to improve safety and future proofing. The proposal is anticipated to allow better connectivity for tourists, freight and local community members. Refer to Section 3.6 for further details on the property acquisition process.
	Interest in the property acquisition process	Where required, property acquisition would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Refer to Section 3.6 for further details on the property acquisition process.

Issue category	Issue raised	Response / where addressed in REF
Community consultation	Support for the Great Western Highway Upgrade Program from the community	Transport acknowledges support for the Great Western Highway Upgrade Program and the benefits it would bring to those travelling in, around and through the Blue Mountains.
Construction impacts	Concern about impact of construction on the environment and existing properties in the proposal area	There are anticipated to be construction impacts from the works that have been assessed in this REF and supporting technical studies. Refer to Section 3.3 for detail on the construction activities and Chapter 6 for environmental assessments of construction impacts.
	Interest in the construction timeframe for the proposal	
	Concern about commuter congestion during construction	
Request for information	Request on technical investigations, assessment and studies	This REF contains technical investigations, assessment and studies related to the proposal. Refer to Chapter 6 for the details of these assessments.

Great Western Highway Upgrade – Medlow Bath Review of Environmental Factors

Transport carried out community consultation for the concept design for the Great Western Highway Upgrade – Medlow Bath between 26 July and 5 September 2021. Community consultation and community engagement was carried out to capture local knowledge, consider potential impacts and identify improvements which could be made to the concept design. This feedback will be considered in the final design of the Medlow Bath Upgrade.

Due to stay-at-home orders in place due to COVID-19 for the duration of the consultation period, all consultation activities were carried out to comply with NSW Health guidelines. The community engagement activities included:

- display of the proposed upgrade in the Katoomba Shopping Centre, which encouraged people to take information home to read
- six community information sessions held online
- online or phone meetings with stakeholder groups, local businesses and individual residents
- advertisements in local newspapers and radio and on the NSW Roads Facebook page.

Submissions received are being reviewed and a report will be published when the project is determined.

Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Review of Environmental Factors

Transport carried out community consultation for the concept design for the Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) (Little Hartley to Lithgow Upgrade) between 23 November 2021 and 16 January 2022. Community consultation and community engagement was carried out to capture local knowledge, consider potential impacts and identify improvements which could be made to the concept design. This feedback will be considered in the final design of the Little Hartley to Lithgow Upgrade.

The community engagement activities included:

- display of the proposed upgrade at the Lithgow City Council Administration Centre and Lithgow Library Learning Centre
- online and face-to-face community information sessions
- online or phone meetings with stakeholder groups, local businesses and individual residents
- advertisements in local newspapers and radio and on the NSW Roads Facebook page.

Submissions received are being reviewed and a report will be published when the project is determined.

5.3 Aboriginal community involvement

The potential Aboriginal heritage impacts of the proposal have been considered in accordance with the requirements of Transport's *Procedure for Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime, 2011). Table 5-3 summarises the stages outlined in the PACHCI.

Table 5-3: Summary of the Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Transport for NSW 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

Stages 1 and 2 of PACHCI have been completed for the proposal. Aboriginal cultural heritage was assessed for the Great Western Highway Upgrade Program in the *Great Western Highway Duplication – Katoomba to Lithgow Archaeological Survey Report* (Jacobs, 2020) (Stage 2 PACHCI).

Consultation was undertaken in accordance with the Stage 2 PACHCI requirements. The consultation actions taken include:

- Identification of key stakeholders:
  - Deerubbin Local Aboriginal Land Council (LALC)
  - the Gundungurra Area Agreement (NI2014/001) Indigenous Land Use Agreement which covers part of the proposal area.
- Field surveys were undertaken through 2019 and 2020 and involved survey of the proposed route corridor by foot and vehicle. A Deerubbin LALC representative was involved with this fieldwork. Prior to the field surveys, a search of Aboriginal objects, sites, and places registered on the Aboriginal heritage information management system (AHIMS) within 50 metres of the proposed route corridor boundary was completed. This search was carried out on 29 October 2019 and verified again on 30 July 2021. There were no previously identified AHIMS sites within or near the proposal area. As such, no AHIMS sites were visited during the section of the archaeological survey which relates to the proposal.
- Deerubbin LALC provided a cultural heritage survey report prepared by Artefact Heritage (2015) to Transport which encompassed much of the proposal area. The Deerubbin LALC also raised no objection to the proposal.

It is also noted that a Stage 3 PACHCI Aboriginal cultural heritage assessment report was carried out for the Great Western Highway Upgrade Program (Jacobs, 2021). This report did not result in additional findings relevant to this proposal which differed from the Stage 2 PACHCI. It is available as part of the Little Hartley to Lithgow Upgrade REF.

As part of the ongoing cultural interpretation strategy development, ongoing workshops are being held with Aboriginal stakeholders to understand stories of local significance that can be used to interpret Aboriginal heritage along the highway alignment.

5.4 Transport and Infrastructure SEPP consultation

Section 2.108 of the Transport and Infrastructure SEPP provides that "development on behalf of a public authority for the purpose of a road or road infrastructure facilities may be carried out without consent" providing that certain key parties are consulted and/or notified about the work.

Blue Mountains City Council has been consulted about the proposal under Sections 2.10(1)(f) and 2.11 due to excavation of council roads and the potential impacts on identified local heritage items during construction of the proposal. The NSW National Parks and Wildlife Service (NPWS) has been consulted about the proposal under Sections 2.15(2)(a) and 2.15(2)(b) because the proposal would occur adjacent to land reserved under the *National Parks and Wildlife Act 1974*[2].

Appendix B contains a Transport and Infrastructure SEPP consultation checklist that documents how Transport and Infrastructure SEPP consultation requirements have been considered.

Issues that have been raised as a result of this consultation are outlined below in Table 5-4.

Table 5-4: Issues raised through Transport and Infrastructure SEPP consultation

Agency	Issue raised	Response/where addressed in REF
Blue Mountains City Council	Request for further consultation as required under the Transport and Infrastructure SEPP.	Transport carried out consultation with Blue Mountains City Council as required under the Transport and Infrastructure SEPP in the preparation of the REF for this proposal. Transport would continue to consult with Council through the development of the proposal.
	Request for Statement of Heritage Impact (SOHI) to inform Council's response to the proposal.	A Statement of Heritage Impact has been carried out for the proposal. It is summarised in Section 6.4 and attached in Appendix F.
	Concern that the proposal will have a more than minor impact on the heritage of the Blue Mountains.	This REF includes assessment of heritage impacts due to the proposal including: • a Statement of Heritage Impact, which assesses the potential non-Aboriginal heritage impacts of the proposal (refer to Section 6.4 for a summary of this assessment) • the cumulative non-Aboriginal heritage impacts, considering the impacts of the Medlow Bath Upgrade, which have been assessed in Section 6.11.4. The Statement of Heritage Impact found that the proposal would result in an impact on heritage in the proposal area however, this would not be a significant impact. Overall, the proposal would be unlikely to cause a significant impact on the environment. Therefore, an environmental impact statement is not required under Division 5.2 of the EP&A Act, as indicated in Section 9.3.
	Request for Environmental Impact Statement given the extent of potential environmental impact with consideration to the cumulative impact when combined with adjoining projects.	The proposal would be unlikely to cause a significant impact on the environment. Therefore, an environmental impact statement is not required under Division 5.2 of the EP&A Act, as indicated in Section 9.3. The cumulative impacts of the proposal are discussed in Section 6.11.4.

[2] Transport are currently in discussions with NPWS about the direct impact on the Blue Mountains National Park

Agency	Issue raised	Response/where addressed in REF
NSW National Parks and Wildlife Service	Need to consider all environmental matters in accordance with NPWS guidelines.	It is noted that this is not a legislative requirement. However, the REF has been prepared in accordance with the Environmental Planning and Assessment Act 1979 and Section 171 of the Environmental Planning and Assessment Regulation 2021. In reference to the items of interest to NPWS, the proposal would minimise impacts to the integrity of heritage sites and cultural values of the community (refer to Section 6.4) and significant trees (refer to Section 6.3).
	Where the project encroaches park and revocation of NPWS land is proposed for the works to become permissible, the REF is to provide details of any compensation proposal, consistent with the *NPWS Revocation, Recategorisation and Road Adjustment Policy*.	The proposed acquisition of part of the Blue Mountains National Park is discussed in Section 4.1.1.
	Request for clear instructions to ensure no unauthorised works, access or encroachments occur in national park.	The construction area would be fenced prior to works commencing and a 'No-Go' zone identified beyond that fence to avoid unauthorised access to the adjoining national park. Additional environmental safeguards and mitigation measures are outlined in Section 7.2.
	Ensuring construction safeguards and mitigation measures are in place to protect the park from construction and operational impacts.	Environmental safeguards and mitigation measures outlined in Section 7.2 would minimise any potential adverse impacts arising from the proposed work on the surrounding environment.
	Need for erosion and sedimentation control techniques to prevent increased risk of erosion or sediment entering the park due to nearby ground disturbance.	There would be erosion and sediment control measures implemented during construction of the proposal (refer to Section 6.1.4). The construction would also have a progressive stabilisation of earthworks to minimise the potential for erosion.
	Need to consider the impacts of altered drainage and runoff flows associated with construction on vegetation communities.	The impacts of altered drainage and runoff flows during construction have been assessed in the Preliminary Erosion and Sedimentation Assessment. This assessment recommends erosion and sediment controls to be implemented during construction. It is attached in Appendix D to the REF and discussed in Section 6.1.
	Need to consider public safety and entry to the park where it intersects with the Great Western Highway.	The Medlow Bath to Blackheath section lies on part of the National Park which is not publicly accessible due to its location within the Water NSW Blackheath Special Catchment Area. As such, the proposal would not disrupt public access to this section of the National Park. However, the proposal would temporarily disrupt access via maintenance tracks, with alternate routes to be provided during construction (refer to Section 7.2). Once operational, the new public active transport route would provide gated access for NPWS to existing trails into the national park. Transport would consult with NPWS further on the access requirements.

Agency	Issue raised	Response/where addressed in REF
	Ensure hygiene protocols for machinery, vehicle and material are established and delivered throughout project to limit propagule and pathogen transmission.	The construction contractor would implement a range of environmental management plans. To provide a co-ordinated approach to avoidance and management a Blue Mountains National Park Management Framework would be prepared to identify 'no-go' zones, and link to other management plans such as the Flora and Fauna Management Plan which includes hygiene protocols in relation to pest and pathogen species (refer to Section 7.2).
	Need to maintain park access during and after construction and ensure adequate notification to community for any road closures or restrictions.	Maintenance access to the Blue Mountains National Park would be maintained during construction and operation of the proposal. Communication of any temporary disruptions during construction would occur in line with the safeguards and management measures outlined in Section 7.2. Once operational, the new public active transport route would provide gated access for NPWS to existing trails into the national park. Transport would consult with NPWS further on the access requirements.
	Request for ongoing communication regarding the project to ensure works adjacent to the park are carried out in a safe manner. This communication should include providing a copy of the determined REF to NPWS and at least one week's notification to NPWS when works are due to commence.	Transport has ongoing, regular communication with NPWS. Transport and the construction contractor would continue to consult with NPWS through the development of the proposal as part of the Blue Mountains National Park Management Framework (refer to Section 7.2).
	Need to avoid direct and indirect impacts on the park and its values.	Construction and operation of the proposal would minimise direct and indirect impacts on the Blue Mountains National Park and its values (refer to Chapter 6). Where possible, trees would be retained. The proposal has also been designed to provide a beneficial effect on water quality (refer to Section 6.1.3). Management measure would be implemented through construction to further avoid and minimise construction impacts.
	Request that felling techniques be used for any tree removal in the park.	Trees would be removed in accordance with the Transport Guidelines - Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects (Roads and Traffic Authority, 2011a).
	Need to address environmental matters pursuant to cl.171 of the Environmental Planning and Assessment Regulation 2021 must be addressed in relation to the park.	Factors listed in Section 171 of the Environmental Planning and Assessment Regulation 2021 have been considered in this REF. Refer to Appendix A.

5.5 Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal, including Blue Mountains City Council, NSW National Parks and Wildlife Service, WaterNSW, Sydney Trains, utility authorities (Endeavour Energy, Telstra, Jemena Gas, Sydney Water, NBN and Optus) and property owners.

Issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in Table 5-5.

Table 5-5: Issues raised through stakeholder consultation

Agency / stakeholder	Activity	Issue raised	Response / where addressed in REF
Blue Mountains City Council	Heritage co-ordination meetings	Heritage issues	Sections 6.8 (Aboriginal cultural heritage) and 6.4 (non-Aboriginal heritage)
	Water quality integration meetings	Water quality issues	Section 6.1
NSW National Parks and Wildlife Service	Fortnightly recurring meeting	Revocation of part of the Blue Mountains National Park boundary and Hartley Historic Village National Park Boundary.	Section 4.1.1
WaterNSW	Water quality integration meetings	Water quality issues	Section 6.1
Sydney Trains	Various discussions through the concept design development	Access to the rail corridor, relocation of rail assets/ utilities.	Section 3.3
Utility authorities	Various discussions through the concept design development	Access to utility services Utility services planning	Section 3.5
Property owners	Various discussions about the impact of the proposal on private property	Property impacts and acquisition	Section 3.6
Blue Mountains Cycling Safety Forum	Active transport integration meetings with Crossley Transport Planning	Opportunities for improved offroad cycling along the proposal.	Section 3.2.3.

5.6 Ongoing or future consultation

Transport will continue to seek feedback from the community and key stakeholders as the proposal progresses, including during detailed design and construction in accordance with the Community and Stakeholder Engagement Plan.

5.6.1 Consultation during public display of the REF

The REF will be placed on public display and comments invited. A range of consultation activities will be undertaken in accordance with the *Communications and Engagement Plan – REF East* and include:

- briefings for stakeholders, local councils and government agencies
- meetings with property owners identified as being subject to partial or full land acquisition
- communication materials
- community information displays and sessions (online or other format, as relevant)
- door knocks/letter box drops

- website updates.

Face-to-face engagement is subject to change based on any COVID-19 health orders in place at the time of the scheduled engagement activities.

Following public display, submissions will be collated, and a submissions report prepared to address any issues raised by stakeholders. The submissions report will be made available to the public via the Transport website: ***nswroads.work/gwheastconsult***.

Transport will continue to identify and manage issues of interest or concern to the community through the REF display period, through the assessment and determination process. Consultation will be ongoing if and when the upgrade proceeds as determined.

The community will be informed of any major design changes that are required to address concerns raised in submissions.

5.6.2 Consultation during construction

Following the REF display period and during the assessment and determination process and the construction of proposal, Transport will continue to identify and manage issues of interest or concern to the community. The aims of ongoing communications and consultation are to provide the community with:

- accurate and accessible information regarding the processes and activities associated with the proposal
- information in a timely manner
- appropriate avenues for providing comment or raising concerns, and to ensure they are aware of the avenues
- a high level of responsiveness to their issues and concerns throughout development and delivery of the proposal.

Following determination, the community would continue to be updated about the progress of construction and provided notification of any road closures, night works or general high impact construction activities in advance of the works occurring.

Community engagement through the construction phase for the overall proposal would be undertaken by Transport. Activities or notifications that could occur include:

- advanced/start of work notifications
- traffic management notifications, including any lane closures, parking or bus stop changes
- night-time work notifications and consultation
- quarterly project updates
- responding to enquiries and complaints
- end of construction
- tree removal
- ongoing construction communications.

Other activities include (but are not limited to) separate engagement with local residents, businesses and stakeholders on specific or sensitive aspects of the overall proposal.

To effectively manage consultation during the construction stage of the proposal, a Community and Stakeholder Engagement Plan would be developed in conjunction with Transport and approved prior to implementation by the construction contractor.

6. Environmental assessment

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

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the guidelines Is an EIS required? (DUAP 1995/1996) as required under Section 171 of the Environmental Planning and Assessment Regulation 2021 and the *Roads and Related Facilities EIS Guideline (DUAP 1996)*. The factors specified in Section 171 of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix A.

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

6.1 Surface water and groundwater

The potential impacts on surface and groundwater during construction and operation of the proposal have been assessed as part of the *Surface Water and Groundwater Technical Assessment Working Paper* (Aurecon, 2022b), provided in Appendix D.

6.1.1 Methodology

The methodology for the surface water and groundwater assessment included:

- a review of relevant planning instruments, Blue Mountains City Council management plans/strategies, licencing, or approval requirements
- a review of potential constraints and considerations relevant to key legislation and government policy, including:
  - *Environmental Planning and Assessment Act 1979*
  - *Water Management Act 2000*
  - NSW State Groundwater Quality Protection Policy (1998)
  - NSW Groundwater Dependent Ecosystems Policy (2002)
  - *Protection of the Environment Operations Act 1997*
  - NSW Aquifer Interference Policy (2012)
- a desktop review and description of key relevant physical features and baseline environmental conditions within the study area (a one-kilometre buffer around the proposal area) (see Figure 6-1), including summary of:
  - catchment context
  - local climate and weather conditions
  - local hydrology
  - flow gauging stations and flow records
  - local surface water receiving environments
  - baseline water quality data for receiving surface waters intersected by the proposal
  - soil landscape characteristics and modelled soil properties
  - geological and hydrogeological landscape characteristics
  - boreholes, groundwater dependent ecosystems and groundwater users within the study area

- a climate change assessment comprising a high-level local climate assessment
- an assessment of potential construction and operational impacts from the proposal
- recommendation of management measures to address potential construction and operational impacts of the proposal.

6.1.2 Existing environment

Climate

Rainfall data from the closest weather observation station (Katoomba, Farnells Road) shows that there is a variable annual rainfall rate, with January, February and March identified as the wettest months on average between 1886 and 2017. The long term 50 year mean rainfall was 1140 millimetres of rain per year, with as little as 800 millimetres and as much as 2100 millimetres recorded in some years.

Temperature near the proposal area varies between mild to warm summers (average maximum temperatures between 20 and 24 degrees Celsius) and cold winter periods with average maximum temperatures below 15 degrees Celsius. In winter, minimum temperatures average around three degrees Celsius.

Topography

Topography is varied across the study area. Natural slope gradients range from around two per cent on plateau surfaces and ridgelines to around 35 per cent. Within the proposal area, steep slopes are located near the twin bridges and on the Woodlands Road ancillary facility site. Steep slopes (greater than 20 per cent) significantly increase the risk of erosion on disturbed ground.

The proposal area is within the elevated Blue Mountains, with the Great Western Highway traversing multiple undulating hills. The elevation of the Katoomba to Medlow Bath section is between 1029 metres in Australian Height Datum (mAHD) at the southern end to 1061 mAHD at the northern end of the proposal. The Medlow Bath to Blackheath section occurs along the crest of a hill, with elevation ranging from roughly 1048 mAHD at the southern end to 1071 mAHD towards the northern end of the proposal.

Surface water

Catchment and waterways

The proposal is located within the Hawkesbury-Nepean catchment, the longest coastal catchment in NSW, draining around 21,400 square kilometres. There are no water bodies within the proposal area.

No major watercourses occur within the proposal area. There are, however, several surface waterways which intersect the study area including the Megalong Creek, Back Creek, Adams Creek and Relton Creek (refer to Figure 6-1).

The creeks on the eastern side of the Great Western Highway are tributaries of the Grose River while the creeks on the western side are tributaries of Coxs River. The Grose River and Coxs River are both perennial rivers that are part of the Hawkesbury-Nepean catchment.

The creeks on the eastern side of the Katoomba to Medlow Bath and Medlow Bath to Blackheath sections flow into the Upper Cascade Creek Dam and Lake Medlow respectively. These dams are located within the Katoomba and Blackheath Special Catchment Areas respectively.

Water sharing plan and drinking water catchments

The proposal is located within the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011. To the west of the proposal is the Upper Nepean and Upstream Warragamba Water Source and to the east of the proposal is the Hawkesbury and Lower Nepean Rivers Water Source. The proposal also intercepts the Sydney Drinking Water Catchment as defined by State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011.

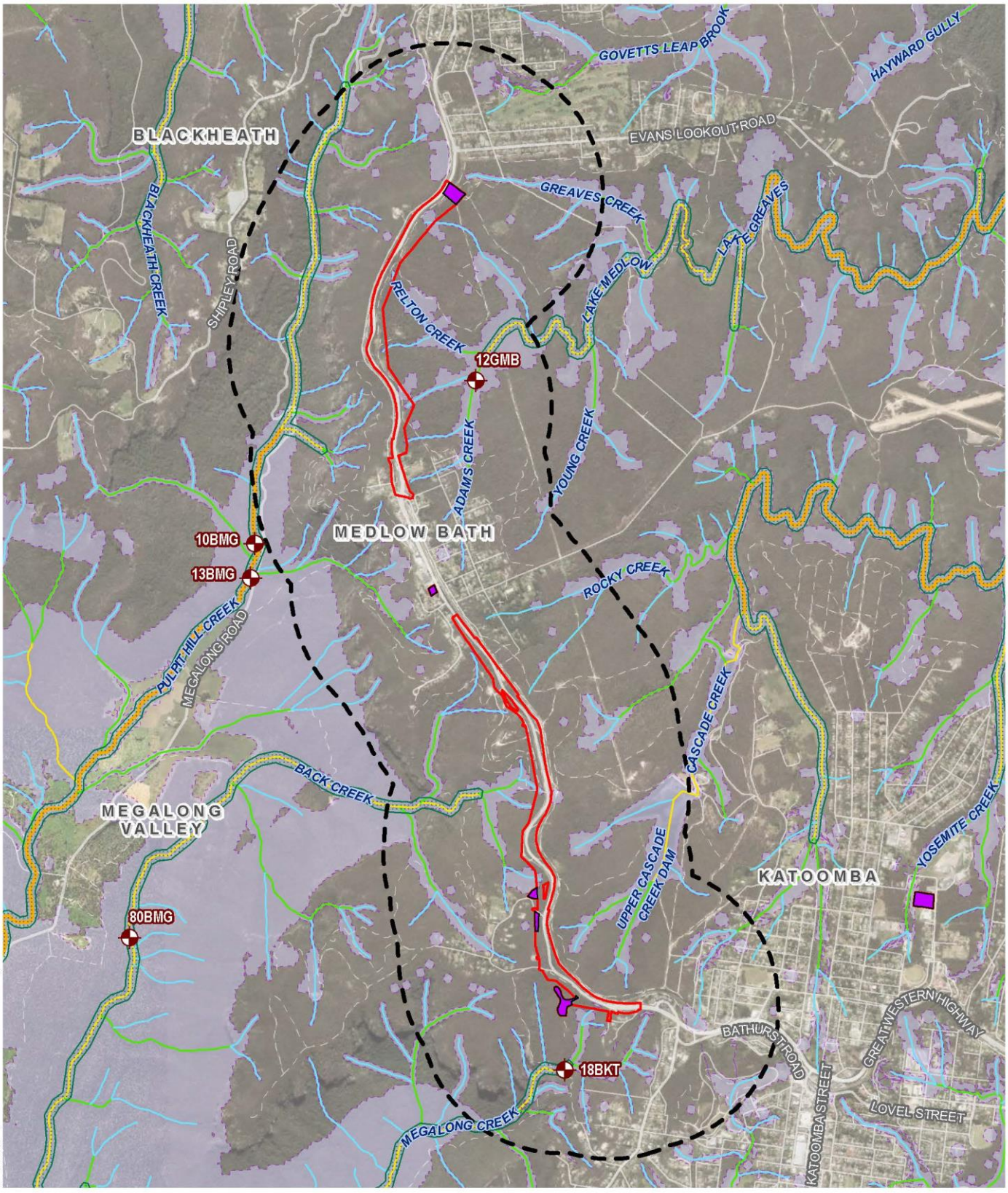
The Katoomba to Medlow Bath section passes through the Katoomba Special Catchment Area, while the Medlow Bath to Blackheath section passes through the Blackheath Special Catchment Area (refer to Section 4.2.12). Special and Controlled Areas are declared under the *Water NSW Act 2014* and WaterNSW regulates certain activities in these areas through the Water NSW Regulation 2020. The Special Catchment Areas are mostly native bushland around water storages and infrastructure. Public access and activities are restricted to protect water quality in these areas. However, it is noted that the Special Catchment Areas that intersect the proposal also cover some residential areas and road and rail infrastructure.

Sensitive receiving environments

The proposal is near the Blue Mountains National Park and much of the surface water that runs off or is discharged from the proposal area (particularly from the Medlow Bath to Blackheath section) would flow into the Blue Mountains National Park and the identified special catchment areas.

Key Fish Habitats (as defined in the *Fisheries Management Act 1991*) are present within waterways identified in the study area, including Megalong Creek, Back Creek, Pulpit Hill Creek and Adams Creek, however no Key Fish Habitats are present within the proposal area (Figure 6-1).

The biodiversity assessment carried out for the proposal identified one threatened ecological community within the proposal area. This is the Blue Mountains Swamp TEC (Plant Community Type 1078). Refer to Section 6.3 for further details.



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Proposal area

Study area

Proposed ancillary facilities

Key fish habitat

High Ecological Value waterways and water dependent ecosystems

Council surface water monitoring locations

Strahler Stream Order

1

2

3

4

Source: Aurecon, LPI, DPIE, BoM

1:40,000 @A4

0 500 1,000 m

Great Western Highway East **Review of Environmental Factors**

Projection: GDA2020 MGA Zone 56

FIGURE 6-1: Key surface water features

Hydrogeology

Aquifers and aquifer properties

In the study area, higher permeability areas are present in Banks Wall sandstone. In these areas, shallow aquifers form and groundwater flows are predominantly horizontal with vertical flow occurring via fissures/fractures that cross-cut bedding. These are local groundwater flow systems of typically fresh groundwater, and relatively short flow paths and residence times. Regional groundwater flow direction is expected to be consistent with the topography, flowing generally to the west and east of the Great Western Highway towards the creeks on either side of the highway.

Hydrogeological landscape

Hydrogeological Landscapes (HGL) are defined by similar areas of salt stores and pathways for salt mobilisation and are characterised by geology, soils, slope, regolith depth and climate. The proposal is located on Hawkesbury Sandstone HGL, with Megalong Valley HGL to the west of the study area. These HGLs are described in Table 6-1.

Table 6-1: Descriptions of hydrogeological landscapes within the study area

HGL	Description
Hawkesbury Sandstone	• Characterised by plateau, scarps, benches and hills on sandstone. • Moderately weathered, comprising consolidated sedimentary rocks from the Triassic period. • Contains the following key lithologies; Hawkesbury Sandstone, Narrabeen Group and Volcanic diatremes. • Groundwater flow is unconfined along structural features (bedding, joints, faults etc) in the fractured bedrock and through interbedded sandstone and sandstone fracturing. • Lateral flow occurs through unconsolidated colluvial sediments on slopes. • Hydraulic conductivity is high. • Transmissivity is moderate to high. • Depth to water table is deep (more than eight metres below ground level). • No salt observed in this landscape. • Groundwater is high quality and relatively fresh.
Megalong Valley	• Characterised by flat lying Permo-Triassic sandstone, claystone, coal, conglomerate and shale within the Hartley and Lithgow Valleys. • Moderately weathered • Layered stratigraphy of bedded and fractured siliceous sandstone, claystone and shale of the Shoalhaven, Illawarra and Narrabeen Groups. • Groundwater flow is unconfined along structural features (bedding, joints, faults etc) in the fractured bedrock and through interbedded sandstone and sandstone fracturing. • Lateral flow occurs through unconsolidated colluvial sediments on slopes. • Depth to water table is deep (more than ten metres below ground level). • No salt observed in this landscape. • Groundwater is high quality and relatively fresh.

Groundwater supply and quality

The proposal occurs across two groundwater sources, with the Sydney Basin Blue Mountains Groundwater Source to the east and the Sydney Basin Coxs River Groundwater Source to the west.

According to Realtime Water NSW, in July 2021, there were 27 registered boreholes within the surface water and groundwater study area. 25 of these boreholes are used for stock, domestic or general use water supply. The registered bores have groundwater levels between 11 and 60 metres below ground level.

One registered groundwater bore was identified within the Katoomba to Medlow Bath section on the Bureau of Meteorology Australian Groundwater Explorer register. This bore is used for stock and domestic water supply. No bores were identified within or near the Medlow Bath to Blackheath section.

No historic groundwater quality data is available for the proposal area.

Groundwater dependent ecosystems

The Groundwater Dependent Ecosystems (GDE) Atlas (Bureau of Meteorology, 2021) was reviewed on 30 July 2021 to identify GDEs within the study area. The identified GDEs included “aquatic” ecosystems that rely on the surface expression of groundwater, and “terrestrial” ecosystems that rely on the subsurface presence of groundwater.

There are numerous terrestrial and aquatic potential GDEs on both sides of the proposal, including Blue Mountains Swamp threatened ecological community (TEC) and other TECs. The swamps are identified as a TEC, the Temperate Highland Peat Swamps on Sandstone, which are listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999*.

One swamp is located in and adjacent to the proposal area under the proposed twin bridges in the Katoomba to Medlow Bath section. They occur on steep valley sides or cliffs and are mostly reliant on groundwater discharge that seeps out along bedding planes and low-permeability layers in the sandstone. Swamps occur at the interface between higher and lower permeability sandstone layers.

There were also many terrestrial GDEs identified on the western side of the study area, with GDE potential ranging from Low to High. No subterranean GDEs are present within the study area or downstream from it.

6.1.3 Potential impacts

Construction

The key potential construction impacts of the proposal on surface water and groundwater include:

- surface water quality impacts due to sediment laden runoff being released to waterways during construction activities such as vegetation removal, earthworks, stockpiling, bridge construction (Katoomba to Medlow Bath section only) and transportation of materials
- potential localised interception of groundwater and resulting groundwater quality impacts to GDEs near construction activities
- surface water and groundwater quality impacts as a result of accidental leaks and spills.

To minimise these potential impacts, a Soil and Water Management Plan (SWMP) would be prepared and implemented during construction. This plan would include the requirement for several erosion and sediment control measures to be maintained during construction.

Surface water

Table 6-2 provides further detail on the potential surface water impacts during construction of the proposal.

Table 6-2: Summary of potential surface water impacts during construction of the proposal

Construction activity	Potential impacts
Vegetation, topsoil removal and earthworks	Removal of vegetation, stripping of topsoil and earthworks, along the entire length of the proposal could potentially lead to erosion of soils and mobilisation of sediment to nearby creeks and unnamed tributaries. This may lead to increased turbidity and other water quality impacts in the following creeks: • Katoomba to Medlow Bath section – Megalong Creek and Back Creek, which are identified as key fish habitats and are located within the Sydney Drinking Water Catchment (Coxs River) and pass through Blue Mountains National Park. • Medlow Bath to Blackheath section – Adams Creek (which drains directly into Lake Medlow, the local water drinking resource), which is identified as key fish habitat downstream to the proposal and is located within the Sydney Drinking Water Catchment (Grose River) and Blue Mountains National Park. Removal of vegetation and earthworks due to the proposal, especially near these creeks, presents the greatest risk to water quality impacts. A Preliminary Erosion and Sedimentation Assessment (PESA) was carried out to assess the erosion hazard of the proposal area. The PESA found that both sections of the proposal represent a high erosion risk (Appendix D).
Construction near or across waterways	Construction activities, including the construction of drainage basins, are expected to occur near or adjacent to waterways within the proposal area and may impact these waterways. There is a risk of blockages of the waterways and drainage lines due to earthworks and other construction activities. Diversion of drainage lines may also create localised areas of flooding and scour. These impacts are expected to be temporary and minor and would be managed through the implementation of standard construction techniques and mitigation measures discussed in Section 6.1.4. The construction of new concrete twin bridges within the Katoomba to Medlow Bath section would cross a tributary to Back Creek. If not managed appropriately, overland flow could wash construction materials, fuels and chemicals into the natural drainage line from the areas of the bridge construction and adjacent road work construction. The downstream environment is within the Katoomba Special Catchment Area, which is a sensitive receiving environment and at high risk of contamination without appropriate safeguards. The removal of vegetation and earthworks at this location would also increase the erosion and sedimentation risk of this tributary causing water quality issues. Removal of vegetation and the construction work would increase the area of impervious surfaces increasing the possibility of scouring for the tributary below the bridge. These impacts and risks also apply to the tributary of Megalong Creek at the south of the Katoomba to Medlow Bath section. For the Medlow Bath to Blackheath section, overland flow could wash construction materials, fuels and chemicals into the natural drainage line from the areas of road work construction if not appropriately managed. The downstream environment is within the Blackheath Special Catchment Area, which is a sensitive receiving environment and at high risk of contamination without appropriate safeguards. Five construction basins are proposed along the length to capture runoff to manage this potential impact. Removal of vegetation and the construction work would increase the area of impervious surfaces increasing the possibility of scouring for the tributaries downstream of the section. Control measures would be installed in accordance with the Blue Book, to minimise any potential impacts.
Construction and use of ancillary facilities	The location and the topography of the Katoomba to Medlow Bath and Medlow Bath to Blackheath sections mean that runoff or leaks may end up in local waterways if not managed correctly. This would pose a risk to water quality if construction materials including fuel, chemicals and ablution from toilet facilities are mobilised by overland flows into adjacent waterways and appropriate procedures are not in place in regard to storage of materials including stockpiles. However, identified ancillary facilities are located more than 40 metres away from local waterways to avoid any potential impacts and management measures would be implemented (refer to Section 6.1.4).

Construction activity	Potential impacts
Stockpiles	If placed in an unsuitable position, stockpiles of raw materials or spoil may obstruct local flow paths and lead to the mobilisation of materials offsite. Stockpile site locations would be confirmed during detailed design and sediment management measures would be used on the stockpile sites to minimise the potential for sediment laden runoff to be discharged offsite and lead to sedimentation impacts to receiving waters.
Leaks and spills	There is the potential for harmful chemicals and substances to accidentally be released to the surface water environment during construction spills or as a result of maintenance work, refuelling and inappropriate storage or handling. Leakage from construction worker facilities or wastewater collection points may occur and produce runoff into receiving waterways. Contamination of exposed soils or mobilisation of contaminated soils and liquids into local watercourses could result in water quality impacts and impact sensitive receiving environments. Refer to Section 6.2.3 for further details. Measures to minimise the potential impacts associated with accidental leaks and spills during construction would be incorporated into a site-specific emergency spill plan.
Discharges	Discharges from the construction area have the potential to cause turbidity and other impacts in the receiving waterways which have been identified as drinking water catchments and sensitive receiving environments. To manage this issue, sediment basins form part of construction management measures to intercept stormwater flows and capture the sediments, before discharging to waterways. Further mitigation measures proposed to minimise or prevent impacts as a result of these discharges are discussed in Section 6.1.4.
Transportation of material	Spillage of waste or construction materials during transportation may lead to pollutants being conveyed in surface run-off to nearby drainage pathways and downstream waterways. Vehicle movements in the area also creates disturbances to sediment increasing the risk of sediment transport either immediately through vehicle movements or subsequently through wind and water runoff. Measures to manage materials during transport would be included within the future CEMP.
Flooding	The proposal area is not located within a floodplain. It runs along a ridgeline between two floodplains. While there would not be any impacts to flood behaviour or additional flood impacts, there is a risk of blockages of waterways and drainage lines due to erosion and sedimentation from earthworks or other activities. This may cause localised flooding and change the ultimate discharge location of overland flows into the receiving watercourses. These temporary impacts are expected to be minor and would be managed through the implementation of standard construction techniques.

Groundwater

Table 6-3 provides further detail on the potential groundwater impacts during construction of the proposal.

Table 6-3: Summary of potential groundwater impacts during construction of the proposal

Construction activity	Potential impacts
Earthworks, piling and dewatering	Groundwater is present at between 15 and 35 metres below ground level according to the search of registered bores within the study area. Earthworks associated with road construction are generally likely to be shallow and include cutting and filling of embankments, utility work and draining work so larger groundwater systems are unlikely to be intercepted during most construction activities. However, due to the potential for perched aquifers in the proposal, it is possible that groundwater could be intercepted in localised areas. Dewatering is not anticipated, however, where shallow groundwater is intercepted, the quality of the groundwater would be considered during groundwater dewatering, management, and release. Piling for bridge and retaining wall construction in the Katoomba to Medlow Bath section may be more likely to intercept groundwater resources due to the increased depth of ground penetration. Groundwater flow interruption is not anticipated due to the localised nature of the piling work during construction. If groundwater was to be intercepted during piling, construction contaminants may be introduced into the groundwater aquifers. These impacts would be short-term. Further monitoring would be carried out to evaluate the existing condition and monitor impacts of the proposal on groundwater, as discussed in Section 6.1.4.
Groundwater quality / GDE impacts	During construction, hydrocarbon spills or leaks may contaminate the perched aquifers or terrestrial GDEs downstream of the proposal. For the Katoomba to Medlow Bath section: • Aquatic GDEs and the Blue Mountains Swamp TEC within or near the proposal area have the potential to be impacted should groundwater contamination occur. However, groundwater contamination is not expected to occur with the proposed mitigation measures in place. These GDEs would also experience potential surface water impacts (including increased flow, reduction in water quality) as many of them are located within local waterways. • Potential impacts to the two aquatic GDEs located downstream of the bridge construction would be high due to potential of experiencing both surface and groundwater impacts if controls are not implemented. However, managing impacts to surface water and groundwater by implementing water quality treatment measures discussed in Section 6.1.4 would reduce the impacts to the aquatic GDEs. • Due to the hydrological soil type in the south of the section, potential for seepage is high and so there may be impacts as a result of seepage to groundwater to these aquatic GDEs. Contamination and spills would be managed within the SWMP and site-specific emergency spill plans as part of the CEMP as discussed in Section 6.1.4. For the Medlow Bath to Blackheath section: • Potential impacts due to construction work and potential leaks and spills to the identified GDE near the proposed northernmost drainage basin would be high due to potential of experiencing both surface and groundwater impacts if controls are not implemented. However, managing impacts to surface water and groundwater by implementing water quality treatment measures discussed in Section 6.1.4 would reduce the impacts to the aquatic GDEs. • Due to the hydrological soil type in this section, potential for seepage is low and so impacts on aquatic GDEs due to seepage of contaminants is low.

Operation

Surface water

The following operational activities could potentially lead to adverse impacts on groundwater and surface water:

- increased impervious surfaces as a result of the highway upgrade, including roadway and pavements, resulting in increased stormwater runoff volume, frequency and rate and associated increases in pollutant loading to receiving waterways.
- scour and erosion at new drainage outlets, downstream of new culverts and within grass drains and channel realignment work if poorly stabilised or if scour protection is poorly constructed
- accidental spills from motorists and personnel undertaking management tasks

The increase in pollutants could result in water quality impacts such as sedimentation, reduced water clarity, increased toxicant and nutrient concentrations and lower dissolved oxygen levels within the receiving waterways. Increases in frequency, rate and volume of flows due to an increase in impervious area may also impact waterway health.

To minimise these impacts, the proposal includes several Gross Pollutant Traps (GPT), water quality basins and swales to retain and treat stormwater runoff (refer to Section 3.2.3). The drainage design includes drainage pipes diverting dirty road water to six bioretention basins along the Katoomba to Medlow Bath section and five bioretention basins along the Medlow Bath to Blackheath section.

A high-level MUSIC model was developed to estimate the change in pollutant load and annual runoff volume as a result of the proposal with consideration to the proposed stormwater treatment strategy. These results are outlined for each section of the proposal in Table 6-4. The modelling found that that the proposal with no treatment would result in a major increase in TSS, total phosphorus (TP), total nitrogen (TN) and gross pollutant loads from the local drainage catchments. However, when the proposed water quality treatments were included in the modelling, the results identified a net beneficial effect on water quality, as per the neutral or beneficial effect on water quality (NorBE) assessment carried out for the proposal (refer to Appendix C).

The proposed water quality treatments would result in a major reduction in gross pollutant loads across both sections of the proposal. There would be a net reduction of 99.6 per cent of total gross pollutants for the Katoomba to Medlow Bath section and 99.2 per cent for the Medlow Bath to Blackheath section, when compared to the existing scenario. Across both sections of the proposal, this would comprise reductions of about:

- 90 per cent in TSS pollutant loads
- 70 per cent in TP pollutant loads
- 50 per cent in TN pollutant loads.

Both sections would meet and exceed Transport's Sustainable Design Guidelines targets.

Table 6-4: MUSIC modelling results

Section	Condition	Total Suspended Solids (kg/yr)	Total Phosphorous (kg/yr)	Total Nitrogen (kg/yr)	Total Gross Pollutants (kg/yr)
Katoomba to Medlow Bath section	Existing scenario	18,950	33.28	144.96	1,218.1
	With proposal (without treatment)	40,476	67.94	276.65	2,971.9
	With proposal (with treatment)	3,352	17.21	126.87	13.3
	% removal in average annual loads	91.7%	74.7%	54.1%	99.6%
Medlow Bath to Blackheath section	Existing scenario	37,820	66.20	286.20	2,404.0
	With proposal (without treatment)	53,600	93.80	398.10	4,229.0
	With proposal (with treatment)	7,051	30.37	207.40	34.4
	% removal in average annual loads	86.8%	67.6%	47.9%	99.2%

While not captured in the MUSIC modelling, the proposed water quality treatments would also reduce concentrations of heavy metals and hydrocarbons compared to existing levels.

Scour and erosion could occur within the local waterways near the proposal. If poorly stabilised or constructed, this could occur at:

- new drainage outlets
- downstream of the new culverts
- adjacent to the bridge pile caps (Katoomba to Medlow Bath section)
- within the grass drains
- near channel realignment work.

However, these features would be designed to minimise potential scour and erosion impacts.

The proposal could cause minor operational flood impacts downstream due to increases in volume, frequency and rate of stormwater runoff as a result of the increased road footprint. Downstream flooding impacts would be limited through the design of the proposal by using:

- detention basins downstream of some cross-drainage locations where the peak major flow rate arriving at the receiving watercourse would otherwise increase due to the proposal
- flow spreaders at discharge locations to limit the velocity of flows at receiving watercourses.

Accidental spills of oils or other chemicals by motorists or personnel carrying out maintenance work could lead to contaminants being released into drainage lines and the receiving waterways. Spills and water quality impacts would be contained within the drainage system and water quality treatment basins.

Groundwater

Operation of the proposal is unlikely to impact the groundwater in the study area. Minor potential operational impacts that may impact upon groundwater are related to hydrocarbon leakages from road users, which are likely to be short term and localised due to the soil type within the proposal area. Any impacts to groundwater, if not mitigated, have the potential to impacts the Blue Mountains Swamp TEC. However, these impacts are unlikely and would be limited due to the proposed water quality strategy implemented as part of the proposal, which includes hydrocarbon traps.

6.1.4 Safeguards and management measures

Safeguards and management measures for surface water and groundwater are outlined in Table 6-5.

Table 6-5: Safeguards and management measures – surface water and groundwater

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will: • identify all reasonably foreseeable risks relating to soil erosion and water pollution, including runoff and the design and construction of waterway crossings • describe how these risks will be addressed during construction • include a construction surface water quality monitoring plan prepared in accordance with the Guideline for Construction Water Quality (Transport, n.d.) and Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (NSW EPA, 2004) • include a construction groundwater monitoring plan, which will provide information on groundwater conditions for design, construction and operation of water quality basins and enable monitor pollution originating from the stormwater seeping into the groundwater The Soil and Water Management Plan (SWMP) will be reviewed by a soil conservationist on the Transport for NSW list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP will then be revised to address the outcomes of the review.	Contractor	Detailed design / pre-construction	Section 2.1 of QA *G38 Soil and Water Management*
Soil and water	The preliminary Erosion and Sedimentation Management Plan (ESMR) and Erosion and Sedimentation Control Plans (ESCP) produced for the proposal (Appendix D to the REF) will be updated during the detailed design phase to confirm the erosion and sedimentation controls for both sections of the proposal, including the construction of progressive ESCPs and the continual updating of these plans.	Transport / Contractor	Detailed design / Pre-construction	Section 2.2 of QA *G38 Soil and Water Management*
Soil and water	An assessment of construction sediment basin discharges will be prepared during detailed design to assess the appropriate water quality limits for sediment basin discharges and ensure consistency with the Water Quality Objectives for this location or agreed upon guideline values in consultation with Blue Mountains City Council.	Transport	Detailed design	Additional safeguard
Soil and water	An assessment to determine appropriate water quality limits for sediment basin discharges will be undertaken as part of detailed design, with reference to the Water Discharge and Reuse Guideline (Transport, 2016b).	Transport	Detailed design	Additional safeguard
Soil and water	Periodic wet weather monitoring will be undertaken within the tributaries of Back Creek and Megalong Creek (Katoomba to Medlow Bath section) and Relton Creek and Adams Creek (Medlow Bath to Blackheath section) that intercept the proposal and the sedimentation discharge points, before and during construction.	Contractor	Pre-construction / Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	Where possible, permanent drainage structures will be installed as early as possible to facilitate effective separation of clean offsite and dirty onsite water.	Contractor	Construction	Additional safeguard
Soil and water	The water quality treatment system will be developed further during detailed design in consultation with Water NSW and Blue Mountains City Council. This will include: • layout and detail of the drainage system including outlet design • minimisation of discharge flows should also be minimised in the basin outflows, to limit scouring in the drainage channels • design within and around the waterways • assessment of culverts and stormwater inlets in the local waterways and recommendation for scour protection within the Medlow Bath to Blackheath section.	Transport	Detailed design	Additional safeguard

6.2 Soils and contaminated land

The potential impacts on soils and contaminated land during construction and operation of the proposal have been assessed as part of the REF.

6.2.1 Methodology

The methodology for this assessment included:

- a desktop review of the proposal area on 10 June 2021, including a review of:
  - historical aerial mapping sourced from the NSW Department of Customer Service and Aerometrex Pty Ltd
  - land-use zoning information
  - geology, soil, topography and registered groundwater bore maps
  - acid sulfate soil (ASS) and salinity risk maps
  - NSW Environment Protection Authority (EPA) databases on the contaminated land record and *Protection of the Environment Operations Act 1997* (POEO Act) licences for the site and the Blue Mountains LGA
  - NSW EPA priority per- and polyfluoroalkyl substances (PFAS) investigation risk sites within five kilometres of the proposal area
  - NSW Department of Primary Industries (DPI) former livestock dip locations and mapping
  - Department of Defence unexploded ordnance risk mapping
  - previous contamination reports, previous contamination registers and records, potential contamination issues and records of illegal dumping or earthworks for the proposal area
- a site inspection of the study area (a 200-metre buffer around the proposal area) on 14 July 2021 for visual assessment of surface filling, dumped wastes, land uses, contamination risks that could constrain the proposal
- development of a Conceptual Site Model (CSM) to evaluate the potential risks to human health and the environment during construction and operation of the proposal
- a preliminary risk assessment, which aims to identify risks to be minimised through design of the proposal and areas for further assessment prior to construction of the proposal
- recommendation of management measures to address identified risks.

6.2.2 Existing environment

The existing environment of topography, surface water and hydrogeology related to the assessment of soils and contamination is discussed in Section 6.1.2.

Study area

A summary of the features of the study area used the assessment of soils and contaminated land, including land zoning, transport corridors, structures and infrastructure and open spaces is outlined in Table 6-6. The surrounding land uses within a 200 metre radius of the proposal have been outlined in Table 6-7.

Table 6-6: Study area setting

Location	Land zone/s	Transport corridors	Buildings or structures	Open spaces
Katoomba to Medlow Bath section	C2 – Environmental Conservation C3 – Environmental Management C4 – Environmental Living SP2 – Infrastructure	Great Western Highway	Rural living properties Rail corridor	Vegetated and undeveloped lots
Medlow Bath to Blackheath section	SP2 – Infrastructure C2 – Environmental Conservation C4 – Environmental Living	Great Western Highway	Rural living properties Rail corridor	Blue Mountains National Park Vegetated and undeveloped lots

Table 6-7: Surrounding land uses

Location	Direction	Land use details	Land use zones
Katoomba to Medlow Bath section	North	Great Western Highway Rail Corridor Rural living properties	SP2 – Infrastructure C2 – Environmental Conservation C3 – Environmental Management C4 – Environmental Living
	East	Rail Corridor Blue Mountains National Park Vegetated and undeveloped lots Residential housing	SP2 – Infrastructure C1 – National Parks and Nature Reserves C2 – Environmental Conservation C4 – Environmental Living
	South	Rural living properties Vegetated lots	C2 – Environmental Conservation C4 – Environmental Living
	West	Vegetated lots Rural living properties Rail radio communication tower	SP2 – Infrastructure C2 – Environmental Conservation C3 – Environmental Management C4 – Environmental Living
Medlow Bath to Blackheath section	North	Vegetated lots Great Western Highway	C1 – National Parks and Nature Reserves C2 – Environmental Conservation
	East	Blue Mountains National Park Rural living properties Vegetated and/or undeveloped lots Trails and unpaved roads	C1 – National Parks and Nature Reserves C2 – Environmental Conservation C4 – Environmental Living
	South	Rail corridor Great Western Highway Residential housing Medlow Bath Station Synonymous Café Blue Mountains Mazda Medlow Bath Rural Fire Brigade Vegetated lots	C2 – Environmental Conservation C4 – Environmental Living SP2 – Infrastructure SP3 – Tourist
	West	Rural living properties Vegetated lots Rail corridor	C2 – Environmental Conservation C4 – Environmental Living SP2 – Infrastructure

Historical aerial imagery

Interpretation of historical aerial imagery from between 1943 and 2021 has identified changes in land use within and near the proposal area.

Within the Katoomba to Medlow Bath section, the Great Western Highway and the surrounding vegetated lots and Blue Mountains National Park have been present since 1943. A small number of buildings, potentially rural living properties, have been removed since 1943, while additional properties were established, especially near Medlow Bath. A Caltex depot was present to the north of Foy Avenue from before 1943 and had been removed by 2002. Geotechnical investigations along the Great Western Highway confirmed the presence of fill within the road shoulders, with fill visible in historical aerials. A site inspection confirmed the general presence of fill across the proposal area, existing stockpiles and dumped items.

Within the Medlow Bath to Blackheath section, the Great Western Highway, rail corridor and the surrounding vegetated lots and Blue Mountains National Park have been present since 1943. Some earthworks and fill were present at the northern end of the proposal in 1943. A small number of buildings, potentially rural living properties, have been removed over the years. Geotechnical investigations along the Great Western Highway have confirmed the presence of fill within nature strips, the road reserve and road shoulders. A site inspection confirmed the general presence of fill across the proposal area and existing stockpiles.

Regulatory database searches

As part of the desktop review outlined in Section 6.2.1, the following databases were searched, and returned no results of contamination within the specified distances of the proposal:

- NSW EPA public register (notified sites and contaminated land record) – 500 metres
- NSW Government PFAS Investigation Program – five kilometres
- Department of Defence Unexploded Ordnance – five kilometres
- NSW DPI livestock dip site locator – five kilometres.

A review of the Environmental Protection Licenses (EPL) issued by the EPA under the POEO Act within 500 metres of the proposal identified the EPLs outlined in Table 6-8. The Katoomba Waste Management Facility was issued a clean-up notice in 2017 and has received a number of non-compliance notices.

Table 6-8: EPLs within 500 metres of the proposal

Licence Number	Licensee	Premises	Status	Scheduled activities	Location to proposal areas
211228	CPB Contractors Pty Limited	Blue Mountains Route Clearance, referring to “all railway stations between Falconbridge and Newnes Junction except Mt Victoria”	Surrendered	• Railway system activities	Medlow Bath Station, located about 80 m south of the Medlow Bath to Blackheath section
1436	Metromix Pty Limited	19 Twynham Street, Katoomba, NSW 2780	No longer in force	• Concrete work	250 m south of the Woodlands Road, Katoomba ancillary facility
5481	Ventia Utility Services Pty Limited	Katoomba Waste Management Facility 49-89 Woodlands	Surrendered	• Waste disposal by application to land	60 m north-east of the Woodlands Road, Katoomba ancillary facility

Licence Number	Licensee	Premises	Status	Scheduled activities	Location to proposal areas
		Road, Katoomba, NSW 2789			
10034	Blue Mountains City Council	Katoomba Waste Management Facility 49-89 and 70-78 Woodlands Road, Katoomba, NSW 2789	Issued	• Waste storage - other types of waste Waste disposal by application to land	60 m north-east of the Woodlands Road, Katoomba ancillary facility
13089	Blue Mountains City Council	Katoomba Waste Management Facility 49-89 and 70-78 Woodlands Road, Katoomba, NSW 2789	Issued	• Waste storage - waste tyres • Waste Storage, Transfer, Separating or Processing • Waste storage - other types of waste • Non-thermal treatment of general waste • Composting	60 m north-east of the Woodlands Road, Katoomba ancillary facility

Site inspection

A preliminary Conceptual Site Model (CSM) was prepared to identify areas of potential environmental concern (APECs) within the proposal area. A summary of the findings of the CSM are outlined in Table 6-9.

Table 6-9: Areas of potential environmental concern within the proposal area

Location	APEC
Katoomba to Medlow Bath section	• Roads and associated emissions from vehicle exhausts and runoff sediments from the Great Western Highway and adjoining rail corridor • Filling and incidental renovations within rural living properties and road reserves • Historical and existing stockpiles, including those adjacent to the rail corridor • Historical Caltex fuel depot located to the north of Foy Avenue which was established prior to 1943 and removed by 2002, with fill and stockpiles present on site. • Illegal dumping, which has been identified throughout the proposal area including on private property and adjacent to the rail corridor.
Medlow Bath to Blackheath section	• Roads and associated emissions from vehicle exhausts and runoff sediments from the Great Western Highway and adjoining rail corridor • Filling and incidental renovations within rural living properties, road reserves and nature strips • Four known stockpiles present adjacent to 12 Coachhouse Lane, Medlow Bath
Woodlands Road, Katoomba ancillary facility	• Roads and associated emissions from vehicle exhausts and runoff sediments from Woodlands Road • Historical development of the site • Proximity of three EPLs and one clean-up noticed issued to the Katoomba Waste Management Facility, 127 metres to the north. One EPL issued to Metromix Concrete, 245 metres to the south.
Great Western Highway, Medlow Bath ancillary facility	• Roads and associated emissions from vehicle exhausts and runoff sediments from the Great Western Highway and adjoining rail corridor • The United Petroleum Medlow Bath service station at 90-92 Great Western Highway, Medlow Bath, located directly north of the site • Historical and existing filling and stockpiles on the site

6.2.3 Potential impacts

Construction

The preliminary risk assessment conducted for the proposal is outlined in Table 6-10. This assessment considered the potential risk factors, pathways and receptors for contaminants near the proposal and the potential exposure to contaminants of potential concern (CoPCs) during construction. The risk ratings applied in the assessment are defined as:

- **Negligible** – the presence of the identified source does not give rise to the potential to cause significant harm.
- **Low** – it is possible that harm could arise to a designated receptor from an identified source though this is likely to be mild.
- **Moderate** – it is possible that harm could arise to a specific receptor, but it is unlikely that such harm would be significant.
- **High** – a designated receptor is likely to experience significant harm from an identified source without remedial action.
- **Very high** – there is a high probability that severe harm could arise to a designated receptor from an identified source without appropriate remedial action.

The assessment found that there may be CoPCs present within fill and stockpiles across the proposal area. Potential risks to the local environment would be managed through implementation of a Construction and Environmental Management Plan (CEMP) during construction as well as other safeguards and management measures outlined in Section 6.2.4.

The surface and groundwater quality impacts related to soils and contamination are discussed in Section 6.1.3.

Table 6-10: Preliminary risk assessment

Location	Potential sources	Potential receptors	Assessment of potential impact	Risk rating
Katoomba to Medlow Bath section	• Roads and associated emissions from vehicle exhausts and runoff sediments • Filling and incidental renovations within rural living properties and road reserves • Historical and existing stockpiles • Historical fuel depot • Illegal dumping	**Human** • Future construction workers • Residents during construction • Workers and visitors to the nearby businesses **Environmental** • Surface water • Groundwater	There may be CoPCs present within fill, stockpiles and dumped present across the section. There may be impacts to the soil and groundwater from the historical Caltex depot, located near Foy Avenue. Given the age of the depot and that it has been removed, it is unlikely that there are elevated CoPC concentrations in the study area near the former depot location. CoPCs may be encountered in soil and groundwater during construction phase As intrusive investigations have not been undertaken along the section, it is possible that CoPCs at concentrations above the applicable Tier I screening guidelines and/or waste classification criteria are present in the study area. Areas of cut and / or any spoil produced should be assessed to inform necessary waste management practices.	Low – Moderate (due to known fill and historical fuel depot)
Medlow Bath to Blackheath section	• Roads and associated emissions from vehicle exhausts and runoff sediments • Filling and incidental renovations within rural living properties, road reserves and nature strips. • Stockpiles	**Human** • Future construction workers • Residents during construction • Workers and visitors to the nearby businesses **Environmental** • Surface water • Groundwater	There may be CoPCs present within fill and stockpiles present across the proposal which may be encountered during excavations and construction. As contamination investigations have not been undertaken along the proposal, it is possible that CoPCs at concentrations above the Tier I screening guidelines and/or waste classification criteria are present in the study area. Areas of cut and / or any spoil produced should be assessed to inform necessary waste management practices.	Low – Moderate (due to known fill)
Woodlands Road, Katoomba ancillary facility	• Roads and associated emissions from vehicle exhausts and runoff sediments • Historical development of the site • EPL facilities	**Human** • Future construction workers • Residents during construction	There may be CoPCs present within fill and stockpiles present across the ancillary facility which may be encountered during excavations and construction. However, previous studies of this ancillary facility have not investigated the full extent of the site. As such, further investigations are required to identify any unknown CoPCs and the potential risks to the local environment should be carried out if the compound site is to be used. There is also a risk that potential impacts from the EPL licenced Katoomba Resource Recovery and Waste Management Facility have mobilised into soils,	Risk rating subject to further investigation

Location	Potential sources	Potential receptors	Assessment of potential impact	Risk rating
		• Workers and visitors to the nearby businesses **Environmental** • Surface water • Groundwater	surface water and groundwater. However, given the distance and local topography, there is a low risk that the ancillary facility would be impacted by the facility.	
Great Western Highway, Medlow Bath ancillary facility	• Roads and associated emissions from vehicle exhausts and runoff sediments • Service stations • Historical and existing filling and stockpiles	**Human** • Future construction workers • Residents during construction • Workers and visitors to the nearby businesses **Environmental** • Surface water • Groundwater	There may be CoPCs present within fill and stockpiles present across the ancillary facility which may be encountered during excavations and construction. There may be impacts to the soil and groundwater from the United petrol station located adjacent to the ancillary facility from historical surficial leaks and spills. There is also a risk of underground storage tanks, which store petrol and other fuels, to have potentially leaked and impacted the surrounding soils and groundwater. These could pose a risk to construction workers and the environment should any spills or leaks be encountered during construction work. As contamination investigations have not been undertaken at the ancillary facility, it is possible that CoPCs at concentrations above the Tier I screening guidelines and/or waste classification criteria are present in the study area. Areas of cut and / or any spoil produced should be assessed to inform necessary waste management practices.	Low – Moderate (due to known fill on site and the nearby service station)

Operation

During operation of the proposal, contamination would be expected to mainly occur due to exhaust particles and discharges from vehicle engines, litter and vehicle waste or accidental spills. These potential contamination sources are already present in the area due to the existing highway. The proposal would not result in a change to the existing situation.

6.2.4 Safeguards and management measures

Safeguards and management measures for soils and contamination are outlined in Table 6-11. Other safeguards and management measures that would address soils and contamination impacts are identified in Section 6.1.4.

Table 6-11: Safeguards and management measures – soils and contamination

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contaminated land	A Contaminated Land Management Plan will be prepared in accordance with the *Guideline for the Management of Contamination* (Transport, 2013a) and implemented as part of the CEMP. The plan will include, but not be limited to: • capture and management of any surface runoff contaminated by exposure to the contaminated land • further investigations required to determine the extent, concentration and type of contamination • management of the remediation and subsequent validation of the contaminated land, including any certification required • an unexpected finds protocol for incidental potential contamination finds during earthworks (such as illegally dumped wastes and stockpiles) • the work methodology to identify, manage, handle and dispose of any contaminated materials or wastes as part of the work • measures to ensure the safety of site personnel and local communities during construction.	Contractor	Detailed design / Pre-construction / Construction	Section 4.2 of QA *G36 Environment Protection*
Accidental spill	A site-specific emergency spill plan will be developed and include spill management measures in accordance with the Transport for NSW *Code of Practice for Water Management* (Roads and Traffic Authority, 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 Transport for NSW and EPA officers).	Contractor	Detailed design / Pre-construction	Section 4.3 of QA *G36 Environment Protection*
Contaminated land	Ancillary facility sites that have been historically developed should be subject to intrusive investigations to identify any contaminants of potential concern on the site to assess the suitability of the site and whether activities that would be undertaken on the site will warrant additional controls.	Contractor	Pre-construction / Construction	Additional safeguard
Contaminated land	Areas of cut material in the proposal area will be assessed through an intrusive investigation to inform a likely waste classification of materials to be excavated (if required), suitability for reuse and/or if offsite disposal is required.	Contractor	Pre-construction / Construction	Additional safeguard
Waste management	Any spoil produced during the construction phase will be assessed in accordance with the NSW EPA (2014) *Waste Classification Guidelines* and *Resource Recovery Order / Exemption under the Protection of Environment (Waste) Operations Act 2000* to determine necessary waste management practices.	Contractor	Pre-construction / Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	The CEMP will include the following hierarchy for reuse, recycling or disposal of spoil produced during construction: • If spoil produced during construction will remain within the Lot and DP from which it was produced, it can be reused if CoPC concentrations are below the applicable NEPM 2013 Tier I screening values for evaluation of potential risk to human health and the environment. • Spoil produced during construction can be reused within the Lot and DP boundaries from which it was produced or on another Transport or third party site if it meets the definition of virgin excavated natural material / excavated natural material in accordance with the applicable *Resource Recovery Order / Exemption under the Protection of Environment (Waste) Operations Act 2000*. • Spoil that does not meet either of the above definitions should be transported to an appropriately licenced facility for recycling if all CoPC concentrations are below the NSW EPA (2014) Waste Classification Guidelines contaminant threshold 1 (CT1) values for General Solid Waste. The soil can be recycled at an appropriately licenced facility in accordance with any current Transport contractual arrangements. • If CoPC concentrations are above the CT1 values, the soil waste should be classified per the Waste Classification Guidelines and disposed at an appropriately licenced facility			
Contaminated land	The risk of potentially impacted soil migrating from the future upgrade work including dust generation and runoff will be minimised utilising standard practices such as dust suppression, and erosion and sedimentation control. These measures along with other measures will be included in the CEMP. Other controls will include proper use of work health and safety equipment and monitoring of work where asbestos or other contamination is identified.	Contractor	Pre-construction / Construction	Additional safeguard

6.3 Biodiversity

The potential impacts on biodiversity during construction and operation of the proposal have been assessed as part of the *Great Western Highway Upgrade East Biodiversity Assessment Report* (BAR) (Transport, 2022), provided in Appendix E.

6.3.1 Methodology

The methodology for the BAR included:

- identification of the biodiversity study area as the area that would be subject to direct impacts (proposal area) and some areas of potential habitat beyond that boundary (refer to Figure 6-2)
- a review of relevant literature, databases and existing vegetation mapping to identify vegetation, threatened flora and fauna and Threatened Ecological Communities (TECs) that are listed under both NSW and Commonwealth legislation, with potential to occur within a 10 kilometre radius of the study area, including:
  - Department of Planning and Environment (DPE) BioNet, Atlas of NSW Wildlife
  - Department of Agriculture, Water and Environment (DAWE) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool
  - Threatened Biodiversity Data Collection
  - Directory of Important Wetlands of Australia published by Environment Australia
  - Bureau of Meteorology Atlas of Groundwater Dependent Ecosystems (GDE)
  - Species Profile and Threats database for EPBC listed threatened species and communities
  - Biodiversity Assessment Method Calculator (BAM-C) for prescribed and candidate threatened biodiversity
- field surveys of the study area to identify and assess biodiversity values in accordance with the Biodiversity Assessment Methodology (BAM) and relevant threatened biodiversity survey guidelines
- an assessment of 'likelihood of occurrence' following the collation of database records and species and community profiles
- assessing the potential impacts to flora, fauna and migratory species within the proposal area including assessments of significance where required
- identification of construction and operational management measures as well as the need for biodiversity offsets.

Biodiversity field surveys for the proposal were carried out for the following seasons:

- Spring/Summer 2020 (14 October – 17 December 2020)
- Winter 2021 (15 – 20 June 2021)
- Spring 2021 (13 – 18 September 2021)
- Summer 2021 (6 December 2021 – 11 January 2022)
- Autumn 2022 (11 March 2022).

These surveys were carried out in accordance with the BAM and included:

- floristic and BAM plots to determine Plant Community Type (PCT) and condition
- habitat mapping (hollow-bearing tree survey, watercourses, rocky outcrops, fallen woody debris and ground refugia, feed trees, nests)
- spotlighting for nocturnal mammals and birds (Winter 2021 and Spring 2021 survey)
- stagwatching (hollow watching) for nesting Glossy Black-Cockatoos (Spring 2021 survey)
- stagwatching (hollow watching) for nesting Gang-gang Cockatoos (Summer 2021 survey)
- terrestrial and arboreal baited camera trapping (Spring 2020 and Summer 2021 survey)

- anabat deployment and analysis (Spring 2020 and Summer 2021 survey)
- opportunistic fauna observations
- targeted threatened flora surveys
- dry pitfall trapping for Blue Mountains Water Skink (*Eulamprus leuraensis*) in Blue Mountains Swamp habitat (Summer 2021 survey)
- targeted survey for Giant Dragonfly (*Petalura gigantea*) in Blue Mountains Swamp habitat (Summer 2021 survey).

The field survey methodology for the proposal is explained further in Section 2 of the BAR, attached to the REF as Appendix E.

6.3.2 Existing environment

The proposal is located in the Wollemi subregion of the Sydney Basin bioregion. The existing environment of topography, geology and soils, surface water and hydrogeology related to the assessment of biodiversity is discussed in Section 6.1.2.

The study area is surrounded by native vegetation to the north, north-east, west and south-west and is moderately to well-connected to the adjoining Blue Mountains National Park. However, parts of the study area have been previously impacted by historical land clearing, residential and commercial development and existing infrastructure. This has slightly reduced the vegetation connectivity in parts of the study area.

Native vegetation

There is 68.80 hectares of native vegetation and 15.11 hectares of non-native vegetation within the study area. Three PCTs were recorded within the study area:

- PCT 1248 – *Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion*
- PCT 967 – *Narrow-leaved Peppermint – Silvertop Ash – Mountain Grey Gum shrubby open forest of the upper Blue Mountains, Sydney Basin Bioregion*
- PCT 1078 – *Prickly Tea-tree – sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion.*

Different vegetation condition classes were identified where obvious differences in structure and quality occurred, resulting in three PCTs and six vegetation conditions. A summary of PCTs and associated vegetation conditions is presented in Table 6-12.

PCT 1078 was recorded in one location on intermittently waterlogged soils in a moderate condition with a variety of common wet ferns, sedges and shrubs. This PCT was the only PCT recorded which corresponded to a TEC listed under the *Biodiversity Conservation Act 2016* (BC Act) (Blue Mountains Swamps in the Sydney Basin Bioregion vulnerable ecological community) and EPBC Act (Temperate Highland Peat Swamps on Sandstone endangered ecological community), referred to collectively as Blue Mountains Swamp TEC.

Areas of PCT 967 were mostly aligned with creeks or depressions and had a greater diversity and abundance of more mesic understorey species compared to surrounding vegetation communities. PCT 1248 is widely distributed and variable across much of the study area. Areas highly disturbed by development, powerlines and maintenance access were of lower condition and had less canopy cover, lower species diversity and typically higher abundance of exotic species.

All six vegetation zones reflected the edge effects from the existing road, including weed occurrence, sedimentation, erosion and some debris. Historical and current clearing is evident across the site.

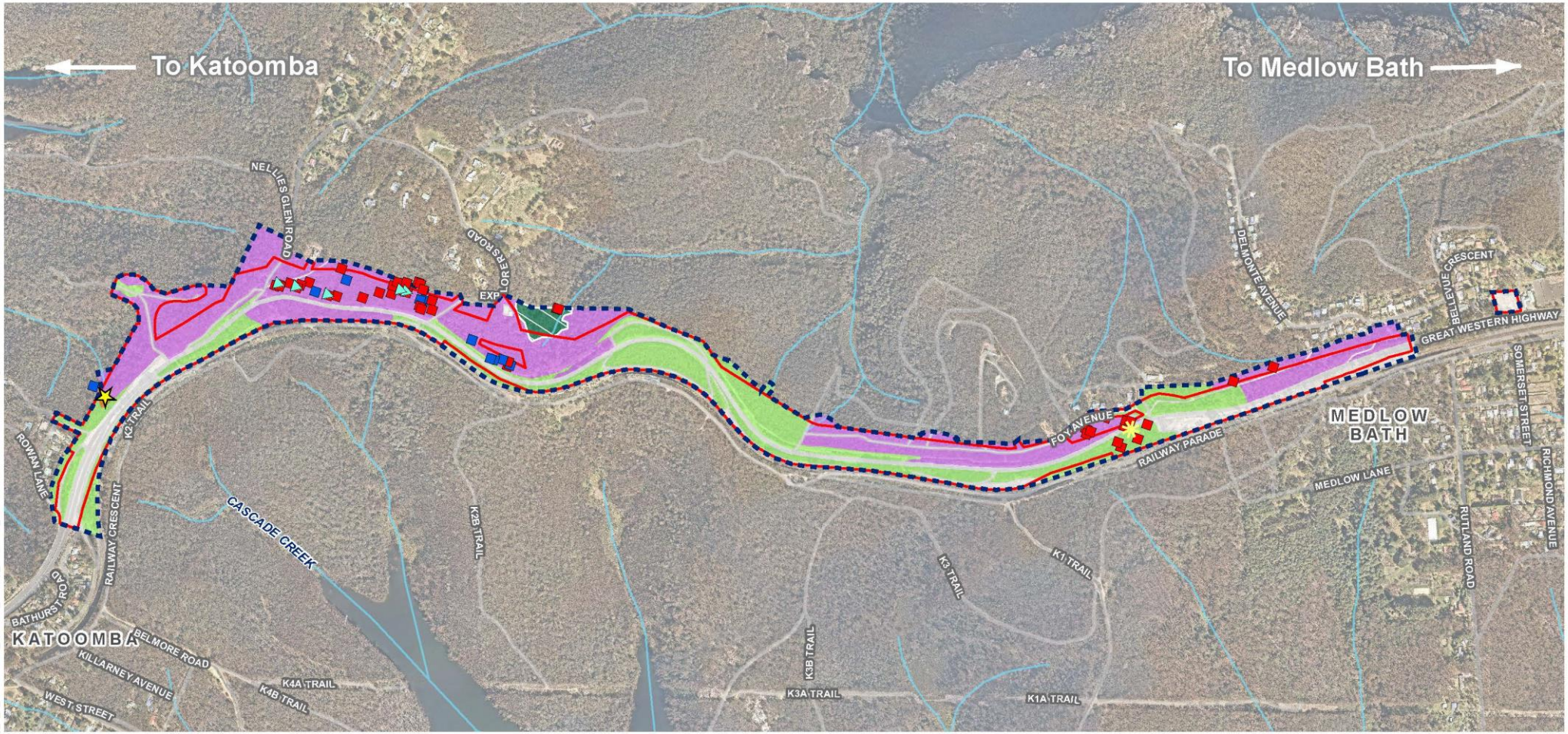
No potential GDEs were identified within the study area that are listed in the Bureau of Meteorology Atlas of GDEs. However, it is known that PCT 1078 is reliant on a combination of surface and groundwater flows. PCT 1078 are formed via groundwater that seeps through permeable sandstone layer and are reliant on groundwater discharge.

The extent of vegetation within the study area is shown in Figure 6-2.

Table 6-12: Plant community types

Vegetation Zone	Vegetation Condition (BAM-C)	Threatened Ecological Community	PCT Cleared Extent	Area within the study area (ha)
PCT 1248	Moderate	Does not align to any TEC	20	43.33
PCT 1248	Low			23.50
PCT 1248	Degraded			0.30
PCT 967	Moderate	Does not align to any TEC	5	0.90
PCT 967	Low			0.06
PCT 1078	Moderate	• Blue Mountains Swamps in the Sydney Basin Bioregion listed as Vulnerable under the BC Act. • Forms part of the TEC Temperate Highland Peat Swamps on Sandstone listed as Endangered under the EPBC Act.	-	0.71
Total native vegetation				68.80
Total non-native vegetation / cleared areas*				15.11
Total area				83.91

* Non-native vegetation / cleared areas comprise areas of planted vegetation or cleared areas including: the existing Great Western Highway, services, footpaths.



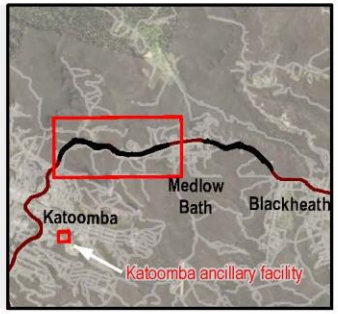
Proposal area
Study area
Culvert
Hollow-bearing stag
Hollow-bearing tree
Fallen timber
Potential cockatoo nest trees (as defined by the BAM)

TEC

1078, Moderate

Validated vegetation and condition (PCT)

0, Non-native / cleared areas
967, Low
1078, Moderate
1248, Moderate
1248, Low



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

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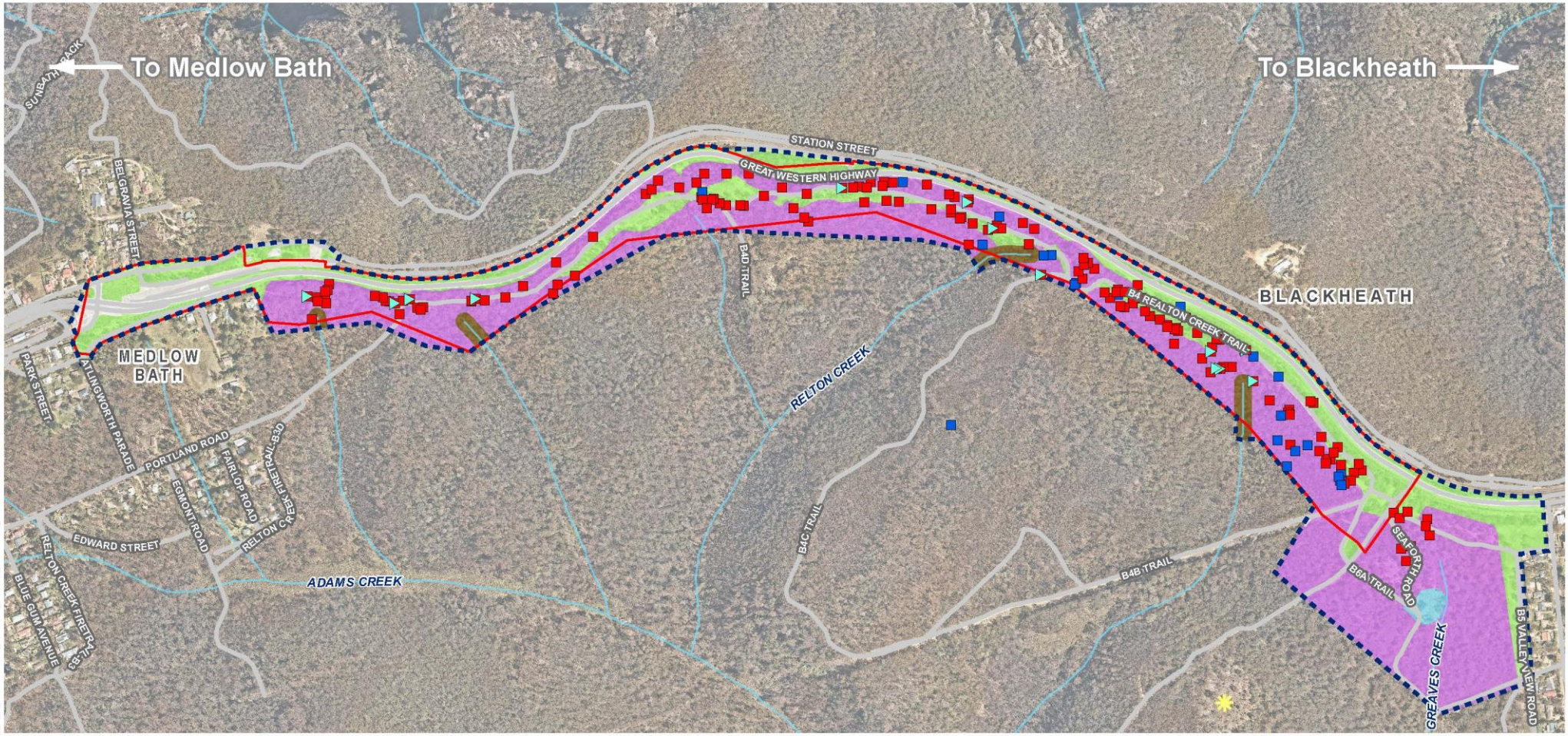
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-2a: Threatened species survey locations



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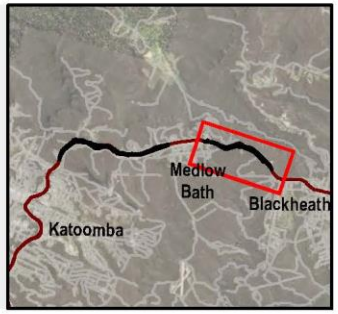
- Proposal area
- Study area
- Culvert
- Hollow-bearing stag
- Hollow-bearing tree
- Fallen timber
- Potential cockatoo nest trees (as defined by the BAM)

Validated vegetation and condition (PCT)

- 0, Non-native / cleared areas
- 967, Moderate
- 1248, Moderate
- 1248, Low
- 1248, Degraded



Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-2b: Threatened species survey locations

Threatened fauna species and habitat

The desktop searches carried out for the proposal identified 67 threatened fauna species as occurring or having potential habitat within the study area or generated by the BAM-C. Forty four threatened fauna species were considered in the biodiversity assessment due to there being a moderate to high likelihood of occurrence of the species within the study area or the species being identified by the BAM-C. This includes:

- 31 species listed under the BC Act only
- one species listed under the EPBC Act only
- 12 species listed under both the BC Act and EPBC Act.

A total of 66 fauna species were recorded during field surveys, comprising three reptiles, 29 birds, 33 mammals and one frog. Eight threatened fauna species were recorded during the field surveys including:

- Eastern Pygmy-possum (*Cercartetus nanus*)
- Large Bentwing-bat (*Miniopterus orianae oceanensis*)
- Little Bentwing-bat (*Miniopterus australis*)
- Gang-gang Cockatoo (*Callocephalon fimbriatum*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern Freetail Bat (*Micronomous norfolkensis*)
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*).

The locations where the threated species were recorded during the field surveys are shown in Figure 6-3.

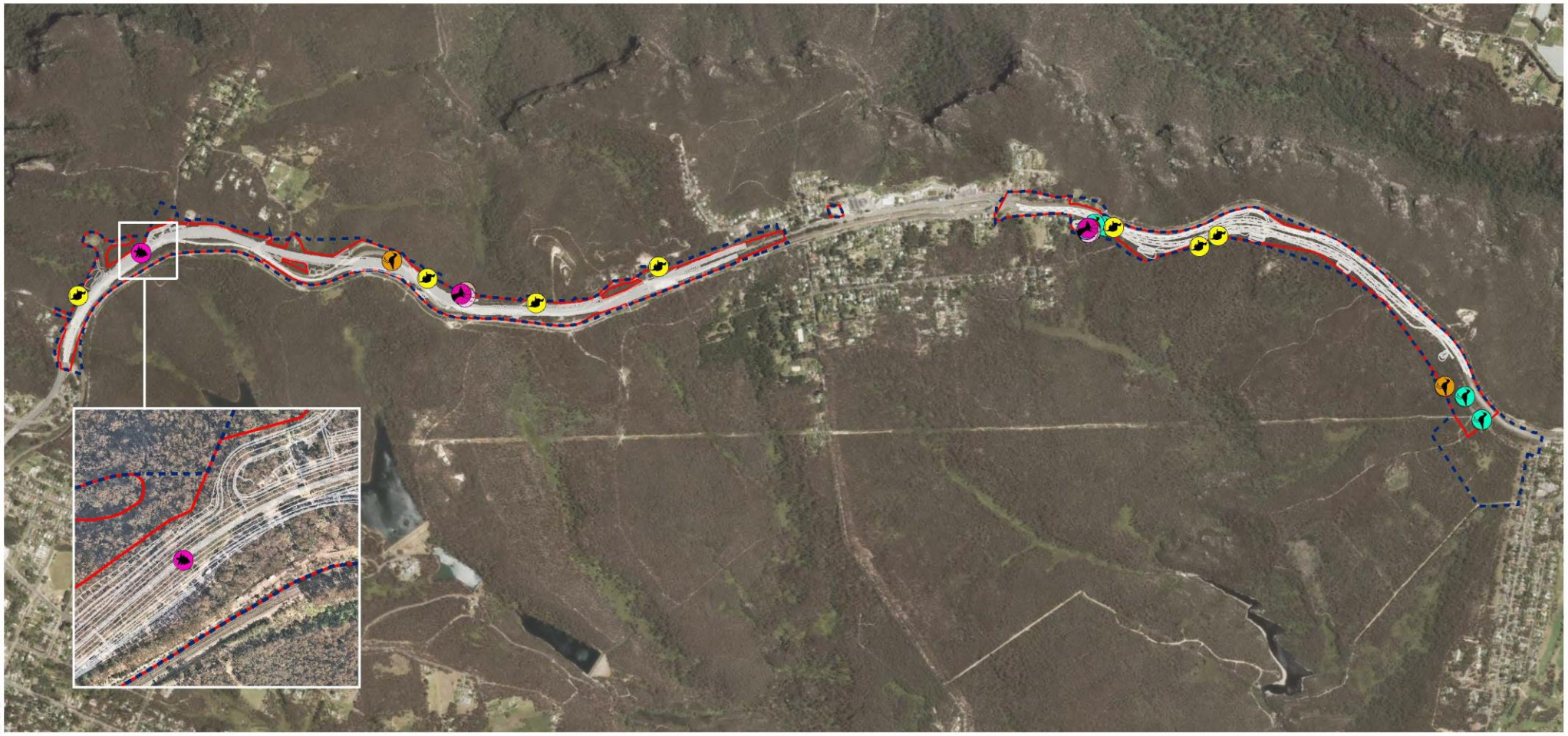
The habitats that occur within the study area consist of moderately to highly connected woody/forest habitat types comprising the PCTs discussed in the previous section. These occupy about 90 per cent of the study area. Some of these areas are mildly disturbed by edge-effects and fragmentation from existing and previous urban encroachment. However, forest habitats within the study area have moderate to high connectivity with large patches of native vegetation especially within the Blue Mountains National Park in the Medlow Bath to Blackheath section. They are considered likely to support a high diversity of both sedentary and transient native fauna species, including birds, reptiles, mammals and frogs.

The fauna habitats that occur within the study area consist of woodland habitat types comprising of the PCTs discussed in the previous section. Mid-storey vegetation across native vegetation ranged from moderately dense to patchy and consisted primarily of native species. The study area generally supports a good amount of ground cover for small mammals and reptiles, fallen woody debris, thick to patchy leaf litter cover and an abundance of feed trees. The habitats facilitate fauna movement throughout the region. The study area is included within a recognised ‘fauna corridor’ under the *Blue Mountains Local Environment Plan 2015*. However, the existing Great Western Highway road corridor is likely to prevent most terrestrial and arboreal species reaching connected habitat in surrounding areas.

There were also 231 hollow-bearing trees identified within the study area. The diameter at breast height (DBH) of hollow-bearing trees was observed to be between 15 and 250 centimetres. The hollow-bearing trees were predominantly *Eucalyptus sieberi* and *Eucalyptus oreades*, with the size of the hollows ranging from less than 5 to 30 centimetres. The only fauna species observed leaving any hollows during the survey were Rainbow Lorikeets (*Trichoglossus haematodus*) and Sulphur-crested Cockatoo (*Cacatua galerita*). There are 18 hollow-bearing trees that have potential to be Gang-gang Cockatoo nest trees.

One culvert (500-millimetre pipe) that could provide fauna habitat was identified in the Katoomba to Medlow Bath section and was considered to provide marginal habitat for roosting bats.

Threatened species habitats are shown on Figure 6-2. Areas of habitat close to the road edges, are likely to be subject to a high level of noise and light pollution. These factors likely limit these areas to only being suitable for highly urban tolerant species.



Design
Proposal area
Study area

Threatened species recorded

Brown Treecreeper (eastern subspecies)
Eastern Freetail Bat
Eastern Pygmy-possum
Gang-gang Cockatoo (foraging only)
Greater Broad-nosed Bat
Large Bentwing-bat
Little Bentwing-bat
Yellow-bellied Sheathtail Bat
Persoonia acerosa

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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

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Projection: GDA2020 MGA Zone 56

FIGURE 6-3: Threatened species recorded

Threatened flora species

The desktop searches carried out for the proposal identified that 37 threatened flora species have the potential to occur or have habitat within the locality. This includes:

- 14 species listed under the BC Act only
- 23 species listed under both the BC Act and EPBC Act.

Of the 37 subject species, one threatened flora species was recorded within the proposal area. Needle Geebung (*Persoonia acerosa*) was recorded within the proposal area during pre-clearing surveys for geotechnical investigations as part of the proposal. Needle Geebung is listed as Vulnerable under the BC Act and EPBC Act.

The remaining species were either surveyed (and not detected) or have been excluded due to lack of suitable habitat within the proposal area.

Weeds

Weeds that were recorded throughout the field investigations collected that are regarded as 'High Threat Weeds', include the following: *Ligustrum sinense* (Small-leaved privet), *Rubus fruticosus* sp. *agg.* (Blackberry), *Bidens pilosa* (Cobblers pegs), and *Juncus acutus*.

6.3.3 Potential impacts

Construction

Impacts to vegetation

The proposal would result in direct impacts on biodiversity from the removal of up to 47.56 hectares of native vegetation (refer to Table 6-13). The largest area of impact would be PCT 1248, with up to 46.8 hectares of this PCT subject to direct impacts due to the proposal. A small area of PCT 967 near waterways on the eastern side of the Medlow Bath to Blackheath section (up to 0.76 hectares) would also be directly impacted by the proposal. While the proposal design has avoided direct impact to the Blue Mountains Swamp TEC (PCT 1078) near the twin bridges in the Katoomba to Medlow Bath section, there may be indirect impacts to 0.12 hectares of the swamp located within the proposal area.

Up to 207 hollow-bearing trees have the potential to be directly impacted. These values are upper limits and would be reduced wherever possible and practical during detailed design.

The proposal would result in indirect impacts to parts of the Blue Mountains National Park and Water NSW Blackheath Special Catchment Area to the east of the Medlow Bath to Blackheath section. Indirect impacts may include:

- increased noise, dust and light from the construction and operational activities
- loss of connectivity and fragmentation of habitats at a regional scale through clearing of native vegetation within the proposal area
- erosion or sedimentation in areas adjoining construction and operational activities
- increased spreading of weed propagules
- increased edge-effects for surrounding vegetated areas.

While there would be no direct impacts to the Blue Mountains Swamp TEC, there may be indirect impacts to the swamp from the construction of the twin bridges. This may include indirect impacts to 0.12 hectares of the swamp within the proposal area due to its proximity to the area required for construction of the

proposed twin bridges. These impacts would be managed through the implementation of targeted mitigation measures. A buffer area of at least five metres between the proposal area and boundary of the Blue Mountains Swamp TEC would be established and lined with sediment fencing to minimise indirect impacts to the swamp near the twin bridges. Other construction erosion and sedimentation controls have been designed to minimise the potential for impacts to the swamp (refer to Section 6.1.4). As such, it is unlikely that run-off from the detention basin would negatively impact the swamp habitat. During construction, dirty water from the bridge deck would also be drained away from the swamp to avoid water flowing into the swamp.

Indirect impacts from construction would generally have a short to medium timeframe and would be minimised through implementation of safeguards and management measures in accordance with the CEMP (refer to Section 7.2).

Table 6-13: Summary of potential impacts to native vegetation during construction of the proposal

Vegetation Zone	Vegetation Condition (BAM-C)	Status (BC Act)	Area within proposal area (ha)	Area subject to direct impacts (ha)	Number of hollow bearing trees directly impacted
PCT 1248	Moderate	Not listed	27.74	27.74	165
PCT 1248	Low	Not listed	19.06	19.06	41
PCT 967	Moderate	Not listed	0.70	0.70	1
PCT 967	Low	Not listed	0.06	0.06	0
PCT 1078	Moderate	• Blue Mountains Swamps in the Sydney Basin Bioregion listed as Vulnerable under the BC Act. • Forms part of the TEC Temperate Highland Peat Swamps on Sandstone listed as Endangered under the EPBC Act.	0.12	0	0
Total			**47.68**	**47.56**	**207**

Impacts to threatened species

The removal of native vegetation would result in impacts to threatened species, including a loss of fauna habitat (refer to Table 6-14). This would impact one threatened flora species and 25 threatened species of fauna.

Table 6-14: Potential impacts to threatened species

Threatened species	Status (BC Act)	Status (EPBC Act)	Habitat or individuals to be impacted
Flora			
Needle Geebung (*Persoonia acerosa*)	Vulnerable	Vulnerable	1 individual identified within the proposal area, which would be impacted by loss of habitat through vegetation clearing, weed incursion, and indirect habitat disturbance
Fauna			
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Vulnerable	Vulnerable	Up to 47.56 ha potential foraging habitat
Koala (*Phascolarctos cinereus*)	Vulnerable	Endangered	Up to 47.56 ha potential foraging habitat

Threatened species	Status (BC Act)	Status (EPBC Act)	Habitat or individuals to be impacted
Grey-headed Flying fox (*Pteropus poliocephalus*)	Vulnerable	Vulnerable	Up to 47.56 ha potential foraging habitat
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	Vulnerable	Endangered	Up to 47.56 ha confirmed foraging habitat
Spotted-tailed Quoll (*Dasyurus maculatus*)	Vulnerable	Endangered	Up to 47.56 ha potential foraging habitat and impacts to connectivity across the widened road corridor
Rosenberg's Goanna (*Varanus rosenbergi*)	Vulnerable	-	Up to 47.56 ha potential habitat (foraging, sheltering, breeding)
Eastern Pygmy Possum (*Cercartetus nanus*)	Vulnerable	-	Up to 47.56 ha confirmed foraging habitat and up to 207 hollow-bearing trees (which provide potential nesting/breeding resources)
Greater Glider (*Petauroides volans*)	-	Vulnerable	Up to 47.56 ha of potential foraging habitat, and up to 207 hollow-bearing trees (which may provide potential nesting/breeding resources)
Squirrel Glider (*Petaurus norfolcensis*)	Vulnerable	-	Up to 47.56 ha of potential foraging habitat, and up to 207 hollow-bearing trees (which may provide potential nesting/breeding resources)
Threatened hollow-dependant bats • **Eastern Coastal Free-tailed Bat (*Micronomous norfolkensis*)** • **Greater Broad-nosed Bat (*Scoteanax rueppellii*)** • **Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*)** • **Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)**	Vulnerable	-	Up to 47.56 ha confirmed foraging habitat and 63 hollow-bearing trees that are considered suitable as potential roosting habitat for these species.
Threatened cave-dependant bats • **Little Bent-winged Bat (*Miniopterus australis*)** • **Large Bent-winged Bat (*Miniopterus orianae oceanensis*)** • **Eastern Cave Bat (*Vespadelus troughtoni*)**	Vulnerable	-	Up to 47.56 ha of confirmed foraging habitat
Threatened woodland birds • **Brown Treecreeper (eastern subspecies) (*Climacteris picumnus*)** • **Varied Sittella (*Daphoenositta chrysoptera*)** • **Diamond Firetail (*Stagonopleura guttata*)** • **Gilbert's Whistler (*Pachycephala inornate*)**	Vulnerable	-	Up to 47.56 ha of confirmed foraging habitat and removal of potential nesting habitat (including up to 207 hollow-bearing trees to be removed and cup nests)

Threatened species	Status (BC Act)	Status (EPBC Act)	Habitat or individuals to be impacted
• **Black-chinned Honeyeater (*Melithreptus glumaris gularis*)** • **Little Lorikeet (*Glossopsitta pusilla*)**			
Threatened woodland robins • **Flame Robin (Petroica phoenicea)** • **Scarlet Robin (Petroica boodang)** • **Hooded Robin (Melanodryas cucullate)**	Vulnerable	-	Up to 47.56 ha of potential foraging habitat and indirect removal of potential nesting habitat (e.g., cup-nests, sheltered sites and shallow tree cavities)

Operation

Direct impacts

Operation of the proposal has the potential to result in fauna injury and death. Threatened fauna most at risk include terrestrial species such as the Koala, Eastern Pygmy-possum, Spotted-tailed Quoll and the Greater Glider. Spotted-tailed Quolls and Eastern Pygmy-possums have been identified close to the road corridor. One recent Koala record (from 2020) has also been identified as road kill near the existing highway about nine kilometres west of the study area.

While fauna are currently at risk of vehicle strikes along the existing highway, the proposal would result in an increased road crossing distance (from about 30 metres to about 100 metres in some locations) and increased volume of traffic. Despite existing obstruction to fauna movement, the ability for gliding and terrestrial fauna to safely cross the Great Western Highway may become constrained due to this increased separation of habitats.

These changes would increase the risk of injury and mortality to local fauna. Fauna mitigation measures to provide safe passage across the road, such as glider poles for the Greater Glider, would be investigated and included as part of a Fauna Connectivity Strategy during detailed design of the proposal. This would also consider the use of fauna fencing to deter fauna from accessing the road corridor and reduce the potential for injury or mortality. Monitoring of road kill during construction and operation of the proposal would also allow any indirect impacts to threatened species to be identified and mitigated where required.

Indirect impacts

Edge effects (such as erosion, dust, intensive light spill and sedimentation) and weed incursion would be likely to occur during operation of the proposal. This impact area would include parts of the Blue Mountains National Park and the Water NSW Blackheath Special Catchment Area to the east of the Medlow Bath to Blackheath section. This area is not currently adjacent to a road corridor and so would experience edge effects for the first time. Parts of the Blue Mountains National Park have tested positive to *Phytophthora cinnamomi* (Phytophthora), which may also spread due to the proposal. Measures to minimise the likelihood of indirect impacts to sensitive receiving environments as a result of the proposal are outlined in Section 6.3.4. Streetlighting would only be installed at the three intersections within the Katoomba to Medlow Bath section and would include ecologically sensitive lighting design. This would minimise indirect impact to surrounding sensitive receiving environments.

Shading from the bridge may result in indirect impacts to the Blue Mountains Swamp TEC due to floristic responses to changes in light and temperature. The greatest shading impact is likely to occur on the

eastern side of the swamp during the morning. However, any shading impacts would be temporal in nature as the area in shadow would shift with the sun during the day as it moves from east to west. There would not be any section of the swamp permanently in shadow and most of the swamp would remain unaffected by shadow.

Altered hydrology may affect sensitive receiving environments near the proposal. This may lead to extended periods of drying or waterlogging, weed incursion or increase in weed abundance and changes in floristics and habitat suitability for dependant flora and fauna at the Blue Mountains Swamp TEC. The proposed water quality and drainage network would result in a beneficial impact on water quality due to the proposal (refer to Section 3.2.3 and Section 6.1.3). This would minimise hydrologic impacts to surrounding sensitive environments, including the Blue Mountains Swamp TEC habitat.

Significance of impacts

Assessments of significance have been carried out for threatened species which were identified with potential to occur within the proposal area. These assessments found that the proposal would not have a significant impact on threatened biota. Significant impacts would be avoided through the implementation of mitigation measures, including the implementation of a Flora and Fauna Management Plan.

As such, the proposal is not likely to significantly impact threatened species or ecological communities or their habitats:

- within the meaning of the *Biodiversity Conservation Act 2016* or *Fisheries Management Act 1994* and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.
- within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.

The proposal's response to Transport's checklist for significance of impacts is outlined in Table 6-15.

Table 6-15: Significance of impacts assessment checklist

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

Eastern Pygmy-possums have been identified at seven camera trap locations within the study area during targeted surveys in 2021. While no survey data exists to demonstrate the extent of the local population, a local population is likely to be widespread due to the extent of high-quality habitat around the proposal (K Madden DPE 2021, personal communication). On this assumption, the proposal is not considered likely to significantly impact a local population of the Eastern Pygmy-possum. To support this conclusion, further surveys for the Eastern Pygmy-possum are proposed to better understand the size and extent of the population within the surrounding area. Following the completion of the monitoring program, a final assessment of significance for the Eastern Pygmy-possum would be generated and mitigation measures further refined.

6.3.4 Safeguards and management measures

Safeguards and management measures for biodiversity are outlined in Table 6-16.

Table 6-16: Safeguards and management measures – biodiversity

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (Roads and Traffic Authority, 2011a) and implemented as part of the CEMP. It will include, but not be limited to: • plans showing areas to be cleared and areas to be protected, including exclusion zones around the proposal (including a five-metre exclusion zone around the Blue Mountains Swamp TEC), protected habitat features and revegetation areas • requirements set out in the *Landscape Guideline* (Roads and Maritime, 2008) • pre-clearing survey requirements, vegetation removal and habitat removal in line with Transport's vegetation clearance protocol • directions for survey, monitoring and management of key threatened species known or considered to be potentially impacted by the proposal • development of a habitat replacement or nest box strategy • procedures for re-establishment of native vegetation • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013) • commitments relating to threatened species management, pest and weed management, and site hygiene practices.	Transport / Contractor	Detailed design / pre-construction / construction	Section 4.8 of QA *G36 Environment Protection*
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Transport / Contractor	Detailed design / pre-construction	Additional safeguard
Biodiversity	Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the proposed construction boundary. A buffer area of at least five metres will be established between the proposal area and boundary of the swamp.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Signposting will be used to inform project personnel and site visitors of areas of conservation value to restrict entry or inform behaviour that will reduce incidental interactions with fauna.			
Biodiversity	The Needle Geebung (*Persoonia acerosa*) individual identified during field surveys will be translocated prior to construction.	Contractor	Pre-construction	Additional safeguard
Biodiversity	For flora species such as Needle Geebung (*Persoonia acerosa*), seed collection will be carried out in an effort to minimise impacts to the species and aid in re-establishment of individuals within protected areas in the vicinity of the study area. This would form part of the seed collection planned by Transport to occur across the Great Western Highway Upgrade Program.	Contractor	Construction / pre-construction	Additional safeguard
Vehicle strike	Transport will monitor road kills along Great Western Highway before, during and after commencement of the proposal.	Transport / Contractor	Pre-construction / construction / operation	Additional safeguard
Indirect impacts on native vegetation and habitat	Measures to further avoid and minimise the area of direct impact on all native vegetation will be investigated during detailed design and implemented where practicable and feasible, especially in sensitive environments and near the Blue Mountains National Park.	Transport	Detailed design	Additional safeguard
Indirect impacts on native vegetation and habitat	Installation of stormwater/sediment and erosion control mechanisms to prevent sediment or dirty water discharging into the Blue Mountain Swamp TEC.	Contractor	Construction	Additional safeguard
Wildlife connectivity, habitat fragmentation and fauna injury and mortality	A Fauna Connectivity Strategy will be developed for the proposal during detailed design to minimise the impacts of the proposal on connectivity. This will include consideration of: • fauna mitigation measures to provide safe passage across the road • fauna fencing.	Transport	Detailed design	Additional safeguard
Changes to hydrology	Changes to existing surface water flows will be minimised during detailed design and mitigated via preparation and implementation of the following: • preparation of progressive Erosion and Sediment Control Plans (ESCPs) and their continual revision and update • preparation of a Storm Water Management Plan and other aspects of the Construction Environment Management Plan to manage water quality impacts during construction of the proposal • preparation of Water Quality Management Plan (surface and groundwater) to describe water quality monitoring before and during construction • design of scour protection at new stormwater outlets and culverts and drainage basins	Transport	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• stormwater drainage design which incorporated a treatment trains and drainage basing to achieve a neutral or beneficial effect on the surrounding waterways.			
Fragmentation of identified habitat corridors	Connectivity measures will be implemented in accordance with the *Wildlife Connectivity Guidelines for Road Projects* (Roads and Traffic Authority, 2011c). Any connectivity measures implemented will be installed under the supervision of an experienced ecologist.	Transport / Contractor	Detailed design / pre-construction / construction	Additional safeguard
Invasion and spread of pathogens and disease	• Any excavated earth will be either disposed or reused appropriately with care taken to avoid spreading propagules of weeds or infested soil or plant material. • Correct plant hygiene will be minimised to minimise spread of weeds, Phytophthora and other contaminants, including wash down when moving between weedy and non-weedy parts of the proposal. • All weed material removed during the construction works will be disposed of in a suitable waste facility and not mulched onsite to avoid the reintroduction and further spread of weeds and pathogens in the area.	Contractor	Construction	Additional safeguard
Noise, light and vibration	Shading and artificial light impacts on sensitive areas or areas adjacent to the Blue Mountains National Park will be minimised during detailed design.	Transport	Detailed design	Additional safeguard
Threatened ecological community (TEC)	• During construction, dirty water from the bridge deck would be drained away from the Blue Mountains Swamp TEC and not flow over into the swamp. • pH levels of water in the nearby water quality basins will be monitored near the Blue Mountains Swamp TEC during construction.	Contractor	Construction	Additional safeguard
Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems (e.g. Upland Swamp) will be minimised through detailed design.	Transport	Detailed design	Additional safeguard
Biodiversity offsets	Where required, Transport would offset vegetation removal in accordance with the Transport 'Guideline for Biodiversity Offsets' (Roads and Maritime, 2016b). Offsets would be sought for both this proposal and any other projects within the Great Western Highway Upgrade Program for which biodiversity impacts have not separately been offset.	Transport	Detailed design	Additional safeguard

Other safeguards and management measures that would address biodiversity impacts are identified in Section 6.1.4.

6.3.5 Biodiversity offsets

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts associated with the proposal, some residual impacts would occur. Transport would provide biodiversity offsets or, where offsets are not reasonable or feasible, supplementary measures for impacts that exceed the thresholds listed under Transport's *Guideline for Biodiversity Offsets* (Transport, 2016b).

The *Guideline for Biodiversity Offsets* refers to BioBanking and the Framework for Biodiversity Assessment. These have been replaced by the Biodiversity Offset Scheme and use of the Biodiversity Assessment Method (BAM) Calculator (BAM-C) to determine offset requirements for unavoidable impacts to biodiversity under the BC Act. As such, the BAM-C has been used to determine the offset requirement for this proposal.

Biodiversity offset thresholds relevant to the proposal and the resulting credit requirements are summarised in Table 6-17. Based on impact to 47.56 hectares of native vegetation, as per the BAM-C, the proposal requires:

- 924 ecosystem credits for impact to known habitat of seven NSW listed threatened ecosystem credit species (Gang-gang Cockatoo, Brown Treecreeper, Large Bentwing-bat, Little Bentwing-bat, Greater Broad-nosed Bat, Eastern Coastal Free-tailed Bat, Yellow-bellied Sheathtail-bat).
- 1233 species credits for impacts to known habitat for the Eastern Pygmy-possum (species credit species under the BAM).

Table 6-17: Transport offset thresholds

Description of activity or impact	Consider offsets or supplementary measures	Relevant to the proposal?	Offsets required
Activities in accordance with Roads and Maritime Services Environmental assessment procedure: Routine and Minor Works (Roads and Traffic Authority, 2011b)	No	No	Not applicable
Works on cleared land, plantations, exotic vegetation where there are no threatened species or habitat present	No	No	Not applicable
Works involving clearing of vegetation planted as part of a road corridor landscaping program (this includes where threatened species or species comprising listed ecological communities have been used for landscaping purposes)	No	No	Not applicable
Works involving clearing of national or NSW listed critically endangered ecological communities (CEEC)	Where there is any clearing of an CEEC in moderate to good condition	No	Not applicable
Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat	Where clearing >1 ha of a TEC or habitat in moderate to good condition	Yes. Clearing of 1 individual of *Persoonia acerosa.*	Area of occupation less than 1 ha. No offsets required.

Description of activity or impact	Consider offsets or supplementary measures	Relevant to the proposal?	Offsets required
Works involving clearing of NSW endangered or vulnerable ecological community	Where clearing > 5 ha or where the ecological community is subject to an SIS	No	Not applicable
Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database	Where clearing > 1ha or where the species is the subject of an SIS	Yes. Clearing of 47.56 ha of known habitat for the Eastern Pygmy-possum.	1233 Eastern Pygmy-possum species credits
Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEH's Threatened Species Profile Database	Where clearing > 5ha or where the species is the subject of an SIS	Yes. Clearing of 47.56 ha of known habitat for 7 NSW listed threatened ecosystem credit species: • Gang-gang Cockatoo • Brown Treecreeper • Large Bentwing-bat • Little Bentwing-bat • Greater Broad-nosed Bat • Eastern Coastal Free-tailed Bat • Yellow-bellied Sheathtail-bat.	924 ecosystem credits
Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries)	Where there is any net loss of habitat	Not applicable	Not applicable

A Biodiversity Offset Strategy (BOS) would be developed by Transport and identify how the offset obligations would be met. The BOS would be updated, and the offset calculations finalised, once detailed design is complete. This would include consideration of offset requirements for both this proposal and any other projects within the Great Western Highway Upgrade Program for which biodiversity impacts have not separately been offset.

6.4 Non-Aboriginal heritage

The potential impacts on non-Aboriginal heritage during construction and operation of the proposal have been assessed as part of the *Statement of Heritage Impact – Great Western Highway East* (Niche Environment and Heritage, 2022), provided in Appendix F.

6.4.1 Methodology

The methodology for the Statement of Heritage Impact (SOHI) included:

- a review of literature and databases, including:
  - Heritage NSW Inventory (World Heritage Register List, State Heritage Register, State Heritage Inventory (SHI), Transport – Roads S170 Register)
  - City of Blue Mountains Heritage Review 2016
  - City of Blue Mountains Local Environmental Plan 2015
  - City of Blue Mountains Development Control Plan 2015
  - Commonwealth heritage registers (Australian Heritage Database, Commonwealth Heritage List, and former Register of the National Estate)
  - previous historical heritage studies and reports within or near the proposal area
- a site inspection in June 2021, which:
  - confirmed places already identified from previous studies or re-evaluated those lists
  - identified physical evidence that could indicate archaeological evidence, structures or other work that may not have been identified in other sources within or near the proposal area
- assessment of the potential non-Aboriginal heritage impacts during construction and operation of the proposal
- the provision of mitigation measures to manage the potential impacts on non-Aboriginal heritage identified.

The SOHI adopted the approach and terminology outlined in the Charter for Places of Cultural Significance (Australia ICOMOS, 2013) (*the Burra Charter*). In addition, this report has been prepared in accordance with the following heritage guidelines and policy documents:

- Cultural Heritage Guidelines (Transport, 2015a)
- Statements of Heritage Impact (Heritage Council of NSW, 2002)
- NSW Heritage Manual (NSW Heritage Office and Department of Urban Affairs and Planning, 1996)
- Assessing Heritage Significance (Heritage Office, 2001)
- Assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Council of NSW, 2009).

6.4.2 Existing environment

Historical context

The regional historical context of the Blue Mountains has been shaped by both the Gundungurra and Dharug Aboriginal people and European exploration west of the Great Dividing Range. Non-Aboriginal heritage across the Blue Mountains has been predominantly about crossing the mountains. Progressively developed transport connections across the Blue Mountains enabled the growth of key settlements in the region.

The local historical themes of *Early Exploration*, *The Western Road*, *The Railway*, *Recreation, Health and Tourism* and *Industry* have influenced the local historical context of the proposal area. This historical context is summarised in Table 6-18.

Table 6-18: Historic context of the proposal

Year	Event
1813	Gregory Blaxland, William Charles Wentworth and William Lawson, assisted by an Aboriginal guide and three convicts were the first Europeans to successfully cross the Blue Mountains. It is believed that Explorers Tree was engraved on this expedition. Explorers Tree was located within the Katoomba to Medlow Bath section and the stump remained in place until February 2021, when it was removed due to safety concerns.
1814 – 1815	Cox's Road (the foundation for what eventually became the Great Western Highway) was constructed over a period of about six months by convict labour. Pulpit Hill, within the Katoomba to Medlow Bath section, was identified as a key point on Cox's Road. Later, Pulpit Hill was also identified as a rest area for drovers, stock and travellers following the construction of the road west, making it another tourist drawcard from the late 19th century until the 21st century.
1831	The area of Blackheath was initially referred to a 41 Mile Tree. The first building in the area was 'The Scotch Thistle Inn', built in 1831 by Andrew Gardener.
1832 – 1835	In 1832, Andrew Murray applied for the purchase of land near Pulpit Hill to construct an inn. The inn was licensed in 1833 as the 'Poor Man's Inn', with licensee Michael Leeson. From 1835 it was licenced as the 'Shepherd and His Flock Inn' by Andrew Murray.
1844	A large convict stockade was built in Blackheath to house convicts engaged in road construction.
1862	On the orders of the Colonial Architect, a lock-up was built near Pulpit Hill in 1862 to hold chained gangs on the march between Bathurst and Sydney (SHI #1170813).
1867	The Gatekeeper's Cottage in Medlow Bath was built by Larkin and Wakeford (SHI # 1170283) and was known as Cottage No. 11.
1868	The Main Western Railway was completed to Mount Victoria, providing a railway connection between Sydney and the proposal area. Following the opening of the railway, townships began to develop around the constructed rail stations, which were located near the early inns, country estates and available water supply. Halt stops were established at Blackheath and Medlow Bath in 1868. The Blackheath halt stop was upgraded to a platform in 1869.
1860s and 1870s	The area of Katoomba was originally known as the 'Crushers', named after a train stop near ballast stone associated with a quarry operation that operated from the 1860s. Katoomba remained a primarily industrial area into the late 1870s, when the Katoomba Coal Mine and coal and shale mining in the nearby Megalong Valley was established.
1880s	The township of Medlow Bath remained small and focused around the sawmill industry until 1902, when Mark Foy took over the Belgravia Hotel and later opened the Hydro Majestic Hotel on the site.
1885	While the first building was built in 1831, the township of Blackheath was declared in 1885.
1888	The lot on which The Pines is located was granted to D. Miller in 1888. Miller, worked at a local sawmill and built himself a house on the lot (SHI # 1170289), making The Pines one of the few 19th century houses in Medlow Bath.
1890s	By the 1890s, Katoomba had seen a shift from a mining town, into a popular tourist centre. This led to subdivision of land and sale into residential lots, with cottages built on much of the land by the turn of the 20th century.
1891	Bonnie Doon Reserve was opened in 1891 and formed the second largest privately constructed track network in the Upper Blue Mountains, after Medlow Bath.
1902	Following duplication in 1898, the railway was extended to Katoomba in 1902.
1900s onwards	In the early 20th century, Blackheath became one of the principal tourist destinations in the mountains. In the interwar period, Blackheath saw a commercial boom with many of the main commercial buildings constructed during this time.
1918	Industrial development within the greater Blue Mountains was limited and largely associated with mining. A quarry was opened by the then Blue Mountains Shire Council at Medlow Bath with the purpose of sourcing sandstone and conglomerate gravel. This later became the Mountain Gravel Co.

Year	Event
	Quarry in 1920. The quarry was closed in 1969 and resumed as part of the Water NSW Special Catchment Area in 1992.
1940s onwards	The popularity of the mountains as a tourist retreat waned in the years after World War II and many of the guesthouses fell into significant disrepair and neglect. In the later decades of the 20th century, the region once again gained popularity and has since maintained a tourist focus.
1951	The rail network was electrified through the proposal area.
1980s	Many of the Bonnie Doon tracks fell into disrepair through most of the 20th century and remained largely neglected for the latter half of the 20th century, with the lookouts restored in the late 1980s.

Heritage items

Heritage items within and adjacent to the proposal are identified in Table 6-19. State and local heritage items within Medlow Bath have not been assessed in this REF as they are not located in direct proximity to the proposal area and have been assessed in the SOHI prepared for the Medlow Bath Upgrade (RPS, 2021). Section 6.11.4 assesses cumulative impacts of the proposal and includes further assessment of the cumulative impacts of the proposal and the Medlow Bath Upgrade.

The potential heritage items within and near the proposal area identified in the historical assessment, previous assessments and the site inspection are listed in Table 6-20. These are not listed heritage items but could have heritage significance.

These items are mapped in Figure 6-4a-h.

Table 6-19: Heritage listings within and near the proposal area

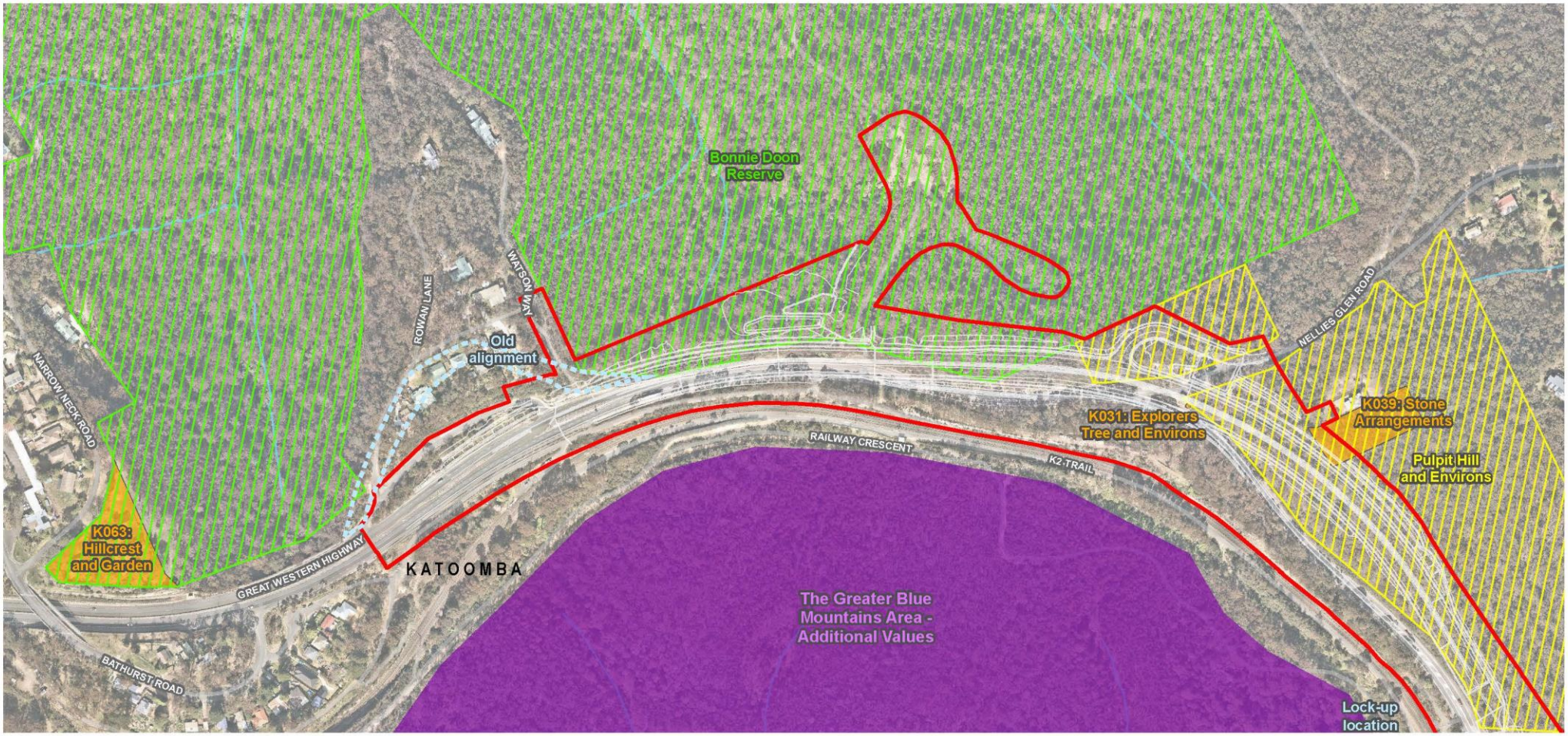
Item	Listing Number	Level of Significance	Description	Location
Greater Blue Mountains Area – Additional Values (Nominated)	105696	National – Nominated	The Greater Blue Mountains Area is a sandstone tableland that encompasses 1.03 million hectares of eucalypt-dominated landscape inland from Sydney. It is one of the largest and most intact tracts of protected bushland in Australia. Its exceptional biodiversity values are complemented by numerous others, including indigenous and post-European-settlement cultural values, geodiversity, water production, wilderness, recreation and natural beauty. The item Greater Blue Mountains Heritage Area – Additional Values is a nominated heritage item only, and not officially listed on the National Heritage List, however, it has been assessed for impacts due to the proposal to follow best practice.	Adjacent to Katoomba to Medlow Bath section Within Medlow Bath to Blackheath section
Bonnie Doon Reserve	K079	Local	Bonnie Doon Reserve has high aesthetic quality as a spectacular scenic backdrop for walkers on the Six Foot Track and Grand Cliff Top Walk, with much of its early track work intact. It was a major private effort to develop and maintain walking tracks for community appreciation of the natural landscape. The area has direct association with John Britty North, considered a founding father of Katoomba and the creator of the Bonnie Doon Reserve.	Within and adjacent to Katoomba to Medlow Bath section
Pulpit Hill and Environs including: **Lock-up** **Stockyard** **Elements of Cox's Road**	K166	Local (Recommended for State listing)	Pulpit Hill is a predominately natural bushland setting, comprising locally important areas of *Eucalyptus Oreades* open forest, an important ecological community. In the early 19th century, Pulpit Hill was an important rest area and a key part of the history and evolution of transport routes across the Blue Mountains The Pulpit Hill environs include sites of heritage significance, including potential historical archaeology associated with the early Cox's Road and early convict graves which have high social value. It is a place where the local community feels a tangible attachment to the early history of the Blue Mountains.	Within Katoomba to Medlow Bath section
Stone Arrangements (within Pulpit Hill curtilage)	K039	Local (Recommended for State listing)	The Stone Arrangements item falls within the larger Pulpit Hill curtilage and contains 22 possible stone arrangements. The possible graves/stone arrangements are located in a small clearing north of the former location of the Explorers Tree and Nellies Glen Road.	Within Katoomba to Medlow Bath section
Shepherd and His Flock Inn site	K082	Local	The Shepherd and Flock Inn served travellers along the Great Western Road in the 1830s. Inns are a significant class of item with historic and social significance as they were a characteristic feature of the Colonial period which exemplify the pattern of land settlement, transport and travel.	Adjacent to Katoomba to Medlow Bath section
Explorer's Tree and Environs	K031	Local	The Explorer's Tree was reputed to have been marked by the explorers Blaxland, Lawson and Wentworth during the First Crossing of the Blue Mountains in 1813. Although the historical authenticity of the tree is uncertain, since at least the 1870s the tree has been	Within Katoomba to Medlow Bath section

Item	Listing Number	Level of Significance	Description	Location
			viewed by visitors to the mountains since as a surviving relic from the 1813 expedition and as a memorial to the early explorers. While the Explorer's Tree was removed in February 2021 due to safety concerns, the environs retain heritage significance through the symbolic representation of the place and as part of the larger Blue Mountains cultural landscape.	
The Pines	MB016	Local	The Pines, 16 Great Western Highway, Medlow Bath is one of the earliest houses in Medlow Bath. It is a good intact example of a verandaed Victorian carpenter vernacular cottage typical of the early houses in the Blue Mountains.	Adjacent to Medlow Bath to Blackheath section
Gatekeeper's Cottage	MB006	Local	The Medlow Bath Gatekeeper's Cottage is one of only five level crossing keepers' cottages which are still habitable on their original site and one of only two which have preserved the original stone privy in the garden. The cottages were important in the interchange of rail and road between 1867 and 1902.	Adjacent to Medlow Bath to Blackheath section

Table 6-20: Non-listed heritage items within and near the proposal area

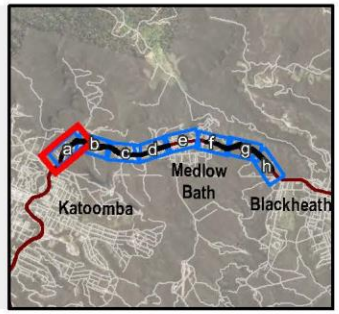
Item	Level of Significance	Description	Location
Great Western Highway	N/A	The Great Western Highway is the primary historical route west from Sydney, following the earliest European lines of exploration and migration over the Blue Mountains. The associated elements such as culverts, retaining, road cuttings and kerbing contribute to the significance of the road.	Within Katoomba to Medlow Bath and Medlow Bath to Blackheath sections
Alignment change	N/A	The alignment change of the Great Western Highway is about 350 metres north of Pulpit Hill and is currently in use as part of the Great Blue Mountains Trail. The trail is largely gravel and rock, with a grassed verge.	Within and adjacent to Katoomba to Medlow Bath section
Old alignment	N/A	The section of old alignment of the Great Western Highway is situated west of Katoomba, along the current Bathurst Road alignment and verge. The location consists of landscaped grass within the verge and several obtrusive service lines, with overgrown vegetation and grass in the area between the highway and Bathurst Road.	Within and adjacent to Katoomba to Medlow Bath section
Culvert XA6	Local (recommended)	Culvert XA6 is a sandstone culvert located on the eastern side of the highway between the road and the railway line and passes underneath the railway line.	Within Katoomba to Medlow Bath section
Culvert XA7	Local (recommended)	Culvert XA7 is a sandstone culvert located on the eastern side of the highway between the road and the railway line and passes underneath the railway line.	Within Katoomba to Medlow Bath section
Culvert XA7a	Local (recommended)	Culvert XA7a is a sandstone culvert located on the eastern side of the highway between the road and the railway line and passes underneath the railway line.	Within Katoomba to Medlow Bath section

Item	Level of Significance	Description	Location
House and Orchards (former Glenara Cottage)	N/A	The House and Orchards was likely used in the first decades of the establishment of the Medlow settlement.	Within Great Western Highway, Medlow Bath ancillary facility
Quarry	N/A	The Quarry is an important item for recognising the resources extracted in the 20th century and local industry in the Blue Mountains.	Within and adjacent to Medlow Bath to Blackheath section
Convergence of tracks	N/A	The large-scale clearing and the series of tracks near the Convergence of tracks is indicative of industrial activities in the area. However, this item was found to have no historic value and so has not been assessed further for this proposal.	Within Medlow Bath to Blackheath section



The design
Proposal area
Potential heritage sites
Blue Mountains LEP 2015
National heritage register (nominated)

Heritage items
Bonnie Doon Reserve
Pulpit Hill and Environs



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

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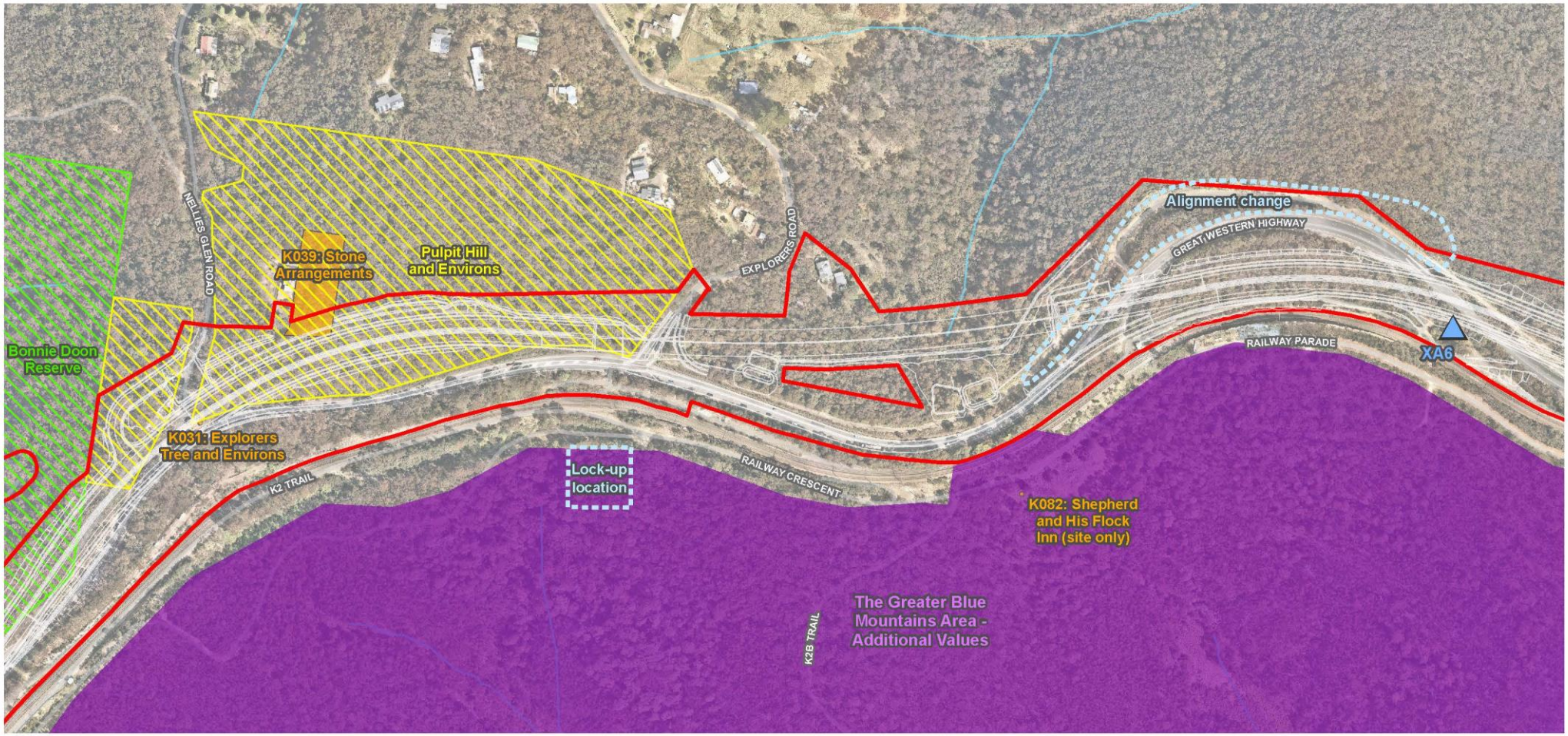
0 50 100m

Projection: GDA2020 MGA Zone 56

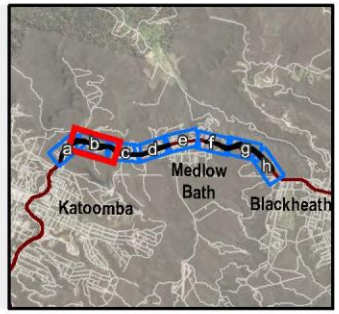
Great Western Highway East **Review of Environmental Factors**

FIGURE 6-4a: Heritage items within and near the proposal area



Culverts
The design
Proposal area
Potential heritage sites
Blue Mountains LEP 2015
National heritage register (nominated)

Heritage items
Bonnie Doon Reserve
Pulpit Hill and Environs



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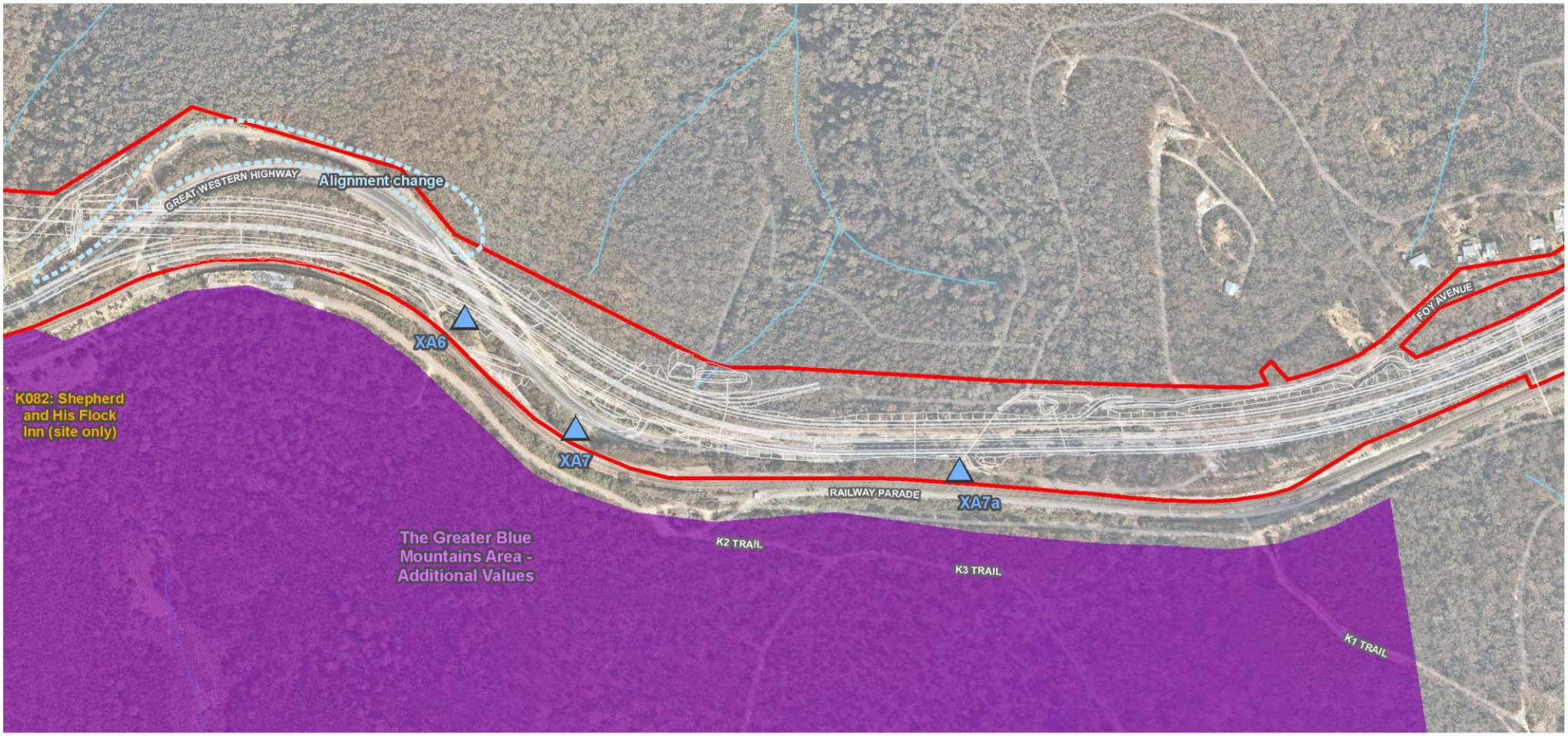
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

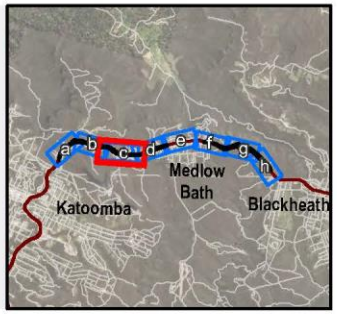
1:5,000@A4
0 50 100m

Projection: GDA2020 MGA Zone 56

FIGURE 6-4b: Heritage items within and near the proposal area



Culverts
The design
Proposal area
Potential heritage sites
Blue Mountains LEP 2015
National heritage register (nominated)



Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

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0 50 100m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-4c: Heritage items within and near the proposal area

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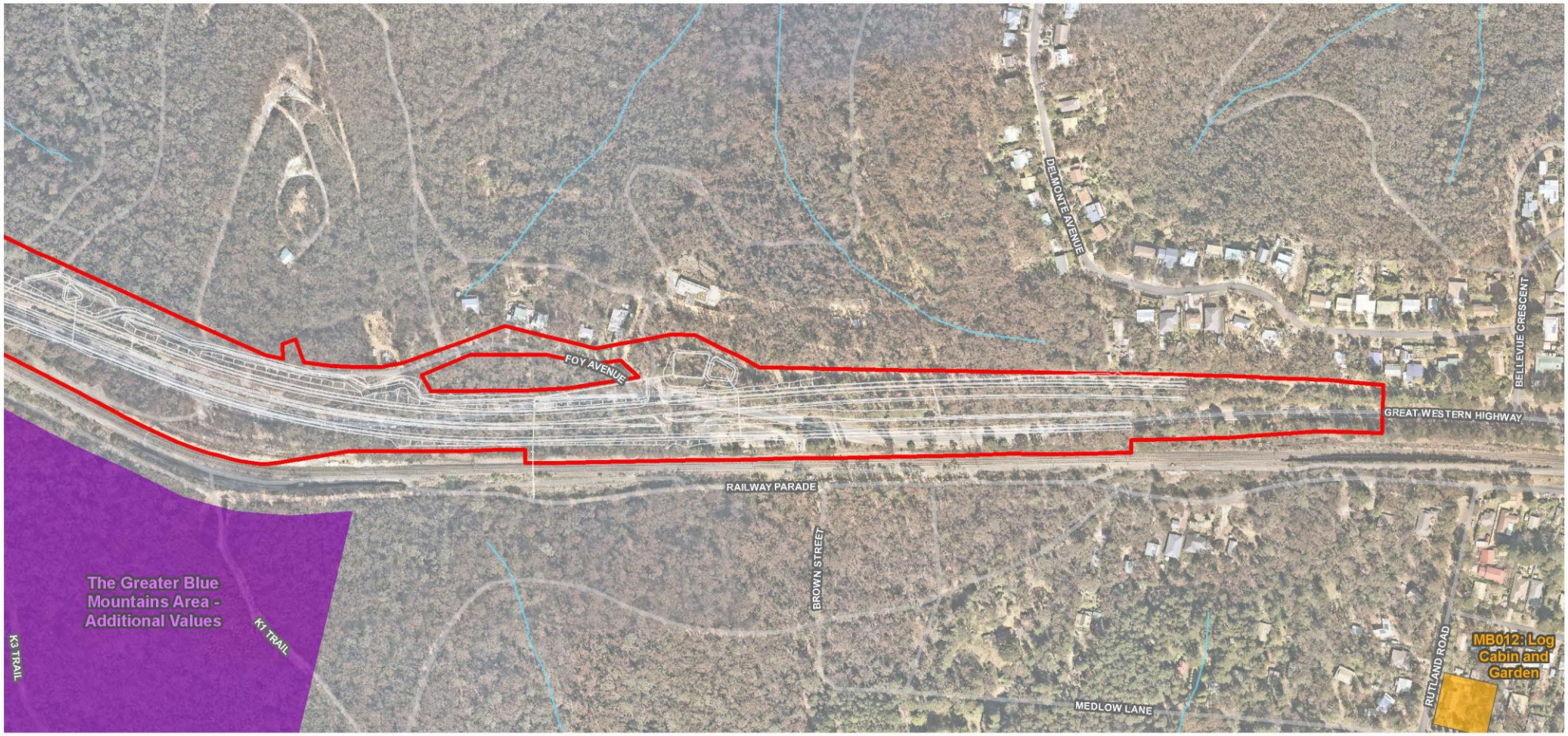

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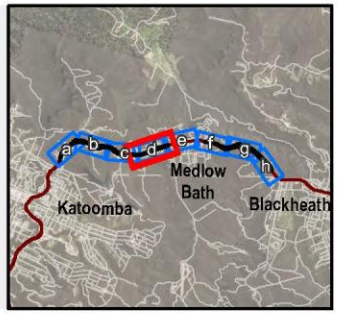
The design
Proposal area
Blue Mountains LEP 2015
National heritage register (nominated)



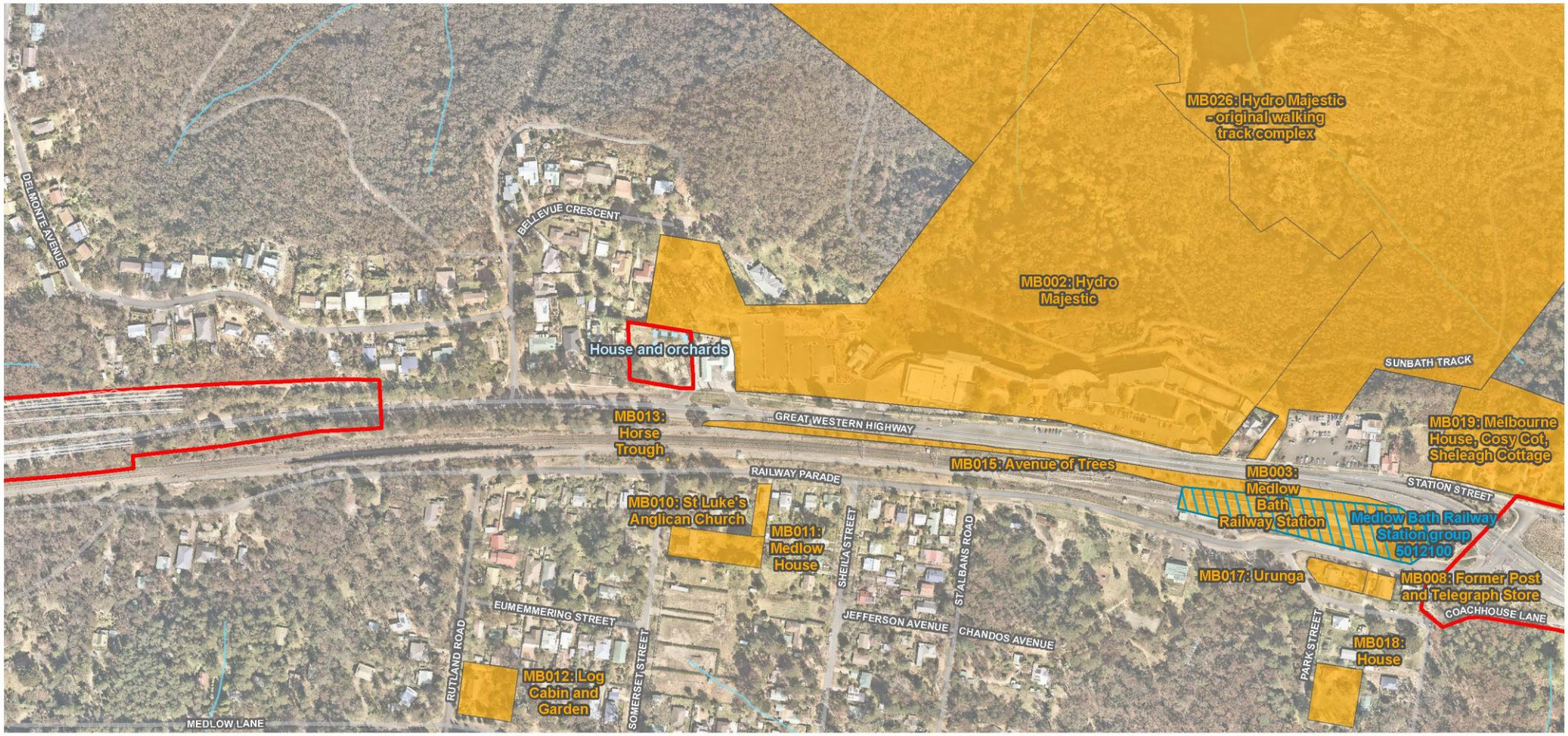
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

1:5,000@A4
0 50 100m

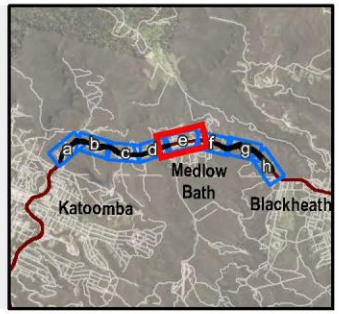
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-4d: Heritage items within and near the proposal area



The design
Proposal area
Potential heritage sites
State heritage register
Blue Mountains LEP 2015



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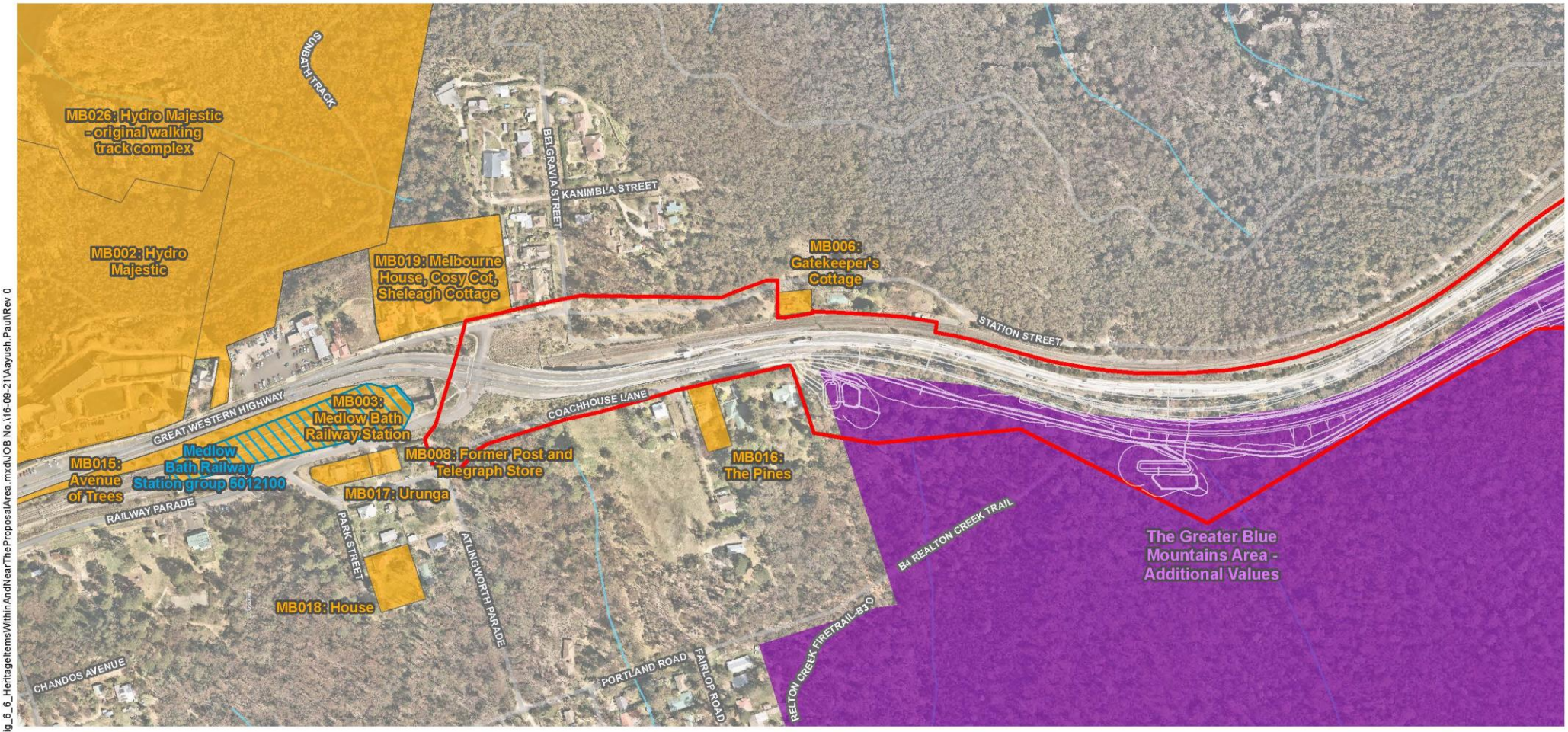
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

1:5,000@A4
0 50 100m

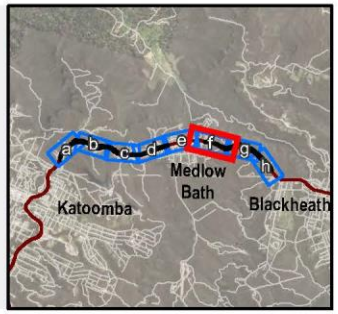
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-4e: Heritage items within and near the proposal area



The design
Proposal area
State heritage register
Blue Mountains LEP 2015
National heritage register (nominated)



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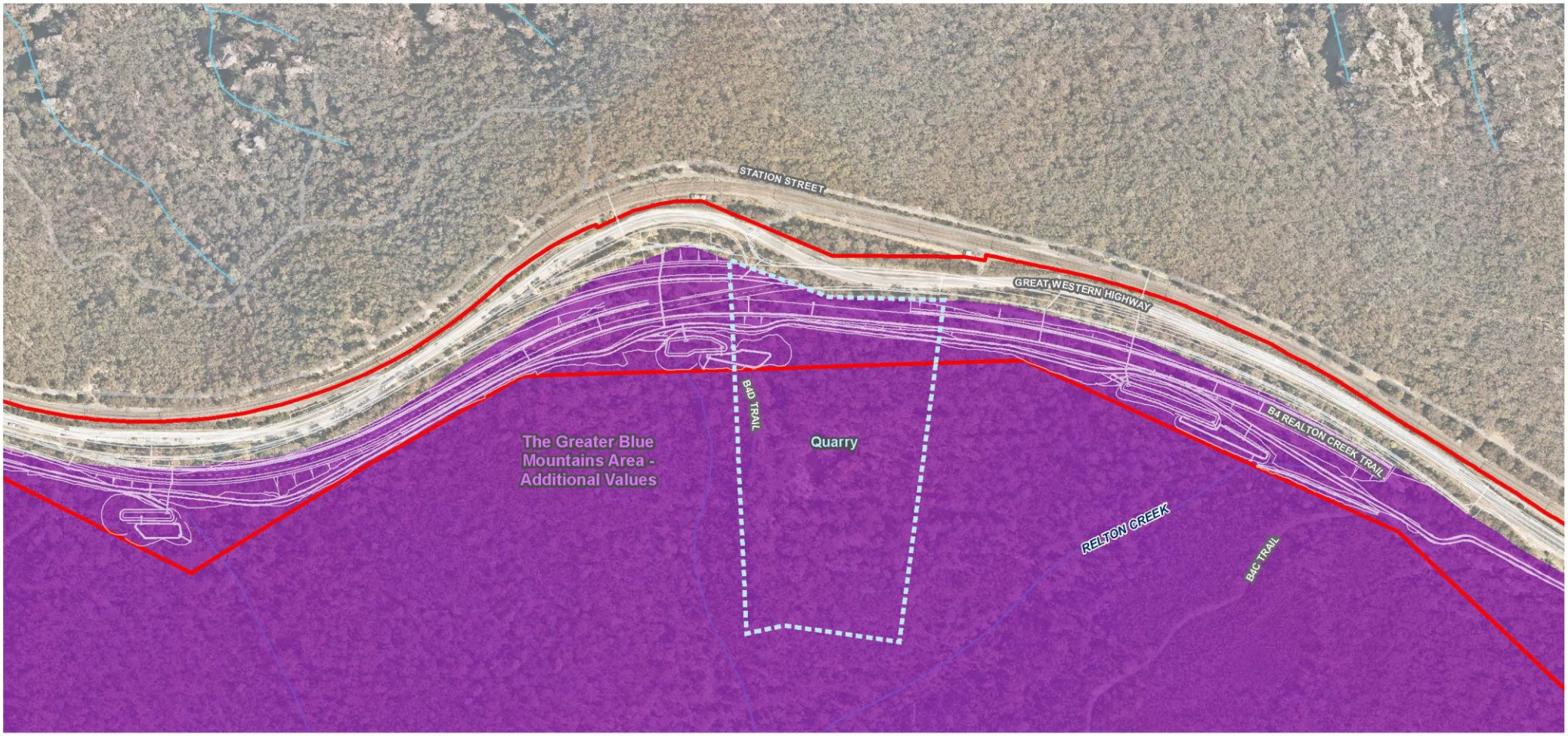
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

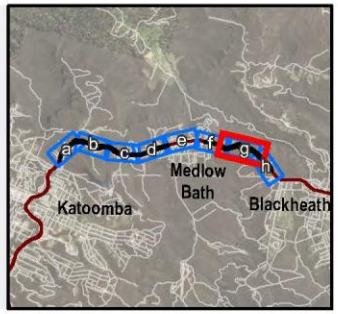
1:5,000@A4
0 50 100m

Projection: GDA2020 MGA Zone 56

FIGURE 6-4f: Heritage items within and near the proposal area



The design
Proposal area
Potential heritage sites
National heritage register (nominated)



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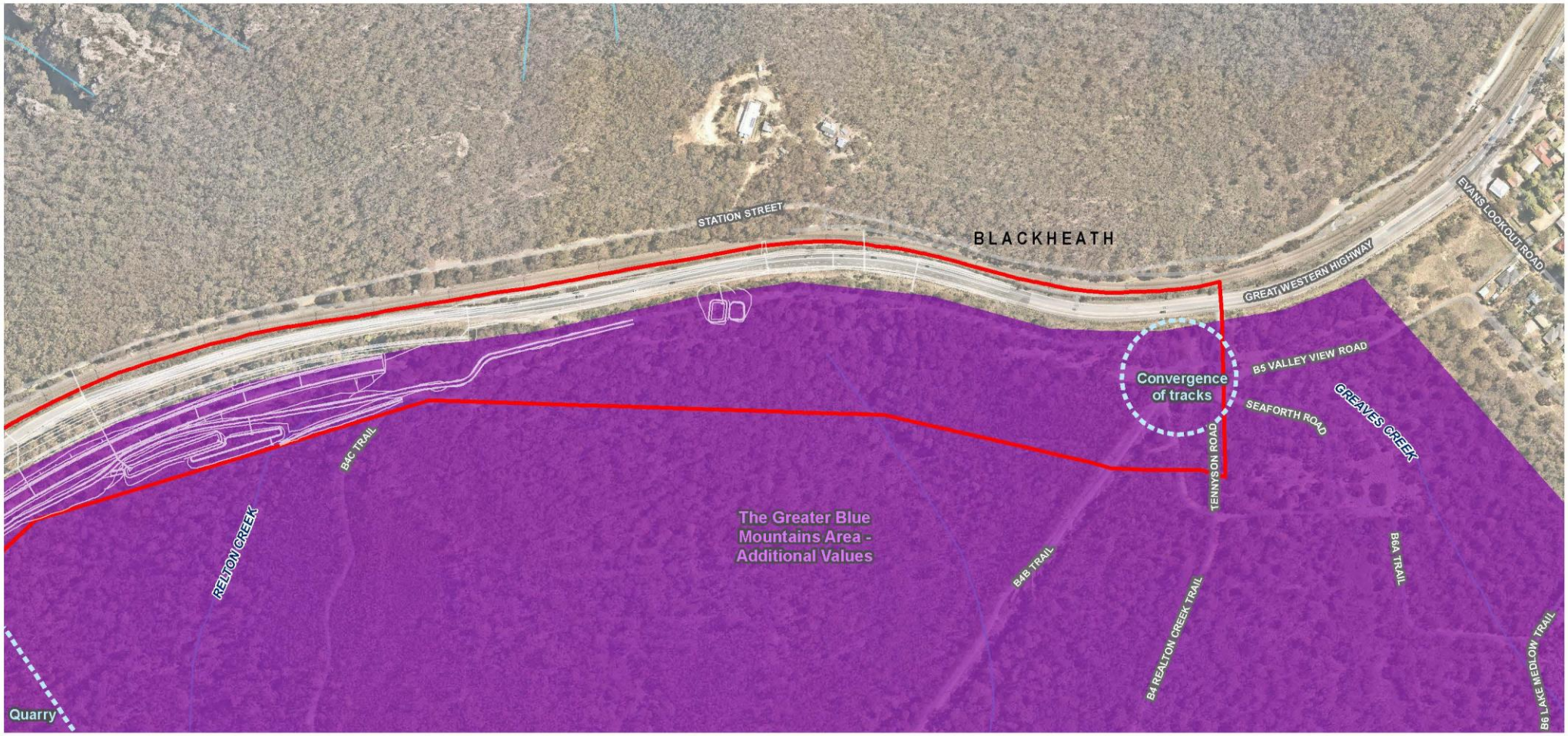
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

1:5,000@A4
0 50 100m

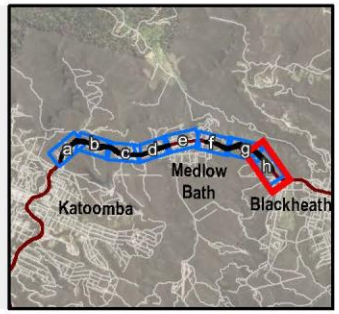
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-4g: Heritage items within and near the proposal area



The design
Proposal area
Potential heritage sites
National heritage register (nominated)



P:\GIS\Project-4\project\511168_GWH\GWHE_REF_Fig_6_6_HeritageItemsWithinAndNearTheProposalArea.mxd\JOB No.\16-09-21\Aayush.Paul\Rev 0

Source: Aurecon, Mott MacDonald, LPI, Nearmap, Niche

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0 50 100m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-4h: Heritage items within and near the proposal area

Archaeological potential of the proposal area

The historical archaeological assessment found largely low potential for subsurface historical archaeological deposits across most of the proposal area. There were some areas with moderate to high levels of potential identified throughout the proposal area. Within or near the Katoomba to Medlow Bath proposal area, there is:

- moderate-high potential evidence of graves on Pulpit Hill
- moderate potential evidence of previous road alignments of the Great Western Highway
- moderate potential evidence of the construction and ongoing use of the railway, including culverts, embankments and workers camps
- moderate-high potential evidence of the Shepherd and His Flock Inn site and Lock-up site
- low-moderate potential evidence of tracks and occupation at Bonnie Doon Reserve
- low potential evidence of the stockyard as a stopping site along previous road alignments
- high potential evidence of settlements at the House at Pulpit Hill.

Within or near the Medlow Bath to Blackheath proposal area, there is high potential evidence of the cottage at the former quarry site.

There is also moderate potential evidence of settlement at the House and Orchards (former Glenara Cottage) site within the Great Western Highway, Medlow Bath ancillary facility.

6.4.3 Potential impacts

Construction

Construction of the proposal would directly and indirectly impact the identified heritage items near the proposed work. Table 6-21 outlines the predicted impacts of the construction of the proposal on these items.

During construction, there would be visual changes that may impact the setting of and views to heritage items, especially within the Katoomba to Medlow Bath section. These visual impacts would mainly be caused by the movement and operation of various machinery and light and heavy vehicles surrounding heritage items, affecting overall amenity and setting. Visual impacts of the proposal are discussed further in Section 6.5.3.

Construction work could also impact on the archaeological potential identified near Pulpit Hill. This would impact the Pulpit Hill and Environs heritage item however would not impact the potential grave sites within the Stone Arrangements curtilage. The proposed design would be further refined during detailed design to minimise heritage impacts on this item. However, it is noted that as part of the Katoomba to Medlow Bath section, the existing heritage interpretation area would be consolidated and improved to better integrate the heritage significance of the Pulpit Hill area and provide better accessibility to visitors.

Table 6-21: Potential impacts on the identified heritage items during construction of the proposal

Item	Listing number	Listing	Predicted impacts
Great Western Highway	N/A	N/A	**Minor partial physical impacts – Katoomba to Medlow Bath and Medlow Bath to Blackheath sections** There would be direct impacts to the Great Western Highway due to the proposed road duplication and ancillary work impacting the existing road corridor. The existing Great Western Highway road alignment holds heritage significance as the crossing of the Blue Mountains and so, in areas that are no longer used, would affect the significance of those areas. Changing the alignment would result in minor impacts to the overall significance of the item.
Greater Blue Mountains Area – Additional Values (Nominated)	105696	National	**No direct or indirect impacts – Katoomba to Medlow Bath section** **Minor partial physical impacts – Medlow Bath to Blackheath section** There would be direct impacts due to vegetation clearance, road widening and construction of associated drainage basins along the western periphery of the Greater Blue Mountains Area - Additional Values area. It would involve the removal of established native trees that contribute to the overall significance of the heritage item however the loss of these elements would not reduce the overall significance of the item.
Bonnie Doon Reserve	K079	Local	**Minor partial physical impacts – Katoomba to Medlow Bath section** There would be direct impact to the northern section of the Bonnie Doon curtilage, along the existing road shoulder. Construction work would involve vegetation clearance, road widening, cut and fills and the construction of a drainage basin in this area. While established native trees that contribute to the overall significance of the heritage item would be removed, their removal would not reduce the overall significance of the item.
Pulpit Hill and Environs including: **Lock-up** **Stockyard** **Elements of Cox's Road**	K166	Local (Recommended for State listing)	**High partial physical impacts – Katoomba to Medlow Bath section** There would be direct physical impacts to the eastern curtilage of this item. This would occur through road widening, earthworks, bridge construction, intersection upgrade and carpark construction. While the heritage interpretation of Pulpit Hill would be partially removed, the existing Blue Mountains City Council heritage interpretation area would be retained. An expanded and cohesive heritage interpretation area would be developed to reinterpret and display the Aboriginal and non-Aboriginal heritage of the area (refer to Section 3.2.3). Whilst there would be no potential heritage impacts to some components of Pulpit Hill and Environs, the cumulative impacts to the greater Pulpit Hill environs would impact the significance of these elements.
Stone Arrangements (within Pulpit Hill curtilage)	K039	Local (Recommended for State listing)	**High partial physical impacts – Katoomba to Medlow Bath section** There would be high direct impacts to this site due to major earthworks and road widening along the eastern curtilage of the Stone Arrangements site, directly adjacent to the recorded locations of stone arrangements. However, there would not be impacts to the potential grave sites within the Stone Arrangements curtilage
Shepherd and His Flock Inn site	K082	Local	**No direct or indirect impacts – Katoomba to Medlow Bath section** While there would be no impacts to this item, due to its location within Pulpit Hill and Environs, there would be high cumulative impacts on the significance of the entire curtilage.

Item	Listing number	Listing	Predicted impacts
Explorer's Tree and Environs	K031	Local	**Minor-moderate partial physical impacts – Katoomba to Medlow Bath section** There would be direct impacts due to earthworks and the construction of the upgraded heritage interpretation area and carpark in the former location of the Explorer's Tree. While the Explorer's Tree has been previously removed, the site is still a heritage listed site and the proposal would have a partial impact on the site. The upgrade of the heritage interpretation area would help to enhance the location in the landscape.
Alignment change	N/A	N/A	**Minor partial physical impacts – Katoomba to Medlow Bath section** There would be direct impacts due to earthworks and road widening at the northern and southern sections of the alignment change. These locations are likely to be heavily disturbed through the previous construction of the Great Western Highway and is unlikely to retain in situ remains in the location of the proposed design.
Old alignment	N/A	N/A	**Minor partial physical impacts – Katoomba to Medlow Bath section** There would be direct impacts due to earthworks and road widening at the western sections of the old alignment. These locations are likely to be heavily disturbed through the previous construction of the Great Western Highway and is unlikely to retain in situ remains in the location of the proposed design.
Culvert XA6	N/A	Local (recommended)	**Minor indirect (vibration) impacts – Katoomba to Medlow Bath section** This culvert would be located directly adjacent to proposed work, but not directly affected. The potential vibration impacts on this item are assessed in Section 6.6.4.
Culvert XA7	N/A	Local (recommended)	**Minor indirect (vibration) impacts – Katoomba to Medlow Bath section** This culvert would be located directly adjacent to proposed work, but not directly affected. The potential vibration impacts on this item are assessed in Section 6.6.4.
Culvert XA7a	N/A	Local (recommended)	**Minor indirect (vibration) impacts – Katoomba to Medlow Bath section** This culvert would be located directly adjacent to proposed work, but not directly affected. The potential vibration impacts on this item are assessed in Section 6.6.4.
The Pines	MB016	Local	**Minor indirect (vibration) impacts – Katoomba to Medlow Bath section** The widened existing road corridor in front of the item would have no direct impact on the item's significance. The potential vibration impacts on this item are assessed in Section 6.6.4.
Gatekeeper's Cottage	MB006	Local	**Minor indirect (vibration) impacts – Katoomba to Medlow Bath section** The Katoomba to Medlow Bath section would widen the existing road in front of the item and would have no direct impact on the item's significance. The potential vibration impacts on this item are assessed in Section 6.6.4.
House and Orchards (former Glenara Cottage)	N/A	N/A	**Moderate temporary partial physical impacts – Medlow Bath ancillary facility** There would be direct impacts to this item during its use as an ancillary facility during construction, including as a temporary site laydown area. An Historic (non-Aboriginal) Archaeological Assessment would be carried out to identify the extent of archaeological resources prior to construction work occurring.

Item	Listing number	Listing	Predicted impacts
Quarry	N/A	N/A	**Minor partial physical impacts – Medlow Bath to Blackheath section** There would be direct impacts to this site due to road widening and earthworks within the western half of this identified area. It may impact the area of an early 20th century cottage associated with the quarry use, however, this cottage does not meet the threshold for local heritage significance.

Operation

Generally, the proposal would be contained within the existing corridor and so would not visually dominate any heritage items more than the current alignment. The proposal would have a low visual impact on the context and views of The Pines and the Gatekeeper's Cottage heritage items. The character of the area around these items would remain similar as the Medlow Bath to Blackheath section would tie into the existing highway at this location. Visual impacts of the proposal are discussed further in Section 6.5.3.

The proposal has been designed to complement the heritage significance of the proposal area by following the original alignment and creating spaces for interpretation and community access. These design features include the consolidation and improvement of the heritage interpretation area near Nellies Glen Road and the provision of improved active transport trails. Further details are available in Section 3.2.3

Transport is currently engaging with specialist heritage consultants GML Heritage and Balarinji Indigenous Design and Strategy to engage stakeholders in developing a cultural interpretation strategy across the Great Western Highway Upgrade Program – Katoomba to Lithgow. This cultural interpretation strategy would look to interpret both Aboriginal and non-Aboriginal heritage along the highway alignment. The Pulpit Hill heritage interpretation area would be further developed as part of the Great Western Highway Upgrade Program cultural interpretation strategy, in consultation with the Blue Mountains City Council, Heritage NSW, Aboriginal knowledge holders and the local community.

As such, the operation of the proposal is not expected to result in any other direct or indirect impacts on the identified heritage items.

6.4.4 Safeguards and management measures

Safeguards and management measures for non-Aboriginal heritage are outlined in Table 6-22.

Table 6-22: Safeguards and management measures – non-Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Transport / Contractor	Detailed design / pre-construction	Section 4.10 of QA *G36 Environment Protection*
Non-Aboriginal heritage	The *Standard Management Procedure - Unexpected Heritage Items* (Transport, 2015d) 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.	Transport / Contractor	Detailed design / pre-construction	Section 4.10 of QA *G36 Environment Protection*
Non-Aboriginal heritage	The proposed design will be further refined during detailed design to avoid and/or minimise non-Aboriginal heritage impact. Should detailed design result in changes to non-Aboriginal heritage impacts, this will be re-evaluated at that stage.	Transport	Detailed design	Additional safeguard
Non-Aboriginal heritage	A Photographic Archival Record of the current state of the Great Western Highway will be prepared prior to the commencement of construction. The archival recording will be submitted to Transport, local historical societies and Blue Mountains City Council.	Contractor	Pre-construction	Additional safeguard
Greater Blue Mountains Area – Additional Values	Removal of vegetation within the Greater Blue Mountains Area – Additional Values areas will be minimised as much as possible.	Transport	Detailed design	Additional safeguard
Pulpit Hill and Environs	• A Conservation Management Plan (CMP) will be prepared for Pulpit Hill and Environs to manage the heritage significance of the site and provide for ongoing management. • The proposed concept design will be further refined during detailed design to minimise adverse heritage impact on the Pulpit Hill and Environs curtilage (including Stone Arrangements site) and interpret the heritage significance of this site, including the role the Explorers Tree played as a waypoint. • If it is not possible to completely avoid the Stone Arrangements, then further information will be required to better understand the constraints and significance of the heritage site. This further study will include: – An Historical Archaeology Assessment including a Historical Research Study	Transport / Contractor	Detailed design / pre-construction / Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	– An Archaeological Research Design (ARD) for archaeological work – An archaeological test excavation targeting a portion of the Stone Arrangements and a soil analysis of excavated soil to confirm the presence of graves – Further remote sensing studies to verify previous study results. • The archaeological test excavation will be carried out to confirm whether a permit under Section 140 of the *Heritage Act 1977* will be required for the proposal. • A heritage interpretation strategy for the Pulpit Hill area will be developed to reinterpret the existing heritage interpretation area and communicate the heritage significance of the Pulpit Hill area. This will be integrated with the cultural interpretation strategy for the Great Western Highway Upgrade Program. The existing interpretation area will be retained as much as possible.			
Bonnie Doon Reserve	Vegetation removal within the Bonnie Doon Reserve curtilage will be limited to as little as needed and unobtrusive as possible.	Transport	Detailed design	Additional safeguard
Culvert XA6, XA7 and XA7a	A further vibration assessment will be prepared to assess the indirect impacts of the proposal near Culvert XA6, XA7 and XA7a.	Transport	Detailed design	Additional safeguard
House and Orchards (former Glenara Cottage)	An Historic (non-Aboriginal) Archaeological Assessment (HAA) will be carried out to the determine the nature, extent and significance of any archaeological resources associated with the House and Orchards (former Glenara Cottage) in this area and identify appropriate management measures.	Contractor	Pre-construction	Additional safeguard
The Pines and The Gatekeeper's Cottage	• A further vibration assessment will be prepared to assess the indirect impacts of the proposal near The Pines and The Gatekeeper's Cottage. • Should detailed design result in changes to the proposal near The Pines and The Gatekeeper's Cottage, visual impacts will be revaluated upon completion of detailed design.	Transport	Detailed design	Additional safeguard

Other safeguards and management measures that would address non-Aboriginal heritage impacts are identified in Section 6.6.4.

6.5 Landscape character and visual impacts

The potential landscape character and visual impacts during construction and operation of the proposal have been assessed as part of the *Urban Design, Landscape Character and Visual Impact Assessment* (Spackman Mossop Michaels, 2022), provided in Appendix G.

6.5.1 Methodology

The landscape character and visual impact assessment (LCVIA) was carried out in accordance with the *Practice Note: Guideline for landscape character and visual impact assessment* (EIA-N04).

The assessment included:

- a landscape character assessment, which assessed the overall impact of a project on an area's character and sense of place
- a visual impact assessment, which assessed the proposal's impacts on views.

The assessment of landscape character involved identifying landscape character zones (LCZ) near the proposal area and assessing the sensitivity and magnitude of the proposal for each zone. This involved analysing aerial imagery to distinguish distinct vegetation communities and growth patterns as well as topography, geology, water and infrastructure. A site visit confirmed the boundary of each zone by experiencing the landscape on foot and in a car.

The assessment of visual impact required the selection of viewpoints overlooking the proposal area. A collection of viewpoints was selected from different locations, distances and directions within the visual catchment of the proposal area. This involved a desktop assessment of the Visual Envelope Map for the proposal and adjustment of each viewpoint to fall within a likely area of observation, including roadways, residential housing, a walking track or lookouts. These viewpoints were verified during the site visit.

The LCVIA identified the sensitivity of individual LCZ and viewpoints and the magnitude of change at each associated with the proposal. Sensitivity refers to how susceptible the environment is to the proposed change. Magnitude refers to the type of proposal and its compatibility with existing landscape character, including scale, form and material composition of elements, as well as their location or setting. Impacts were determined by assessing sensitivity and magnitude using the matrix shown in Table 6-23.

Table 6-23: Landscape character and visual impact rating matrix

Sensitivity		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.5.2 Existing environment

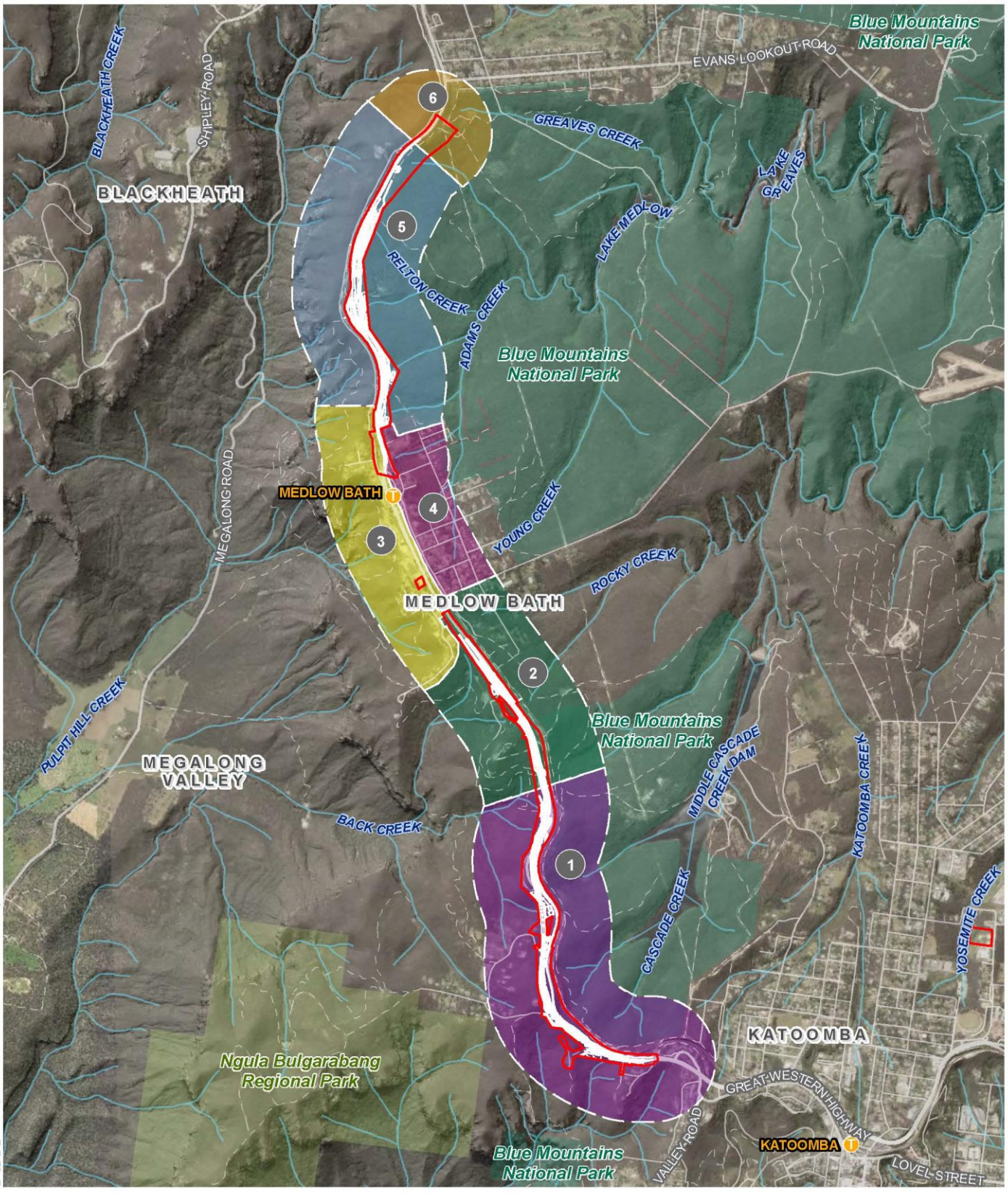
The proposal area contains mostly environmental landscapes. The Katoomba to Medlow Bath section follows undulating topography and is dominated by dense vegetation along the road corridor. As such, most of the Great Western Highway in this section does not have views over the adjoining rail corridor. However, the rail corridor is more visible within the Medlow Bath to Blackheath section. This section is relatively flat, with the Blue Mountains National Park directly to the east of the road corridor in this section.

There are six distinct LCZ for the proposal that are outlined in Table 6-24 and are shown in Figure 6-5. Due to their location, LCZ 3 and 4 are considered across both sections of the proposal. This assessment included the town of Medlow Bath due to its proximity to the two sections of the proposal. The proposal area has been shaped by natural and cultural elements over time. Landscape character has been shaped by landforms, vegetation, views, settlement patterns, and built structures within and adjacent to the proposal area.

Table 6-24: Landscape character zone description

Zone	Description	Landscape view
LCZ 1 – Pulpit Hill (Katoomba to Medlow Bath section)	High landform with densely established indigenous open forest bushland vegetation, dissected by the Great Western Highway.	
LCZ 2 – Enclosed Bushland (Katoomba to Medlow Bath section)	High quality plant communities, densely vegetated enclosed bushland with prominent rock cuttings, edged by roadside vegetation.	
LCZ 3 – Medlow Bath Western Plateau (Katoomba to Medlow Bath and Medlow Bath to Blackheath sections)	Plateau adjacent to the Megalong Valley escarpment, rich in high visual and scenic qualities.	

Zone	Description	Landscape view
LCZ 4 – Medlow Bath East Village (Katoomba to Medlow Bath and Medlow Bath to Blackheath sections)	Flat to gently undulating topography, predominantly low-density housing surrounded by remnant stands of woodland vegetation and mature planted exotics.	
LCZ 5 – Ridgeline Transition (Medlow Bath to Blackheath section)	Native forest, natural bushland sitting high atop the ridgeline. Man-made elements including powerlines detract from the natural landscape in the east, whilst open views over the Megalong Valley exist in the west.	
LCZ 6 – Blackheath Approach (Medlow Bath to Blackheath section)	A mix of natural bushland to the west with steep slopes toward the Megalong Valley and single storey dwellings in the east with planted exotics.	



The design
Proposal area
Blue Mountains National Park
Ngula Bulgarabang Regional Park
Watercourses

Landscape character zone

1 - Pulpit Hill
2 - Enclosed Bushland
3 - Medlow Bath Western Plateau
4 - Medlow Bath East Village
5 - Ridgeline Transition
6 - Blackheath Approach

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Source: Aurecon, LPI, DPIE, BoM, Niche

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Great Western Highway East **Review of Environmental Factors**

Projection: GDA2020 MGA Zone 56

FIGURE 6-5: Landscape Character Zones

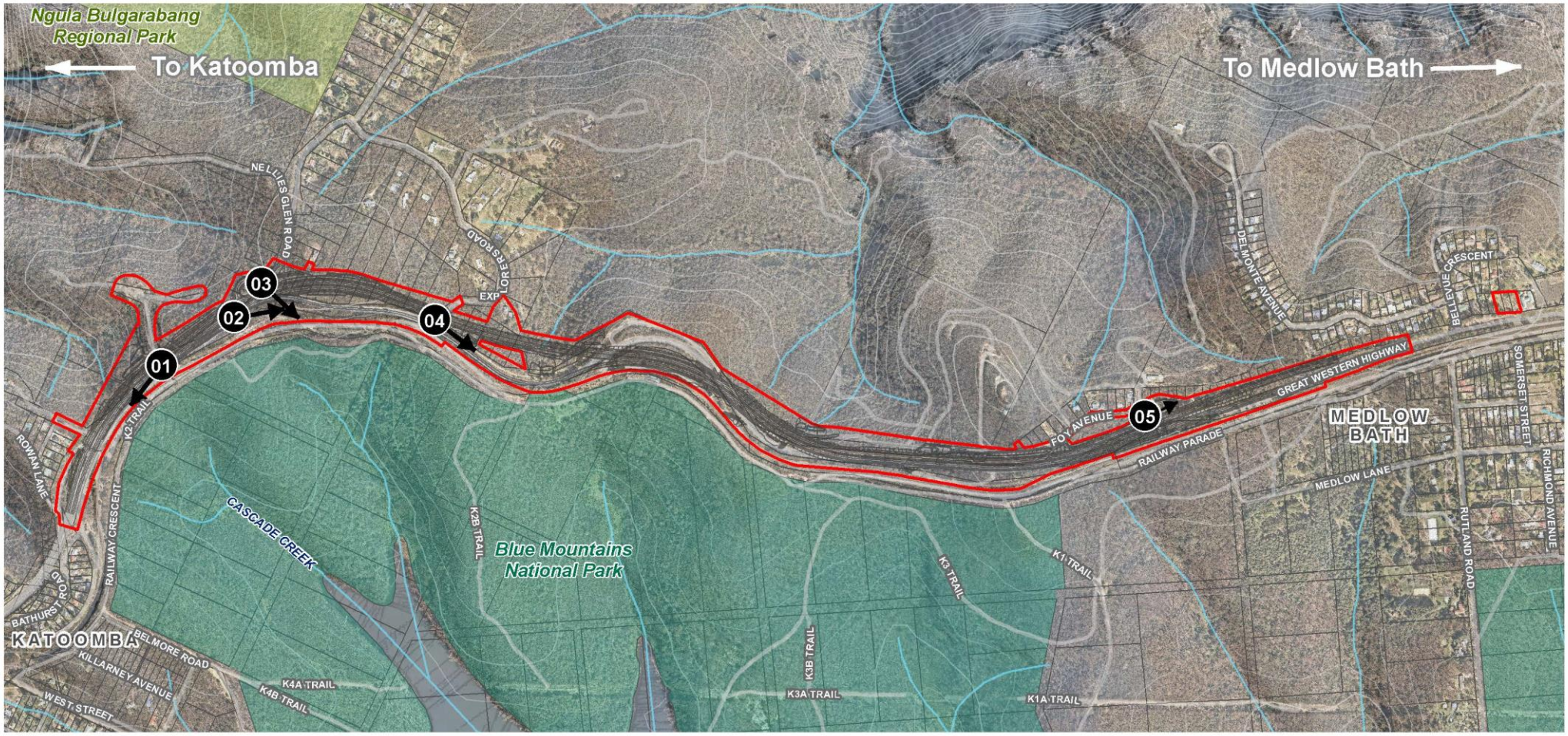
Eight viewpoints were selected to represent receivers or sites that have potential to be visually impacted by the proposal. There are five viewpoints (VP 1, VP 3, VP 4 and VP 5) within the Katoomba to Medlow Bath section and three viewpoints (VP 6, VP 7 and VP 8) within the Medlow Bath to Blackheath section. The receivers in these viewpoints include residents, tourists, recreational and park users, pedestrians, cyclists and motorists. The eight viewpoints are shown in Table 6-25 and Figure 6-6a-b.

Table 6-25: Summary description associated with viewpoints

Viewpoint	Description
 **VP 1: Entry into Bonnie Doon Reserve along the Great Blue Mountains Trail, looking south east.**	The existing road infrastructure makes up an even proportion of the existing view for motorists and recreational users of the adjacent trail.
 **VP 2: Heritage Interpretation Area along Nellies Glen Road, looking north toward the Great Western Highway.**	The existing vegetation and exposed rock makes up a large proportion of the existing view for motorists travelling along the Great Western Highway.
 **VP 3: Heritage Interpretation Area along Nellies Glen Road, looking north toward the Great Western Highway.**	The existing road infrastructure is in the background of this view, with Nellies Glen Road in the mid-ground. The existing view is dominated by vegetation along the fringes of the existing Heritage Interpretation Area, Nellies Glen Road and the existing Great Western Highway. This view is typical for motorists travelling along Nellies Glen Road, pedestrians and cyclists using the Great Blue Mountains Trail or Six Foot Track, and visitors to the Pulpit Hill heritage interpretation area and adjoining informal carpark.

Viewpoint	Description
 **VP 4: Multi use access track on the corner of Explorers Road and the Great Western Highway, looking north.**	An even proportion of the view comprises of the existing road corridor and existing vegetation for pedestrians and cyclists using the Great Blue Mountains Trail and motorists travelling along Explorers Road.
 **VP 5: The corner of Foy Avenue and the Great Western Highway looking north toward the proposal. The viewpoint is representative of a number of views from residences along this portion of Foy Avenue.**	The existing road infrastructure makes up an even proportion of the existing view for residents, motorists and recreational users of the adjacent trail. The existing Great Blue Mountains Trail is buffered by existing vegetation between the roadway.
 **VP 6: Existing Great Blue Mountains Trail along Station Street, looking east toward the proposal.**	The existing road and rail corridors are seen in the background of this viewpoint by motorists travelling along Station Street and pedestrians and cyclists using the Great Blue Mountains Trail. This existing infrastructure is partially screened by existing established vegetation.

Viewpoint	Description
 **VP 7: The Gatekeepers Cottage along Station Street, looking Southeast across the Main Western Railway Line toward the Great Western Highway.**	The viewpoint is representative of a number of views experienced by residents on Station Street, rail commuters and pedestrians and cyclists. The existing road and rail infrastructure are dominant features within this view.
 **VP 8: Coachhouse Lane looking north toward the proposal and rail corridor in the background.**	The view is made up of both transport infrastructure and mature tree and larger shrub vegetation along the road verge and the background. This is representative of the views of residents of Coachhouse Lane and pedestrians.



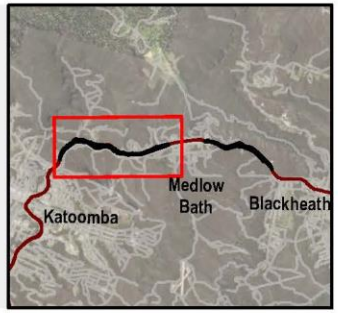
The design

Proposal area

Blue Mountains National Park

Ngula Bulgarabang Regional Park

01 Viewpoints



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Source: Aurecon, Mott MacDonald, LPI, Nearmap

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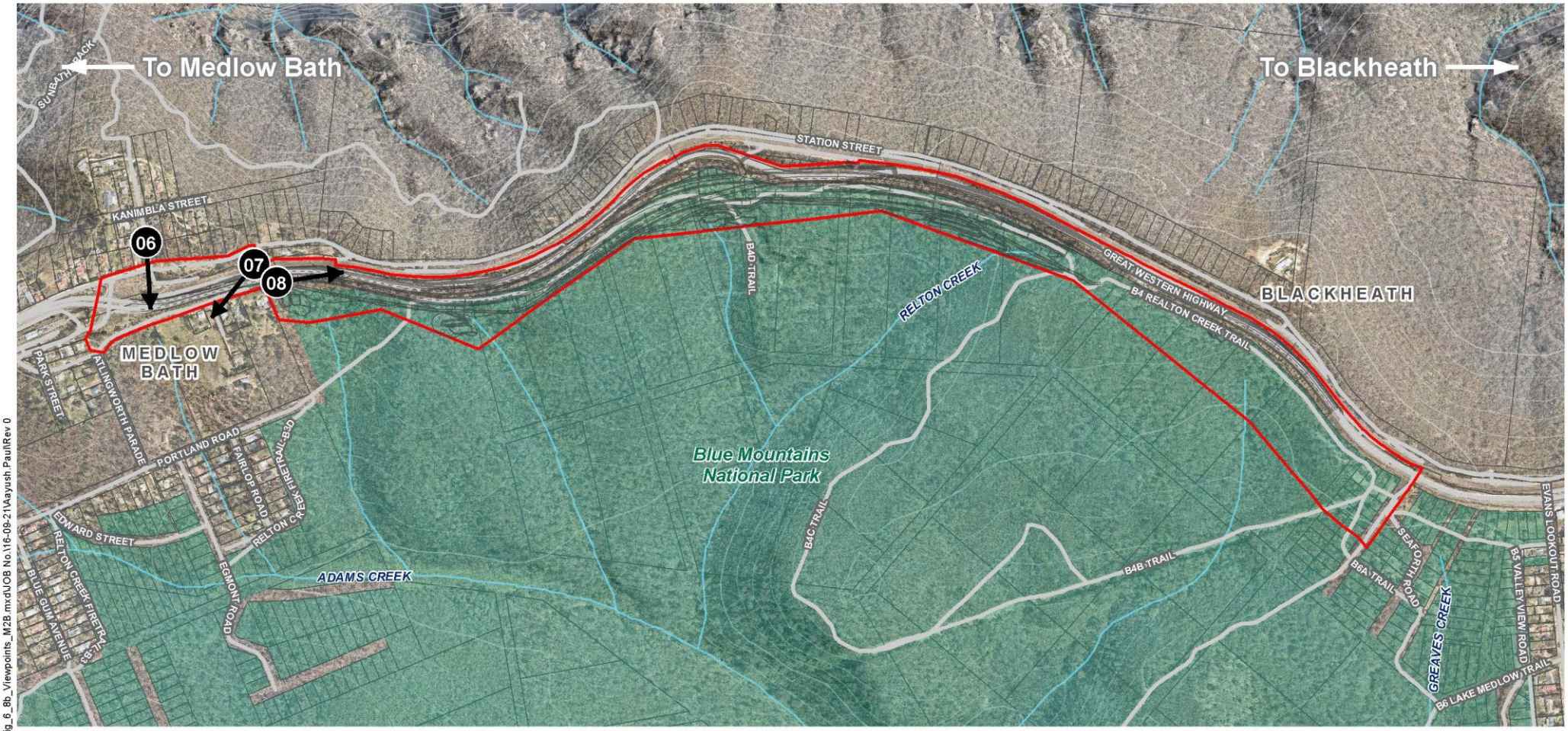
Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-6a: Viewpoints

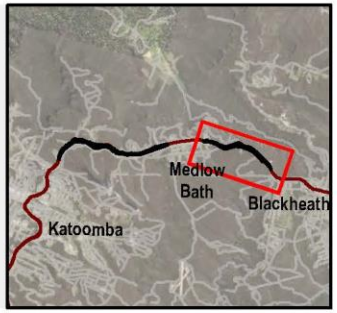


The design

Proposal area

Blue Mountains National Park

01 Viewpoints



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, RFS

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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-6b: Viewpoints

6.5.3 Potential impacts

Construction

General construction activities would result in temporary visual impacts on views near the work for the duration of construction. These include the movement and operation of machinery, light and heavy vehicles, and the erection of temporary structures such as fencing, lighting and construction ancillary facilities. Visual impacts would be experienced due to clearance of vegetation, excavations and earthworks and the presence of construction areas including ancillary facilities and plant and equipment. The visual impacts would be seen by motorists, recreational walkers and cyclists.

However, the greatest visual impacts would be experienced by residents that overlook the construction sites due to their proximity to the proposed work sites. Within the Katoomba to Medlow Bath section, this would include residents on Rowan Lane, Katoomba; Foy Avenue and Delmonte Avenue, Medlow Bath. There would be major visual impacts experienced at residences on Explorers Road, especially those down the valley due to their proximity to the construction of the twin bridges. The incremental construction of the twin bridges would involve construction work at a greater elevation than the current Great Western Highway. Within the Medlow Bath to Blackheath section, visual impacts experienced by residents would be limited to those who live on Coachhouse Lane and Station Street, Medlow Bath near the southern end of the section.

There are no anticipated residual landscape or visual impacts resulting from the construction phase of the proposal. Contractors would be required to rehabilitate all work sites prior to and at the end of the construction period. Landscape and visual impacts may arise from rehabilitation work and would be most evident during the first year of operation. Visual impacts may vary depending on final construction methods and staging identified in detailed design.

Operation

Landscape character impacts

The six landscape character zones have been assessed as part of the landscape character study and consider areas both within and beyond the proposal area. A summary of the landscape character impact assessment is presented in Table 6-26.

Table 6-26: Landscape character impacts during operation of the proposal

Zone	Sensitivity	Magnitude	Impact
LCZ 1 – Pulpit Hill	**High** • Well established indigenous open forest bushland. • Bushland plays an important role as a visual backdrop. • This LCZ is highly sensitive to change and would not be easily able to absorb changes.	**High** • The proposal would increase the amount of the road-related infrastructure in this LCZ. • It would require clearing of mature bushland vegetation. • Changes to the natural landform.	**High**
LCZ 2 – Enclosed Bushland	**High** • Densely vegetated LCZ has a strong relationship with the surrounding National Park, road and rail corridor. • Undulating topography and windy nature of the Great Western Highway contributes to the character. • Bushland is important as a visual backdrop to the Great Western Highway. • This LCZ is highly sensitive to change and would not be easily able to absorb changes.	**Moderate** • The proposal would increase the amount of the road-related infrastructure in this LCZ. • It would require clearing of mature bushland vegetation and changes to the natural landform.	**High – Moderate**
LCZ 3 – Medlow Bath Western Plateau	**Moderate** • Nature of the Western Plateau is one of both high visual amenity, overlooking the Megalong Valley and also contributing to the neighbourhood feel of Medlow Bath. • Existing proximity to the road and rail corridor allows for this LCZ to absorb change more successfully.	**Low** • The proposal would increase road related infrastructure in the northern portion of the Medlow Bath Western Plateau LCZ. • The majority of work within this LCZ would be within the existing road corridor. • At the tie-in with the Medlow Bath Upgrade, spatial character of the LCZ would be maintained, with the proposal following the existing alignment of the Great Western Highway.	**Moderate – Low**
LCZ 4 – Medlow Bath East Village	**Moderate** • Medlow Bath East Village LCZ predominantly consists of low-density residential housing. • This LCZ has a reasonable ability to absorb change near Coachhouse Lane due to an existing retaining wall between the proposal and residences along Coachhouse Lane and the existing proximity of these residences to the road and rail corridor.	**Low** • The proposal would increase pedestrian and cyclist access along Coachhouse Lane. • Existing bushland along the north-eastern fringe of this LCZ within the proposal area is likely to be cleared.	**Moderate – Low**

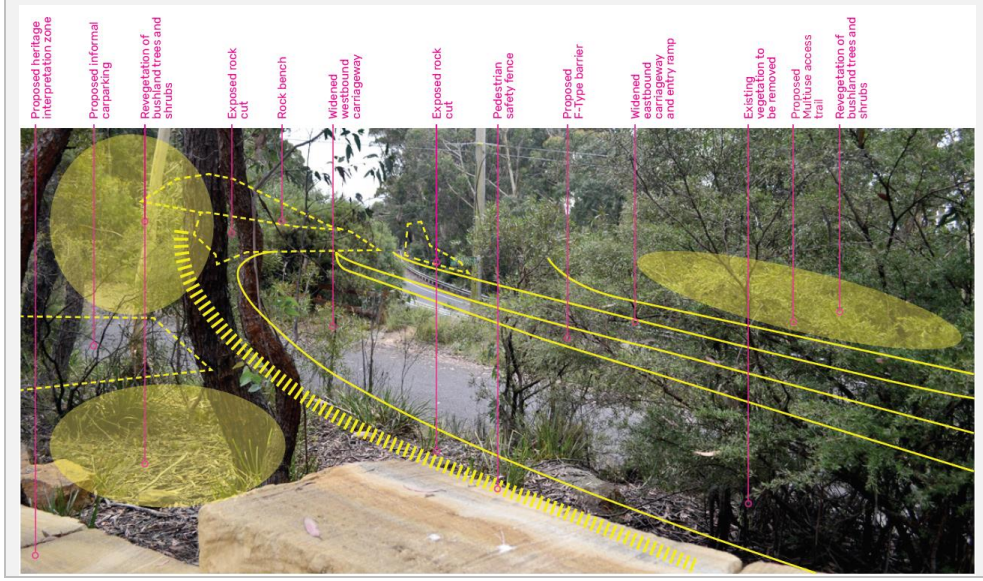
Zone	Sensitivity	Magnitude	Impact
LCZ 5 – Ridgeline Transition	**Moderate** • Well established natural bushland that sits high atop the ridgeline, overlooking the Megalong escarpment to the west. • Combination of mature bushland along the fringes of the road corridor to the east and the rail corridor and associated infrastructure to the west. • This LCZ would find it difficult to absorb changes.	**Moderate** • The proposal would increase the hard surface to the east of the existing Great Western Highway. • Existing vegetation removal to accommodate the expansion of the roadway and adjacent multi use access path. • The changes would only slightly impact the spatial character given the existing conditions along the Great Western Highway.	**Moderate**
LCZ 6 – Blackheath Approach	**Moderate** • Consists of a mix of natural bushland with steep slopes away from the transport corridor in the west and single-storey dwellings to the east. • This LCZ would find it difficult to absorb changes.	**Moderate** • The proposal would slightly increase the hard surface to the east of the existing Great Western Highway. • Existing vegetation removal to accommodate the expansion of the roadway and adjacent multi use access path. The changes would only slightly impact the spatial character given the existing conditions along the Great Western Highway.	**Moderate**

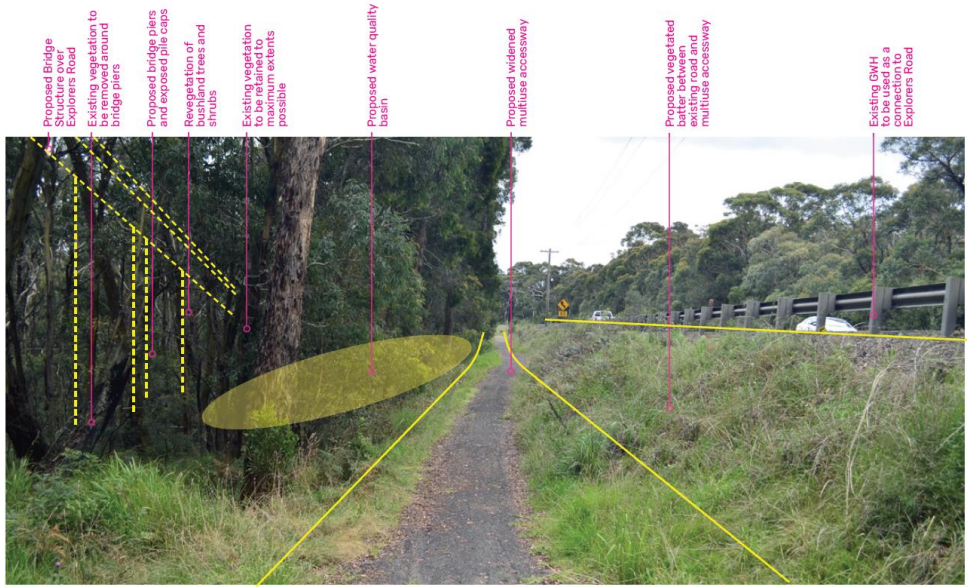
Visual impacts

Assessment of the visual impacts at eight viewpoints within or near the proposal area and are summarised in Table 6-27.

Table 6-27: Viewpoint impact assessment summary

Viewpoint	Sensitivity	Magnitude	Impact
VP 1 	**High** • Existing road infrastructure makes up an even proportion of the existing view. • The experiential quality of the meandering roadway enclosed by bushland is highly sensitive to change given any work that would remove vegetation and alter the perceived curvature of the roadway would affect the road user experience.	**Moderate** • Widening of pavement in the foreground of this viewpoint. • Vegetation along the southbound carriageway will require clearing. • Vegetation installed as part of the proposal landscape design would somewhat reduce the visual effect of change over time and mitigate increased light spill at night.	**High – Moderate**
VP 2 	**High** • Existing vegetation and exposed rock make up a large proportion of the existing view. • The experiential quality of the meandering roadway enclosed by bushland is highly sensitive to change and changes to this spatial quality via the removal of vegetation and increase in hardstand would substantially affect the road user experience.	**High** • Large benched cutting directly adjacent to the widened northbound carriageway. • Vegetation clearing and the widening of the roadway would result in a substantial change to the visual composition of this viewpoint. • Vegetation installed as part of the proposal landscape design would only provide minor mitigation over time.	**High**

Viewpoint	Sensitivity	Magnitude	Impact
VP 3 	**Moderate** • Existing view is dominated by vegetation along the fringes of the existing Heritage Interpretation Area • This viewpoint would be sensitive to change as changes to the vegetation would result in limited ability to absorb changes.	**Moderate** • The proposal would relocate the existing Nellies Glen Road behind the location of this viewpoint. • Introduction of a large rock cutting along the northbound carriageway to enable a realignment of the road corridor. • Vegetation clearing and the widening of the roadway will result in a substantial change to the visual composition of this viewpoint. • Vegetation installed as part of the Proposal landscape design would reduce the visual effect of change over time.	**Moderate**

Viewpoint	Sensitivity	Magnitude	Impact
VP 4 	**Moderate** • An even proportion of the view comprises of the existing road corridor and existing vegetation. • This viewpoint would be sensitive to change given alterations to dense vegetation would result in limited ability to absorb changes.	**High** • The proposal would provide a bridge crossing over Explorers Road, increasing light spill. • Removal of existing bushland vegetation. • Existing Highway would remain as an access way onto the Great Western Highway, from Explorers Road. • Substantial changes to the enclosed character of this portion of the proposal would result in a high magnitude of change. • Revegetation strategies installed as part of the proposal landscape design would reduce the visual effect of change over time and further mitigate light spill. • Given the required bridge infrastructure and setbacks the experience of users is unlikely to be regained	**High – Moderate**

Viewpoint	Sensitivity	Magnitude	Impact
VP 5 	**Moderate** • The existing road infrastructure makes up an even proportion of the existing view. • The existing Great Blue Mountains Trail is buffered by existing vegetation between the roadway. • The experiential quality of the roadway upon entering Medlow Bath is enclosed by mature vegetation and as such is sensitive to change given any work that would remove vegetation and alter road user experience	**Moderate** • The proposal would introduce the raising and widening of the. • Vegetation along the northbound carriageway will require clearing with fill batters proposed on either side of the carriageway. • Vegetation installed as part of the proposal landscape design would reduce the visual effect of change over time and light spill.	**Moderate**

Viewpoint	Sensitivity	Magnitude	Impact
VP 6 	**Low** • The existing road infrastructure is seen in the background of this view, partially screened by existing established vegetation. • The foreground of the existing view is dominated by vegetation along the fringes of the existing rail corridor, the highway and rail infrastructure are seen as dominant existing features in the background. • As a result, this viewpoint would be able to absorb changes given the existing screen planting, as well as existing built elements	**Low** • The proposal would relocate the existing retaining wall along the rail corridor and relocate the associated rail infrastructure. • As a result of this widening, there would not be a substantial change to the visual composition of this viewpoint. • Vegetation installed as part of the proposal landscape design would assist in further reducing the visual effect of change over time.	**Low**
VP 7 	**Low** • The existing road and rail infrastructure are dominant features within this view. • As a result of extensive infrastructure in the foreground, this viewpoint would be able to successfully absorb changes.	**Moderate** • The proposal would relocate the existing retaining wall along the rail corridor and relocate the associated rail infrastructure. • The proposal would not be a significant change to the visual composition of this viewpoint. • There would likely be increased traffic travelling past this viewpoint and light spill at night from the proposal.	**Moderate – Low**

Viewpoint	Sensitivity	Magnitude	Impact
VP 8 	**High** • The view is made up of an even ratio of transport infrastructure and mature tree and larger shrub plantings along the road verge and the background. • The sensitivity of this view to change is high given the limited ability of this view to absorb changes to the removal of existing established vegetation along the fringe of the road corridor. • The view is sensitive given the existing residential properties along Coachhouse Lane, which would be impacted by changes to this view, in the form of partial screening of incoming traffic from this viewpoint.	**Moderate** • The proposal would introduce the widening of pavement in the foreground of this viewpoint. • Introduction of a multi-use access trail, where previous access was restricted. • Vegetation along the southbound carriageway would require clearing with a retaining wall and batter proposed along the edge of the roadway and access path. • Vegetation installed as part of the proposal landscape design along the batter would somewhat reduce the visual effect of change over time and reduce increased light spill.	**High – Moderate**

6.5.4 Safeguards and management measures

Safeguards and management measures for landscape and visual impacts are presented in Table 6-28.

Table 6-28: Safeguard and management measures – landscape character and visual impact

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	An Urban Design Plan will be prepared to support the final detailed project design and implemented as part of the CEMP. The Urban Design Plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for: • location and identification of existing vegetation and proposed landscaped areas, including species to be used • built elements including retaining walls, bridges and noise walls • pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • fixtures such as seating, lighting, fencing and signs • details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage • procedures for monitoring and maintaining landscaped or rehabilitated areas.	Contractor	Detailed design/pre-construction	Standard safeguard
Proposal design	• Rail infrastructure will be screened using shrubs and trees, where possible • Cut and fill batters will be rounded to help integrate into the existing landform and create a more naturalised appearance. • Opportunities to reduce the proposal footprint will be explored during detailed design • Connectivity and access to the existing and proposed heritage interpretation area will be enhanced. • Exposed rock faces will be retained in the rock cuttings	Transport	Detailed design	Additional safeguard
Bridges	• The bridge design and the design of peripheral elements will be refined to reduce its visual impact.	Transport	Detailed design	Additional safeguard
Bicycle and pedestrian	• Cyclist and pedestrian access will be improved through new and upgraded, multi-use access tracks • Visibility of proposed multi-use access tracks and adjoining residential properties will be improved.	Transport	Detailed design	Additional safeguard
Structures	• Design of new retaining walls will have finishes of a high standard and quality that is in keeping with the Great Western Highway character.	Transport	Detailed design	Additional safeguard
Landscape implementation	• Fill batters will be screened where possible using seeding, shrubs and trees, as well as bushland reconstruction techniques.	Transport	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• Buffer planting will be introduced in front of the retaining wall at the southern entry into Medlow Bath to minimise visual impacts. • Bushland reconstruction and bushland seeding will be maximised where possible. • Native and endemic plantings will be used along the highway outside of the village. • Revegetation with appropriate species will be maximised along the highway to reduce perceived corridor width. • The selection of plant species will complement and integrate with the existing environment. • Opportunities for additional tree plantings along the proposal corridor will be investigated.			
Construction visual impact	The layout of ancillary facility sites will be designed to limit impact. The design will consider: • screening of boundaries facing sensitive receivers or views • careful placement of structures and buildings to maintain viewpoints or provide additional screening of site activities.	Contractor	Pre-construction / Construction	Additional safeguard
Construction visual impact	Ancillary facilities will be maintained, kept tidy and well-presented including sorting regular removal of excess materials to reduce visual impact.	Contractor	Construction	Additional safeguard
Construction visual impact	Ancillary facility sites and temporary construction areas will be progressively restored to at least their pre-construction conditions when no longer required.	Contractor	Construction	Additional safeguard

6.6 Noise and vibration

The potential noise and vibration impacts during construction and operation of the proposal have been assessed as part of the *Noise and Vibration Technical Paper* (Renzo Tonin, 2022), provided in Appendix H.

6.6.1 Methodology

The methodology for the noise and vibration assessment involved:

- identifying the noise and vibration assessment study area and associated sensitive receivers
- measuring the existing background noise levels at seven noise monitoring locations and carrying out concurrent traffic count surveys to calibrate the existing road traffic noise models
- grouping sensitive receivers that are located at similar distances from noise generating activities into seven noise catchment areas (NCA) and describing the existing noise environment for each NCA
- defining relevant assessment criteria to assess noise and vibration impacts
- identifying 'realistic worst-case' construction scenarios and representative plant and equipment for each scenario
- predicting and assessing construction noise levels for the construction scenarios using CadnaA software in accordance with the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and Construction Noise and Vibration Guideline (CNVG) (Transport, 2016a)
- calculating and assessing construction vibration using source vibration levels and minimum working distances in accordance with relevant guidelines
- assessing the predicted operational road traffic noise levels using CadnaA software in accordance with the Road Noise Policy (RNP) (DECCW, 2011)
- recommending safeguards and management measures to be implemented to minimise noise and vibration impacts during construction and operation of the proposal, with reference to the CNVG and Noise Mitigation Guideline (NMG) (Transport, 2015c).

Noise monitoring

Noise monitoring was carried out near the proposal to determine the existing background noise environment. Unattended noise monitoring was completed during August 2021. The noise monitoring locations were chosen to be representative of the different NCAs surrounding the proposal. Five of the seven noise monitors were installed at residences with an unobstructed view of Great Western Highway, which were the most appropriate locations for calibration of the traffic noise model.

Additional noise monitoring was conducted at two locations (L5 and L7) to obtain background noise levels for setting construction noise goals.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. Traffic count surveys were carried out alongside the long-term unattended noise monitoring surveys to calibrate the road traffic noise volumes.

While noise monitoring was conducted during a COVID-19 lockdown period, operational traffic noise predictions are based on previous traffic volumes monitored in March and April 2021 when there was no lockdown period. Future traffic volumes and growth estimates were also based on pre-pandemic conditions so that traffic volumes are not underestimated.

Construction noise and vibration assessment model and scenarios

Construction noise at sensitive receivers was modelled using CadnaA software.

The nine construction scenarios developed for construction noise modelling were:

- site preparation (SP)
- site establishment (SE)
- bulk earthworks (BE)
- drainage infrastructure (DI)
- paving / asphalting (including concrete sawing) (PA)
- finishing work (FW)
- bridge work – foundations (BWF)
- bridge work – launching (BWD)
- ancillary facility operational (AFO).

These scenarios provide 'realistic worst-case' activity sequences for different construction activities. They were attributed a unique assessment identification number for each section of the proposal. The bridge work scenarios were only modelled for the Katoomba to Medlow Bath section.

The scenarios represent one possible way that the proposal could be constructed and may not necessarily be the same methodology that the contractor engaged to construct the proposal would use. The final construction methodology (including the full plant and equipment list) and the expected construction noise levels would be confirmed during detailed design.

The assessment has considered potential noise impacts from work during standard working hours as well as out-of-hours periods for all scenarios. Refer to Section 3.3.4 for more information on the proposed construction hours.

Operational noise assessment model and scenarios

A noise model of the 'operational study area' has been used to predict noise levels from the operation of the proposal to surrounding receivers using CadnaA software. Various inputs and parameters were applied to the model including local terrain, surrounding buildings, typical vehicle speeds, traffic volumes, vehicle types and road surfaces.

The operational study area has been defined as 600 metres from the centre of the outside lanes of the project roads, as required by the Noise Criteria Guideline (NCG) (Transport, 2015b).

With exception of the new twin bridges over the valley from Pulpit Hill near Explorers Road, all 'project' roads are considered to be 'redeveloped' as per the NCG. The twin bridges are assessed as a 'new' road due to change in alignment and elevation compared to the existing Great Western Highway in this area.

There is a 'type 1 transition zone' at the new bridges where residences are impacted by road noise from both the new bridges and the redeveloped roads at the northern and southern ends of the bridges. Receivers located within the type one transition zone have been assigned transition zone criteria (refer to Section 6.6.3) based on the level of exposure to the new and redeveloped roads.

There are 'type 2 transition zones' at the western end of the proposal in Blackheath and at the eastern end of the proposal in Katoomba where the proposal ties in with the existing Great Western Highway. For receivers in these zones, the contribution of road traffic noise from all roads is calculated to determine if the receiver should be considered for additional noise mitigation (as per the NMG).

Operational traffic noise levels were modelled for the 14 scenarios outlined in Table 6-29. The assessment considered both the 'build' (with the proposal) and 'no build' (without the proposal) scenarios.

Table 6-29: Noise modelling scenarios

Label	Description
2021 Existing – day	Daytime, based on existing measured 2021 traffic and road alignment for model validation purposes
2021 Existing – night	Night-time, based on existing measured 2021 traffic and road alignment for model validation purposes
2026 No build – day	Daytime based on 2026 ‘No build’ scenario
2026 No build – night	Night-time based on 2026 ‘No build’ scenario
2036 No build – day	Daytime based on 2036 ‘No build’ scenario
2036 No build – night	Night-time based on 2036 ‘No build’ scenario
2026 Build – day	Daytime based on 2026 with 'Build’ scenario (with and without low noise pavement)
2026 Build – night	Night-time based on 2026 with 'Build’ scenario (with and without low noise pavement)
2036 Build – day	Daytime based on 2036 with 'Build’ scenario (with and without low noise pavement)
2036 Build – night	Night-time based on 2036 with 'Build’ scenario (with and without low noise pavement)

6.6.2 Existing environment

Noise catchment areas and sensitive receivers

The nearest sensitive receivers to the proposal are residential properties near:

- Rowan Lane, Katoomba (Katoomba to Medlow Bath section)
- Explorers Road, Katoomba (Katoomba to Medlow Bath section)
- Foy Avenue, Medlow Bath (Katoomba to Medlow Bath section)
- Delmonte Avenue, Medlow Bath (Katoomba to Medlow Bath section)
- Coachhouse Lane, Medlow Bath (Medlow Bath to Blackheath section).

There are other sensitive receivers, especially in the town of Medlow Bath, between the two sections of the proposal. A comprehensive list of ‘other sensitive’ receivers (non-residential) identified within the study area is provided in Section 3.2 of Appendix H to the REF.

Seven NCAs have been identified surrounding the proposal, which each represent an area that contains a group of receivers that may be similarly affected by road traffic noise from the proposal. This may reflect the different land uses and existing background noise levels within and surrounding the proposal area. The NCAs, sensitive receivers and noise monitoring locations for the proposal are shown in Figure 6-7a-b.

Background noise levels

Existing noise levels in the proposal area are generally dominated by road traffic noise from the Great Western Highway as well as noise from the rail corridor when trains pass by. The noise monitoring results of the existing noise levels are summarised in Table 6-30.

Table 6-30: Background noise levels

ID	Address	L_{A90} Rating Background Noise (RBL)				
		Day[1]	Shoulder 1[4]	Evening[2]	Night[3]	Shoulder 2[5]
L1	60-81 Station Street, Blackheath	48	39	33	30[6] (28)	32
L2	16 Coachhouse Lane, Medlow Bath	45	38	31	30[6] (26)	34
L3	136 Great Western Highway, Medlow Bath	47	40	33	30[6] (28)	35
L4	43 Foy Avenue, Medlow Bath	45	40	33	30[6] (27)	32
L5	26 Explorers Road, Katoomba	44	38	32	30[6] (23)	32
L6	313 Bathurst Road, Katoomba	47	40	38	30[6] (28)	34
L7	46-56 Woodlands Road, Katoomba	36	35	30	30[6] (28)	33

Notes:
1. Day is 7:00am to 6:00pm on all days except Sundays and Public Holidays when it is 8:00am to 6:00pm
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Shoulder period 1 of 6pm to 7pm, Monday to Friday
5. Shoulder period 2 of 6am to 7am, Monday to Friday
6. Number in brackets represents the measured (actual) RBL value, which is below the minimum policy value of 30 dB(A) during the evening or night period or 35 dB(A) during the day period.

6.6.3 Criteria

Construction

Construction noise assessment periods

The assessment time periods adopted in the assessment are outlined in Table 6-31. As noted in Section 3.3.4, Transport is seeking approval for 'extended construction hours' for this proposal beyond the standard hours derived from the ICNG.

Table 6-31: Construction hours

Construction hours	Monday to Friday	Saturday	Sunday / Public holiday
Recommended standard construction hours			
Standard hours	7am to 6pm	8am to 5pm	No work
Outside recommended standard construction hours			
Extended construction hours	6am to 7am 6pm to 7pm	N/A	N/A
Out-of-Hours Work (Day)	N/A	5pm to 6pm	8am to 6pm
Out-of-Hours Work (Evening)	7pm to 10pm	6pm to 10pm	6pm to 10pm
Out-of-Hours Work (Night)	10pm to 6am	10pm to 8am	10pm to 8am

Construction noise criteria

Project-specific noise management levels (NMLs) were established for noise-affected receivers. The residential NMLs for the proposal have been determined based on the RBLs and are presented in Table 6-32. The only non-residential NML relevant to this assessment was the internal noise level objective for hospital wards and operating theatres NML of 45dB(A).

The ICNG also states that where construction noise levels are above 75 dBA at residential receivers during standard hours, they are considered 'highly noise affected' and require additional consideration in terms of noise mitigation and management measures.

Table 6-32: Construction noise management levels at residential receivers

NCA	Logger ID	Noise management level (NML) LAeq(15min)						Sleep disturbance screening criterion LAmax dB(A)
		Standard hours (RBL+10dB)	Extended/out-of-hours work (OOHW) (RBL+5dB)					
		Day	Day	Shoulder 1	Evening	Night	Shoulder 2	
NCA01	L1	58	53	44	38	35	37	55
NCA02	L2	55	50	43	36	35	39	55
NCA03	L3	57	52	45	38	35	40	55
NCA04	L4	55	50	45	38	35	37	55
NCA05	L5	54	49	43	37	35	37	55
NCA06	L6	57	52	45	43	35	39	55

Construction traffic

The potential impacts from construction traffic associated with the proposal when travelling on public roads are assessed under the NSW EPA RNP (DECCW, 2011) and CNVG. An initial screening test was first applied to evaluate whether existing road traffic noise levels were expected to increase by more than 2.0 dB because of construction traffic. Where this was considered likely, further assessment was required using the RNP and NCG.

Construction vibration

Construction vibration impacts have been assessed using the CNVG minimum working distances for human comfort, building contents and structural/cosmetic damage.

Human comfort vibration

People can sometimes perceive vibration impacts when vibration generating construction work is located close to occupied areas and buildings. The EPA's *Assessing Vibration: a technical guideline* (DECC, 2006) was used to determine the criteria for intermittent vibration based on the Vibration Dose Value (VDV).

Structural damage criteria

If vibration from construction works is sufficiently high, it can cause cosmetic damage to structural elements of affected buildings. Industry standard cosmetic damage vibration limits are specified in British Standard *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* (BS 7385; British Standards Institute, 1993) and German Standard *DIN 4150: Part 3-2016 Structural vibration – Effects of vibration on structures* (DIN 4150; Deutsches Institute fur Normung, 1999).

Heritage listed buildings and structures should be considered on a case-by-case basis but as noted in BS 7385 should not be assumed to be more sensitive to vibration, unless structurally unsound. Where a heritage building is deemed to be sensitive, the more stringent DIN 4150 Group 3 guideline values of 2.5 millimetres per second can be applied.

Minimum working distances for vibration intensive work

Minimum working distances for typical vibration intensive construction equipment are provided in the CNVG and are outlined in Section 12.1 of Appendix H to this REF. They suggest that where work is further from receivers than the quoted minimum distances then impacts are not considered likely.

Operation

Operational noise

The NCG criteria for residential receivers relevant to this proposal are shown in Table 6-33. For these receivers, the criteria shown have been applied to the receiver based off the type of road at the relevant part of the proposal. The NCG criteria for relevant 'other sensitive' receivers are shown in Table 6-34. The NCG does not consider commercial and industrial receivers as being sensitive to operational road traffic noise impacts.

Table 6-33: NCG criteria for residential receivers

Road category	Type of project/land use	Assessment criteria (dB)	
		Daytime (7am to 10pm)	Night-time (10pm to 7am)
Freeway/ arterial/ sub-arterial roads **roads**	1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	$L_{Aeq(15hr)}$ 55 (external)	$L_{Aeq(9hr)}$ 50 (external)
	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hr)}$ 60 (external)	$L_{Aeq(9hr)}$ 55 (external)
	4. Existing residences affected by both new roads and the redevelopment of existing freeway/arterial/sub-arterial roads in a Transition Zone[1]	Between $L_{Aeq(15hr)}$ 55-60 (external)	Between $L_{Aeq(9hr)}$ 50-55 (external)

Notes
1. The criteria assigned to the entire residence depend on the proportion of noise from the new and redeveloped road. See the NCG for further information.
2. The criteria at each facade are determined from the existing traffic noise level plus 12dB(A).

Table 6-34: NCG criteria for other sensitive receivers

Existing sensitive land use	Assessment criteria (dB)	
	Daytime (7am – 10pm)	Daytime (7am – 10pm)
Hospital wards	$L_{Aeq(1\ hour)}$ 35 (internal)	$L_{Aeq(1\ hour)}$ 35 (internal)

The NMG provides guidance to control road traffic noise and describes the principles to be applied when reviewing noise mitigation for predicted exceedances of the adopted NCG criteria. The NMG provides three triggers where receivers may qualify for considerations of 'additional noise mitigation':

- Trigger 1 – the predicted noise level with the proposal exceeds the NCG controlling criterion and the noise level increase due to the proposal (i.e. the noise predictions for with the proposal minus without the proposal) is greater than 2.0 dB
- Trigger 2 – the predicted noise level with the proposal is 5 dB or more above the NCG controlling criterion (i.e. exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the proposal
- Trigger 3 – the noise level contribution from the road project is acute (daytime LAeq(15hour) 65 dBA or higher, or night-time LAeq(9hour) 60 dBA or higher) even if noise levels are controlled by a non-project road.

Feasible and reasonable noise mitigation measures would be considered for sensitive receives that would exceed the noise criteria.

A maximum noise level assessment has also been carried out for the proposal to inform assessment of noise impacts in areas where traffic is slow moving, accelerating and decelerating. Changes to maximum noise levels have been calculated by modelling the existing and future road alignments using a source height of about 3.6 metres above the road (about the height of a truck exhaust). This is because maximum noise level events would typically be during compression braking events from heavy vehicles.

6.6.4 Potential impacts

Construction

The construction noise impact assessment is conservative in nature as it assumes:

- several items of construction equipment are in use simultaneously. In reality, there would frequently be periods when construction noise levels are much lower or where no noise- generating equipment would be in use.
- construction equipment is at the closest point to each receiver. For most work, the construction noise impacts would frequently be lower than predicted as the worst-case situation typically only occurs for a relatively short period.

Standard construction hours

During standard construction hours, there would be exceedances of the daytime NMLs where work is occurring near receivers. A summary of exceedances per scenario during standard construction hours is presented in Table 6-35 (Katoomba to Medlow Bath section) and Table 6-36 (Medlow Bath to Blackheath section). These tables reflect the expected exceedances due to work in each section of the proposal. Impacts would be greatest in NCA02 and NCA03 near Medlow Bath due to the close proximity of residential receivers to construction work near the village. High noise impacts during construction scenarios would occur during:

- the early site establishment construction scenarios
- the bulk earthworks phase
- the road construction work.

Figure 6-7a-b shows the worst-case noise impacts of the bulk earthworks construction scenario identified as ‘BE’ in Table 6-35 (Katoomba to Medlow Bath section) and Table 6-36 (Medlow Bath to Blackheath section). This scenario has the highest assumed construction activity noise level of any construction scenario. Further details on other construction scenarios are provided in Appendix H to this REF.

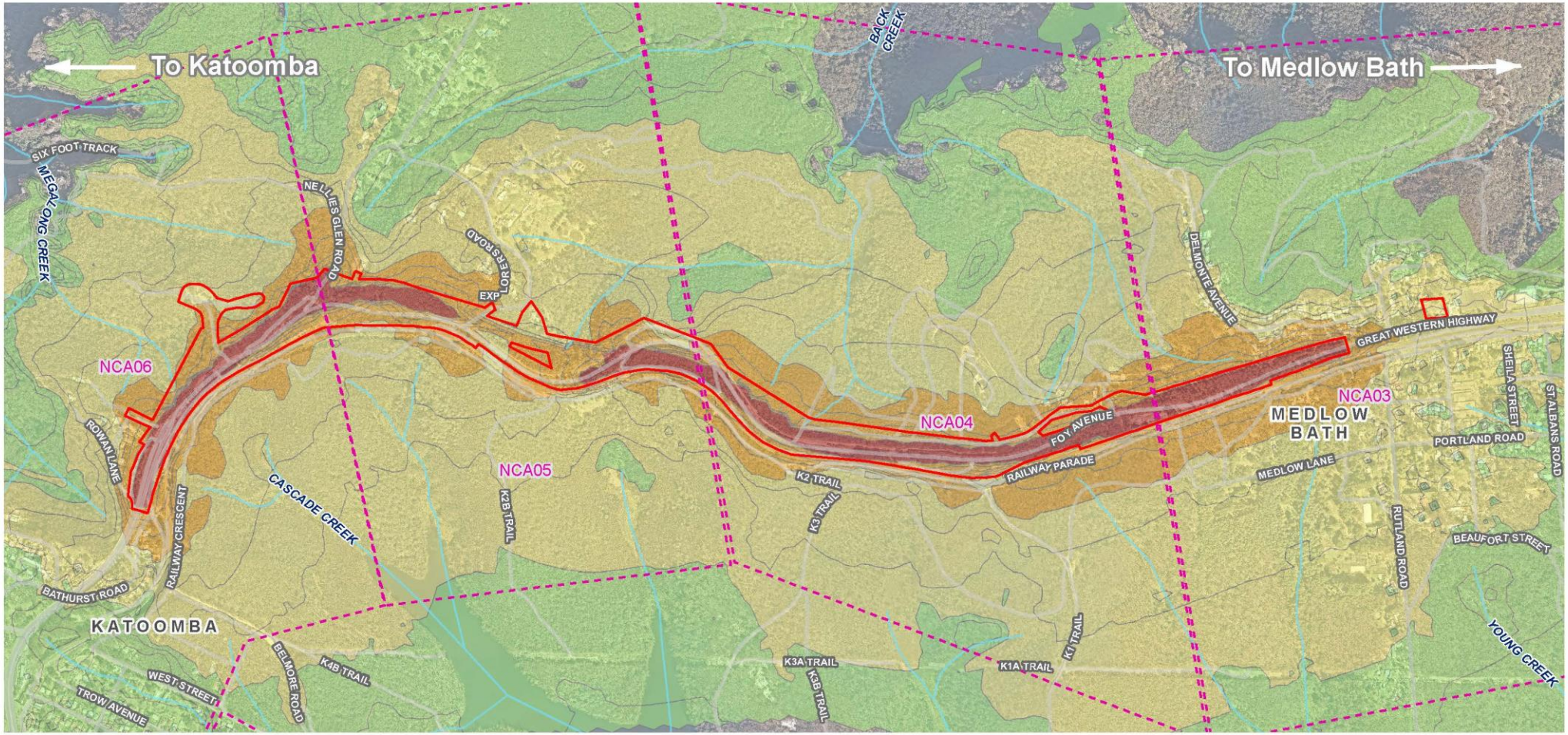
Up to six receivers are predicted to be highly noise affected at the western end of Medlow Bath due to site establishment, bulk earthworks, and road paving stages of work in the Medlow Bath to Blackheath section. Up to three receivers are predicted to be highly noise affected at the eastern end of Medlow Bath during the bulk earthworks phase in the Katoomba to Medlow Bath section.

Table 6-35: Summary of construction noise exceedances for all scenarios – Day standard hours, Katoomba to Medlow Bath section

NCA	dB(A) above NML ($L_{Aeq,15min}$)	Number of exceedances per scenario								
		SP	SE	BE	DI	PA	FW	BWF	BWD	AFO
01	-	Due to their location, receivers in NCA01 would not be subject to exceedances during construction of the Katoomba to Medlow Bath section								
02	-	Due to their location, receivers in NCA02 would not be subject to exceedances during construction of the Katoomba to Medlow Bath section								
03	0 to 10	30	76	76	16	41	9			
	>10	4	14	19		8				
	>75dBA		2	3						
04	0 to 10	2			7	3	4			
	>10	1	7	7		4				
	>75dBA	4								
05	0 to 10	5	13	15	2	9	6		11	1
	>10		2	2			1		3	
	>75dBA									
06	0 to 10	8	15	19	8	10	4			
	>10	2	8	8		4				
	>75dBA									
07	0 to 10		8	16						10
	>75dBA									

Table 6-36: Summary of construction noise exceedances for all scenarios – Day standard hours, Medlow Bath to Blackheath section

NCA	dB(A) above NML ($L_{Aeq,15min}$)	Number of exceedances per scenario					
		SP	SE	BE	DA	PA	FW
01	0 to 10	2	3	2		3	
	>10			1			
	>75dBA						
02	0 to 10	10	34	34	9	17	3
	>10	7	9	9	6	3	6
	>75dBA	1	6	6		6	
03	0 to 10	7	12	12	3	10	1
	>10		3	4			
	>75dBA						
04	-	Due to their location, receivers in NCA04 would not be subject to exceedances during construction of the Medlow Bath to Blackheath section					
05	-	Due to their location, receivers in NCA05 would not be subject to exceedances during construction of the Medlow Bath to Blackheath section					
06	-	Due to their location, receivers in NCA06 would not be subject to exceedances during construction of the Medlow Bath to Blackheath section					
07	-	Due to their location, receivers in NCA07 would not be subject to exceedances during construction of the Medlow Bath to Blackheath section					

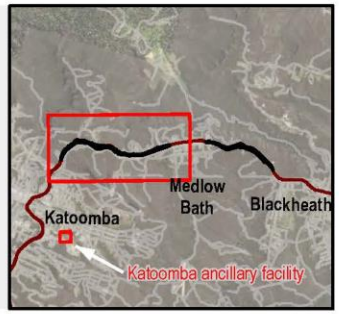


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 40 - 50
- 50 - 65
- 65 - 85
- >85



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

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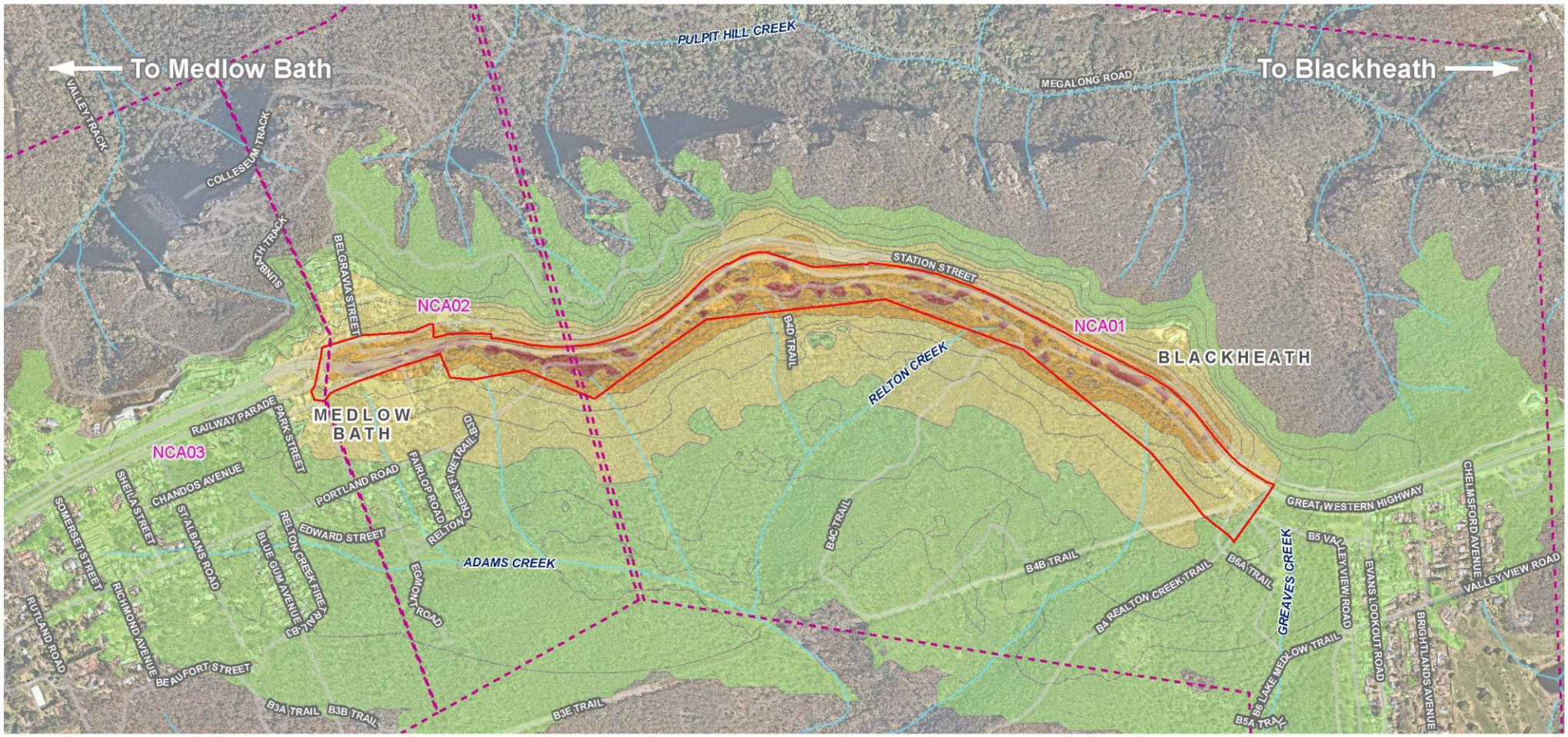
Projection: GDA2020 MGA Zone 56

FIGURE 6-7a: Indicative worst-case noise impacts - bulk earthworks construction scenario

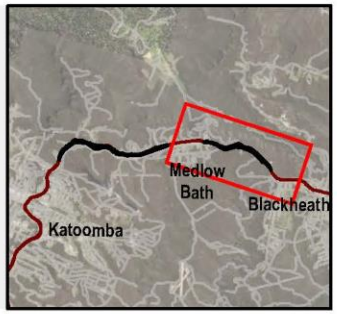


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 40 - 50
- 50 - 65
- 65 - 85
- >85



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Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-7b: Indicative worst-case noise impacts - bulk earthworks construction scenario

Out of hours

During out of hours construction periods, there would be exceedances of the Shoulder 1, Evening, Night and Shoulder 2 NMLs (refer to Table 6-32) when construction work is occurring near receivers in all scenarios. Given the existing low background noise levels throughout the study area, exceedances are predicted for residential receivers in all NCAs. A summary of the number of exceedances per construction scenario during out of hours work periods is presented in Table 6-37 and Table 6-38.

Due to there being stricter NML criteria for these construction periods, greater noise impacts are expected than during standard construction hours. The highest noise impacts are expected for the Night construction period which has the strictest NML criteria for each NCA of any out of hours construction period (refer to Section 6.6.3).

Where work is occurring between the towns of Katoomba, Medlow Bath and Blackheath with no residences nearby, there may be an opportunity to work outside standard construction hours and comply with the relevant NMLs. However, justification would be required for any out of hours work. This may include areas where the proposal ties into the existing Great Western Highway.

Use of the batch plant within the Woodlands Road ancillary facility during out of hours is predicted to cause exceedances of the out of hours work NMLs at nearby residences and sensitive receivers. Batching of concrete would be limited to standard hours where feasible.

Table 6-37: Summary of construction noise exceedances – Katoomba to Medlow Bath section

NCA	Scenario	Number of exceedances per scenario (L_{Amax})								
		SP	SE	BE	DI	PA	FW	BWF	BWD	AFO
01	Sleep disturbance	0	1	1	0	0	0	0	0	Refer to Table 6-38
02	Shoulder 1	0	2	7	0	0	0	0		
	Evening	7	49	49	0	45	0	0	0	
	Night	33	49	49	0	49	0	0	0	
	Shoulder 2	0	49	49	0	2	0	0	0	
	Sleep disturbance	49	49	49	49	49	49	0	0	
03	Day OOHW	81	170	193	40	98	25	0	0	1
	Shoulder 1	193	276	284	112	218	81	0	0	6
	Evening	284	290	290	231	289	193	0	7	30
	Night	289	290	290	276	290	231	0	25	44
	Shoulder 2	264	290	290	210	284	141	0	0	18
	Sleep disturbance	290	290	290	290	290	290	28	49	290
04	Day OOHW	7	7	7	7	7	7	0	0	0
	Shoulder 1	7	7	7	7	7	7	0	0	0
	Evening	7	7	7	7	7	7	0	1	0
	Night	7	7	7	7	7	7	0	5	0
	Shoulder 2	7	7	7	7	7	7	0	1	0
	Sleep disturbance	7	7	7	7	7	7	7	7	7
05	Day OOHW	15	33	35	7	17	4	1	21	1
	Shoulder 1	33	44	44	17	39	14	29	35	4
	Evening	44	44	44	39	44	26	41	42	13

NCA	Scenario	Number of exceedances per scenario (L_{Amax})								
		SP	SE	BE	DI	PA	FW	BWF	BWD	AFO
	Night	44	44	44	43	44	35	41	42	16
	Shoulder 2	44	44	44	39	44	26	41	42	13
	Sleep disturbance	44	44	44	44	44	44	43	44	44
06	Day OOHW	22	43	47	12	27	8	16	0	0
	Shoulder 1	47	127	179	33	57	22	0	0	0
	Evening	57	208	245	38	73	27	0	14	0
	Night	271	349	352	127	312	61	3	142	8
	Shoulder 2	127	312	324	57	208	43	0	30	6
	Sleep disturbance	349	359	360	324	349	324	220	306	361
07	Day OOHW	2	101	141	0	16	0	0	0	57
	Shoulder 1	8	141	169	0	27	0	0	0	89
	Evening	101	544	650	16	169	0	0	28	352
	Night	101	544	650	16	169	0	0	28	352
	Shoulder 2	27	215	321	0	66	0	0	0	175
	Sleep disturbance	544	910	1038	215	544	215	0	216	1044

Table 6-38: Summary of construction noise results – Medlow Bath to Blackheath section

NCA	Scenario	Number of exceedances per scenario (L_{Amax})						
		SP	SE	BE	DI	PA	FW	AFO
01	Day OOHW	3	3	3	3	3	1	0
	Shoulder 1	13	118	136	3	37	3	0
	Evening	118	220	221	37	155	5	0
	Night	176	223	223	100	209	37	40
	Shoulder 2	136	221	222	53	176	13	22
	Sleep disturbance	223	223	223	220	223	220	223
02	Day OOHW	46	49	49	22	49	16	0
	Shoulder 1	49	49	49	49	49	46	0
	Evening	49	49	49	49	49	49	0
	Night	49	49	49	49	49	49	0
	Shoulder 2	49	49	49	49	49	49	0
	Sleep disturbance	49	49	49	49	49	49	49
03	Day OOHW	12	43	59	9	16	5	Refer to Table 6-33
	Shoulder 1	59	174	189	18	91	12	
	Evening	189	286	290	110	217	59	
	Night	228	290	290	174	270	110	
	Shoulder 2	153	244	270	76	189	23	
	Sleep disturbance	290	290	290	286	290	286	
04	Evening	0	0	2	0	0	0	
	Night	0	7	7	0	0	0	
	Shoulder 2	0	2	5	0	0	0	
	Sleep disturbance	7	7	7	0	7	0	

NCA	Scenario	Number of exceedances per scenario (L_{Amax})						
		SP	SE	BE	DI	PA	FW	AFO
05	Sleep disturbance	0	0	2	0	0	0	
06	-	No exceedances						
07	-	No exceedances						

Construction traffic

Construction of the proposal would generate additional road traffic noise from construction vehicles. The vehicle movements expected during construction would be as follows:

- Katoomba to Medlow Bath section – an average of 275 vehicle movements per day and 550 during peak construction periods
- Medlow Bath to Blackheath section – an average of 255 vehicle movements per day and 450 during peak construction periods.

When compared with existing traffic volumes, the predicted increase in road traffic noise as a result of construction traffic would be less than 1dB(A) on the Great Western Highway. This would not be audible and noise impacts from construction traffic on the Great Western Highway are considered negligible.

For the use of the Woodlands Road ancillary facility, as it is unknown the number of heavy vehicles that would be accessing the site, a conservative approach was taken to assess the construction noise impacts. The most sensitive receiver near the facility is the Blue Mountains District ANZAC Memorial Hospital on Woodland Road. The RNP noise criteria for hospital wards of $35dB_{Aeq\ 1\ hour}$ (internal noise level) was used to determine the number of heavy vehicles that could pass the hospital without triggering the noise level. This equates to four heavy vehicles per hour. During detailed design, further investigation would be carried out to confirm the use of the Woodland Road ancillary facility as well as traffic movements. This would then be considered in further noise assessment to appropriately assess the construction noise impacts.

Construction vibration

The worst-case item of vibration intensive equipment during construction would be high vibration 11-tonne padfoot rollers. While other items of vibration generating equipment would be required at times during construction, they are expected to be less vibration intensive.

Vibration offset distances have been determined from the CNVG minimum working distances for cosmetic damage (20 metres for padfoot rollers) and human annoyance (120 metres for padfoot rollers). Two heritage structures (Culvert XA6 and Culvert XA7a) have been identified as being within the minimum working distances for cosmetic damage of 20 metres using padfoot rollers. These items are about 10 metres away from proposed work and would experience indirect vibration impacts due to the proposal. No other heritage structures identified in the proposal area are within the cosmetic damage minimum working distance.

A number of residential receivers have been identified within the minimum working distances for human annoyance in NCA01 – NCA06 (refer to Table 6-39). Occupants of affected buildings may be able to perceive vibration impacts at times when vibration intensive equipment is in use.

Table 6-39: Number of affected receivers within the minimum working distance for human annoyance

NCA	Number of affected receivers (day-time)	Number of affected receivers (night-time)
01	0	1
02	8	8
03	18	28
04	4	7
05	0	1
06	6	7
07	0	0

Operation

Table 6-40 assesses the expected operational noise impacts of the proposal in each NCA without consideration of any mitigation measures. These impacts are for the 2026 and 2036 operational scenarios during the daytime and night-time.

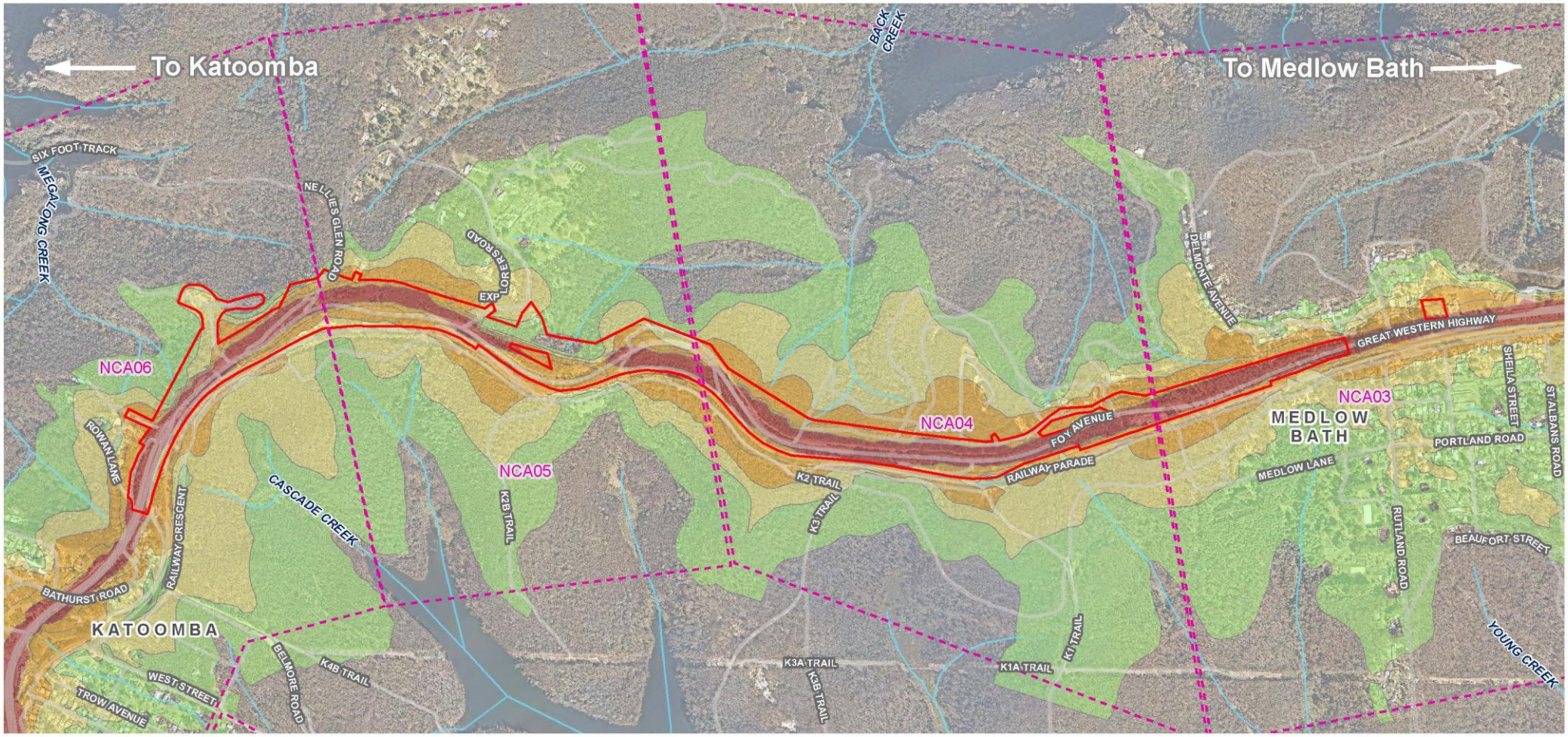
The greatest predicted noise levels are adjacent to the new road corridor. Changes in noise impacts due to the proposal would be highest where the proposal is located away from the current alignment and where topographic and other environmental features impact road noise levels. Operational noise impacts are displayed for:

- the day-time scenario during operation of the proposal in 2036 in Figure 6-8a-b
- the day-time scenario without the proposal in 2036 in Figure 6-9a-b
- the night-time scenario during operation of the proposal in 2036 in Figure 6-10a-b
- the night-time scenario without the proposal in 2036 in Figure 6-11a-b.

Table 6-40: Operational noise impacts (without mitigation)

NCA	Proposal description	Potential impacts due to the proposal
01	The proposal would widen the Great Western Highway to the east by up to 100 m in parts of this NCA. However, the highway would remain mostly on the existing road corridor near the residences on the western end of Station Street, near Blackheath.	• Receivers in Blackheath are not expected to experience a noticeable increase of more than 2dB(A) due to the proposal. • The 3 residences on Station Street within the proposal area would experience a decrease of up to 1dB(A) due to the proposal shifting the highway away. These decreases would be realised in the day and night scenarios in 2026 and 2036.
02	The proposal would widen the Great Western Highway to the east by up to 30 m in this NCA and by up to 5 m towards residences on Coachhouse Lane.	• Receivers are not expected to experience a noticeable increase (more than 2dB(A)) in traffic noise in any operational scenario. • However, residential receivers in this NCA along Coachhouse Lane and Station Street are exposed to existing traffic noise and future traffic noise which would exceed the NCG criteria by 5dB(A). This includes two heritage structures (The Pines and Gatekeeper's Cottage).
03	The proposal would widen the Great Western Highway to the west by between about 15 and 25 m in this NCA.	• There would be a decrease in traffic noise by about 2 to 3dB(A) for receivers on Railway Parade in all operational scenarios. • An increase in traffic noise of up to 3dB(A) for receivers along Delmonte Avenue and an exceedance of the NCG criteria by more than 5dB(A) is expected. Four receivers on Delmonte Avenue would experience an increase more than 2dB(A) in all scenarios.

NCA	Proposal description	Potential impacts due to the proposal
04	The proposal would realign the road corridor to be about 5 to 10 m away from residences on the western end of Foy Avenue, however, would mostly remain on the existing road corridor. Further east, the road corridor would be widened to be about 10 to 15 m closer to the residences at the eastern end of Foy Avenue.	• Traffic noise levels are expected to increase for receivers in this NCA along Foy Avenue. At three residences along Foy Avenue are predicted to exceed the NCG criteria by more than 5dB(A). One residence is predicted to experience an increase in traffic noise of up to 2.1dB(A) in the 2026 night-time scenario.
05	The construction of the twin bridges would result in the road corridor being about 100 m closer to the most impacted receivers on Explorers Road than the existing scenario.	• For three residences within about 200 m of the proposed alignment, noise levels are predicted to be above the NCG criteria and are predicted to increase as a result of the road corridor being moved closer. • While the road corridor is being realigned closer to residences, residences on Explorers Road are predicted to experience a decrease in noise levels during all operational scenarios as the bridge deck shields the traffic. For example: – four residences on Explorers Road, Pulpit Hill Road and Saywell Road, noise levels are predicted to decrease, typically by up to 1dB(A) – at 11 Explorers Road, noise levels are predicted to decrease by up to 6dB(A) due to the twin bridges bridge being elevated higher than the existing road corridor, resulting in residences having a more obstructed view of the road.
06	There would be minimal realignment of the road corridor on the eastern end of this NCA near the tie-in with the existing Great Western Highway at Katoomba. Further west, the road corridor would be realigned by about 30 m to the south-west.	• Receivers are not expected to experience a noticeable increase (more than 2dB(A)) in traffic noise in any operational scenario. • However, six residential receivers in this NCA near Rowan Lane are exposed to existing traffic noise and future traffic noise which would exceed the NCG criteria by 5dB(A).
07	N/A – NCA07 is outside of the operational study area being far enough away from the proposal to not be affected.	

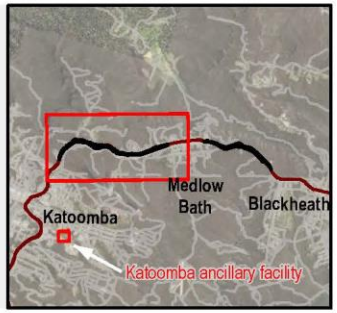


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

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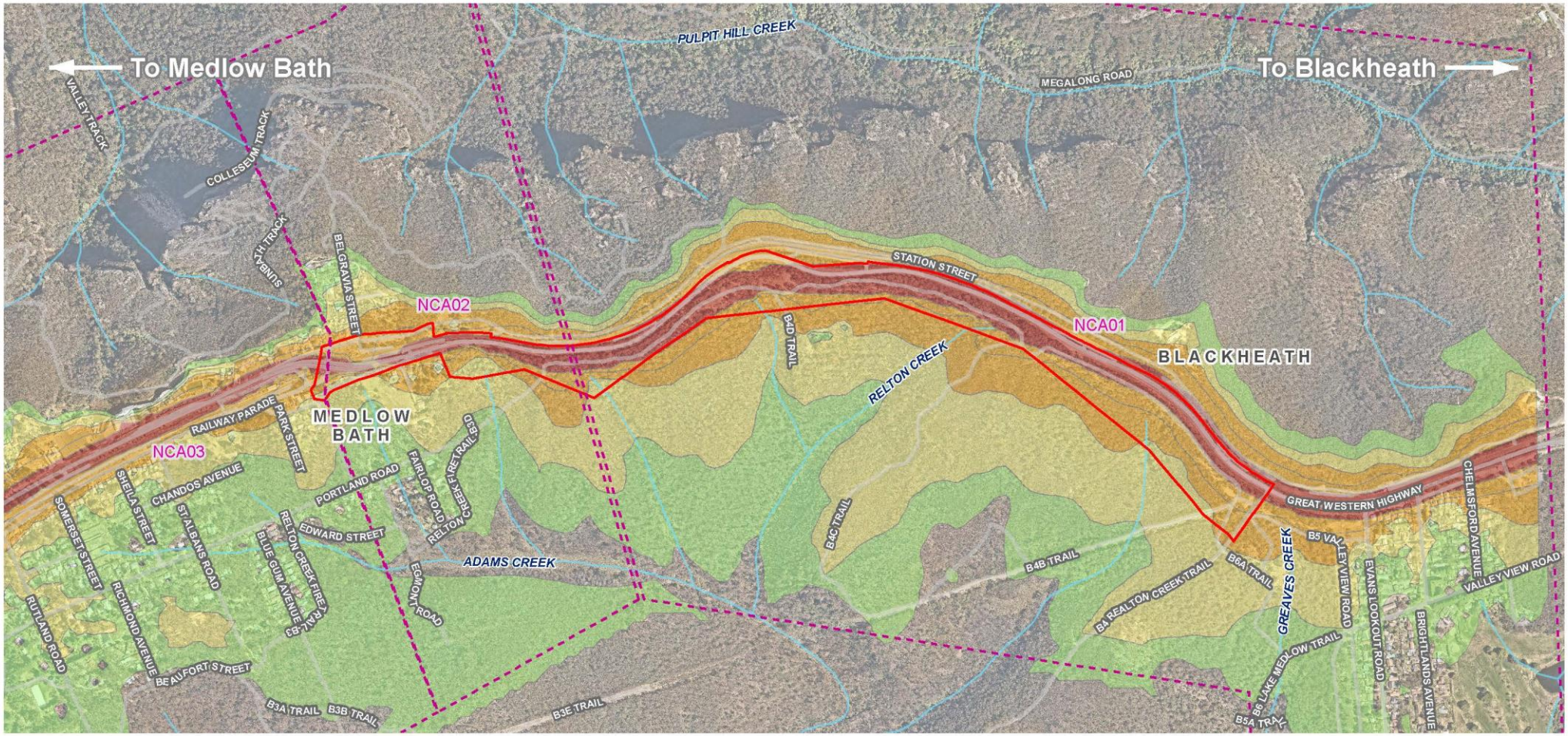
0 150 300m

Projection: GDA2020 MGA Zone 56

FIGURE 6-8a: Predicted noise levels during operation of the proposal (day-time scenario, 2036)

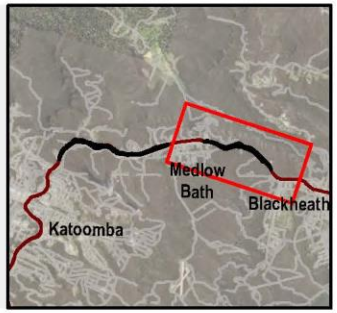


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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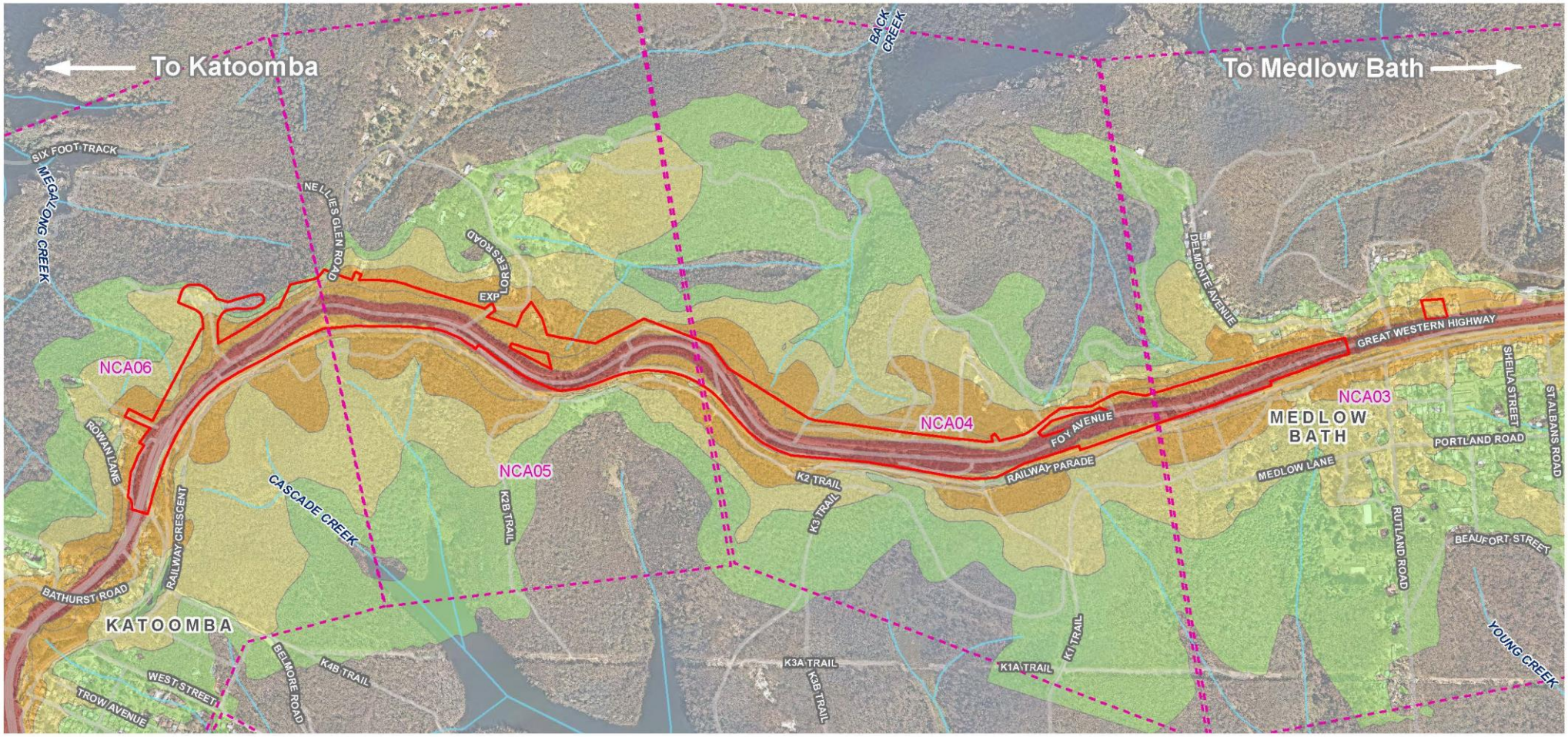
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

1:14,000@A4

0 150 300m

Projection: GDA2020 MGA Zone 56

FIGURE 6-8b: Predicted noise levels during operation of the proposal (day-time scenario, 2036)

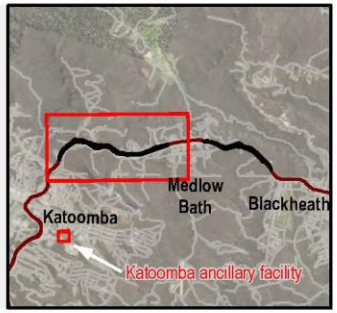


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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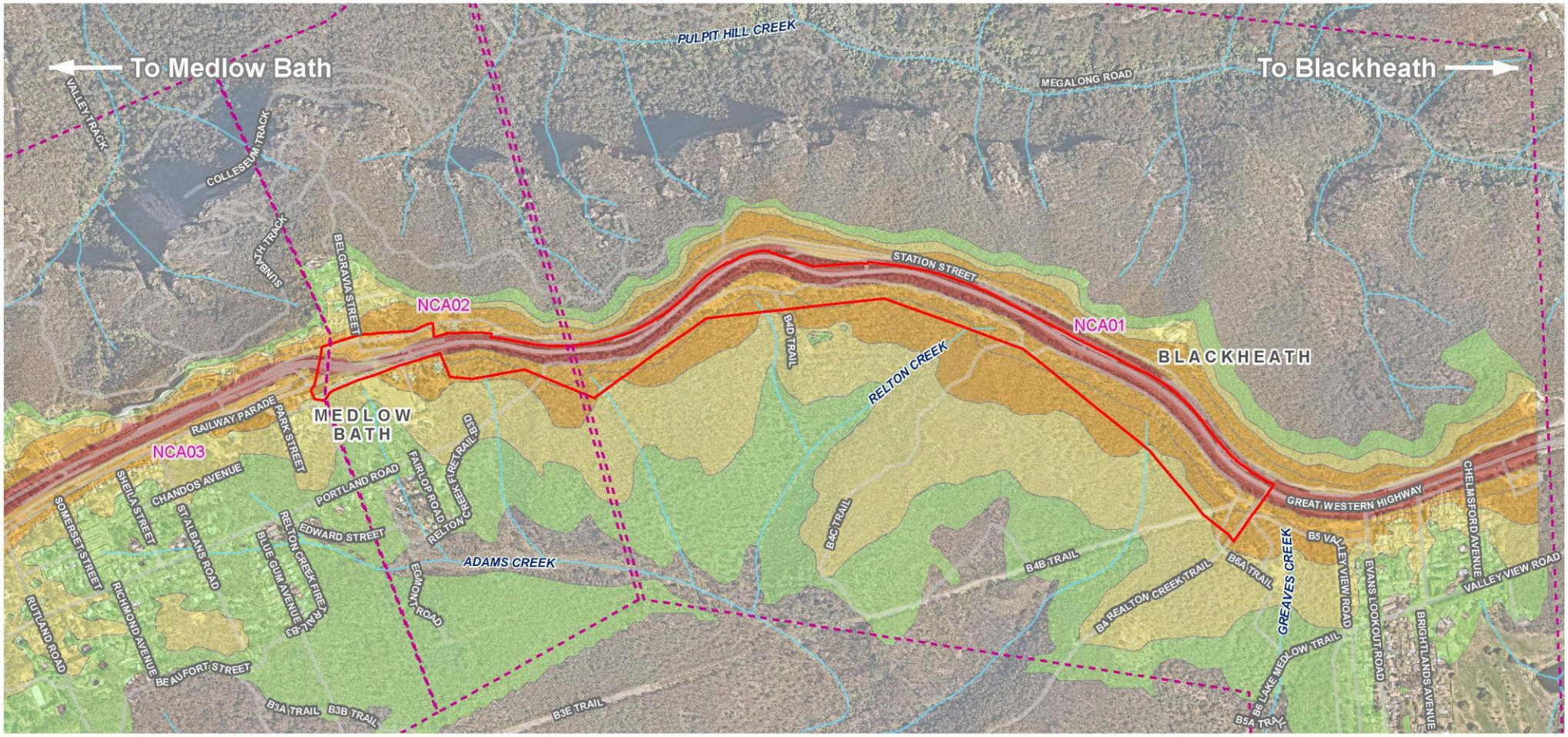
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

1:15,000@A4

0 150 300m

Projection: GDA2020 MGA Zone 56

FIGURE 6-9a: Predicted noise levels without the proposal (day-time scenario, 2036)

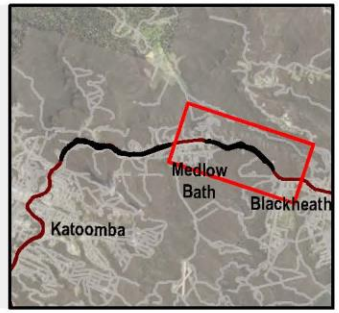


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

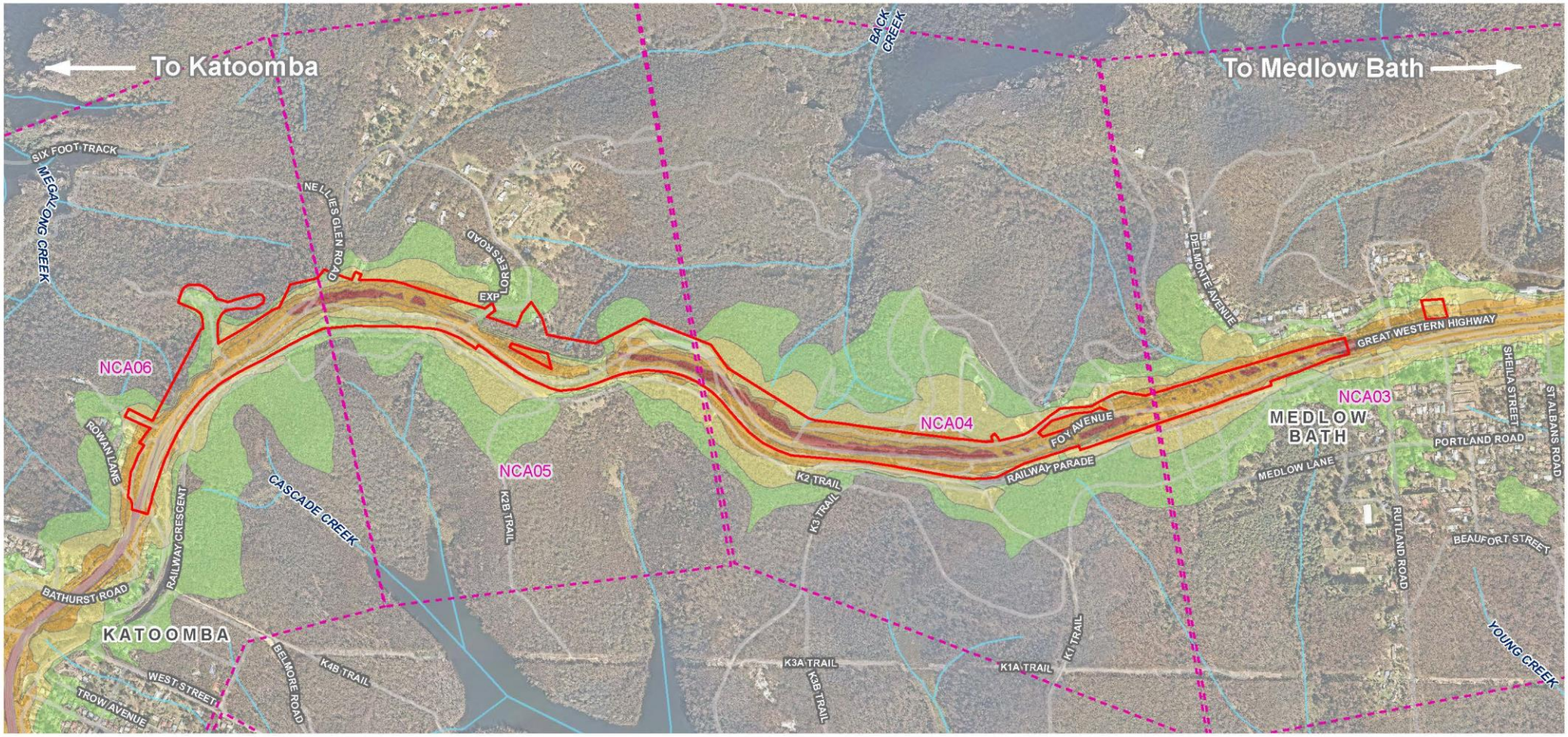
1:14,000@A4

0 150 300m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-9b: Predicted noise levels without the proposal (day-time scenario, 2036)

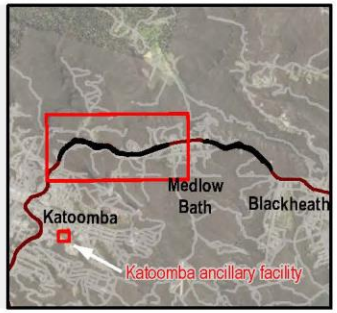


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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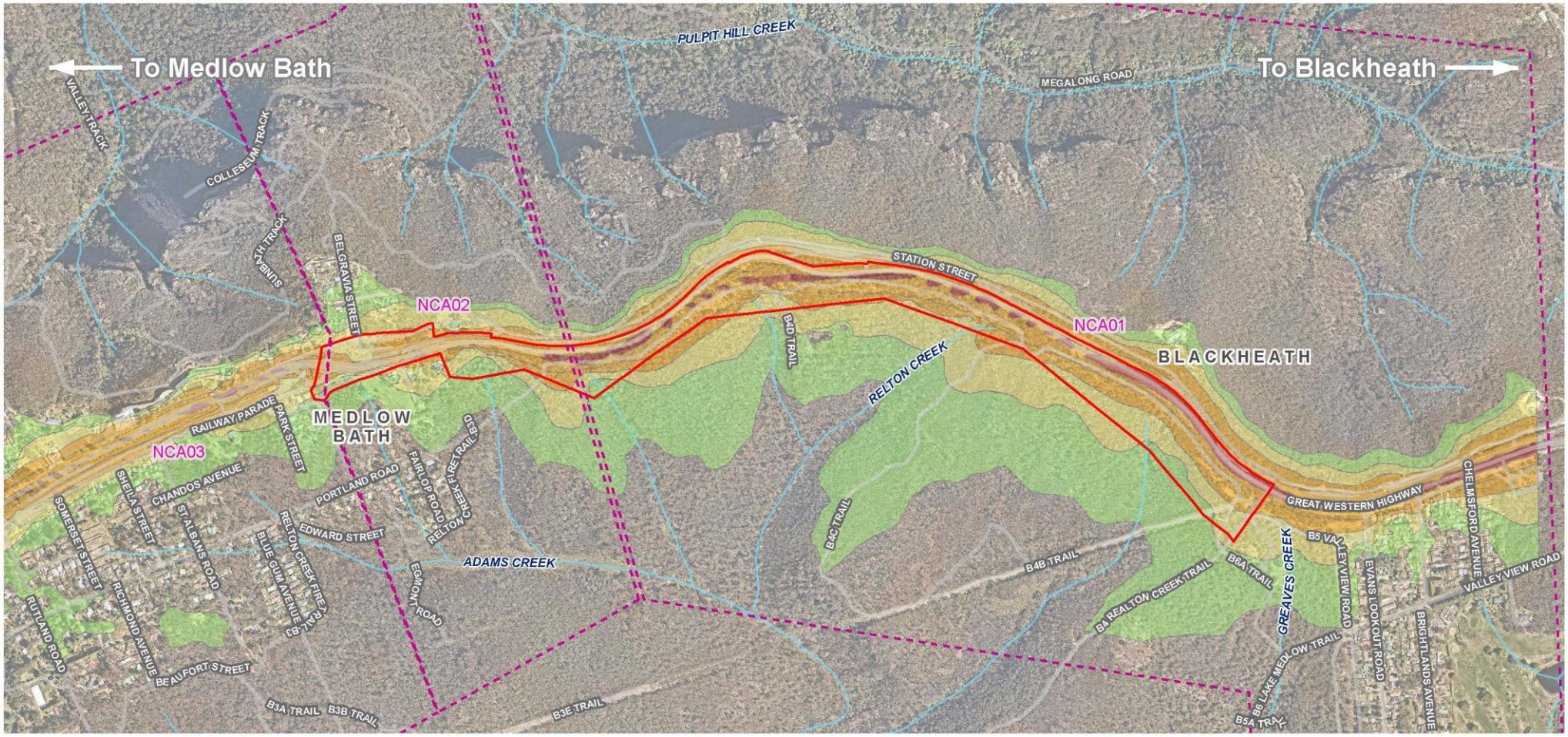
Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

1:15,000@A4

0 150 300m

Projection: GDA2020 MGA Zone 56

FIGURE 6-10a: Predicted noise levels during operation of the proposal (night-time scenario, 2036)

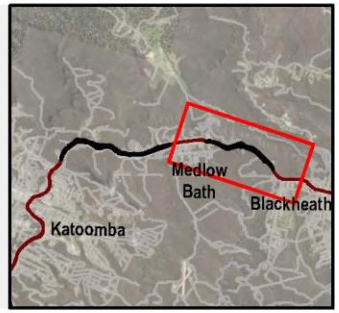


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

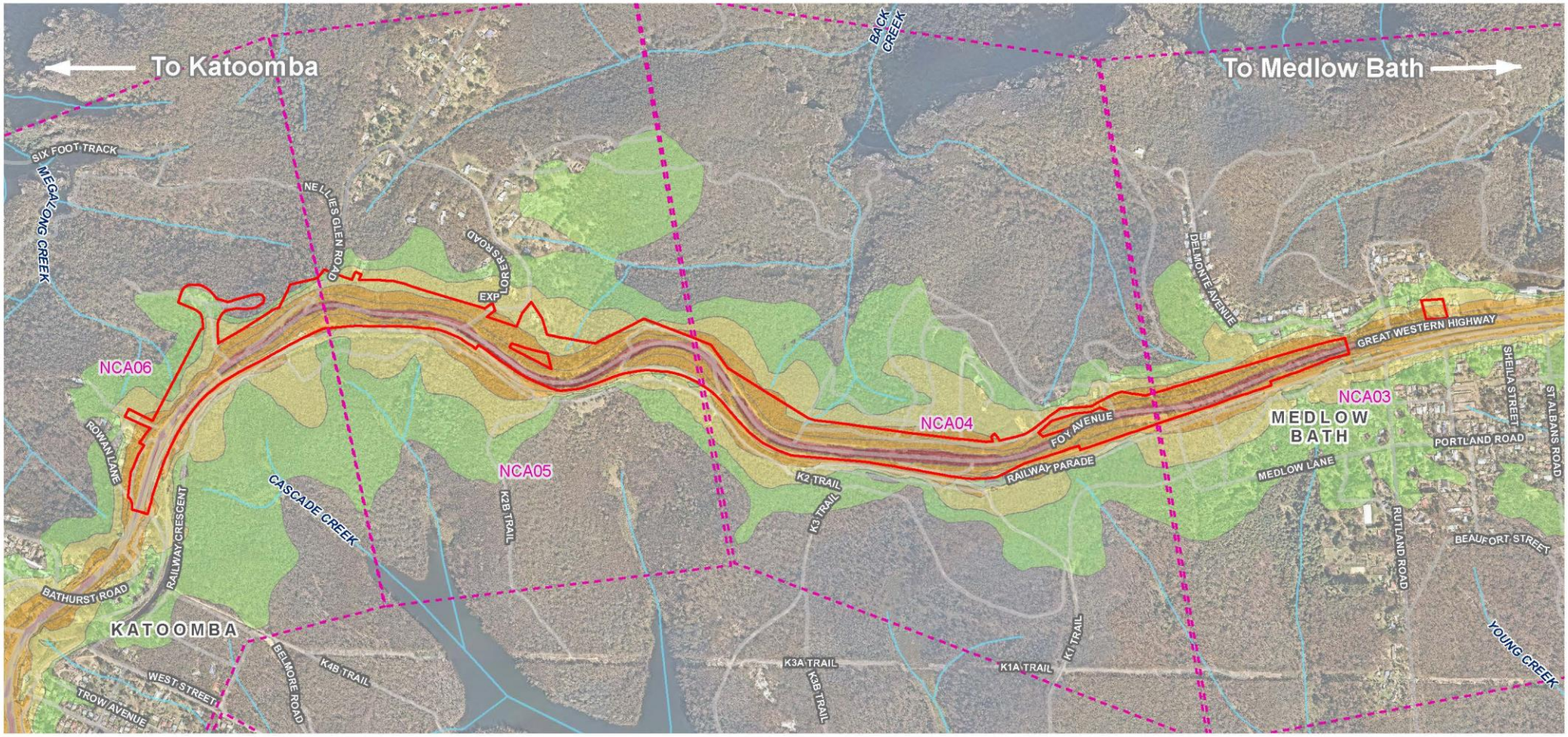
1:14,000@A4

0 150 300m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-10b: Predicted noise levels during operation of the proposal (night-time scenario, 2036)

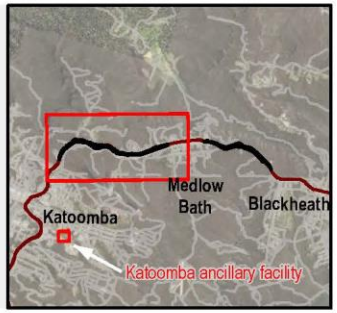


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

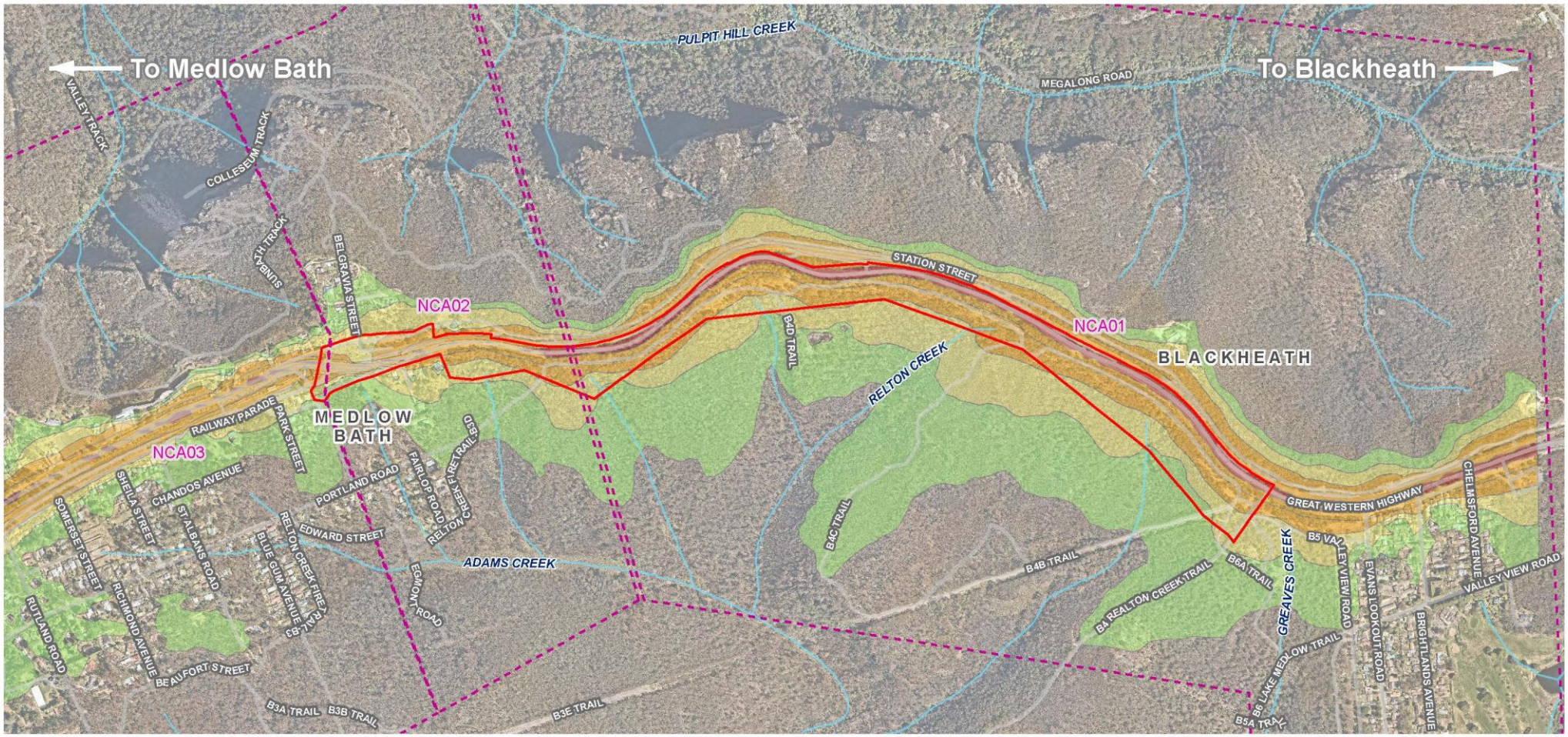
1:15,000@A4

0 150 300m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-11a: Predicted noise levels without the proposal (night-time scenario, 2036)

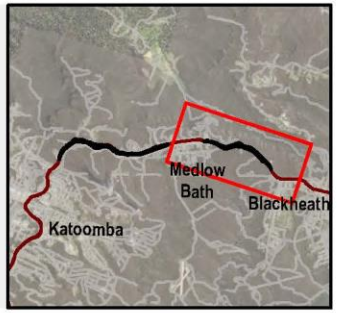


Proposal area

Noise catchment areas (NCA)

Predicted noise levels (dB)

- 50 - 55
- 55 - 60
- 60 - 70
- >70



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, Renzo Tonin

1:14,000@A4

0 150 300m

Projection: GDA2020 MGA Zone 56

FIGURE 6-11b: Predicted noise levels without the proposal (night-time scenario, 2036)

Predicted maximum noise levels

As the proposal would widen and realign the Great Western Highway, there is potential for changes to maximum noise level events in the operational noise study area due to the widening of the road corridor towards sensitive receivers. These predicted changes are presented in Table 6-41. Predicted increase is dependent on the façade of most affected dwelling in each NCA.

Table 6-41: Predicted change in maximum noise level

NCA	Predicted change
01	No change to the predicted maximum noise level as there would be no realignment of road corridor in this NCA.
02	1dB(A) increase in the maximum noise level in this NCA. This would be due to the widening of road corridor about 5 m closer to the nearest receivers on Coachhouse Lane.
03	3dB(A) increase in the maximum noise level in this NCA. Widening of road corridor about 15 to 25 m to the west of the existing Great Western Highway.
04	2dB(A) increase in the maximum noise level in this NCA. Widening of the road corridor about 5 to 10 m closer on the western end and 10 to 15 m closer on the eastern end of the NCA.
05	7dB(A) increase in the maximum noise level in this NCA. Realignment of road corridor along the twin bridges about 100 m closer to receivers. The highway would be elevated above residences, with direct line of sight to heavy vehicle exhausts on the westbound bridge.
06	1dB(A) increase in the maximum noise level in this NCA. Minimal widening of the road corridor would impact some receivers between Watson Way and Rowan Lane.
07	No change as NCA07 is outside of the operational study area

Receivers eligible for consideration of ‘additional noise mitigation’

A total of 31 sensitive residential receiver buildings are predicted to have exceedances of the NCG operational road traffic noise criteria. As such, these receivers are eligible for consideration of ‘additional noise mitigation’. This includes the two receivers identified in the Medlow Bath Upgrade.

Two of these residences in NCA03 have previously been identified for at-property treatment in the noise and vibration assessment prepared for the Medlow Bath Upgrade. Noise mitigation for these properties should consider the results of this assessment in determining the correct mitigation to be established.

6.6.5 Safeguards and management measures

Construction noise mitigation options

Construction noise would be managed in accordance with the CNVG, which provides several standard mitigation measures. The CNVG also notes the need to consider additional mitigation measures, where feasible and reasonable, where construction noise is predicted to exceed the NMLs. The CNVG triggers and related recommended types of mitigation measures are presented in Table 37 in Section 11.5.3 of the noise and vibration assessment, included in Appendix H to the REF.

Further detail regarding the implementation of specific safeguards and management measures at sensitive receivers would be confirmed during detailed design and outlined in the Construction Noise and Vibration Management Plan.

Operational noise mitigation options

The noise assessment considered the range of noise mitigation options for those receivers that exceed the NCG noise criteria. Of the possible options, low noise pavement and at-house treatments were considered reasonable and feasible options for the proposal. Noise barriers or mounds were not considered as it was not in character for the Great Western Highway.

Safeguards and management measures for landscape and visual impacts are presented in Table 6-42.

Table 6-42: Safeguard and management measures – noise and vibration

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	A Construction Noise and Vibration Management Plan (CNVMP) will be prepared and implemented as part of the CEMP. The CNVMP will generally follow the approach in the Interim *Construction Noise Guideline* (ICNG) (DECC, 2009) and identify: • all potential significant noise and vibration generating activities associated with the activity • feasible and reasonable mitigation measures to be implemented, taking into account *Beyond the Pavement: urban design policy, process and principles* (Transport, 2014). • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Detailed design / pre-construction	Section 4.6 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	All sensitive receivers (e.g. schools, local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: • the project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information.	Contractor	Detailed design / pre-construction	Additional safeguard
Noise and vibration	Less vibration emitting construction methods will be used where feasible and reasonable, for example vibratory rollers can, where practicable, be operated with the vibratory mode switched off to reduce vibration impact.	Contractor	Construction	Additional safeguard
Out of hours work	Out of hours works will be undertaken in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime 2016). This includes: • Offer respite and/or restricted construction hours where noise intensive works are planned over extended periods, especially where they occur outside of standard hours. This may include moving the construction work front to different areas so that sensitive receivers are not impacted for longer than two consecutive days • No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise negotiated with affected receivers.	Contractor	Construction	Additional safeguard
Out of hours work	Noisiest activities will be limited to standard construction hours, where practicable	Contractor	Construction	Additional safeguard
Noise and vibration	A register of most affected noise and vibration sensitive receivers (NVSRs) will be kept on site and maintained. The register will include the following details for each NVSR: • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number. The register is to be included as part of the Proposal's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.	Contactor	Construction	Additional safeguard
Noise and vibration	Source controls will be employed to minimise noise impacts, such as using noise screens and mufflers, maximising offset distance, and orienting plant away from sensitive receivers.	Contractor	Construction	Additional safeguard
Noise and vibration	The selection of plant and machinery will consider noise emissions, operated to reduce maximum noise levels, maintained regularly and turned off when not in use	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Operational road traffic noise	Further assessment of operational road traffic noise impacts will be carried out to inform consideration of appropriate noise mitigation during detailed design. Where a parcel of land would be impacted by multiple projects within the Great Western Highway Upgrade Program, noise treatment options will be considered for the greater of the predicted noise impacts.	Transport	Detailed design	Additional safeguard
Operational road traffic noise	Implement at-property noise mitigation treatments as early as feasible in the construction program in consultation with the property owner.	Transport / Contractor	Pre-construction / construction	Additional safeguard
Woodlands Road ancillary facility	During detailed design, further investigation will be carried out to confirm the use of the Woodland Road ancillary facility as well as traffic movements.	Transport	Detailed design	Additional safeguard

6.7 Traffic and transport

The potential impacts on traffic and transport during construction and operation of the proposal have been assessed as part of the *Traffic and Transport Assessment Report* (Aurecon, 2022c), provided in Appendix I.

6.7.1 Methodology

The methodology for the traffic and transport assessment included:

- collecting traffic volume data, including mid-block and intersection counts, at six locations along the Great Western Highway in March and April 2021
- reviewing the existing and future conditions of the transport network within and surrounding the proposal, using publicly available information, data collected for the proposal and traffic growth forecasts prepared by Transport
- modelling the traffic performance of the concept design, using SIDRA modelling software for intersection performance analysis, for the following scenarios within the study area:
  - 2021 existing conditions – existing traffic network
  - 2026 with the proposal – proposed transport network with projected 2026 weekday and weekend peak traffic volumes
  - 2031 with the proposal – proposed transport network with projected 2031 weekday and weekend peak traffic volumes
  - 2036 with the proposal – proposed transport network with projected 2036 weekday and weekend peak traffic volumes
  - 2036 without the proposal – existing transport network with projected 2036 weekday and weekend peak traffic volumes
- assessing the impacts of the proposal on traffic and transport performance during construction and operation
- recommending mitigation measures to minimise potential traffic or transport impacts from the proposal.

There have been recent changes to the Nellies Glen Road and Foy Avenue intersections after completion of the traffic modelling. These intersections were modelled as follows:

- Nellies Glen Road – left-in, left-out only
- Foy Avenue – left-in, left-out only.

No modelling changes for the existing scenario were deemed necessary as intersection performance would not be impacted.

6.7.2 Criteria

The key intersection performance indicators extracted from the SIDRA network analysis for assessment of traffic and transport impacts in the Katoomba to Medlow Bath section include level of service (LOS). The LOS criteria adopted for intersection performance analysis within this section are outlined in Table 6-43.

The performance of non-intersection road conditions for the Medlow Bath to Blackheath section was assessed using a mid-block capacity analysis in accordance with the *Austroads Guide to Traffic Management Part 3* guidelines. The basic freeway segments LOS criteria adopted for mid-block analysis within this section are outlined in Table 6-44.

LOS range from LOS A (best possible operating conditions) to LOS F (worst possible operating conditions) and identify the performance of an intersection or freeway segment.

Table 6-43: Transport LOS criteria – intersection performance

LOS	Average vehicle delay (seconds)	Traffic signal and roundabout	Give-way and Stop signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity	At capacity, requires other control mode
F	Greater than 71	At signals, incidents will cause excessive delays	Unsatisfactory with excessive queueing, requires other control mode

Table 6-44: Austroads LOS criteria – basic freeway segments

LOS	Maximum density (passenger car per kilometre per lane)	Basic freeway segments
A	7	Free-flow operations
B	11	Reasonably free-flow operations
C	16	Speeds near the free flow speed (the speed at which motorists would feel comfortable to drive with no congestion on the highway)
D	22	Speeds decreased from the free flow speed
E	28	Operation at or near capacity
F	> 28	Unstable flow

6.7.3 Existing environment

Road conditions

The Great Western Highway is a State highway located within the Blue Mountains LGA and managed by Transport. The existing road conditions for the proposal are outlined in Table 6-45.

Table 6-45: Existing road conditions near the proposal

Road	Description	Access	Posted speed limit	Lanes
Great Western Highway – Katoomba to Medlow Bath section	About 3.5 km east-west between Rowan Lane, Katoomba and Bellevue Crescent, Medlow Bath	Access to: • the local roads of Nellies Glen Road, Explorers Road and Foy Avenue • active transport trails • the rail corridor	70 km/h	Mostly a two-lane single carriageway
Great Western Highway – Medlow Bath to Blackheath section	About 1.8 km east-west between the Great Western Highway and Railway Parade intersection and Tennyson Road, Blackheath (in the Blue Mountains National Park)	Access to the rail corridor	60 km/h for about 800 m north of Railway Parade, Medlow Bath and then 80 km/h for about one km until Tennyson Road, Blackheath	Two-lane single carriageway

Road	Description	Access	Posted speed limit	Lanes
Nellies Glen Road	Local road	Access to Pulpit Hill Road, Explorers Road, Six Foot Track (a walking trail) and surrounding properties	50 km/h	Two-lane single carriageway
Explorers Road	Local road	Access to Saywell Road, Pulpit Hill Road, Nellies Glen Road and surrounding properties	50 km/h	Two-lane single carriageway
Foy Avenue	Local road	Access to residential properties and active transport trails	50 km/h	Two-lane single carriageway

There are no parking provisions along the Great Western Highway within the proposal area. However, there are informal emergency stopping locations along areas of the Great Western Highway where the road shoulder is wider. There is also informal parking for about 20 vehicles available on Nellies Glen Road for people to access the heritage interpretation area and surrounding walking trails.

The nearest rest areas on the Great Western Highway for light and heavy vehicles are Kedumba Park in Wentworth Falls and Sutton Park in Blackheath.

Key intersections

The key intersections with the Great Western Highway that are within the proposal area are detailed in Table 6-46. As noted in Table 6-45, there are no intersections within the Medlow Bath to Blackheath section of the proposal.

Table 6-46: Summary of key intersections within the proposal area

Intersection	Existing layout
Great Western Highway / Nellies Glen Road	• Priority controlled one-way intersection, with left-in westbound travel movement only with Nellies Glen Road. • Great Western Highway westbound has a short left-turn lane into Nellies Glen Road and one through lane. • Great Western Highway eastbound has one through lane.
Great Western Highway / Explorers Road	• Priority controlled three-way intersection with all traffic movements. • Left or right turn permitted out of Explorers Road onto the Great Western Highway. • Great Western Highway westbound has one through lane, with left turn permitted into Explorers Road. • Great Western Highway eastbound has one dedicated right turn lane into Explorers Road. This lane continues as a short waiting bay for vehicles exiting Explorers Road turning eastbound onto the Great Western Highway. There is also one through lane.
Great Western Highway / Foy Avenue	• Priority controlled three-way intersection with all traffic movements. • Left or right turn permitted out of Foy Avenue onto the Great Western Highway. • Great Western Highway westbound has one through lane, with left turn permitted into Foy Avenue. • Great Western Highway eastbound has one through lane, with a dedicated right turn lane into Foy Avenue.

Traffic volumes

The traffic counts carried out in March and April 2021 have been analysed to identify average daily traffic volumes for the proposal (refer to Table 6-47). This data was calibrated with data collected near the proposal in 2019 and 2020. This found that COVID-19 conditions at that time did not materially affect traffic numbers.

Traffic counts revealed that average traffic volumes were higher on weekends compared with weekdays, which emphasises the importance of the Great Western Highway for regional and recreational travel. Westbound traffic volumes were higher for both sections of the proposal on weekdays, with eastbound traffic volumes being the dominant direction on weekends. Table 6-47 also shows the importance of the Great Western Highway as a freight route with a high proportion of heavy vehicles. Heavy vehicles made up about 16 to 23 per cent of 24-hour traffic on a weekday and about six to 14 per cent of 24-hour traffic on a weekend. The Great Western Highway forms part of the freight and heavy vehicles network connecting the Central West and Orana, Blue Mountains, Western Sydney and Greater Sydney regions. It currently accommodates freight and heavy vehicles up to 19 metre B-Doubles (over 50 tonnes).

Table 6-47: Average daily traffic volumes for the proposal

Section		Weekday			Weekend		
		Eastbound	Westbound	Total	Eastbound	Westbound	Total
Katoomba to Medlow Bath section	Average daily traffic volume	10,700	11,980	22,680	12,099	11,293	23,392
	Per cent heavy vehicles	22	25	23	13	15	14
Medlow Bath to Blackheath section	Average daily traffic volume	10,053	10,543	20,596	11,608	10,779	22,387
	Per cent heavy vehicles	16	27	22	6	15	11

Hourly traffic volumes show relatively constant weekday traffic volumes throughout the day. On an average weekday:

- During the AM peak (6 – 9am), heavy vehicle volumes are higher, comprising about 29 per cent of total combined traffic on the Katoomba to Medlow Bath section. On the Medlow Bath to Blackheath section, heavy vehicles comprised about 27 per cent of total combined traffic.
- Combined hourly traffic volumes are highest between 3 – 4pm, with 1771 vehicles through the Katoomba to Medlow Bath section and 1656 on the Medlow Bath to Blackheath Section.

On an average weekend:

- Westbound flows are higher than eastbound flows during the AM peak (6 – 9am) while eastbound flows are higher than westbound flows during the PM peak (4 – 7pm), which could be explained by day trips by the local community and tourists within the Blue Mountains.
- Combined hourly traffic volumes are highest between 11am – 12pm, with 2137 vehicles on the Katoomba to Medlow Bath section and 2091 vehicles on the Medlow Bath to Blackheath section.

Existing road performance

Existing intersection performance were assessed for the three key intersections within the proposal. The worst performing approach for these intersections was consistently the local road leg of the intersection. The weekday performance during the most congested hour in the AM and PM peak periods of the local road leg of the intersections are detailed in Table 6-48. The Great Western Highway / Nellies Glen Road and Great Western Highway / Foy Avenue intersections operate at LOS A. The Great Western Highway / Explorers Road intersection was the worst performing intersection. It operates near capacity at LOS D in

the weekday PM peak (with the most congested hour being 3.30 – 4.30pm) due to the right turn movement onto the highway, where it is required to give way to the highway traffic. The performance of this intersection improved to good condition (LOS A) for the weekend PM peak (with the most congested hour being 3 – 4pm) scenario, with lower hourly traffic volumes recorded than the weekday PM peak scenario.

Table 6-48: Existing 2021 weekday intersection performance (local road leg)

Intersection	Peak hour	Traffic volume (vehicles/hour)	Average vehicle delay (seconds)	LOS
Great Western Highway / Nellies Glen Road	AM (8.30 – 9.30am)	1383	10.7	A
	PM (3.30 – 4.30pm)	1632	12.8	A
Great Western Highway / Explorers Road	AM (8.30 – 9.30am)	1376	25.5	B
	PM (3.30 – 4.30pm)	1628	46.0	D
Great Western Highway / Foy Avenue	AM (8.30 – 9.30am)	1356	9.3	A
	PM (3.30 – 4.30pm)	1617	8.5	A

For the Medlow Bath to Blackheath section, mid-block capacity analysis was carried out to determine the road performance as there are no intersections within this section. Results from the analysis during the most congested hour of the AM and PM peak periods are detailed in Table 6-49. The existing performance of this section was satisfactory (LOS C) during weekday conditions, with performance deteriorating on weekends to LOS D. In all scenarios except the weekend PM peak (4 – 7pm) scenario, the LOS decreased on weekends due to increased traffic density on the road corridor in this section.

Table 6-49: Existing 2021 performance – Medlow Bath to Blackheath section

Scenario	Peak hour	Traffic volume per hour	Density (pc/km/ln)	LOS
Eastbound – weekday	AM (6 – 9am)	1014	14.5	C
	PM (4 – 7pm)	1112	15.9	C
Westbound – weekday	AM (6 – 9am)	1014	14.5	C
	PM (4 – 7pm)	1112	15.9	C
Eastbound – weekend	AM (6 – 9am)	1126	16.1	D
	PM (4 – 7pm)	1164	16.6	D
Westbound – weekend	AM (6 – 9am)	1341	19.2	D
	PM (4 – 7pm)	1065	15.2	C

Crash data

Over the 12-year period ending in 2021, there were 37 crashes along the Katoomba to Medlow Bath section. These included:

- one fatal crash due to an opposite head-on collision
- six serious injury crashes, at Nellies Glen Road intersection, west of Explorers Road and near Bellevue Crescenteleven moderate injury crashes
- four minor/other injury crashes
- fifteen non-casualty towaway crashes
- one uncategorised crash.

Most accidents occurred between Nellies Glen Road and to the west of Explorers Road. Most of these accidents are head on collisions, with a small number of rear end and run off bend crashes.

Within the same period, 65 crashes were recorded along the Medlow Bath to Blackheath section of the proposal. These included:

- one fatal crash due to an opposite head-on collision
- seven serious injury crashes
- twenty-nine moderate injury crashes
- no minor/other injury crashes
- twenty-nine non-casualty towaway crashes.

Within the Medlow Bath to Blackheath section, most accidents occurred near about Chainage 5600 – 6000, about one kilometre west of the Great Western Highway / Railway Parade intersection in Medlow Bath.

Public transport

There are a number of bus services that service the Great Western Highway within the proposal area. These services include:

- 690K – Springwood to Katoomba
- 698 – Katoomba to Blackheath (loop service)
- 698V – Katoomba to Blackheath (loop service)
- 8321 – Katoomba to Blackheath Station (school buses)
- 8705 – Springwood High School to Katoomba (school buses)
- 8710 – Wentworth Falls Public School to Blackheath (school buses).

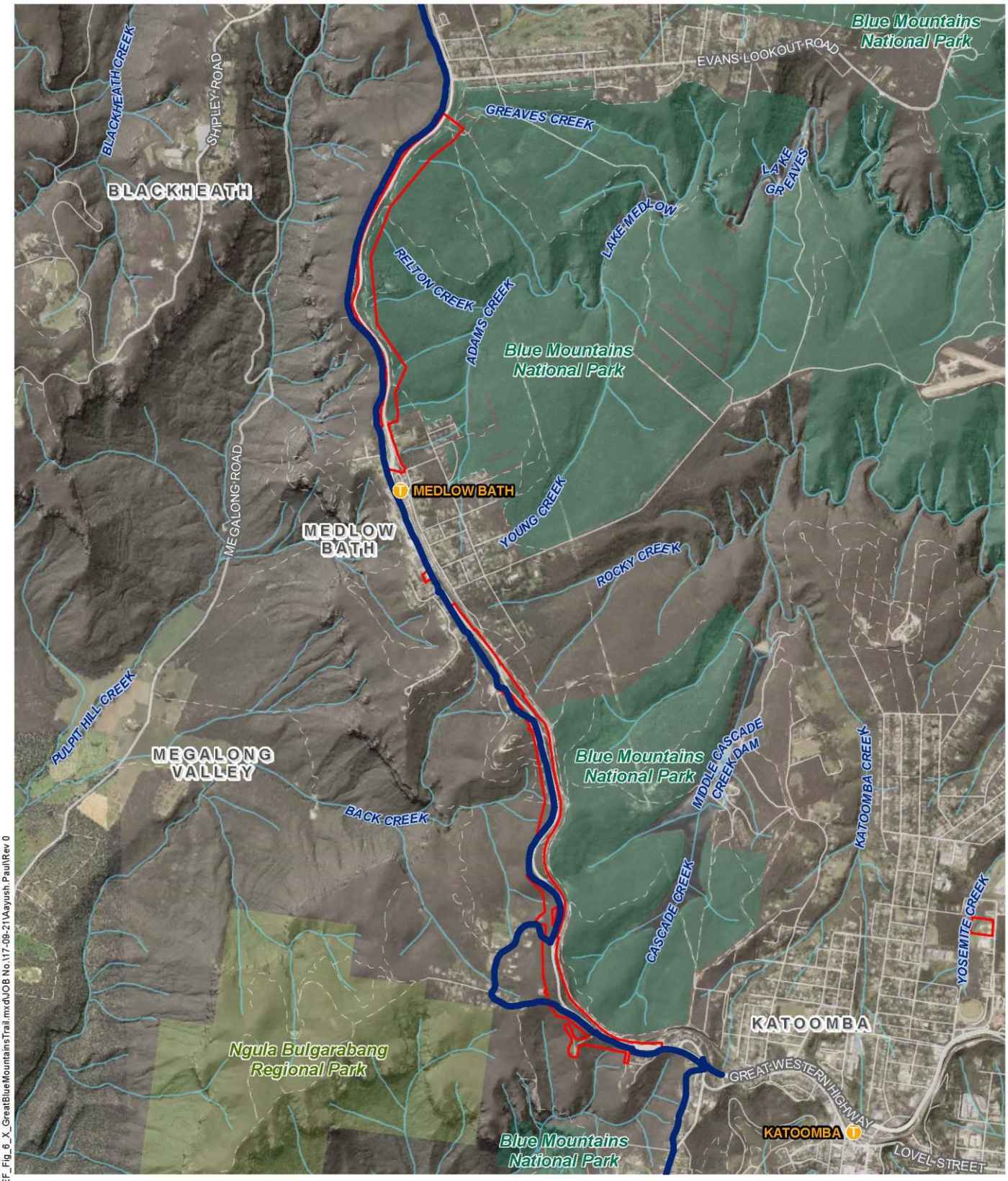
All bus services stop near Bonnie Doon Reserve and Foy Avenue, which are along the western side of the Great Western Highway between Katoomba and Medlow Bath. These bus stops are not sheltered and do not have signage or seating. There are no existing bus stops along the Medlow Bath to Blackheath section.

While the Main Western railway line runs parallel to the Great Western Highway throughout the proposal area, there are no rail stations within either section of the proposal, with the nearest stations located in Katoomba, Medlow Bath and Blackheath. Many of the identified bus routes connect with these train stations.

Active transport

No formal active transport infrastructure is associated with the Great Western Highway. However, the Great Blue Mountains Trail runs on the western side of the proposal, in some locations, following close to the Great Western Highway between Katoomba and Blackheath (refer to Figure 6-12). This includes a 245-metre concrete active transport trail immediately westbound of Rowan Lane.

While marked as a regional on-road cycle route, no formal cycling facilities exist on the Great Western Highway. Shared paths which form part of the Great Blue Mountains Trail are identified on the Blue Mountains Cycling Map, including Explorers Road, which is marked as an on-road cycle route.



Proposal area

Blue Mountains National Park

Ngula Bulgarabang Regional Park

Great Blue Mountains Trail

Watercourses

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Source: Aurecon, LPI, DPIE, BoM, Niche

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Great Western Highway East **Review of Environmental Factors**

Projection: GDA2020 MGA Zone 56

FIGURE 6-12: Great Blue Mountains Trail

6.7.4 Potential impacts

Construction

For the Katoomba to Medlow Bath section, the westbound carriageway would be constructed offline and result in little or no impact to the existing traffic between Katoomba and Medlow Bath. Once completed, the main highway traffic would be diverted onto the westbound carriageway in a contraflow operation, resulting in minimal impacts to traffic during the construction of the new eastbound carriageway. As some work may be undertaken immediately adjacent to the highway, there may be the need to drop the speed limit along the highway during work to assure the safety of workers. This could result in some short-term localised traffic delays.

However, at points where the proposal needs to pass over the existing highway or at the tie in points at the ends of the section, there may be some minor disruption to traffic.

For the Medlow Bath to Blackheath section, the eastbound carriageway would be constructed offline with limited impact to existing traffic between Medlow Bath and Blackheath. Once completed, the main highway traffic would be diverted onto the eastbound carriageway in a contraflow operation, resulting in minimal impacts to traffic during the construction of the new westbound carriageway. As all work may be undertaken immediately adjacent to the highway, there may be the need to drop the speed limit along the highway during work to assure the safety of workers. This could result in some short-term localised traffic delays.

Other traffic and transport impacts associated with the construction of the proposal are outlined in Table 6-50.

Table 6-50: Other traffic and transport impacts associated with the construction of the proposal

Impact	Description
Local road impacts	Upgrades to local roads could result in disruption or delays to local road traffic. Impacts to local roads would occur in the Katoomba to Medlow Bath section: • Nellies Glen Road would be temporarily closed to traffic as the intersection is reconstructed further south of the existing intersection. Access to residents on Pulpit Hill and for visitors to the Six Foot Track would be retained from Great Western Highway via Explorers Road. • When work is occurring to the bridge structure over Explorers Road, disruptions to local traffic may occur including temporary closures of the road. Access to Explorers Road would be retained via the upgraded Nellies Glen Road intersection alignment. During construction of the eastbound carriageway, access to Foy Avenue would be maintained from the highway via a temporary side-track with controlled access.
Construction traffic	The vehicle movements expected during construction would be as follows (refer to Section 3.3.3): • **Katoomba to Medlow Bath section** – 275 average total vehicle movements per day and 550 vehicle movements per day at peak construction periods • **Medlow Bath to Blackheath section** – 255 average total vehicle movements per day and 450 vehicle movements per day at peak construction periods These traffic volumes are low compared with the existing traffic volumes on the Great Western Highway (refer to Section 6.7.3). As such, construction traffic is unlikely to affect the performance of the Great Western Highway during construction. However, a localised increase in traffic may be seen along the road corridor near access points and at intersections.
Active transport	During construction of the westbound carriageway, the active transport trail between Katoomba and Medlow Bath would be closed. This would be reconstructed and reopened upon completion of this carriageway. There would be no impacts to other active transport trails during construction of the proposal. Access to the Six Foot Track would still be possible via Explorers Road when Nellies Glen Road is closed for construction.
Public transport	During construction, the bus stops at Bonnie Doon Reserve and at Foy Avenue would be temporarily relocated. This may increase the distance required to travel to the bus stops for some commuters. Transport would endeavour to keep these bus stops operational in consultation with

Impact	Description
	local bus companies. As such, it is not expected that there would be any changes to any bus routes that run between Katoomba and Blackheath due to the proposal. Individual bus services may experience temporary localised delays due to construction work. Where feasible, the construction workforce would be encouraged to use public transport to access the proposal area, which could increase patronage at the two bus stops and along the public transport network. Any work required which would impact the operation of the rail corridor would be conducted during planned rail possessions when no trains would be running in consultation with Sydney Trains and NSW TrainLink. This would cause no additional impacts to rail services due to the proposal. Transport (Sydney Trains) is relocating the existing Medlow Bath West Sectioning Hut under a separate planning approval as it has reached its end of life.
Emergency services	Emergency service access along the Great Western Highway would be maintained throughout construction. For the Medlow Bath to Blackheath section, at least one emergency service vehicle crossing would be provided where there is separated carriageways during construction.
Parking	Access to the existing parking area on Nellies Glen Road would be removed during the reconstruction of Nellies Glen Road and the upgrades to the heritage interpretation area. As there is a lack of parking along Great Western Highway and nearby local roads, parking for construction workers would be provided at the identified ancillary facilities (refer to Section 3.4). There may be a need for construction vehicles to access the worksite and temporarily park on the worksite.
Property access	Property access would be maintained for residents and business owners on Nellies Glen Road, Explorers Road and Foy Avenue during construction. There may be temporary localised impacts experienced by some property owners. As previously noted, there would be temporary disruption to the Nellies Glen Road and Explorers Road intersections during construction of the proposal. Access to the rail corridor and Blue Mountains National Park for maintenance would be maintained during construction in consultation with the rail and national park authorities on an as-required basis.

Operation

The permanent changes to the Great Western Highway and the key intersections within the proposal area during operation of the proposal are detailed in Section 3.2.3. In addition, a new service road would be created alongside the new bridge structure that would provide alternative southbound access from the highway to connect with Explorers Road and the Pulpit Hill area.

Traffic modelling for the Great Western Highway Upgrade Program indicates that an increase in traffic volumes is expected between the existing scenario and 2036. Without the proposal, daily traffic volumes between Katoomba and Blackheath would increase from about 23,000 in 2021 to about 26,000 in 2036. With the proposal and the opening of other projects within the Great Western Highway Upgrade Program, daily traffic volumes would increase to about 28,000 in 2036 between Katoomba and Blackheath.

Road network impacts

For the Katoomba to Medlow Bath section, the impact of the proposal on key intersection performance has been assessed (refer to Table 6-51 for the 2036 weekday scenarios and Table 6-52 for the 2036 weekend scenarios). The operation of the proposal would result in good operation (LOS A) at the three key intersections within the proposal area in 2026, 2031 and 2036, meaning that all intersections would operate at acceptable levels. The intersection upgrades would be successful in accommodating the expected increased traffic volumes in 2036. Specific impacts of the proposal on each intersection would be as follows:

- **Great Western Highway / Nellies Glen Road intersection** – while the LOS at the intersection would not change when comparing the with and without proposal in 2036, with the increased capacity of the proposal, the average delay would decrease by three to four seconds.
- **Great Western Highway / Explorers Road intersection** – the proposal would improve the LOS from LOS C during the 2036 weekday scenario and LOS B during the 2036 weekend scenario without the proposal to LOS A with the proposal during both the weekday and weekend scenario. In 2036, the

proposal would reduce the average delay from about 36 seconds to seven seconds at this intersection. This is mostly due to Explorers Road no longer connecting with the highway but rather connecting with the service road.

- **Great Western Highway / Foy Avenue intersection** – there would be no change in LOS due to the proposal compared with modelling results for without the proposal in 2036. At this intersection, the proposal would slightly increase average delay time by about three seconds due to the change from a give-way to stop signal control. Queue lengths would be reduced at this intersection, resulting in an improvement of existing conditions in 2036 during of the operation of the proposal.

Table 6-51: Modelled intersection performance – 2036 weekday scenarios

Intersection	Peak hour	2036 weekday scenario without the proposal			2036 weekday scenario with the proposal		
		Traffic volume (vehicles per hour)	Average vehicle delay (seconds)	LOS	Traffic volume (vehicles per hour)	Average vehicle delay (seconds)	LOS
Great Western Highway / Nellies Glen Road	AM (8.30 – 9.30am)	1545	11.5	A	1737	9.5	A
	PM (3.30 – 4.30pm)	1806	14.2	A	2048	10.4	A
Great Western Highway / Explorers Road	AM (8.30 – 9.30am)	1539	36.2	C	108	7.5	A
	PM (3.30 – 4.30pm)	1803	74.2	F	112	7.4	A
Great Western Highway / Foy Avenue	AM (8.30 – 9.30am)	1515	11.6	A	1707	13.9	A
	PM (3.30 – 4.30pm)	1793	9.5	A	2032	10.4	A

Table 6-52: Modelled intersection performance – 2036 weekend scenarios

Intersection	Peak hour	2036 weekend scenario without the proposal			2036 weekend scenario with the proposal		
		Traffic Volume (vehicles per hour)	Average Vehicle Delay (seconds)	LOS	Traffic Volume (vehicles per hour)	Average Vehicle Delay (seconds)	LOS
Great Western Highway / Nellies Glen Road	AM (11am – 12pm)	1575	13.7	A	1801	10.3	A
	PM (3 – 4pm)	1390	11.2	A	1590	9.4	A
Great Western Highway / Explorers Road	AM (11am – 12pm)	1581	25.1	B	88	7.3	A
	PM (3 – 4pm)	1380	16.8	B	86	7.3	A
Great Western Highway / Foy Avenue	AM (11am – 12pm)	1578	9.2	A	1806	10.3	A
	PM (3 – 4pm)	1393	7.5	A	1594	9.5	A

For the Medlow Bath to Blackheath section, the impact of the proposal on mid-block capacity has been assessed to determine the road network, as there are no intersections as part of this section. Refer to Table 6-53 for the weekday scenarios and Table 6-54 for the weekend scenarios.

With the proposal, the Medlow Bath to Blackheath section would operate acceptably at LOS B in 2031 and 2036 under both weekend and weekday scenarios. In 2026, the proposal would have good operation (LOS A) for the westbound AM peak (6 – 9am) weekday, eastbound weekday and PM peak (4 – 7pm) westbound weekend scenarios. Without the proposal, in 2036, the Medlow Bath to Blackheath section would:

- operate at LOS C or D on a weekday
- operate at LOS D in both directions on a weekend.

During operation of the proposal, the volume to capacity ratio, which measures the level of congestion, would increase slightly due to the higher traffic volumes compared to without the proposal. This indicates that the proposal would improve traffic flow along the Medlow Bath to Blackheath section while accommodating for the future estimated increases in traffic volumes.

Table 6-53: Modelled mid-block performance – weekday scenarios

		Eastbound weekday scenarios			Westbound weekday scenarios		
Scenario	**Peak hour**	**Traffic Volume (vehicles per hour)**	**Density (passenger cars per kilometre per lane)**	**LOS**	**Traffic Volume (vehicles per hour)**	**Density (passenger cars per kilometre per lane)**	**LOS**
2036 without Proposal	AM (6 – 9am)	1069	15.3	C	1219	17.4	D
	PM (4 – 7pm)	1168	16.7	D	1314	18.8	D
2026 with Proposal	AM (6 – 9am)	988	6.2	A	1085	6.8	A
	PM (4 – 7pm)	1075	6.7	A	1183	7.4	B
2031 with Proposal	AM (6 – 9am)	1142	7.1	B	1212	7.6	B
	PM (4 – 7pm)	1238	7.7	B	1335	8.3	B
2036 with Proposal	AM (6 – 9am)	1186	7.4	B	1281	8.0	B
	PM (4 – 7pm)	1288	8.0	B	1403	8.8	B

Table 6-54: Modelled mid-block performance – weekend scenarios

		Eastbound weekend scenarios			Westbound weekend scenarios		
Scenario	**Peak hour**	**Traffic Volume (vehicles per hour)**	**Density (passenger cars per kilometre per lane)**	**LOS**	**Traffic Volume (vehicles per hour)**	**Density (passenger cars per kilometre per lane)**	**LOS**
2036 without Proposal	AM (6 – 9am)	1239	17.7	D	1503	21.5	D
	PM (4 – 7pm)	1304	18.6	D	1214	17.3	D
2026 with Proposal	AM (6 – 9am)	1167	7.3	B	1399	8.7	B
	PM (4 – 7pm)	1214	7.6	B	1118	7.0	A
2031 with Proposal	AM (6 – 9am)	1372	8.6	B	1627	10.2	B
	PM (4 – 7pm)	1413	8.8	B	1288	8.1	B
2036 with Proposal	AM (6 – 9am)	1413	8.8	B	1684	10.5	B
	PM (4 – 7pm)	1340	8.4	B	1340	8.4	B

Overall, the proposal would improve the existing performance of the Great Western Highway, even with an increase in traffic volumes in 2036. It would also improve the safety and the performance of the Great Western Highway. These sections of the Great Western Highway would have sufficient capacity to accommodate the expected annual growth after 2036.

Heavy vehicle impacts

The proposal would contribute to the broader upgrade of the Great Western Highway between Katoomba and Lithgow, improving freight efficiency for heavy vehicles as steeply graded sections and lane capacity would be upgraded. Heavy vehicle numbers, composition and vehicle types are not anticipated to change until completion of the entire Great Western Highway Upgrade Program and the heavy vehicle size

restrictions on Mount Victoria Pass is removed. Future performance of the corridor would be assessed by the cumulative impacts of the Blackheath to Little Hartley Upgrade.

The proposal is anticipated to provide a substantial improvement in heavy vehicle safety between Katoomba and Blackheath through improved road alignment and capacity. In addition, truck stopping areas would be provided to help drivers manage fatigue and comply with driving hours regulations and help the freight industry to support safe heavy vehicle operations. One would be located on the new service road eastbound, near Explorers Road, while the other would be provided westbound about one kilometre west of Medlow Bath. The provision of truck stopping areas along the proposal would improve safety for heavy vehicle drivers travelling along the Great Western Highway. This would discourage the current observed behaviour of heavy vehicles stopping in front of the Hydro Majestic and in other informal shoulder areas along the corridor.

Other traffic and transport impacts

Other traffic and transport impacts associated with the operation of the proposal are outlined in Table 6-55.

Table 6-55: Other traffic and transport impacts associated with the operation of the proposal

Impact	Description
Active transport	Within the Katoomba to Medlow Bath section, the proposal would upgrade and realign parts of the Great Blue Mountains Trail, including near the Pulpit Hill heritage interpretation area. This would reinstate the same level of pedestrian and cyclist access currently available, in consultation with relevant community interest groups. Within the Medlow Bath to Blackheath section, the proposal would establish a new active transport trail to the east of the Great Western Highway along the Blue Mountains National Park. This active transport trail would create a new active transport link between Medlow Bath and Blackheath which only exists to the western side of the rail corridor along Station Street. This would improve active transport connections in the area.
Public transport	The proposal would have a minimal impact on the two bus stops within the proposal area. The existing bus stop at Bonnie Doon Reserve on the Great Western Highway would be relocated to the left turn bay into Nellies Glen Road to improve safety for commuters. The existing bus stop at Foy Avenue would be adjusted and upgraded, with a dedicated bus bay constructed on the northern side of the intersection to suit the proposed road alignment. The proposal would have no impacts to bus or rail services.
Emergency services	By increasing the number of lanes from one to two lanes in each direction, the proposal would improve reliability of access for emergency services along the Great Western Highway. The four-lane configuration would provide more opportunities for emergency crossover at intersections. Variable speed limits and Variable Message Signs would improve the ability to manage traffic incidents and emergency events. The proposal would also maintain the ability for emergency services to stop where shoulder width permits along the road corridor in both directions. Access to the rail corridor would be maintained for emergency access.
Fire trails	Through the Medlow Bath to Blackheath section, the provision of the new active transport trail would also allow for maintenance access into the adjoining National Park.
Parking	Proposed changes to the Pulpit Hill heritage interpretation area would formalise parking at this location. This would improve safety and capacity of parking for light vehicles and tourist buses. This would reduce the disruption to residents of buses parking and obstructing property access on Nellies Glen Road and Explorers Road. The proposal would not affect current parking restrictions along the Great Western Highway.
Property access	Where existing rail corridor access would be disrupted by the proposal, alternative access arrangements and new gate locations would be established in consultation with Sydney Trains. There would be minimal impacts to the current access arrangements for the Blue Mountains National Park. However, an access from Coachhouse Lane onto the proposed active transport trail and maintenance access path would be provided.

6.7.5 Safeguards and management measures

Safeguards and management measures for traffic and transport are outlined in Table 6-56.

Table 6-56: Safeguards and management measures – traffic and transport

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport *Traffic Control at Work Sites Manual* (Transport, 2020c) and *QA Specification G10 Control of Traffic* (Transport, 2020b). The TMP will include: • confirmation of haulage routes • measures to maintain access to local roads and properties • a provision for the monitoring of delays or queues forming at access points with a suitable response such as temporary detours or cessation of construction access movements to clear the queue • construction traffic control plans outlining site-specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access where possible • requirements and methods to consult and inform the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • a response plan for any construction traffic incident • monitoring, review and amendment mechanisms.	Transport / Contractor	Detailed design / Pre-construction	Section 4.8 of QA *G36 Environment Protection*
Construction site access	Construction site access will be designed and implemented in consideration of: • road design guidelines and turning paths for heavy vehicles • appropriate sight distances to allow traffic to safely enter and exit • visibility of compliant warning and way finding signs • use of accredited traffic controllers, where appropriate and/or other controls to separate, slow down or temporarily stop traffic for safe entry/exit • minimising use of local roads, where practical • provision of deceleration lanes at accesses next to highly trafficked roads.	Contractor	Pre-construction/ construction	Additional safeguard
Impact on bus stops or routes	For the Katoomba to Medlow Bath section, temporary and permanent bus stop relocation will be discussed with the relevant bus operator. Transport will discuss the temporary relocation of the Bonnie Doon Reserve and Foy Avenue bus stops.	Transport / Contractor	Detailed design / Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Transport will inform the community of the temporary relocation of the bus stops prior to the relocation.			
Temporary access changes	Detours during temporary access changes will be implemented with directional signage along alternate routes.	Contractor	Construction	Additional safeguard
Traffic management measures	Any temporary traffic diversions or road closures will be implemented in accordance with Transport Management Centre (TMC) and Blue Mountains City Council requirements and notified to emergency services.	Contractor	Construction	Additional safeguard
Property access	Property access will be maintained where feasible and reasonable and property owners will be consulted well in advance of work starting that may temporarily restrict or control access.	Contractor	Construction	Additional safeguard
Local road or shared path closures	Blue Mountains City Council will be consulted with prior to any local road or shared path closures to identify suitable mitigation measures such as detour routes.	Contractor	Construction	Additional safeguard
Damage to local roads	Any damage to the local road network identified to be caused by construction vehicles for the proposal will be remediated by the contractor to be similar to the existing road condition.	Contractor	Construction	Additional safeguard

6.8 Socio-economic, property and land use

The potential impacts on socio-economic, property and land use during construction and operation of the proposal have been assessed as part of the *Great Western Highway Upgrade – East Project Socio-economic impact assessment* (Aurecon, 2022a), provided in Appendix J.

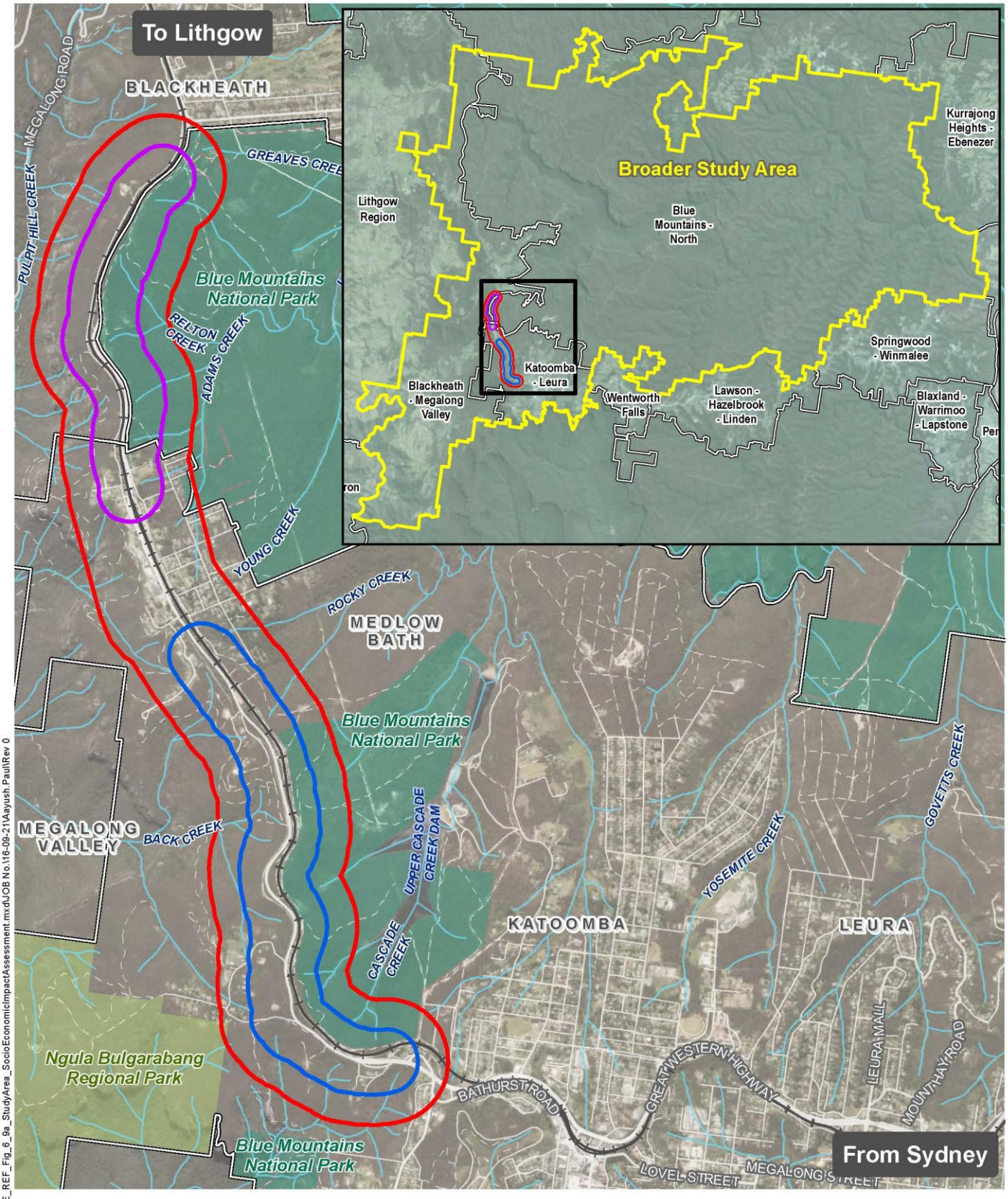
6.8.1 Methodology

The socio-economic impact assessment has been prepared for a 'moderate' level assessment as specified by Transport's *Environmental Impact Assessment Practice Note – Socio-economic Assessment (EIA-N05)* (Transport, 2020a). The methodology for the assessment included:

- a review of statutory planning and legislative requirements, including a review of existing State and local government strategies relevant to the social and economic environment of the study areas, including the *Blue Mountains Community Strategic Plan 2035* and the *NSW Western City District Plan* (Greater Sydney Commission, 2018).
- a site visit on Monday 8 February 2021 to examine the existing environment and assess the potential direct and indirect impacts of the proposal
- identification of the existing socio-economic environment of the study areas, including
  - data on land use and development, population, demographics, local business and industry, employment, income and dwelling characteristics in the study area
  - access, connectivity, existing social infrastructure and community features
  - key community issues from previous community consultation for the overall Great Western Highway Upgrade Program
- identification and assessment of the potential socio-economic impacts of the construction and operation of the proposal
- recommendation of measures to avoid, minimise and manage potential impacts on the socio-economic environment.

Study area

The socio-economic impact assessment consisted of three study areas in line with EIA-N05 (Transport, 2020a), which are shown in Figure 6-13 and outlined in Table 6-57.



Direct study area - Katoomba to Medlow Bath section

Direct study area - Medlow Bath to Blackheath section

Socio-economic study area

ABS Statistical area 2

Blue Mountains National Park

Ngula Bulgarabang Regional Park

Railway

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Source: Aurecon, LPI, DPIE

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Great Western Highway East **Review of Environmental Factors**

Projection: GDA2020 MGA Zone 56 **FIGURE 6-13:** Study area - socio-economic impact assessment

Table 6-57: Study areas for the socio-economic assessment

Study area	Description	How the assessment is informed by the study area
Direct study area	200 m buffer around the Katoomba to Medlow Bath and Medlow Bath to Blackheath sections separately. This includes residents who live just off the Great Western Highway but may still experience direct impacts of the proposal.	Direct impacts are assessed in this area, which include impacts on amenity impacts (noise and visual), property and access, and the surrounding community.
Socio-economic study area	400 m buffer from the outer edge of the design, which encompasses both the Katoomba to Medlow Bath and Medlow Bath to Blackheath sections. This considers the walking distance around the proposal.	Indirect impacts of the overall proposal (primarily impacts to access and connectivity, as well as some amenity impacts that may occur from people using the proposal but not as frequently as those within the direct study area).
Broader study area	Based on the following Australian Bureau of Statistics (ABS) 'Statistical Area 2' areas: • Katoomba – Leura • Blackheath – Megalong Valley • Blue Mountains – North. Comparison of these areas are made against the Blue Mountains LGA and Greater Sydney.	Representative of the surrounding Blue Mountains community likely to use the Great Western Highway corridor through the proposal area. Key features of the surrounding area include train stations, retail, town centres and places of special/community interest and develop context about the existing environment. By understanding the broader study area, movements through and around the Great Western Highway are assessed to determine the potential impacts of the overall proposal.

6.8.2 Criteria

The significance of likely impacts has been assessed based on the sensitivity and magnitude of the impacts. These terms are defined as follows:

- **Sensitivity** – the qualities of the receptor which influence its vulnerability to change and capacity to adapt.
- **Magnitude** – the scale, duration, intensity and scope of the overall proposal including how it will be constructed and operated.

The socio-economic assessment applied the impact grading matrix presented in EIA-N05 to assess the level of significance for potential negative impacts only.

Table 6-58: Criteria applied in the socio-economic impact assessment to assess the level of significance

		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
Sensitivity	**High**	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.8.3 Existing environment

Population and demography

In 2016, the population of the broader study area was 18,798, which was about 23.8 per cent of the Blue Mountains LGA population (ABS, 2016). Key features of the population include that:

- the broader study area has an older population, when compared with the Blue Mountains LGA and Greater Sydney
- there is a high Aboriginal and Torres Strait Islander population (about 2.6 per cent in 2016, compared with 1.5 per cent for Greater Sydney)
- in 2016, Katoomba – Leura and Blackheath – Megalong Valley had lower than average economic and social conditions for people and households compared with the Blue Mountains LGA and whole of NSW
- in 2016, employment in accommodation and food services, health care and social assistance, retail trade and education and training comprised the highest proportion of the work force in both the broader study area and Blue Mountains LGA
- in 2016, the broader study area had the highest proportion of people walking to work or working from home compared to the Blue Mountains LGA and Greater Sydney
- population is expected to increase by about six per cent in the Blue Mountains LGA from 78,835 in 2016 to 83,578 in 2041
- the number of households in the Blue Mountains LGA is expected to increase by 9.55 per cent between 2016 and 2036.

Land use

The proposal is located in the Blue Mountains LGA and occurs in the suburbs of Katoomba, Medlow Bath and Blackheath. The direct study area comprises a mix of land use areas defined in the *Blue Mountains Local Environmental Plan 2015* (LEP), as outlined in Section 4.1.2.

Within the proposal area, the Great Western Highway is a two-lane road zoned as SP2 – Infrastructure. It is located within a wide corridor which has grassed and vegetated areas along its extent. Housing is mostly set back from the Great Western Highway road corridor, except near the towns of Katoomba, Medlow Bath and Blackheath, where some properties are located next to the road corridor.

The Katoomba to Medlow Bath section is bounded by mostly private or Council-owned property to the west and the Main Western railway corridor to the east. Residential properties in this area are set back from the road corridor and accessed via local roads from the western side of the highway.

The Medlow Bath to Blackheath section is bounded by the Main Western railway corridor to the west and the Blue Mountains National Park to the east. While part of the Blue Mountains National Park forms the Greater Blue Mountains World Heritage Area, the section immediately adjacent to the proposal is not part of the World Heritage Area. The direct study area between Medlow Bath and Blackheath is mostly undeveloped, with some dispersed properties to the west.

The socio-economic study area and broader study area contain a range of industrial, commercial, agricultural and residential land uses, including some land in Medlow Bath zoned as SP3 – Tourist and RE1 – Public Recreation. There are accommodation and tourism services, as well as local town centres and villages comprised of small businesses, community services and facilities. To the west of the socio-economic study area is a steep escarpment overlooking Megalong Valley.

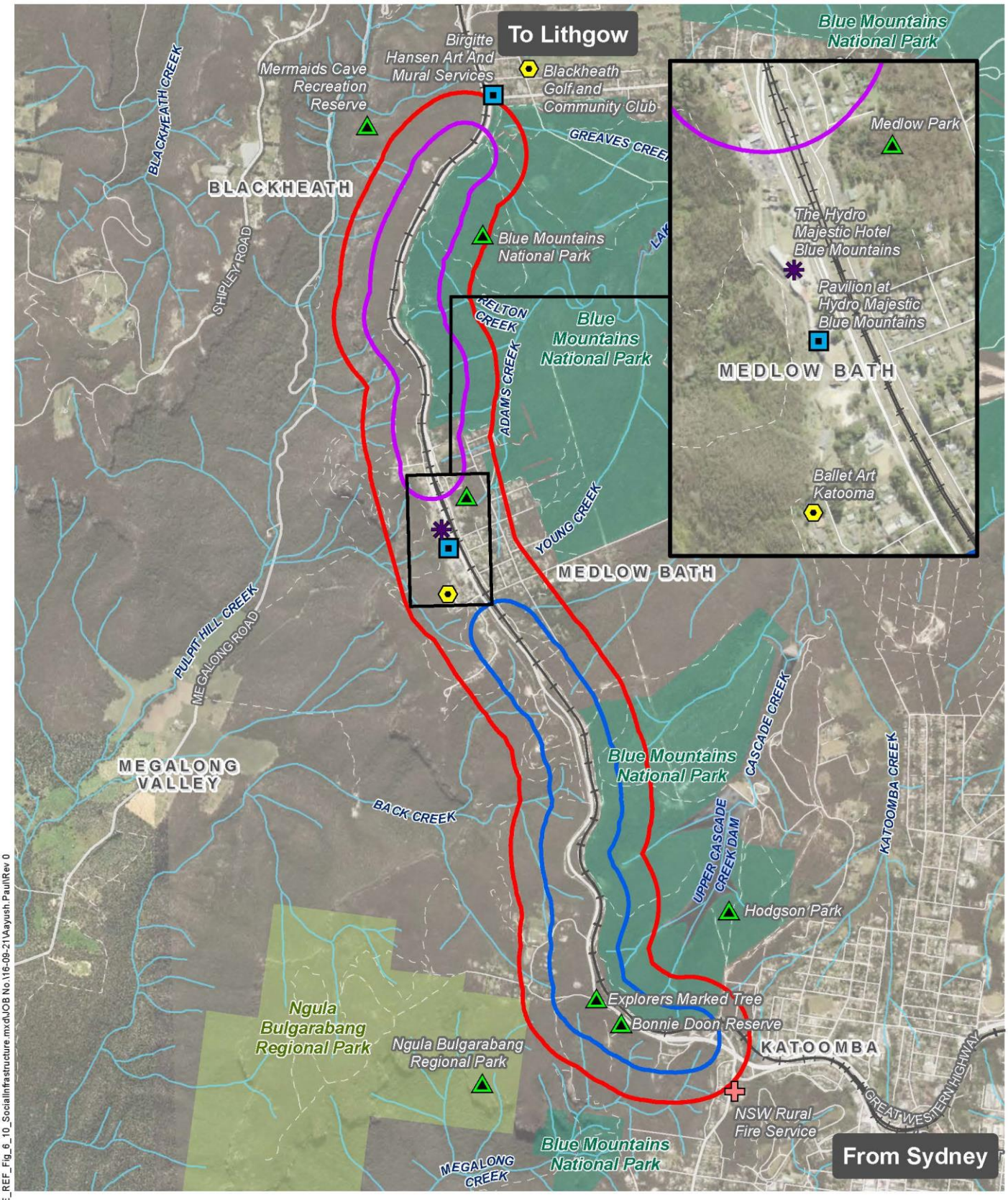
The broader study area is likely to experience some development in the coming years, consistent with existing land uses. The Blue Mountains Wildlife and Tourism Development Park and Great Western Highway Upgrade program are both currently in the planning phase and would improve tourism opportunities and connectivity in the Blue Mountains respectively.

Social infrastructure facilities

The social infrastructure near the proposal is shown in Figure 6-14. Within the direct study area, the key items of social infrastructure are parks and reserves, including the Bonnie Doon Reserve near Katoomba and the Blue Mountains National Park to the east of the proposal. Areas of community interest include:

- Blue Mountains National Park, which has a range of iconic lookouts, waterfalls, Aboriginal culture, historic walking tracks, mountain biking, and other adventure sports. There are notable sites including the 'Three Sisters' at Echo Point, Katoomba, the Blue Mountains Heritage Centre and destinations near Blackheath, such as Govets Leap and Grand Canyon. The Blue Mountains National Park contains pathways, resources and cultural associations important to the local Aboriginal community.
- Pulpit Hill and surrounds, which was identified on an 1814 Survey Map as a key site on the first road west across the Blue Mountains. Pulpit Hill includes areas of heritage significance near the now removed Explorers Tree, convict graves and an old rail house.
- Water NSW Special Catchment Area, which protects water quality by providing buffer zones of bushland around dams and immediate catchment areas. These special catchment areas are not open to the public through areas of National Park.

There is a high degree of mobility of residents and visitors to the proposal area between Katoomba, Medlow Bath and Blackheath. In Katoomba, there is a high level of social infrastructure, including schools, education facilities, and recreation facilities. The Great Western Highway provides an important link to social infrastructure facilities in the broader study area.



Direct study area - Katoomba to Medlow Bath section
Direct study area - Medlow Bath to Blackheath section
Socio-economic study area
Blue Mountains National Park
Ngula Bulgarabang Regional Park
Railway

Social infrastructure

Business
Community facilities, centres, halls
Emergency services
Parks and reserves
Recreational faciilites

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Source: Aurecon, LPI, DPIE

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Great Western Highway East **Review of Environmental Factors**

Projection: GDA2020 MGA Zone 56

FIGURE 6-14: Social infrastructure

Access and connectivity

Private vehicle use

Within the broader study area, residents are typically reliant on private vehicles. In 2016, only 6.5 per cent of households did not own a private vehicle (ABS, 2016).

There is no formal parking along the Great Western Highway in the proposal area. The closest formal parking to the proposal is available in Katoomba, Medlow Bath and Blackheath.

There is an informal parking area on Nellies Glen Road near the heritage interpretation area. At present, this poses an ongoing safety hazard and makes resident access challenging. There are also informal emergency stopping locations along the Great Western Highway where the road shoulder is wider.

Freight

The Great Western Highway forms part of the freight and heavy vehicles network connecting the Central West and Orana, Blue Mountains, Western Sydney and Greater Sydney regions. It currently carries around 9 million tonnes of road freight each year, with a further 7 million tonnes transported by rail. The Great Western Highway currently accommodates freight and heavy vehicles up to 19 metre B-Doubles (over 50 tonnes).

About half of the freight which passes through Blue Mountains is transported by road, to allow efficient and direct access to retail precincts and industrial areas. This freight includes refrigerated goods, livestock and retail goods. The dominant patterns of freight movement are:

- east to west - manufactured products, food and general freight such as furniture and fuel
- west to east – timber, food and agricultural products and sand and gravel from quarries in the Blue Mountains.

Heavy vehicle traffic makes up about 23 per cent of total traffic volume between Katoomba and Medlow Bath and about 22 per cent of total traffic volume between Medlow Bath and Blackheath. For further details on heavy vehicle traffic, refer to Section 6.7.3.

Active transport

Within the proposal area, there is one formal active transport trail along the Great Western Highway, between Rowan Lane and Bonnie Doon Reserve. This forms part of the Great Blue Mountains Trail, which runs along the western side of the Great Western Highway between Katoomba and Blackheath. Most of the pedestrian activities in the socio-economic study area take place on off-road sealed and unsealed bush walking tracks.

While it is marked as a regional on-road cycle route, no formal cycling facilities exist on the Great Western Highway. Shared paths which form part of the Great Blue Mountains Trail are identified on the Blue Mountains Cycling Map.

Community values

Community feedback received while developing the *Blue Mountains Community Strategic Plan 2035* (CSP; Blue Mountains City Council, 2017) identified the following directions for the CSP:

- Lead: inspiring leadership
- Protect: an environmentally responsible city
- Care: an inclusive, health and vibrant city
- Live: a liveable city
- Move: an accessible city
- Thrive: an economically sustainable city.

These directions contribute to the liveability of the Blue Mountains LGA and this has been reflected within the community consultation undertaken for the proposal (refer to Section 5.2).

The CSP aims to foster the social and economic well-being of the communities, while maintaining and protecting the surrounding World Heritage Area for future generations. It is noted that tourism and events are important to the community across the Blue Mountains LGA.

6.8.4 Potential impacts

Construction

Property acquisition and adjustments

The proposal would require the acquisition and adjustment of properties within the direct study area. In addition, some land parcels would also be temporarily leased for ancillary facilities and construction work. A list of properties impacted and details on the property acquisition process is provided in Section 3.6.

Property acquisition can result in stress and anxiety, particularly for owners that are vulnerable to forced relocation such as requiring assistance, older or of lower levels of economic resources. For the Katoomba to Medlow Bath section, about 36 properties to the west of Great Western Highway would be acquired. Most of these properties are Council owned, so there are limited impacts to private residential properties. There would be six full private property acquisitions, five of which are vacant land.

A portion of the Medlow Bath to Blackheath section is on land currently reserved as national park. The land which would be revoked is not currently publicly accessible due to its location within the Water NSW Blackheath Special Catchment Area so there would not be a loss of recreation land due to this revocation.

Property acquisition and adjustments for the overall proposal would have a moderate social impact. The overall significance would be:

- moderate-low for the Katoomba to Medlow Bath direct study area due to the moderate sensitivity of stakeholders and low magnitude of temporary and permanent changes during construction
- moderate-low for the Medlow Bath to Blackheath direct study area due to the low sensitivity in using existing publicly owned land and moderate magnitude of temporary and permanent changes to land ownership during construction.

Land use

Land use changes during construction would be mostly confined to the proposed ancillary facilities. These areas would be restored to their previous use upon completion of construction. The land use changes associated with construction of the proposal include:

- the bridge launch site, bridge ancillary facility and Bonnie Doon brick pit site ancillary facilities, which are currently zoned C1 – National Parks and Nature Reserves and C2 – Environmental Conservation
- the ancillary facility south of Evans Lookout Road, Blackheath, which is currently zoned C2 – Environmental Conservation.

The land use would change on the part of the Blue Mountains National Park within the Medlow Bath to Blackheath section which would be revoked prior to determination of this REF. This would change the land use from C1 – National Parks and Nature Reserves to SP2 – Infrastructure.

Changes to land use during construction would have minimal social or economic impact. There would be low sensitivity to changes in land use during construction by the community and broader study area of the proposal. This would be due to the type and small number of areas potentially impacted, including areas which are near existing road corridor or not easily accessible by the public. There would be moderate magnitude of the changes, resulting in the overall significance of the impact being moderate-low.

Access and connectivity

The proposal would result in some temporary changes to access and connectivity within and surrounding the direct study area. This would include:

- temporary delays and alternative traffic arrangements for resident, tourist, freight and commercial vehicle movements along the Great Western Highway during construction of the proposal
- temporary changes to local street access for Nellies Glen Road and Explorers Road
- temporary lane closures near Nellies Glen Road and Foy Avenue
- provision of alternative rail corridor and Blue Mountains National Park access as required
- temporary closure of the parking area on Nellies Glen Road
- temporary relocation of bus stops at Bonnie Doon Reserve and Foy Avenue
- detours and temporary closure of the Great Blue Mountains Trail (between Katoomba and Medlow Bath only).

There would be no changes to bus routes between Katoomba and Blackheath. Temporary, localised delays for individual bus services may occur due to traffic management on the operating highway. Emergency service access along the highway and to Coachhouse Lane would also be maintained during construction.

Changes to traffic conditions along the Great Western Highway would impact the liveability of the socio-economic study area. Residents may feel stressed or anxious in response to changes to the road network and temporary access routes. This may also be inconvenient for regular active transport path users, especially those with limited mobility. Lane closures during construction would be timed during low traffic periods (such as at night or outside peak periods) where possible to reduce impacts on the local road network and road users.

Delays due to construction would also lead to increased stress and anxiety for locals and regular users of the Great Western Highway. The magnitude of these impacts would depend on how long delays are expected and the staging of the proposal. Delays that impact on freight movement could have a negative economic impact, resulting in stress and unease for suppliers.

The sensitivity of people to changes in access and connectivity would be moderate. The overall significance would be:

- moderate for the Katoomba to Medlow Bath direct study area due to the moderate magnitude of the temporary changes during construction
- low for the Medlow Bath to Blackheath direct study area due to the low magnitude of the temporary changes during construction.

Social infrastructure facilities

The proposal would result in temporary changes on traffic movement and access points, impacting people accessing social infrastructure such as parks for recreation. There would also be temporary impacts to amenity for people using parks.

Several social infrastructure facilities within the socio-economic study area would be impacted by construction of the proposal, including:

- Bonnie Doon Reserve, which would experience negative short-term impacts. The proposal would impact public access to Bonnie Doon Reserve during construction, due the potential use of the Brick pit site as an ancillary facility. Pathways around the reserve, Nellies Glen Road and the Great Blue Mountains Trail between Katoomba and the reserve would be closed. There would be noise and visual impacts, inconveniencing locals and tourists who use this area for recreation purposes. Where possible, Transport would identify detours or temporary alternative access to Bonnie Doon Reserve.

- Pulpit Hill heritage area, which would experience direct and high non-Aboriginal heritage impacts through road widening, earthworks, bridge construction, intersection upgrades and carpark construction (refer to Section 6.4.2). Temporary impacts to this area include visual amenity and noise impacts which may affect community values around the natural environment. Public access and use of the site during construction would be limited.
- Medlow Park, which would experience accessibility impacts during construction, due to reduced speeds through the proposal area. Patronage may also increase at Medlow Park during construction due to disruption of other recreational sites, including Bonnie Doon Reserve or Pulpit Hill.
- Blue Mountains National Park between Medlow Bath and Blackheath, which would experience visual, noise and air quality impacts. However, this part of the National Park is within the Blackheath Special Catchment Area and so access is already legally restricted. As such, the impacts of the construction of the proposal on surrounding receivers would be limited.

The overall level of significance of impacts would be moderate-low due to moderate sensitivity of social infrastructure to potential construction impacts, including visual and noise impacts and low magnitude of impacts.

Commercial operations and businesses

The construction of the proposal would have minimal negative impacts on commercial operations and businesses, including people working from home. These impacts would be related to visual, air quality, access, noise and vibration during construction. These impacts would be particularly evident near:

- Mountain House, Nellies Glen Road and Karuna Sanctuary, Saywell Road, due to construction of upgraded intersections and the proposed twin bridges. There would be impacts to access during construction due to alternate traffic arrangements and potential delays due to construction on the Great Western Highway. Noise and vibration associated with construction are not expected to impact on business activities due to their setback from the Great Western Highway.
- The United Petroleum due to the presence of construction equipment and machinery at the adjoining proposed ancillary facility. This may impact the patronage to the business due to the reluctance of some patrons to access the petrol station due to construction work.
- Businesses in Medlow Bath which may experience access and connectivity impacts and concerns about loss of passing trade during the construction of the proposal. These businesses, and those located in the Medlow Bath section of the socio-economic area would also be impacted by the Medlow Bath Upgrade. Cumulative impacts of the proposal are discussed in Section 6.11.

The proposal would also create additional employment opportunities for construction and trade workers and lead to an increase in expenditure in the broader study area during construction.

Construction of the proposal may lead to amenity impacts for residents working from home. High levels of construction noise may impact concentration and interrupt work from home, leading to frustration and concern. The construction noise impacts of the proposal are discussed further in Section 6.6.4.

The overall level of significance of impacts would be moderate-low. This is due to low sensitivity of businesses to potential construction impacts because of the existing environment and large distance to construction activities for many of the businesses and moderate magnitude of the impacts.

Amenity and community values

The proposal would result in a reduction of amenity and community values. This would be due to the high sensitivity of the area and substantial changes proposed to the existing heritage interpretation area (Katoomba to Medlow Bath section) and the Blue Mountains National Park (Medlow Bath to Blackheath section).

The greatest temporary amenity impacts during construction would be:

- during construction activities that use noise or vibration intensive equipment for receivers closer to the highway or areas further away from the Great Western Highway due to topography, especially near the valley north of Explorers Road
- noisy work required outside standard construction hours which may have adverse impacts on the health and wellbeing of residents
- visual impacts of construction plant and machinery, including lighting for nightworks would also impact those living within, visiting and travelling through the direct study area
- partial removal of the bushland surrounding the Great Western Highway resulting in a larger cleared area with construction machinery, impacting the spatial character and liveability of the direct study area, particularly surrounding the Pulpit Hill heritage interpretation area
- air quality impacts, including an increase in dust levels from vegetation removal, stripping of topsoil and excavations associated with earthworks, as well as from heavy vehicle movements near the proposal, resulting in the community avoiding social infrastructure.

Construction activities would move along the corridor as construction progressed, so that one group of sensitive receivers would not be exposed to amenity impacts for the entire construction period.

The Blue Mountains City Council CSP identified that the community values the natural environment. The proposal would require vegetation removal for the widening of the Great Western Highway, impacting the natural backdrop for recreational users within this area. This may result in a loss of vegetation (refer to Section 6.3.3) and a sense of loss and impacts to feelings of community character. This would be most noticeable near Pulpit Hill in the Katoomba to Medlow Bath section and near the part of the Blue Mountains National Park proposed for revocation as part of the Medlow Bath to Blackheath section. However, the lack of known Aboriginal cultural heritage sites in the proposal area and management measures to be implemented (refer to Section 7.2), potential impacts to Blue Mountains National Park cultural heritage and values are not expected to be significant.

The CSP also identified that the community also values movement. Construction of the proposal would temporarily impact the accessibility and connectivity of residents, motorists, pedestrians, cyclists and businesses along the Great Western Highway.

The overall level of significance of impacts would be moderate due to high-moderate sensitivity of the community to changes in amenity and values and moderate magnitude of the impacts.

Operation

Property acquisition and adjustments

All property acquisition or adjustments would occur during construction. No further acquisition would take place during operation. As such, the impacts of property acquisition and adjustments during operation of the proposal would be negligible.

Land use

The operation of the proposal would result in minor permanent changes in land use. Most changes to land use would be related to the construction of the proposed road corridor in areas that were previously vegetated or vacant. These areas would be rezoned as SP2 – Infrastructure and be removed from recreational use.

However, the Medlow Bath to Blackheath section, would have a new publicly accessible recreational trail to the east of the Great Western Highway between Medlow Bath and Blackheath. This would provide positive impacts on recreation as the land is currently closed to public access.

The overall significance would be:

- moderate-low for the Katoomba to Medlow Bath direct study area due to the low sensitivity of land occupiers, owners and the community to permanent changes in land use and moderate magnitude of these changes
- moderate for the Medlow Bath to Blackheath direct study area due to the moderate sensitivity of land occupiers, owners and the community to permanent changes in land use and moderate magnitude of these changes.

Access and connectivity

The proposal would result in substantial access and connectivity benefits. Operation of the proposal would improve travel times and safety for motorists and commuters travelling along the Great Western Highway. This would result in decreased motorist stress and anxiety and improved driver confidence through:

- improved resilience of the road corridor during breakdowns, crashes, extreme weather events or other emergencies, with the ability to maintain traffic flow during these events
- reduction in congestion for emergency vehicles along the road corridor
- improved safety of vehicles overtaking
- improved safety of and reduced queuing at intersections, especially Nellies Glen Road and Foy Avenue
- improved safety of bus stops, especially through the relocation of the Bonnie Doon Reserve bus stop to Nellies Glen Road.

There may also be initial confusion and frustration from the community at the proposed changes to the intersections at Explorers Road and Foy Avenue. This would lead to increased travel times for residents.

The proposed upgrade to the Pulpit Hill heritage interpretation area on Nellies Glen Road would result in positive impacts for residents who currently are disrupted by informal parking in this area. Improved connectivity at this location would also lead to an increased likelihood of the community visiting this area for recreation and result in improved physical and mental wellbeing of the community. The reintroduction of a redesigned left-out turn previously removed to safety concerns would also improve safety for motorists using Nellies Glen Road.

Improved freight transport access and efficiency would result in fewer vehicles on the road and positive impacts on the community. A reduction in freight vehicles would decrease frustration from other motorists at congestion and slow movement, increasing liveability in the socio-economic and broader study area. The provision of heavy vehicle stopping bays would also improve safety for heavy vehicle drivers.

The proposal would improve liveability and active transport facilities by maintaining access to, and upgrading parts of, the Great Blue Mountains Walking Trail. This would have a positive impact on pedestrians and cyclists, allowing continued physical and mental benefits of exercise and ongoing enjoyment of important local areas.

Between Medlow Bath and Blackheath, the proposed new active transport trail would have a positive impact on the community who would have a new access link between the villages. Pedestrians and cyclists would no longer need to cross the Great Western Highway at Station Street to travel between Medlow Bath and Blackheath. This would have a positive impact on tourism as trails contribute to the wider attraction of recreation in the Blue Mountains.

The overall level of significance of impacts would be moderate-low due to moderate sensitivity of road and active transport users to changes in access and connectivity and low magnitude of the impacts.

Social infrastructure facilities

Reduced congestion due to the proposal would improve connectivity and access to services and social infrastructure facilities within the direct study area and socio-economic study area.

Several social infrastructure facilities within the socio-economic study area would be impacted by operation of the proposal, including:

- Bonnie Doon Reserve, which would experience positive impacts due to the reopening of the reserve. The proposal would reinstate improved access to nature and natural recreation, which is important to the community.
- Pulpit Hill heritage area, which would be reinstated in line with the Heritage Interpretation Strategy to be developed for the proposal. This would have a positive impact by recognising heritage significance and providing an attractive site for locals and tourists to visit. Parking is also currently an issue in the area and better parking facilities for visitors would be provided.
- Blue Mountains National Park between Medlow Bath and Blackheath, which would experience improved accessibility.

The overall level of significance of impacts would be low due to low sensitivity of social infrastructure during operation of the proposal and low magnitude of impacts.

Commercial operations and businesses

The proposed increase in road capacity and traffic efficiency would benefit commercial operations and businesses near the direct study areas. Tourism businesses are expected to benefit from improved access and connectivity due to the proposal. It is expected that there would be minimal impacts to business patronage due to access changes to Explorers Road. There would also be flow on effects to economic productivity and growth for freight carriers and vehicles travelling on the Great Western Highway and within the broader study area.

The overall level of significance of impacts would be low due to low sensitivity of businesses during operation and low magnitude of the impacts.

Amenity and community values

Community consultation for the proposal identified that the local community values movement and connectivity, especially given high private motor vehicle ownership. The proposal would have positive impacts to all road users by improving movement and reducing congestion as well as by providing access to improved walking and cycling opportunities. These impacts would improve liveability in the socio-economic study area, through reduced time in traffic, reduced frustration from congestion, and access to active transport links. However, the operation of the proposal may result in increased noise within the socio-economic study areas. These impacts are outlined in Section 6.6.4.

Community values of local heritage and amenity would be impacted by the proposal. These impacts include:

- The reduction of natural bushland and changes to the spatial character would impact visual amenity within the Katoomba to Medlow Bath direct study area and northern portion of the Medlow Bath to Blackheath direct study area (refer to Section 6.5.3)
- A sense of cultural and historical loss and impacts to liveability within the socio-economic study area due to heritage impacts to Pulpit Hill and the surrounding environs, during the operation of the Katoomba to Medlow Bath section (refer to Section 6.4.3). However, it is noted that the proposal would include the consolidation and improvement of the Pulpit Hill heritage interpretation area on Nellies Glen Road (refer to Section 3.2.3). The proposal would relocate the Nellies Glen Road intersection, allowing the existing heritage interpretation area to be retained and extended and provide improved visitor parking. This would better connect the individual and separate heritage items associated with Pulpit Hill, to provide a more cohesive Aboriginal and non-Aboriginal interpretation of the area.

The overall level of significance of impacts would be moderate due to high-moderate sensitivity of the community to changes in amenity and values and moderate magnitude of the impacts.

6.8.5 Safeguards and management measures

Safeguards and management measures for socio-economic, property and land use impacts are outlined in Table 6-59. Other safeguards and management measures that would address socio-economic, property and land use impacts are identified in Sections 6.4.4, 6.5.4, 6.6.5, 6.7.5 and 6.9.4.

Table 6-59: Safeguards and management measures – socio-economic, property and land use

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	A Communication Plan (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): • people or organisations to be consulted during the delivery of the proposal • procedures and mechanisms for the regular distribution of information about the proposal • mechanisms to keep relevant stakeholders updated on construction activities, schedules and milestones • avenues for the community to provide feedback (including a 24-hour, toll free proposal information and complaints line) or to register complaints through which Transport will respond to community feedback • a process to resolve complaints and issues raised. The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (Roads and Traffic Authority, 2008).	Contractor	Detailed design / pre-construction	Additional safeguard
Community consultation	Transport will continue to consult with the community until the completion of the proposal. Discussions would include the nature and timing of construction work.	Transport	Pre-construction / construction	Additional safeguard
Property acquisition	Land acquisition will occur in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the *Local Government Act 1993*. Transport will continue to consult with Blue Mountains City Council regarding council owned land and assets. The design for the proposal will also be refined during detailed design to minimise impacts on community land, where possible.	Transport	Pre-construction	Additional safeguard
Amenity	Amenity impacts will be managed through other safeguards for the proposal (including those related to noise and vibration, visual changes, heritage and traffic)	Transport	Pre-construction / construction	Additional safeguard
Changes in access	Temporary and permanent changes in access will be discussed with impacted land occupiers (including Sydney Trains and NPWS) prior to commencement of construction and during construction activities should arrangements change. This includes properties which may be impacted by intersection upgrades at Nellies Glen Road, Explorers Road and Foy Avenue.	Transport	Pre-construction / construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Social infrastructure	Transport will consult with local community groups that use facilities including the walking/ hiking trails throughout construction.	Transport	Pre-construction/ construction	Additional safeguard
Relocation of bus stops	Public transport users will be notified in advance of any changes to bus stop locations through signage at the existing bus stop during construction. Public transport users will also be notified of permanent bus stop relocations. Adequate way finding signage will be installed. Consultation with the relevant bus authorities will be undertaken to mitigate potential impacts to bus routes.	Transport	Pre-construction / construction	Additional safeguard
Traffic management for all road users, including pedestrians and cyclists	Transport will consider opportunities for alternative transport arrangements to provide access for vulnerable community members who would normally access the Great Blue Mountains Trail. Alternative routes for active transport users during construction will be clearly identified by signage and the use of traffic controllers where required.	Transport	Pre-construction / construction	Additional safeguard
Provision of parking	Transport will develop a car parking strategy to inform the operation of upgraded car parking opportunities (including near the Pulpit Hill interpretation area) in conjunction with the Great Western Highway Upgrade – Medlow Bath.	Transport	Detailed design / pre-construction	Additional safeguard

6.9 Aboriginal cultural heritage

This section describes the Aboriginal cultural heritage impacts associated with the proposal. It summarises the findings relevant to the proposal area outlined in the *Great Western Highway Duplication – Katoomba to Lithgow Archaeological Survey Report* (Archaeological Survey Report) (Jacobs, 2020), provided in Appendix K. This report is the Stage 2 *Procedure for Cultural Heritage Consultation and Investigation* (PACHCI) outlined in Section 5.3 prepared for the Great Western Highway Upgrade Program.

6.9.1 Methodology

The Archaeological Survey Report assessed a 37-kilometre section of the Great Western Highway between Katoomba and Lithgow. A 50-metre buffer was applied either side of the proposed road alignment, which is the study area for this assessment. The study area included the Katoomba to Medlow Bath and Medlow Bath to Blackheath sections.

A desktop assessment of the study area was conducted, including:

- a review of the environmental context
- a review of the ethnographic and cultural context
- a search and review of the Aboriginal Heritage Information Management System (AHIMS)
- a review of relevant heritage data from previous archaeological assessments.

Consultation with Aboriginal stakeholders was carried out following the requirements described for Stage 2 of PACHCI. This involved Deerubbin Local Aboriginal Land Council (LALC) providing a cultural heritage survey report to Transport.

The desktop assessment and consultation informed an archaeological survey of the study area. Field walkovers of the area covered by this proposal were conducted with representatives from the Deerubbin LALCs between November 2019 and March 2020. All previously recorded AHIMS sites within the study area were visited, where feasible and property access was granted.

Due to the findings of this assessment within the proposal area (refer to sections 6.9.2 and 6.9.3), no further Aboriginal cultural heritage assessments were carried out as part of the proposal.

6.9.2 Existing environment

Aboriginal cultural heritage context

The study area and surrounding region are known to have been important to and extensively used by Aboriginal people. The proposal occurs on the land of the Dharug people, who spoke different dialects depending on their location. The land near the proposal was known as Muru-Marak or mountain pathway (Attenbrow, 2003). The broader study area spans the Aboriginal language groups of the Gundungurra and Wiradjuri peoples as well.

Aboriginal groups in the Upper Blue Mountains exploited the natural resources near the proposal. The resources of the Macquarie River, hunting of game (such as kangaroos and emus) and native flora were valuable sources of food for Aboriginal people. Stone artefactual material identified within the study area is part of the eastern regional sequence. The sequence consists of artefact types changing their appearance, frequencies of production, and use of different materials through time.

Early interaction between Aboriginals and Europeans was minimal. The first European thought to have entered the Blue Mountains was ex-convict John Wilson, who entered Gundungurra territory in 1792. The crossing of Gregory Blaxland, William Lawson and William Charles of the Blue Mountains in 1813 occurred

near the proposal. Aboriginal people assisted their crossing in accessing food and following pathways normally used by Aboriginal groups to cross the mountains. Interaction became more frequent in the 1800s, substantially increasing after the opening of Coxs Road across the Victoria Pass in 1815.

Aboriginal culture has influenced many aspects of Australian culture, including the names of animals, localities, creeks and rivers and endures to this day across the proposal area. The proposal falls within the Deerubbin Local Aboriginal Land Council (LALC). The Gundungurra Area Agreement (NI2014/001) Indigenous Land Use Agreement also covers part of the proposal area. Members of the Aboriginal community continue to experience connection with the proposal area through cultural and family associations.

A search of the Native Title Tribunal Native Title Vision website was carried out on 12 October 2021, with no Native Title claimants identified in the proposal area.

However, there is a lot which is subject to an Aboriginal land claim (undetermined) (Lot 215 DP751657) within the Katoomba to Medlow Bath section. There is also a lot owned by the Deerubbin LALC, located adjacent to the Medlow Bath to Blackheath section.

Archaeological context

The proposal area follows a narrow ridgeline following a north-south alignment in the Upper Blue Mountains. It comprises Narrabeen Sandstone forming abrupt scarp edges and sandstone outcrops exposed within the dissected sandstone plateau landform pattern.

Predictive modelling of archaeological context identified that there was potential for Aboriginal sites within the proposal area. These sites are listed from most likely to not anticipated and included:

- rockshelters on slopes at valley heads
- pigment rock art within rockshelters
- grinding grooves on sandstone surfaces, most likely dipping into water
- scarred trees
- stone artefact sites
- engraved rock art.

During the archaeological survey, the proposal area was found to be highly disturbed as it is mostly within the existing Great Western Highway road corridor. Previous expansion and realignment of the highway has resulted in major landform modifications. These modifications include cutting into the natural rock and clearance of vegetation near the road corridor. Drainage channels and culverts have disturbed any deposits that may have existed within the road corridor. The northern end of the Katoomba to Medlow Bath section near Foy Avenue and the southern end of the Medlow Bath to Blackheath section near Coachhouse Lane are largely disturbed due to the nearby urban settlement. Little to no areas of the natural land surface are visible.

The comparison of historical aerial photographs from 1973 and 2015 indicates that much of the vegetation occurring along the road corridor is relatively young and largely consists of recent regrowth.

Aboriginal cultural heritage register searches

There were no Aboriginal cultural heritage items identified on the AHIMS database within the proposal area when searched in October 2019. There were also no Aboriginal cultural heritage items identified on the State Heritage Register, Schedule 5 of the *Blue Mountains Local Environment Plan 2015* within the proposal area.

A search of the AHIMS database was carried out in September 2021 for the Woodlands Road, Katoomba ancillary facility. No Aboriginal cultural heritage items were identified within a 50 metre radius of this property.

However, the Greater Blue Mountains Area – Additional Values nationally listed nominated heritage item was identified within the Medlow Bath to Blackheath section on the Australian Heritage Database. As this is not an identified Aboriginal cultural heritage item, this heritage item has been assessed as part of the Statement of Heritage Impact attached to the REF as Appendix F, which is summarised in Section 6.4.

6.9.3 Potential impacts

Construction

Construction would involve ground disturbing activities, such as excavation. If present, these activities would impact Aboriginal cultural heritage items. However, as indicated in section 6.9.2, there are no known Aboriginal cultural heritage items within the proposal area and so no impacts are expected.

Construction of the proposal is not expected to result in any impacts to Aboriginal cultural heritage. As noted in Section 6.9.2, a lot subject to an undetermined Aboriginal land claim would be impacted by the Katoomba to Medlow Bath section. However, Transport would continue to consult with the Deerubbin LALC and Crown Lands during detailed design about the impact to this lot. Part of the Medlow Bath to Blackheath section is adjacent to land owned by the Deerubbin LALC. The proposal would not encroach or otherwise disturb the site.

The high levels of previous ground disturbance within the proposal area reduce the likelihood of the discovery of unexpected Aboriginal cultural heritage items during construction. However, an unexpected finds procedure would be put in place, to assure that any items, if found, are managed.

Operation

The operation of the proposal is not expected to impact on any items of Aboriginal cultural heritage.

Transport is currently engaging with specialist heritage consultants GML Heritage and Balarinji Indigenous Design and Strategy to engage stakeholders in developing a cultural interpretation strategy across the Great Western Highway Upgrade Program – Katoomba to Lithgow. This cultural interpretation strategy would look to interpret both Aboriginal and non-Aboriginal heritage along the highway alignment and recognise the Aboriginal cultural significance of the region. The Pulpit Hill heritage interpretation area would be further developed as part of the Great Western Highway Upgrade Program cultural interpretation strategy, in consultation with the Blue Mountains City Council, Heritage NSW, Aboriginal knowledge holders and the local community.

6.9.4 Safeguards and management measures

Safeguards and management measures for Aboriginal cultural heritage are outlined in Table 6-60.

Table 6-60: Safeguards and management measures – Aboriginal cultural heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the *Procedure for Aboriginal cultural heritage consultation and investigation* (Roads and Maritime, 2011) and *Standard Management Procedure - Unexpected Heritage Items* (Transport for NSW, 2015d) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts 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 Environment Protection*
Aboriginal heritage	*The Standard Management Procedure - Unexpected Heritage Items* (Transport for NSW, 2015d) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*
Aboriginal heritage	Transport will develop a cultural interpretation strategy across the Great Western Highway Upgrade Program. This cultural interpretation strategy will look to interpret both Aboriginal and non-Aboriginal heritage along the highway alignment. The Pulpit Hill heritage interpretation area will be further developed as part of this strategy, in consultation with the Blue Mountains City Council, Heritage NSW, Aboriginal knowledge holders and the local community.	Transport	Detailed design	Additional safeguard

6.10 Other impacts

6.10.1 Existing environment and potential impacts

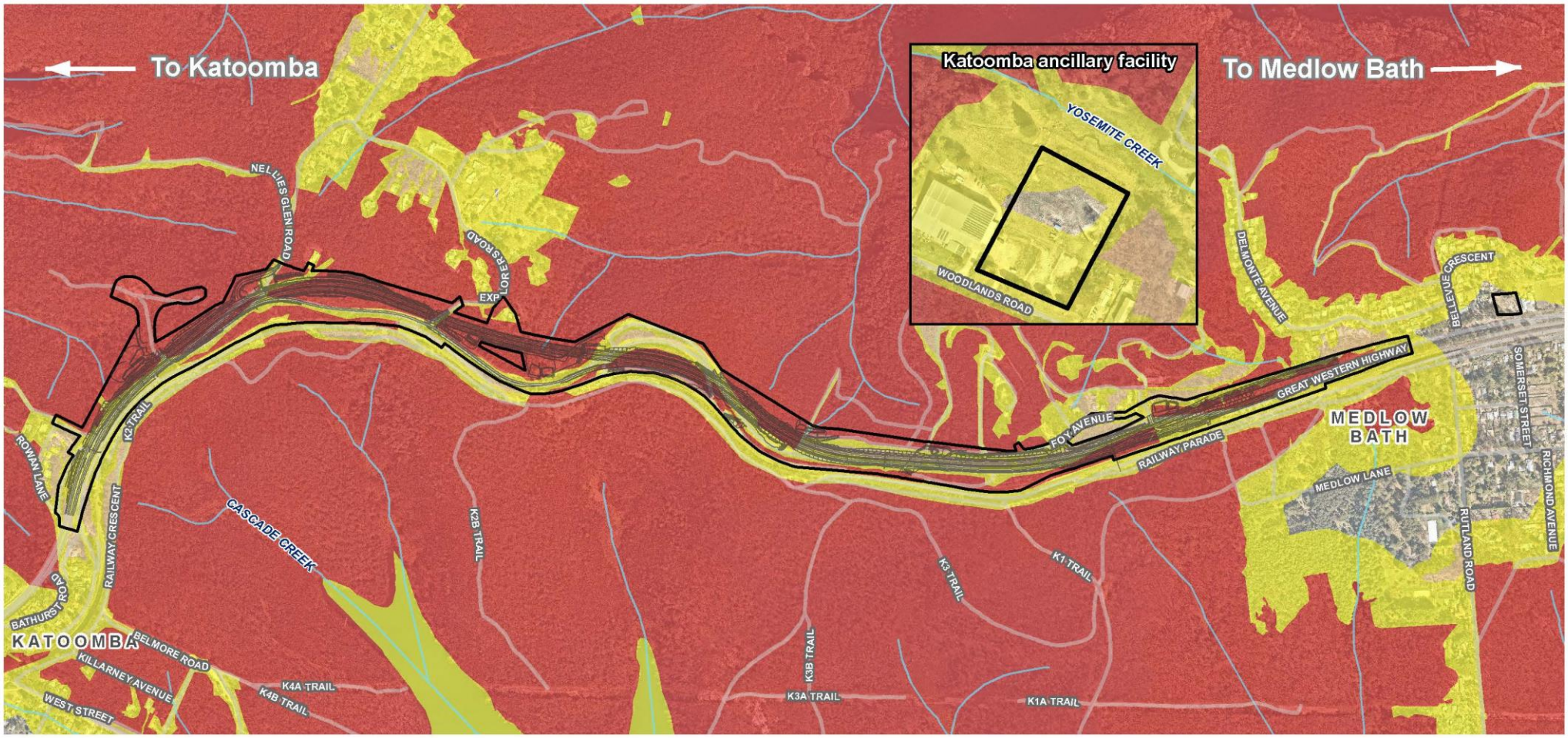
The existing environment and potential impacts of the proposal for other environmental factors are outlined in Table 6-61.

Table 6-61: Existing environment and potential impacts – other impacts

Environmental factor	Existing environment	Potential impacts
Air quality	There are no permanent air quality monitoring stations in the proposal area. However, the closest monitoring station is the Katoomba Air Quality Monitoring Station, which monitored ambient air quality near the proposal between May 2019 and May 2020 as part of the NSW EPA's Blue Mountains and Lithgow Air Watch program. Results from the program showed that the region near the proposal had very good air quality with air pollutants below Australian air quality standards. Local air quality is influenced by emissions and odours from vehicles travelling along the Great Western Highway and local roads, as well as private residences, for example through the emission of woodfire smoke.	During construction, the activities which could generate air emission and dust or odour and impact air quality would include: • clearing of vegetation • stripping, stockpiling and managing of topsoil • building demolition • earthworks, excavation and landscaping • road sub-grade preparation and road pavement work • transport and handling of soil • use of construction vehicles, machinery and plant • spray painting of the road for line marking. These air quality impacts have potential to impact surrounding residential receivers and construction workers. However, impacts would be localised and largely be dependent on daily weather conditions. During operation, air quality is not expected to worsen compared to the existing scenario. The upgraded Great Western Highway would have a higher capacity than the existing road corridor, which could result in increased traffic use and emissions. However, the proposal would result in reduced congestion, which should result in reduced vehicle emissions, even with an increase in traffic volumes. In addition, the impacts on air quality in relation to the clearance of vegetation would be partially offset through revegetation work. Implementation of Transport's *Future Transport 2056 Strategy* and *Future Energy Action Plan 2020-2025* as part of the proposal would result in long-term improvements in air quality. These policies contribute to the NSW Government Climate Change Policy Framework's goal of net zero emissions by 2050. The successful implementation of the Action Plan and achieving the objectives and targets of the overarching Policy and Strategy would likely improve air quality in and around the proposal area in the long-term.

Environmental factor	Existing environment	Potential impacts
Bushfire hazard and risk management	The proposal area is surrounded by highly vegetated landscapes, including public land as well as vegetated private properties. To the west of the proposal area, there is a steep densely vegetated escarpment overlooking Megalong Valley. To the east of the proposal area is the Blue Mountains National Park. Bushfire prone land near the proposal area is shown in Figure 6-15a-b. The existing road corridor is mostly categorised as a bushfire buffer zone. Surrounding vegetation is identified as being mostly Category 1 high risk bushfire prone land and otherwise Category 2 low risk bushfire prone land. This is due to the proposal area's setting surrounded by mature vegetation and steep topography. During the summer 2019-2020 bushfire season, about 79 per cent, or 855,310 hectares of the Greater Blue Mountains World Heritage Area, was burnt (Smith, 2021). While these bushfires did not occur within the proposal area, on 21 December 2019, the Great Western Highway was closed between Katoomba and Hartley between 2.45pm and 5.30pm due to the bushfire risk. As such, the risk of bushfires which impact the proposal area is present and ongoing danger.	Construction activities that may increase bushfire risk during construction include mulch stockpiling, hot work such as welding, as well as fuel/chemical storage and plant operation near densely vegetated areas. Any disruption to access along the Great Western Highway during construction could impact the safety of the community who might need to evacuate along the road corridor during a bushfire emergency. However, as noted in Section 3.3.8, the road corridor would remain operational during construction, with only minor delays expected. During a bushfire emergency, work would stop on the Great Western Highway, which would further reduce the potential delays due to construction work experienced by residents evacuating along the road corridor. Once operational, the proposal would improve the resilience of the Great Western Highway and surrounding community to respond to natural disasters and traffic incidents. The proposal would widen the road corridor and increase the width of the buffer zone which exists across the road. Trees would be cleared where appropriate to maintain required driver sight lines. Where the Great Western Highway adjoins the rail corridor, the buffer zone would increase to a width of about 75 metres. This would improve the likelihood of the Great Western Highway remaining trafficable during bushfire periods. The proposal would also improve emergency access to the communities of Katoomba, Medlow Bath and Blackheath. The new second, separated carriageway would allow contraflow if one carriageway is required to close due to a bushfire (as was the case in the summer 2019-2020 bushfires). The proposal would also increase capacity of the road network in the event of an emergency.
Spoil, waste and resource management	The resource management hierarchy principles in order of priority as outlined in the *Waste Avoidance and Resource Recovery Act 2001* would be applied to the proposal. These are: • avoidance of unnecessary resource consumption • resource recovery (including reuse, reprocessing, recycling and energy recovery) • disposal. By adopting the above principles, Transport encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development.	During construction, the proposal would require a number of resources including road base, concrete, steel and landscaping materials. Details of the materials and estimated volumes are provided in Section 3.3.7. Waste generated during construction would be mostly located at ancillary facilities. Waste sources may include: • residual road and building materials including concrete, asphalt and aggregate • packing materials including pallets, crates, plastics • domestic garbage including food waste and general site waste and litter • wastewater from facilities, vehicle wash down and dust suppression • residual chemical including oils, lubricants, waste fuels and batteries • green waste including timber, vegetation and weeds • hazardous waste including asbestos, oils, lubricants, waste fuels and batteries.

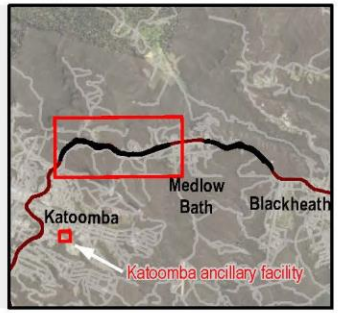
Environmental factor	Existing environment	Potential impacts
		There would be about 333,000 cubic metres of cut material due to the proposal. The Katoomba to Medlow Bath section would have about 272,000 cubic metres and Medlow Bath to Blackheath section would have 61,000 cubic metres. The Medlow Bath to Blackheath section would reuse all the cut material generated and would use an additional 63,000 cubic metres from the Katoomba to Medlow Bath section. There would be an excess of 111,000 cubic metres in cut material from Katoomba to Medlow Bath section. Where possible, this excess material would be used for landscaping in the section; otherwise it would be disposed of at an off-site waste facility. Inappropriately managed waste has the potential to result in impacts to air quality, human health, water quality contamination and visual impacts which are details in the relevant sections. Waste would be reused and recycled on site where possible, however surplus or contaminated material would be classified and disposed of at a licensed waste facility in accordance with EPA Waste Classification Guidelines (NSW EPA, 2014). During operation, waste sources would likely include: • roadside litter • waste material associated with roadside maintenance • green waste from landscape maintenance • illegal dumping.



The design
Proposal area

NSW bushfire prone land

Vegetation Category 1
Vegetation Category 2
Vegetation Category 3
Vegetation Buffer



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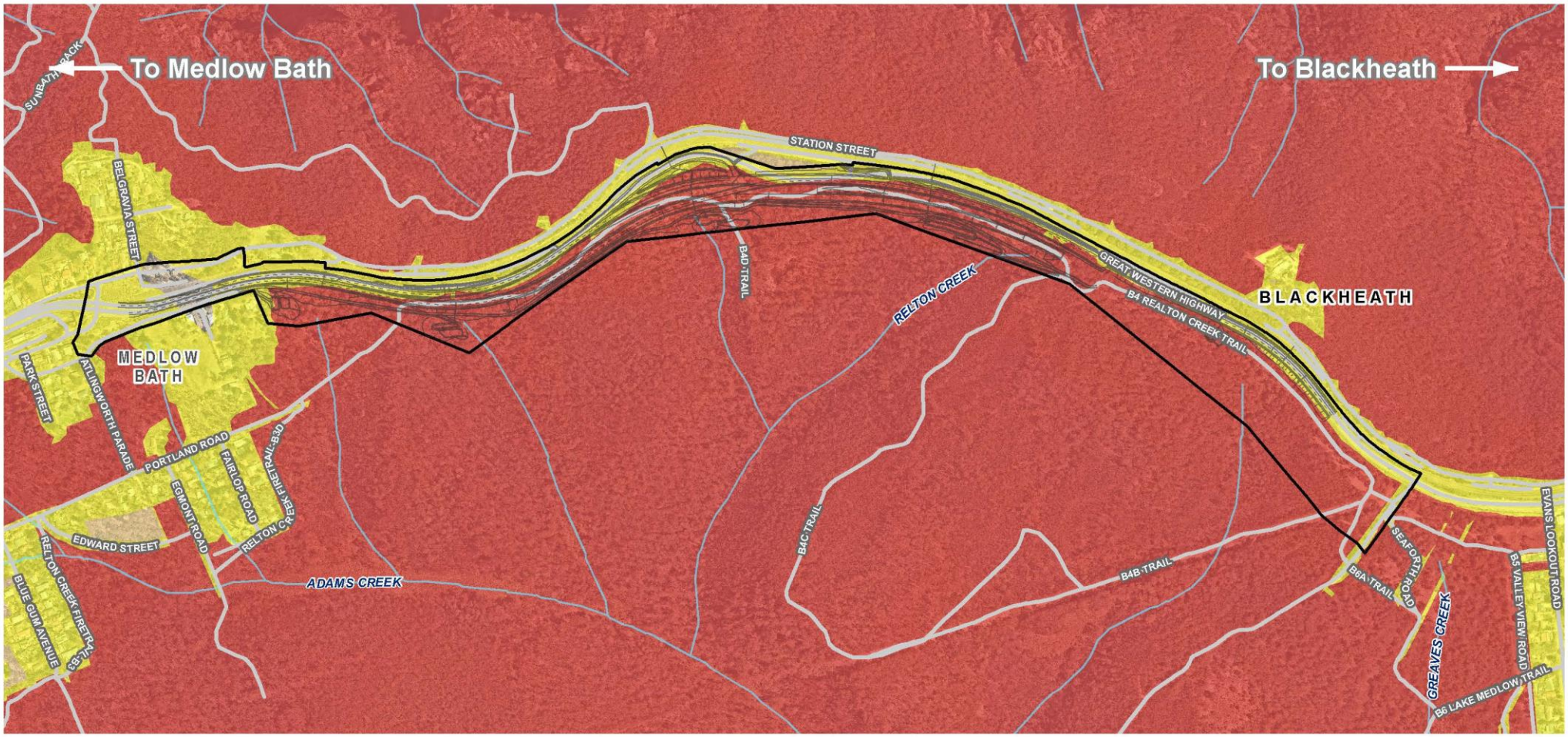
Source: Aurecon, Mott MacDonald, LPI, Nearmap, RFS

1:13,500@A4
0 150 300m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

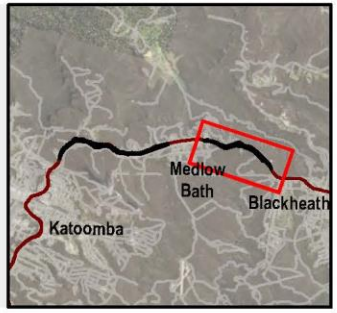
FIGURE 6-15a: Bushfire prone land map



The design
Proposal area

NSW bushfire prone land

Vegetation Category 1
Vegetation Category 2
Vegetation Category 3
Vegetation Buffer



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Source: Aurecon, Mott MacDonald, LPI, Nearmap, RFS

1:10,000@A4
0 100 200m

Projection: GDA2020 MGA Zone 56

Great Western Highway East **Review of Environmental Factors**

FIGURE 6-15b: Bushfire prone land

6.10.2 Safeguards and management measures

Safeguards and management measures for other impacts are outlined in Table 6-62.

Table 6-62: Safeguards and management measures – other impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	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: • potential sources of air pollution • air quality management objectives consistent with any relevant published EPA and/or Energy, Environment and Science (EES)/Department of Planning, Industry and Environment guidelines • mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces.	Transport / Contractor	Detailed design / pre-construction	Section 4.4 of QA G36 Environment Protection
Waste and resource management	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: • measures to avoid and minimise waste associated with the project • classification of wastes and management options (re-use, recycle, stockpile, disposal) • statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • procedures for storage, transport and disposal of spoil and waste • monitoring, record keeping and reporting. The WMP will be prepared taking into account the *Environmental Procedure - Management of Wastes on Roads and Maritime Services Land* (Roads and Maritime, 2014) and relevant Transport for NSW Waste Fact Sheets.	Transport / Contractor	Detailed design / pre-construction	Section 4.2 of QA G36 Environment Protection
Waste and resource management	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 Roads and Maritime Technical Procedure: Mulch Management	Transport / Contractor	Detailed design / pre-construction	Additional Safeguard
Waste and resource management	Recycling facilities will be provided at site compounds for recycling paper, plastic, glass and other re-useable materials. Liquid wastes, such as paints and solvents, will be disposed of in accordance with the Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009) and the POEO Act.	Transport / Contractor	Detailed design / pre-construction	Additional Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Bushfire hazards and risk management	The CEMP will include a bushfire management plan prepared in accordance with Planning for Bush Fire Protection 2019 (NSW Rural Fire Service, 2019). Measures to be implemented to manage bushfire risk include: • monitoring of weather and local bushfire ratings • consultation requirements for community notifications in the event of a bushfire • maintaining equipment in good working order • ensuring plant and equipment are fitted with appropriate spark arrestors, where practicable • ensuring site workers are informed of the site rules including designated smoking areas and putting rubbish in designated bins. • obtaining hot work permits and implementing total fire bans as required • implementing adequate storage and handling requirements for potentially flammable substances in accordance with the relevant guidelines.	Contractor	Pre-construction / construction	Additional Safeguard
Bushfire hazards and risk management	Consultation with emergency services, including the Rural Fire Service and Fire and Rescue NSW to: • ensure emergency access is maintained during construction • co-ordinate any bush fire emergency actions as outlined in the project's Bushfire Management Plan.	Contractor	Construction	Additional Safeguard

6.11 Cumulative impacts

This section discusses the potential cumulative impacts that may arise as a result of the construction and operation of the proposal and the combined impacts of this and other projects near the proposal. The cumulative impacts relate to both the individual environmental and social impacts of the proposal as well as the combined effects of this and other proposals that form part of the Great Western Highway Upgrade Program.

6.11.1 Study area

The cumulative impact assessment has considered other projects and developments in the Blue Mountains region near the Great Western Highway. It has considered projects which would be under construction at the same time as, or close to, the proposal.

6.11.2 Broader program of work

The proposal is part of the Great Western Highway Upgrade Program, which is an infrastructure program of national importance. The NSW Government has progressively upgraded sections of the Great Western Highway to make it safer and more reliable for all road users. The broader program would complete the final 34-kilometre connection of a modern dual-carriageway link across the Blue Mountains.

The Great Western Highway Upgrade Program consists of four projects, which are:

- Great Western Highway East – Katoomba to Blackheath (Katoomba to Blackheath Upgrade, this proposal). Refer to Section 3.2.3 for details on the proposal.
- Great Western Highway Upgrade – Medlow Bath (Medlow Bath Upgrade). This project involves upgrading and duplicating the existing surface road corridor with intersection improvements and a new pedestrian bridge. The western end of the Katoomba to Medlow Bath section of this proposal would tie in to the eastern end of this project. The REF for this project was exhibited for consultation between July and September 2021, with construction beginning late 2022.
- Great Western Highway Blackheath to Little Hartley (Blackheath to Little Hartley Upgrade). This project involves the construction of a tunnel bypass of Blackheath and Mount Victoria, with connectivity between the two proposed tunnels currently under further investigation. The western end of the Medlow Bath to Blackheath section of this proposal would tie in to the eastern end of this project. It is anticipated that the Environmental Impact Statement would be exhibited for consultation mid-2022.
- Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) (Little Hartley to Lithgow Upgrade). This project involves upgrading, duplicating and widening the existing surface road corridor, with connections to a tunnel portal at Little Hartley. The REF for this project was exhibited for feedback from 23 November 2021 to 16 January 2022.

These four projects would be constructed at similar times and consecutively geographically. They have the potential to result in cumulative impacts to local communities as well as road users throughout the Blue Mountains area.

This cumulative impact assessment has considered those projects that have progressed sufficiently enough to understand the impacts of each project. These projects are all in the planning stage, however only the Medlow Bath Upgrade and Little Hartley to Lithgow Upgrade have assessed the environmental impacts of the projects so that they could be considered as part of this cumulative impact assessment.

Transport (Sydney Trains) is also replacing and relocating the Medlow Bath West Sectioning Hut which is at the end of asset life. The sectioning hut is located within the Medlow Bath to Blackheath section of this proposal. This work is being assessed through a separate Minor Works REF.

6.11.3 Other projects and developments

The other projects and developments which have been identified as relevant when considering the cumulative impacts of the proposal are outlined in Table 6-63. The Blackheath to Little Hartley Upgrade has not progressed sufficiently to understand the impacts of the project. Cumulative impacts of this project would be considered at a later stage as part of its own environmental assessment.

Table 6-63: Relevant future projects

Project	Construction impacts	Operational impacts
Great Western Highway Upgrade – Medlow Bath • Upgrade of the Great Western Highway from two lanes to four lanes in Medlow Bath • Construction expected to commence in 2022, pending planning approval	Construction impacts of this project include: • temporary delays to motorists and increased construction traffic • change in pedestrian and cyclist access through Medlow Bath • bus service delays • temporary localised air quality, noise and vibration and visual amenity impacts due to construction work • physical impact to non-Aboriginal heritage items.	Operational impacts of this project include: • improved traffic flows and road safety through Medlow Bath • provision of new public transport and active transport facilities through Medlow Bath • capacity for larger freight vehicles to use the Great Western Highway, reducing the number of heavy vehicles. • visual impacts to the mountain village from the duplication of the highway and the new pedestrian bridge.
Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) • Upgrade of the Great Western Highway from two lanes to four lanes between Little Hartley and Lithgow • Construction expected to commence in 2022, pending planning approval	Construction impacts of this project include: • removal of 75.19 ha of native PCT vegetation and 215.32 ha of non-PCT vegetation • minor increases in traffic volumes due to construction traffic • localised noise and vibration impacts to sensitive receivers and structures, including from blasting near River Lett Hill • direct and indirect impacts to Aboriginal heritage sites • direct and indirect impacts to non-Aboriginal heritage items, including major impacts to one listed heritage item and three unlisted heritage items • acquisition of private and public land • temporary local visual amenity impacts from light spill during night work and vegetation clearing.	Operational impacts of this project include: • improved safety and road network performance between Little Hartley and Lithgow, with an expected 57 per cent reduction of the total crash rate on this section of the Great Western Highway • reduced pollutant loads compared to existing conditions, resulting in a beneficial effect on water quality • increased localised flooding near River Lett and Rosedale Creek • increased road traffic noise levels for sensitive receivers due to the revised alignment of the Great Western Highway • long term positive impacts on access and connectivity between the Central West, Blue Mountains and Sydney • safer access and enhanced amenity for residents and businesses within the Little Hartley Village • provision of an upgraded active transport network.

Project	Construction impacts	Operational impacts
Medlow Bath West Sectioning Hut • Construction expected to be complete by 2023	Construction impacts of this project include: • localised noise and vibration impacts to sensitive receivers near Coachhouse Lane, Belgravia Street, Kanimbla Street and Station Street, Medlow Bath • minor native and non-native vegetation removal, including up to 0.47 ha of low condition PCT 1248 (native vegetation) and up to 0.12 ha of non-native vegetation • increased construction traffic and temporary traffic detours.	Operational impacts of this project include noise impacts from use of a temporary generator during maintenance periods and increased visual dominance of the rail corridor and infrastructure for motorists and pedestrians using Station Street.

6.11.4 Potential impacts

The potential cumulative impacts of the proposal and other nearby projects have been assessed during the period of construction and within 10 years of opening of the proposal, where sufficient information on impacts is publicly available.

Traffic and transport

Construction of the proposal would partially overlap with the construction of the Medlow Bath Upgrade and would be constructed simultaneously with the Little Hartley to Lithgow Upgrade. Concurrent construction work between the projects near Medlow Bath would be staged to minimise concurrent traffic impacts through Medlow Bath and between Katoomba and Blackheath. The proposal has been developed to enable the continual operation of the highway by maintaining traffic flow in line with the existing conditions during construction.

The Great Western Highway between Katoomba and Lithgow and the broader Blue Mountains road network may experience some traffic fatigue between 2023 and 2027 during construction of these projects. Motorists travelling along the Great Western Highway between Katoomba and Lithgow would be most affected by these ongoing disruptions. There would be localised traffic disruptions such as short-term stoppages, traffic switches and incident response during construction along this length of the highway. Access to ancillary facilities and work sites would be in discrete locations that may cause traffic delays through the proposal area and cause frustration for motorists, pedestrians or cyclists. These delays would be most noticeable on weekends and during peak holiday periods, when the Great Western Highway is known to experience higher traffic volumes.

The Blackheath to Little Hartley Upgrade would still be under construction once the other projects within the Great Western Highway Upgrade Program are operational. This may see additional construction vehicles and heavy machinery travelling along the highway until construction of this project is completed.

Once all projects within the Great Western Highway Upgrade Program are operational, there would be positive cumulative impacts associated with improved travel time, safety, freight efficiency, resilience and reduced congestion along the road corridor between Katoomba and Lithgow. The Great Western Highway Upgrade Program would deliver more efficient and reliable journeys for those travelling in, around and through the Blue Mountains, and better connect communities in the Central West.

Transport would also seek to maintain and enhance active transport opportunities along the length of the Great Western Highway Upgrade Program, with these benefits to be realised once construction of the program is complete.

Surface water, groundwater and flooding

Potential impacts to surface water for these projects would be relatively confined to particular catchments, but if not managed appropriately would affect water quality and sensitive receiving environments more broadly in the Blue Mountains area.

Of particular concern would be any downstream impacts to the Blue Mountains National Park and the Special Catchment Areas. The Medlow Bath Upgrade would result in a beneficial effect on surface water quality through an operational water quality treatment process involving the installation of an onsite stormwater detention basin. This process is designed to remove gross pollutants and reduce residual pollutants from surface water runoff from the Great Western Highway. This would minimise the potential for cumulative contamination of surface water sources due to this project and the proposal.

The Little Hartley to Lithgow Upgrade is also expected to result in reduced pollutant loads and a beneficial effect on surface water quality compared to existing conditions through cross and longitudinal drainage and permanent dry biofiltration basins. Cumulative impacts associated with surface water and flooding between this project and the proposal are not expected.

Localised flooding impacts associated with the Medlow Bath Upgrade would be minimised through drainage upgrades. The potential for cumulative impacts between this project and the proposal are anticipated to be minor. These cumulative impacts have been minimised by considering the section of the Medlow Bath Upgrade that drains towards Foy Avenue in the drainage and water quality design for this proposal.

Blockage or diversion of local drainage lines during construction could result in localised flooding upstream of work. This could carry additional contaminants into receiving watercourses, resulting in minor and localised impacts. Across all projects, Transport would appropriately manage runoff from construction in accordance with industry best practice.

The Great Western Highway Upgrade Program would result in a cumulative increase to existing impervious areas and horizontal/vertical alignments along the upgraded road corridor. At present, there is minimal piped infrastructure. This would increase the volume and flow of surface water into receiving catchments and reduce the rate of recharge of groundwater. Changes in stormwater and groundwater interactions may also cause an increase in groundwater and soil salinity.

However, the proposed design for the Great Western Highway Upgrade Program includes provision for capture of surface runoff with a large pit and pipe network and lead to a minimal impact on the receiving surface water sources. This would result in an improvement along the entire Great Western Highway road corridor between Katoomba and Lithgow compared to the existing scenario. Transport would continue to work with Blue Mountains City Council, Lithgow City Council and Water NSW to develop a water quality strategy across the upgrade program to improve water runoff from the highway.

Heritage

The Great Western Highway Upgrade Program would result in impacts to both Aboriginal and non-Aboriginal heritage items between Katoomba and Lithgow. The entire Blue Mountains region has a high level of Aboriginal and non-Aboriginal cultural significance. This includes a high number of heritage items connected with European exploration of the region near the road corridor as well as Aboriginal objects, sites, and places including those registered on AHIMS.

The Great Western Highway Upgrade Program would generate positive outcomes for both non-Aboriginal and Aboriginal heritage values in the Blue Mountains. Transport is currently engaging with specialist heritage consultants and stakeholders to develop a heritage interpretation strategy across the Great Western Highway Upgrade Program – Katoomba to Lithgow. This heritage interpretation strategy would look to interpret both Aboriginal and non-Aboriginal heritage along the highway alignment.

Non-Aboriginal heritage

The Medlow Bath Upgrade would impact non-Aboriginal heritage items including those near Medlow Bath Railway Station, Avenue of Trees and Bellevue Crescent. The project has also avoided impact to other heritage items through the village of Medlow Bath.

The Little Hartley to Lithgow Upgrade would impact listed and unlisted heritage items, including major impacts to four items (including one locally listed heritage item) and moderate impacts to four items (including two State and one locally listed heritage items).

Cumulatively, the Great Western Highway Upgrade Program would result in impacts to multiple individual non-Aboriginal heritage items between Katoomba and Lithgow. However, each project has avoided, minimised or mitigated impacts to these items where possible. Impacts to non-Aboriginal heritage across all projects are not significant when considered cumulatively.

Aboriginal cultural heritage

An Aboriginal Cultural Heritage Assessment Report (Transport, 2021c) has been carried out for the Great Western Highway Upgrade Program.

No AHIMS records have been identified near the proposal or the Medlow Bath Upgrade. The study areas for these projects are highly modified as a result of previous development of the existing Great Western Highway and associated infrastructure and the townships of Medlow Bath and Blackheath. The high levels of previous ground disturbance within these study areas reduces the likelihood of the discovery of unexpected Aboriginal cultural heritage items during construction.

The project area for the entire Great Western Highway Upgrade Program (inclusive of adjacent sites) contains a total of 25 Aboriginal sites. The overall significance of these Aboriginal sites falls within a range of low to high. These have been identified near the Blackheath to Little Hartley Upgrade and Little Hartley to Lithgow Upgrade. These sites located near the Great Western Highway are of increased significance due to their rarity in an increasingly developed environment. Any impact to these sites during construction of each project would minimise the broader cumulative Aboriginal cultural heritage impacts of the Great Western Highway Upgrade Program.

Biodiversity

Residential and infrastructure development near the Great Western Highway (particularly between Mt Victoria and Lithgow) in historic and recent times has led to extensive vegetation clearing near the identified projects. In some areas, remaining remnant vegetation and habitat has also been affected by a variety of disturbance mechanisms, including clearing of undergrowth, altered fire regimes, feral animals and weed invasion. In other areas, large extents of vegetation remain close to the highway, include remnant bushland that wraps around town development and areas that have regenerated such as around Pulpit Hill.

The Great Western Highway Upgrade Program would result in further vegetation removal. This would result in long-term effects such as habitat fragmentation and some loss of wildlife connectivity corridors in the area. Invasion and further spread of weeds, pests and pathogens, and changes to surface hydrology may occur due to these projects and the associated vegetation removal. The direct biodiversity impacts of the identified projects to native vegetation, where publicly available, are identified in Table 6-64.

Table 6-64: Direct impacts to native vegetation

Plant Community Type (PCT)	Direct impacts to native vegetation (hectares)			
	Katoomba to Blackheath Upgrade (this proposal)	Medlow Bath Upgrade	Medlow Bath West Sectioning Hut	Little Hartley to Lithgow Upgrade
PCT 85 – River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	-	-	-	4.3
PCT 731 – Broad-leaved Peppermint – Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	-	-	-	30.13
PCT 732 – Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	-	-	-	6.42
PCT 963 – Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion	-	-	-	1.2
PCT 967 – Narrow-leaved Peppermint – Silvertop Ash – Mountain Grey Gum shrubby open forest of the upper Blue Mountains, Sydney Basin Bioregion	0.76	-	-	-
PCT 1103 – Ribbon Gum – Yellow Box grassy woodland on undulating terrain of the eastern tablelands; South Eastern Highlands Bioregion	-	-	-	23.42
PCT 1155 – Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion	-	-	-	9.72
PCT 1248 – Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion	46.8	0.34	0.47	-

Most of the vegetation likely to be affected by the proposal is located adjacent to the Great Western Highway and has been subject to historic clearing and edge effects. It is thinned in areas and some areas are dominated by a range of introduced species. This increase is considered unlikely to significantly exacerbate impacts on biodiversity such that the critical threshold would be reached or that there cumulative significant impacts.

The implementation of a biodiversity offset strategy for individual projects within the Great Western Highway Upgrade Program (where required) would mean that offsets are attributed to the relevant projects. As such, further offsets beyond those identified for each project are not required. The significance of impacts and requirement for offset strategies for each project is as follows:

- This proposal is not likely to significantly impact threatened species or ecological communities or their habitats. However, it requires a biodiversity offset strategy due to the area of vegetation impacted under Transport's guidelines. Refer to Section 6.3.5 for details.
- The Medlow Bath Upgrade is not likely to have a significant impact on threatened species, ecological communities and their habitats. Residual impacts are to be minimised and mitigated. As such, a biodiversity offset strategy is not required for this project.
- The Little Hartley to Lithgow Upgrade is likely to have a significant impact on the critically endangered ecological community White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland, listed as critically endangered under the BC Act. A biodiversity offset strategy would be prepared for this project under the BAM.

Indirect impacts on biodiversity from noise, dust, light and contaminant pollution are likely to result from the projects and would likely result in incremental cumulative effects. The environmental safeguards and mitigation measures implemented as part of each project would minimise potential impacts such as appropriate controls to manage dust emission, runoff, spills and leaks during construction.

Even though the Little Hartley to Lithgow Upgrade is likely to have a significant impact on threatened species or ecological communities or their habitats, this finding does not change the non-significant impact finding of this proposal.

As part of the Great Western Highway Upgrade Program, Transport is considering a parcel of land which may be suitable to meet its biodiversity offset requirements as well as provide compensatory land for the national park revocation. This offset land could be protected as part of the Blue Mountains National Park.

Property and land use

The Medlow Bath Upgrade would result in the full acquisition of eight properties and partial acquisition of one property. The Little Hartley to Lithgow Upgrade would result in the full acquisition of 11 properties (including four properties owned by the NPWS) and the partial acquisition of 50 properties. While this proposal would also result in property acquisition, impacts to affected property owners would be localised. This would minimise the potential for any cumulative impacts due to property acquisition.

However, as noted, both this proposal and the Little Hartley to Lithgow Upgrade would impact part of the Blue Mountains National Park. Transport is seeking to revoke the land required for the program.

There could be cumulative impacts to the natural and cultural resources which exist within the national park by reducing its extent. However, the area proposed for revocation is a small part of the entire Blue Mountains National Park and is adjacent to the existing highway, with numerous access trails. Part of the revocation process is providing compensatory lands to the national park being revoked in all areas of the Great Western Highway Upgrade Program. Transport is investigating opportunities for additional land near the Great Western Highway to be gazetted as national park to offset the cumulative impact on national park in the area. This would result in more land in the Blue Mountains region being protected as national park and enhance protection of the natural and cultural resources of the regional landscape. These discussions are ongoing between Transport and NPWS.

Noise

Construction noise impacts from the Medlow Bath Upgrade, the Little Hartley to Lithgow Upgrade and this proposal would be expected to impact some sensitive receivers during construction.

The Little Hartley to Lithgow Upgrade would result in construction noise impacts to receivers, including sparsely distributed rural residential properties and a small number of commercial properties. This project and the proposal are not expected to cause cumulative construction noise impacts due to the length of the project and because the noise impacts would be localised.

The construction of the Medlow Bath Upgrade has been staged to be complete before main construction work commences for this proposal (refer to Section 3.3.2). This is to deliver access improvements in Medlow Bath and limit the amenity impacts of multiple construction projects running in and around Medlow Bath at the same time.

Construction staging would mean that construction work from both projects would not be occurring simultaneously. This would mean that there is no cumulative increase in construction noise levels for sensitive receivers near Coachhouse Lane, Foy Avenue and Delmonte Avenue, Medlow Bath, near the tie-in of the proposal with the Medlow Bath Upgrade. However, there may be some sensitive receivers in these areas who may also experience noise impacts over a longer duration due to the projects. However, the impacts would not be for the full construction period of the proposal and the Medlow Bath Upgrade.

Transport would work with eligible receivers to provide appropriate mitigation, including respite periods where feasible.

There would also be cumulative operational noise impacts on some receivers in these areas. The noise and vibration assessment carried out for this proposal identified two sensitive receivers as being eligible for at-property treatment which were also identified as part of the Medlow Bath Upgrade. These cumulative noise impacts would be considered when determining noise mitigations for individual receivers. Transport would also make sure that noise impacts are treated consistently across all projects within the Great Western Highway Upgrade Program.

Landscape character and visual impact

Construction work for the Great Western Highway Upgrade Program would be linear, and as such, static receivers such as townships or receivers would experience limited cumulative landscape character and visual impacts. Medlow Bath residents who travel regularly to Katoomba or Blackheath would be exposed to the visual impacts of the proposal, the Medlow Bath West Sectioning Hut project and the Medlow Bath Upgrade. These future projects would have localised visual impacts in the township.

The largest cumulative visual impacts from the upgrade program would be motorists and active transport users travelling along the Great Western Highway beyond one project area.

There would be a change in landscape character between Katoomba and Lithgow due to the entire Great Western Highway Upgrade Program. The removal of vegetation and widening of the Great Western Highway road corridor from one to two lanes in each direction would lead to cumulative operational visual impacts. This would be most noticeable for motorists travelling the length of the upgraded highway. However, the Great Western Highway Upgrade Program has applied a consistent urban design framework across all projects. The design of the Medlow Bath Upgrade is an integrated design that fits with the existing visual qualities, ecology and character of Medlow Bath and the Blue Mountains. This proposal has also considered the urban design and visual impacts on the township of Medlow Bath. The design of the Little Hartley to Lithgow Upgrade integrates the project within the surrounding rural landscape and minimises the visual impact of the proposal.

The application of the consistent urban design strategy would minimise the potential for inconsistent landscape character impacts along the upgraded road corridor between Katoomba and Lithgow.

Socio-economic

Some residents of the Blue Mountains community may be impacted by consultation for and construction of multiple upgrades within the Great Western Highway Upgrade Program. This may lead to consultation and construction fatigue for local communities and stakeholders, with construction of these projects spanning from 2023 to 2027.

Cumulative impacts from construction would be in the form of reduced amenity and disruptions for road users during the construction of the Medlow Bath Upgrade, Little Hartley to Lithgow Upgrade and this proposal. There would be air quality, noise and visual impacts which could impact on the health and wellbeing of sensitive receivers who live near the Great Western Highway between Katoomba and Lithgow. These impacts would also be experienced by active transport users travelling between Katoomba and Blackheath along the existing active transport network. While the Medlow Bath Upgrade may be completed prior to the main construction work of this proposal, there would be extended impacts along the road corridor beyond the length of one of the projects. However, due to the linear nature of the projects, impacts at any one location would be localised for only part of each project's construction period. Transport would manage the staging of construction of the Great Western Highway Upgrade Program to minimise these impacts on receivers.

Cumulatively, the projects within the Great Western Highway Upgrade Program would improve connection to social infrastructure and provide new active transport opportunities along the Great Western Highway. There would be long term positive impacts on access and connectivity for local and regional communities, business and industry. The projects would improve resilience for local traffic movements, including during peak travel periods and emergencies. The Medlow Bath Upgrade would provide better east/west connectivity for residents, visitors and recreation users on the proposed shared user path. This would enhance the tourism reputation of the town of Medlow Bath and broader Blue Mountains area. The Little Hartley to Lithgow Upgrade also includes provision for the future development of shared paths near that project. These features would also provide wellbeing benefits to residents and visitors, who would be more easily able to access recreational sites in the region.

Significance of impacts

The impact of this proposal, when considered cumulatively with other projects, would not increase to the extent that would change a non-significant impact (identified in Sections 6.1 to 0) to a significant impact. For biodiversity, the significant impact from Little Hartley to Lithgow Upgrade due to TEC impacts would not result in a cumulatively larger impact or change the impacts of this proposal to be significant. As such, there would not be significant cumulative assessed impacts of the Great Western Highway Upgrade Program.

Overall, a number of positive cumulative impacts would occur across the Great Western Highway Upgrade Program through completion of upgrades to the last section of the Great Western Highway (between Sydney and Lithgow). This would result in improved:

- resilience and emergency management conditions
- connectivity for all road users along and across the corridor
- active transport links
- consistency of travel conditions
- network efficiency and freight productivity
- safety for all road users
- quality of surface water run off to the surrounding environment
- local amenity through heritage interpretation.

6.11.5 Safeguards and management measures

Safeguards and management measures for cumulative impacts are outlined in Table 6-65.

Table 6-65: Safeguards and management measures – cumulative impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impacts	Ongoing consultation will be carried out between proponents and construction contractors of nearby projects to identify the potential for cumulative impacts to occur should construction occur concurrently with the proposal.	Transport / Contractor	Detailed design / Pre-construction / Construction	Additional safeguard
Cumulative impacts	Co-ordination of traffic management controls will be considered to minimise cumulative traffic impacts, particularly during peak holiday periods.	Transport / Contractor	Detailed design / Pre-construction / Construction	Additional safeguard
Cumulative impacts	Co-ordination of out of hours work will be considered across the Great Western Highway East – Katoomba to Blackheath and the Great Western Highway Upgrade – Medlow Bath in Medlow Bath to minimise out of hours work periods and minimise ongoing out of hours work noise to sensitive receivers and ensure respite periods are achieved where required.	Transport / Contractor	Detailed design / Pre-construction / Construction	Additional safeguard

7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer, prior to the commencement of any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the [adjust as necessary: 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 will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed 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 impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following: • any requirements associated with statutory approvals • details of how the project will implement the identified safeguards outlined in the REF • issue-specific environmental management plans • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • procedures for emergency and incident management • procedures for audit and review. • The endorsed CEMP will be implemented during the undertaking of the activity.	Contractor / Transport for NSW project manager	Pre-construction / detailed design	Additional 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 prior to commencement of the activity.	Contractor / Transport project manager	Pre-construction	Standard safeguard
GEN3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include*:* • areas of non-Aboriginal heritage sensitivity	Contractor / Transport project manager	Pre-construction / detailed design	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• threatened species habitat • adjoining residential areas requiring particular noise management measures • Blue Mountains National Park boundary protocols.			
GEN4	General – Blue Mountains National Park	A Blue Mountains National Park Management Framework will be prepared to collate and manage potential impacts to the national park. As a minimum the strategy will: • ensure demarcation of the national park boundary • outline water quality controls to be implemented during construction (refer to the Erosion and Sedimentation Control Plans (ESCP) prepared for the proposal) • identify requirements for ongoing management of stormwater runoff through operational water quality controls • apply tree protection protocols on the national park interface in accordance with *Australian Standard 4970-2009 Protection of Trees on Development Sites* • establish hygiene protocols for machinery, vehicles, equipment and materials working near the national park boundary to avoid introduction of any pests or diseases • require access to be maintained to the adjoining national park entry roads and management trails • inform communication between Transport and the NSW National Parks and Wildlife Service, including notice periods for construction work and notices of park access closure • identify additional risks to the national park and opportunities to maintain the conservation values of the national park during construction and operation of the proposal.	Contractor / Transport	Detailed design / Pre-construction / Construction	
Surface water and groundwater					
SGW1	Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will: • identify all reasonably foreseeable risks relating to soil erosion and water pollution, including runoff and the design and construction of waterway crossings • describe how these risks will be addressed during construction • include a construction surface water quality monitoring plan prepared in accordance with the Guideline for Construction Water Quality (Transport, n.d.) and Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (NSW EPA, 2004) • include a construction groundwater monitoring plan, which will provide information on groundwater conditions for design, construction and operation of water quality basins and enable monitor pollution originating from the stormwater seeping into the groundwater	Contractor	Detailed design / pre-construction	Section 2.1 of QA *G38 Soil and Water Management*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The Soil and Water Management Plan (SWMP) will be reviewed by a soil conservationist on the Transport for NSW list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP will then be revised to address the outcomes of the review.			
SGW2	Soil and water	The preliminary Erosion and Sedimentation Management Plan (ESMR) and Erosion and Sedimentation Control Plans (ESCP) produced for the proposal (Appendix D to the REF) will be updated during the detailed design phase to confirm the erosion and sedimentation controls for both sections of the proposal, including the construction of progressive ESCPs and the continual updating of these plans.	Transport / Contractor	Detailed design / Pre-construction	Section 2.2 of QA *G38 Soil and Water Management*
SGW3	Soil and water	An assessment of construction sediment basin discharges will be prepared during detailed design to assess the appropriate water quality limits for sediment basin discharges and ensure consistency with the Water Quality Objectives for this location or agreed upon guideline values in consultation with Blue Mountains City Council.	Transport	Detailed design	Additional safeguard
SGW4	Soil and water	An assessment to determine appropriate water quality limits for sediment basin discharges will be undertaken as part of detailed design, with reference to the Water Discharge and Reuse Guideline (Transport, 2016b).	Transport	Detailed design	Additional safeguard
SGW5	Soil and water	Periodic wet weather monitoring will be undertaken within the tributaries of Back Creek and Megalong Creek (Katoomba to Medlow Bath section) and Relton Creek and Adams Creek (Medlow Bath to Blackheath section) that intercept the proposal and the sedimentation discharge points, before and during construction.	Contractor	Pre-construction / Construction	Additional safeguard
SGW6	Soil and water	Where possible, permanent drainage structures will be installed as early as possible to facilitate effective separation of clean offsite and dirty onsite water.	Contractor	Construction	Additional safeguard
SGW7	Soil and water	The water quality treatment system will be developed further during detailed design in consultation with Water NSW and Blue Mountains City Council. This will include: • layout and detail of the drainage system including outlet design • minimisation of discharge flows should also be minimised in the basin outflows, to limit scouring in the drainage channels • design within and around the waterways • assessment of culverts and stormwater inlets in the local waterways and recommendation for scour protection within the Medlow Bath to Blackheath section.	Transport	Detailed design	Additional safeguard
Soils and contamination					
SC1	Contaminated land	A Contaminated Land Management Plan will be prepared in accordance with the *Guideline for the Management of Contamination* (Transport, 2013a) and implemented as part of the CEMP. The plan will include, but not be limited to:	Contractor	Detailed design / Pre-construction / Construction	Section 4.2 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• capture and management of any surface runoff contaminated by exposure to the contaminated land • further investigations required to determine the extent, concentration and type of contamination • management of the remediation and subsequent validation of the contaminated land, including any certification required • an unexpected finds protocol for incidental potential contamination finds during earthworks (such as illegally dumped wastes and stockpiles) • the work methodology to identify, manage, handle and dispose of any contaminated materials or wastes as part of the work • measures to ensure the safety of site personnel and local communities during construction.			
SC2	Accidental spill	A site-specific emergency spill plan will be developed and include spill management measures in accordance with the Transport for NSW *Code of Practice for Water Management* (Roads and Traffic Authority, 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 Transport for NSW and EPA officers).	Contractor	Detailed design / Pre-construction	Section 4.3 of QA *G36 Environment Protection*
SC3	Contaminated land	Ancillary facility sites that have been historically developed should be subject to intrusive investigations to identify any contaminants of potential concern on the site to assess the suitability of the site and whether activities that would be undertaken on the site will warrant additional controls.	Contractor	Pre-construction / Construction	Additional safeguard
SC4	Contaminated land	Areas of cut material in the proposal area will be assessed through an intrusive investigation to inform a likely waste classification of materials to be excavated (if required), suitability for reuse and/or if offsite disposal is required.	Contractor	Pre-construction / Construction	Additional safeguard
SC5	Waste management	Any spoil produced during the construction phase will be assessed in accordance with the NSW EPA (2014) *Waste Classification Guidelines* and *Resource Recovery Order / Exemption under the Protection of Environment (Waste) Operations Act 2000* to determine necessary waste management practices. The CEMP will include the following hierarchy for reuse, recycling or disposal of spoil produced during construction: • If spoil produced during construction will remain within the Lot and DP from which it was produced, it can be reused if CoPC concentrations are below the applicable NEPM 2013 Tier I screening values for evaluation of potential risk to human health and the environment.	Contractor	Pre-construction / Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Spoil produced during construction can be reused within the Lot and DP boundaries from which it was produced or on another Transport or third party site if it meets the definition of virgin excavated natural material / excavated natural material in accordance with the applicable *Resource Recovery Order / Exemption under the Protection of Environment (Waste) Operations Act 2000*. • Spoil that does not meet either of the above definitions should be transported to an appropriately licenced facility for recycling if all CoPC concentrations are below the NSW EPA (2014) Waste Classification Guidelines contaminant threshold 1 (CT1) values for General Solid Waste. The soil can be recycled at an appropriately licenced facility in accordance with any current Transport contractual arrangements. • If CoPC concentrations are above the CT1 values, the soil waste should be classified per the Waste Classification Guidelines and disposed at an appropriately licenced facility			
SC6	Contaminated land	The risk of potentially impacted soil migrating from the future upgrade work including dust generation and runoff will be minimised utilising standard practices such as dust suppression, and erosion and sedimentation control. These measures along with other measures will be included in the CEMP. Other controls will include proper use of work health and safety equipment and monitoring of work where asbestos or other contamination is identified.	Contractor	Pre-construction / Construction	Additional safeguard
Biodiversity					
B1	Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (Roads and Traffic Authority, 2011a) and implemented as part of the CEMP. It will include, but not be limited to: • plans showing areas to be cleared and areas to be protected, including exclusion zones around the proposal (including a five-metre exclusion zone around the Blue Mountains Swamp TEC), protected habitat features and revegetation areas • requirements set out in the *Landscape Guideline* (Roads and Maritime, 2008) • pre-clearing survey requirements, vegetation removal and habitat removal in line with Transport's vegetation clearance protocol • directions for survey, monitoring and management of key threatened species known or considered to be potentially impacted by the proposal • development of a habitat replacement or nest box strategy • procedures for re-establishment of native vegetation • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013)	Transport / Contractor	Detailed design / pre-construction / construction	Section 4.8 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• commitments relating to threatened species management, pest and weed management, and site hygiene practices.			
B2	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Transport / Contractor	Detailed design / pre-construction	Additional safeguard
B3	Biodiversity	Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the proposed construction boundary. A buffer area of at least five metres will be established between the proposal area and boundary of the swamp. Signposting will be used to inform project personnel and site visitors of areas of conservation value to restrict entry or inform behaviour that will reduce incidental interactions with fauna.	Contractor	Construction	Additional safeguard
B4	Biodiversity	The Needle Geebung (*Persoonia acerosa*) individual identified during field surveys will be translocated prior to construction.	Contractor	Pre-construction	Additional safeguard
B5	Biodiversity	For flora species such as Needle Geebung (*Persoonia acerosa*), seed collection will be carried out in an effort to minimise impacts to the species and aid in re-establishment of individuals within protected areas in the vicinity of the study area. This would form part of the seed collection planned by Transport to occur across the Great Western Highway Upgrade Program.	Contractor	Construction / pre-construction	Additional safeguard
B6	Vehicle strike	Transport will monitor road kills along Great Western Highway before, during and after commencement of the proposal.	Transport / Contractor	Pre-construction / construction / operation	Additional safeguard
B7	Indirect impacts on native vegetation and habitat	Measures to further avoid and minimise the area of direct impact on all native vegetation will be investigated during detailed design and implemented where practicable and feasible, especially in sensitive environments and near the Blue Mountains National Park.	Transport	Detailed design	Additional safeguard
B8	Indirect impacts on native vegetation and habitat	Installation of stormwater/sediment and erosion control mechanisms to prevent sediment or dirty water discharging into the Blue Mountain Swamp TEC.	Contractor	Construction	Additional safeguard
B9	Wildlife connectivity, habitat fragmentation and fauna injury and mortality	A Fauna Connectivity Strategy will be developed for the proposal during detailed design to minimise the impacts of the proposal on connectivity. This will include consideration of: • fauna mitigation measures to provide safe passage across the road • fauna fencing.	Transport	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B10	Changes to hydrology	Changes to existing surface water flows will be minimised during detailed design and mitigated via preparation and implementation of the following: • preparation of progressive Erosion and Sediment Control Plans (ESCPs) and their continual revision and update • preparation of a Storm Water Management Plan and other aspects of the Construction Environment Management Plan to manage water quality impacts during construction of the proposal • preparation of Water Quality Management Plan (surface and groundwater) to describe water quality monitoring before and during construction • design of scour protection at new stormwater outlets and culverts and drainage basins • stormwater drainage design which incorporated a treatment trains and drainage basing to achieve a neutral or beneficial effect on the surrounding waterways.	Transport	Detailed design	Additional safeguard
B11	Fragmentation of identified habitat corridors	Connectivity measures will be implemented in accordance with the *Wildlife Connectivity Guidelines for Road Projects* (Roads and Traffic Authority, 2011c). Any connectivity measures implemented will be installed under the supervision of an experienced ecologist.	Transport / Contractor	Detailed design / pre-construction / construction	Additional safeguard
B12	Invasion and spread of pathogens and disease	• Any excavated earth will be either disposed or reused appropriately with care taken to avoid spreading propagules of weeds or infested soil or plant material. • Correct plant hygiene will be minimised to minimise spread of weeds, Phytophthora and other contaminants, including wash down when moving between weedy and non-weedy parts of the proposal. • All weed material removed during the construction works will be disposed of in a suitable waste facility and not mulched onsite to avoid the reintroduction and further spread of weeds and pathogens in the area.	Contractor	Construction	Additional safeguard
B13	Noise, light and vibration	Shading and artificial light impacts on sensitive areas or areas adjacent to the Blue Mountains National Park will be minimised during detailed design.	Transport	Detailed design	Additional safeguard
B14	Threatened ecological community (TEC)	• During construction, dirty water from the bridge deck would be drained away from the Blue Mountains Swamp TEC and not flow over into the swamp. • pH levels of water in the nearby water quality basins will be monitored near the Blue Mountains Swamp TEC during construction.	Contractor	Construction	Additional safeguard
B15	Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems (e.g. Upland Swamp) will be minimised through detailed design.	Transport	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B16	Biodiversity offsets	Where required, Transport would offset vegetation removal in accordance with the Transport 'Guideline for Biodiversity Offsets' (Roads and Maritime, 2016b). Offsets would be sought for both this proposal and any other projects within the Great Western Highway Upgrade Program for which biodiversity impacts have not separately been offset.	Transport	Detailed design	Additional safeguard
Non-Aboriginal heritage					
NA1	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Transport / Contractor	Detailed design / pre-construction	Section 4.10 of QA *G36 Environment Protection*
NA2	Non-Aboriginal heritage	The *Standard Management Procedure - Unexpected Heritage Items* (Transport, 2015d) 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.	Transport / Contractor	Detailed design / pre-construction	Section 4.10 of QA *G36 Environment Protection*
NA3	Non-Aboriginal heritage	The proposed design will be further refined during detailed design to avoid and/or minimise non-Aboriginal heritage impact. Should detailed design result in changes to non-Aboriginal heritage impacts, this will be re-evaluated at that stage.	Transport	Detailed design	Additional safeguard
NA4	Non-Aboriginal heritage	A Photographic Archival Record of the current state of the Great Western Highway will be prepared prior to the commencement of construction. The archival recording will be submitted to Transport, local historical societies and Blue Mountains City Council.	Contractor	Pre-construction	Additional safeguard
NA5	Greater Blue Mountains Area – Additional Values	Removal of vegetation within the Greater Blue Mountains Area – Additional Values areas will be minimised as much as possible.	Transport	Detailed design	Additional safeguard
NA6	Pulpit Hill and Environs	• A Conservation Management Plan (CMP) will be prepared for Pulpit Hill and Environs to manage the heritage significance of the site and provide for ongoing management. • The proposed concept design will be further refined during detailed design to minimise adverse heritage impact on the Pulpit Hill and Environs curtilage (including Stone Arrangements site) and interpret the heritage significance of this site, including the role the Explorers Tree played as a waypoint. • If it is not possible to completely avoid the Stone Arrangements, then further information will be required to better understand the constraints and significance of the heritage site. This further study will include: – An Historical Archaeology Assessment including a Historical Research Study – An Archaeological Research Design (ARD) for archaeological work – An archaeological test excavation targeting a portion of the Stone Arrangements and a soil analysis of excavated soil to confirm the presence of graves	Transport / Contractor	Detailed design / pre-construction / Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		– Further remote sensing studies to verify previous study results. • The archaeological test excavation will be carried out to confirm whether a permit under Section 140 of the *Heritage Act 1977* will be required for the proposal. • A heritage interpretation strategy for the Pulpit Hill area will be developed to reinterpret the existing heritage interpretation area and communicate the heritage significance of the Pulpit Hill area. This will be integrated with the cultural interpretation strategy for the Great Western Highway Upgrade Program. The existing interpretation area will be retained as much as possible.			
NA7	Bonnie Doon Reserve	Vegetation removal within the Bonnie Doon Reserve curtilage will be limited to as little as needed and unobtrusive as possible.	Transport	Detailed design	Additional safeguard
NA8	Culvert XA6, XA7 and XA7a	A further vibration assessment will be prepared to assess the indirect impacts of the proposal near Culvert XA6, XA7 and XA7a.	Transport	Detailed design	Additional safeguard
NA9	House and Orchards (former Glenara Cottage)	An Historic (non-Aboriginal) Archaeological Assessment (HAA) will be carried out to the determine the nature, extent and significance of any archaeological resources associated with the House and Orchards (former Glenara Cottage) in this area and identify appropriate management measures.	Contractor	Pre-construction	Additional safeguard
NA10	The Pines and The Gatekeeper's Cottage	• A further vibration assessment will be prepared to assess the indirect impacts of the proposal near The Pines and The Gatekeeper's Cottage. • Should detailed design result in changes to the proposal near The Pines and The Gatekeeper's Cottage, visual impacts will be revaluated upon completion of detailed design.	Transport	Detailed design	Additional safeguard
Landscape character and visual impacts					
V1	Landscape character and visual impact	An Urban Design Plan will be prepared to support the final detailed project design and implemented as part of the CEMP. The Urban Design Plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for: • location and identification of existing vegetation and proposed landscaped areas, including species to be used • built elements including retaining walls, bridges and noise walls • pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • fixtures such as seating, lighting, fencing and signs • details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage	Contractor	Detailed design/pre-construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• procedures for monitoring and maintaining landscaped or rehabilitated areas.			
V2	Proposal design	• Rail infrastructure will be screened using shrubs and trees, where possible • Cut and fill batters will be rounded to help integrate into the existing landform and create a more naturalised appearance. • Opportunities to reduce the proposal footprint will be explored during detailed design • Connectivity and access to the existing and proposed heritage interpretation area will be enhanced. • Exposed rock faces will be retained in the rock cuttings	Transport	Detailed design	Additional safeguard
V3	Bridges	• The bridge design and the design of peripheral elements will be refined to reduce its visual impact.	Transport	Detailed design	Additional safeguard
V4	Bicycle and pedestrian	• Cyclist and pedestrian access will be improved through new and upgraded, multi-use access tracks • Visibility of proposed multi-use access tracks and adjoining residential properties will be improved.	Transport	Detailed design	Additional safeguard
V5	Structures	• Design of new retaining walls will have finishes of a high standard and quality that is in keeping with the Great Western Highway character.	Transport	Detailed design	Additional safeguard
V6	Landscape implementation	• Fill batters will be screened where possible using seeding, shrubs and trees, as well as bushland reconstruction techniques. • Buffer planting will be introduced in front of the retaining wall at the southern entry into Medlow Bath to minimise visual impacts. • Bushland reconstruction and bushland seeding will be maximised where possible. • Native and endemic plantings will be used along the highway outside of the village. • Revegetation with appropriate species will be maximised along the highway to reduce perceived corridor width. • The selection of plant species will complement and integrate with the existing environment. • Opportunities for additional tree plantings along the proposal corridor will be investigated.	Transport	Detailed design	Additional safeguard
V7	Construction visual impact	The layout of ancillary facility sites will be designed to limit impact. The design will consider: • screening of boundaries facing sensitive receivers or views • careful placement of structures and buildings to maintain viewpoints or provide additional screening of site activities.	Contractor	Pre-construction / Construction	Additional safeguard
V8	Construction visual impact	Ancillary facilities will be maintained, kept tidy and well-presented including sorting regular removal of excess materials to reduce visual impact.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
V9	Construction visual impact	Ancillary facility sites and temporary construction areas will be progressively restored to at least their pre-construction conditions when no longer required.	Contractor	Construction	Additional safeguard
Noise and vibration					
NV1	Noise and vibration	A Construction Noise and Vibration Management Plan (CNVMP) will be prepared and implemented as part of the CEMP. The CNVMP will generally follow the approach in the Interim *Construction Noise Guideline* (ICNG) (DECC, 2009) and identify: • all potential significant noise and vibration generating activities associated with the activity • feasible and reasonable mitigation measures to be implemented, taking into account *Beyond the Pavement: urban design policy, process and principles* (Transport, 2014). • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Detailed design / pre-construction	Section 4.6 of QA *G36 Environment Protection*
NV2	Noise and vibration	All sensitive receivers (e.g. schools, local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: • the project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information.	Contractor	Detailed design / pre-construction	Additional safeguard
NV3	Noise and vibration	Less vibration emitting construction methods will be used where feasible and reasonable, for example vibratory rollers can, where practicable, be operated with the vibratory mode switched off to reduce vibration impact.	Contractor	Construction	Additional safeguard
NV4	Out of hours work	Out of hours works will be undertaken in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime 2016). This includes: • Offer respite and/or restricted construction hours where noise intensive works are planned over extended periods, especially where they occur outside of standard hours. This may include moving the construction work front to different areas so that sensitive receivers are not impacted for longer than two consecutive days	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise negotiated with affected receivers.			
NV5	Out of hours work	Noisiest activities will be limited to standard construction hours, where practicable	Contractor	Construction	Additional safeguard
NV6	Noise and vibration	A register of most affected noise and vibration sensitive receivers (NVSRs) will be kept on site and maintained. The register will include the following details for each NVSR: • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number. The register is to be included as part of the Proposal's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.	Contactor	Construction	Additional safeguard
NV7	Noise and vibration	Source controls will be employed to minimise noise impacts, such as using noise screens and mufflers, maximising offset distance, and orienting plant away from sensitive receivers.	Contractor	Construction	Additional safeguard
NV8	Noise and vibration	The selection of plant and machinery will consider noise emissions, operated to reduce maximum noise levels, maintained regularly and turned off when not in use	Contractor	Construction	Additional safeguard
NV9	Operational road traffic noise	Further assessment of operational road traffic noise impacts will be carried out to inform consideration of appropriate noise mitigation during detailed design. Where a parcel of land would be impacted by multiple projects within the Great Western Highway Upgrade Program, noise treatment options will be considered for the greater of the predicted noise impacts.	Transport	Detailed design	Additional safeguard
NV10	Operational road traffic noise	Implement at-property noise mitigation treatments as early as feasible in the construction program in consultation with the property owner.	Transport / Contractor	Pre-construction / construction	Additional safeguard
NV11	Woodlands Road ancillary facility	During detailed design, further investigation will be carried out to confirm the use of the Woodland Road ancillary facility as well as traffic movements.	Transport	Detailed design	Additional safeguard
Traffic and transport					
TT1	Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport *Traffic Control at Work Sites Manual* (Transport, 2020c) and *QA Specification G10 Control of Traffic* (Transport, 2020b). The TMP will include: • confirmation of haulage routes • measures to maintain access to local roads and properties	Transport / Contractor	Detailed design / Pre-construction	Section 4.8 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• a provision for the monitoring of delays or queues forming at access points with a suitable response such as temporary detours or cessation of construction access movements to clear the queue • construction traffic control plans outlining site-specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access where possible • requirements and methods to consult and inform the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • a response plan for any construction traffic incident • monitoring, review and amendment mechanisms.			
TT2	Construction site access	Construction site access will be designed and implemented in consideration of: • road design guidelines and turning paths for heavy vehicles • appropriate sight distances to allow traffic to safely enter and exit • visibility of compliant warning and way finding signs • use of accredited traffic controllers, where appropriate and/or other controls to separate, slow down or temporarily stop traffic for safe entry/exit • minimising use of local roads, where practical • provision of deceleration lanes at accesses next to highly trafficked roads.	Contractor	Pre-construction/ construction	Additional safeguard
TT3	Impact on bus stops or routes	For the Katoomba to Medlow Bath section, temporary and permanent bus stop relocation will be discussed with the relevant bus operator. Transport will discuss the temporary relocation of the Bonnie Doon Reserve and Foy Avenue bus stops. Transport will inform the community of the temporary relocation of the bus stops prior to the relocation.	Transport / Contractor	Detailed design / Pre-construction	Additional safeguard
TT4	Temporary access changes	Detours during temporary access changes will be implemented with directional signage along alternate routes.	Contractor	Construction	Additional safeguard
TT5	Traffic management measures	Any temporary traffic diversions or road closures will be implemented in accordance with Transport Management Centre (TMC) and Blue Mountains City Council requirements and notified to emergency services.	Contractor	Construction	Additional safeguard
TT6	Property access	Property access will be maintained where feasible and reasonable and property owners will be consulted well in advance of work starting that may temporarily restrict or control access.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TT7	Local road or shared path closures	Blue Mountains City Council will be consulted with prior to any local road or shared path closures to identify suitable mitigation measures such as detour routes.	Contractor	Construction	Additional safeguard
TT8	Damage to local roads	Any damage to the local road network identified to be caused by construction vehicles for the proposal will be remediated by the contractor to be similar to the existing road condition.	Contractor	Construction	Additional safeguard
Socio-economic, property and land use					
SE1	Socio-economic	A Communication Plan (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): • people or organisations to be consulted during the delivery of the proposal • procedures and mechanisms for the regular distribution of information about the proposal • mechanisms to keep relevant stakeholders updated on construction activities, schedules and milestones • avenues for the community to provide feedback (including a 24-hour, toll free proposal information and complaints line) or to register complaints through which Transport will respond to community feedback • a process to resolve complaints and issues raised. The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (Roads and Traffic Authority, 2008).	Contractor	Detailed design / pre-construction	Additional safeguard
SE2	Community consultation	Transport will continue to consult with the community until the completion of the proposal. Discussions would include the nature and timing of construction work.	Transport	Pre-construction / construction	Additional safeguard
SE3	Property acquisition	Land acquisition will occur in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the *Local Government Act 1993*. Transport will continue to consult with Blue Mountains City Council regarding council owned land and assets. The design for the proposal will also be refined during detailed design to minimise impacts on community land, where possible.	Transport	Pre-construction	Additional safeguard
SE4	Amenity	Amenity impacts will be managed through other safeguards for the proposal (including those related to noise and vibration, visual changes, heritage and traffic)	Transport	Pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SE5	Changes in access	Temporary and permanent changes in access will be discussed with impacted land occupiers (including Sydney Trains and NPWS) prior to commencement of construction and during construction activities should arrangements change. This includes properties which may be impacted by intersection upgrades at Nellies Glen Road, Explorers Road and Foy Avenue.	Transport	Pre-construction / construction	Additional safeguard
SE6	Social infrastructure	Transport will consult with local community groups that use facilities including the walking/ hiking trails throughout construction.	Transport	Pre-construction/ construction	Additional safeguard
SE7	Relocation of bus stops	Public transport users will be notified in advance of any changes to bus stop locations through signage at the existing bus stop during construction. Public transport users will also be notified of permanent bus stop relocations. Adequate way finding signage will be installed. Consultation with the relevant bus authorities will be undertaken to mitigate potential impacts to bus routes.	Transport	Pre-construction / construction	Additional safeguard
SE8	Traffic management for all road users, including pedestrians and cyclists	Transport will consider opportunities for alternative transport arrangements to provide access for vulnerable community members who would normally access the Great Blue Mountains Trail. Alternative routes for active transport users during construction will be clearly identified by signage and the use of traffic controllers where required.	Transport	Pre-construction / construction	Additional safeguard
SE9	Provision of parking	Transport will develop a car parking strategy to inform the operation of upgraded car parking opportunities (including near the Pulpit Hill interpretation area) in conjunction with the Great Western Highway Upgrade – Medlow Bath.	Transport	Detailed design / pre-construction	Additional safeguard
Aboriginal cultural heritage					
A1	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the *Procedure for Aboriginal cultural heritage consultation and investigation* (Roads and Maritime, 2011) and *Standard Management Procedure - Unexpected Heritage Items* (Transport for NSW, 2015d) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts 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 Environment Protection*
A2	Aboriginal heritage	*The Standard Management Procedure - Unexpected Heritage Items* (Transport for NSW, 2015d) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
A3	Aboriginal heritage	Transport will develop a cultural interpretation strategy across the Great Western Highway Upgrade Program. This cultural interpretation strategy will look to interpret both Aboriginal and non-Aboriginal heritage along the highway alignment. The Pulpit Hill heritage interpretation area will be further developed as part of this strategy, in consultation with the Blue Mountains City Council, Heritage NSW, Aboriginal knowledge holders and the local community.	Transport	Detailed design	Additional safeguard
Other Impacts					
O1	Air quality	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: • potential sources of air pollution • air quality management objectives consistent with any relevant published EPA and/or Energy, Environment and Science (EES)/Department of Planning, Industry and Environment guidelines • mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces.	Transport / Contractor	Detailed design / pre-construction	Section 4.4 of QA G36 Environment Protection
O2	Waste and resource management	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: • measures to avoid and minimise waste associated with the project • classification of wastes and management options (re-use, recycle, stockpile, disposal) • statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • procedures for storage, transport and disposal of spoil and waste • monitoring, record keeping and reporting. The WMP will be prepared taking into account the *Environmental Procedure - Management of Wastes on Roads and Maritime Services Land* (Roads and Maritime, 2014) and relevant Transport for NSW Waste Fact Sheets.	Transport / Contractor	Detailed design / pre-construction	Section 4.2 of QA G36 Environment Protection
O3	Waste and resource management	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 Roads and Maritime Technical Procedure: Mulch Management	Transport / Contractor	Detailed design / pre-construction	Additional Safeguard
O4	Waste and resource management	Recycling facilities will be provided at site compounds for recycling paper, plastic, glass and other re-useable materials. Liquid wastes, such as paints and solvents, will be disposed of in accordance with the Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009) and the POEO Act.	Transport / Contractor	Detailed design / pre-construction	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
O5	Bushfire hazards and risk management	The CEMP will include a bushfire management plan prepared in accordance with Planning for Bush Fire Protection 2019 (NSW Rural Fire Service, 2019). Measures to be implemented to manage bushfire risk include: • monitoring of weather and local bushfire ratings • consultation requirements for community notifications in the event of a bushfire • maintaining equipment in good working order • ensuring plant and equipment are fitted with appropriate spark arrestors, where practicable • ensuring site workers are informed of the site rules including designated smoking areas and putting rubbish in designated bins. • obtaining hot work permits and implementing total fire bans as required • implementing adequate storage and handling requirements for potentially flammable substances in accordance with the relevant guidelines.	Contractor	Pre-construction / construction	Additional Safeguard
O6	Bushfire hazards and risk management	Consultation with emergency services, including the Rural Fire Service and Fire and Rescue NSW to: • ensure emergency access is maintained during construction • co-ordinate any bush fire emergency actions as outlined in the project's Bushfire Management Plan.	Contractor	Construction	Additional Safeguard
Cumulative impacts					
C1	Cumulative impacts	Ongoing consultation will be carried out between proponents and construction contractors of nearby projects to identify the potential for cumulative impacts to occur should construction occur concurrently with the proposal.	Transport / Contractor	Detailed design / Pre-construction / Construction	Additional Safeguard
C2	Cumulative impacts	Co-ordination of traffic management controls will be considered to minimise cumulative traffic impacts, particularly during peak holiday periods.	Transport / Contractor	Detailed design / Pre-construction / Construction	Additional Safeguard
C3	Cumulative impacts	Co-ordination of out of hours work will be considered across the Great Western Highway East – Katoomba to Blackheath and the Great Western Highway Upgrade – Medlow Bath in Medlow Bath to minimise out of hours work periods and minimise ongoing out of hours work noise to sensitive receivers and ensure respite periods are achieved where required.	Transport / Contractor	Detailed design / Pre-construction / Construction	Additional Safeguard

7.3 Licensing and approvals

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Protection of the Environment Operations Act 1997 (s43)	Environment protection licence (EPL) for road construction within the Katoomba to Medlow Bath section from the EPA.	Prior to start of the activity.
Water Management Act 2000 (s304)	Notice to the Minister for Agriculture and Western NSW to exercise functions in special areas within the catchment area.	14 days prior to exercising functions.
Crown Land Management Act 2016 (Division 3.4, 5.5 and 5.6)	Lease or licence to occupy areas of Crown land.	Prior to start of the activity
National Parks and Wildlife Act 1974	Revocation of land reserved as a National Park to occur via an Act of Parliament.	Prior to the determination of any land reserved under the National Parks and Wildlife Act 1974
Roads Act 1933 (s138)	A Road Occupancy Licence would be required from the relevant roads authority by the contractor for prior to work on public roads	Prior to start of the activity.
Water NSW Act 2014 (s50)	Notice to Water NSW to exercise functions in the Katoomba and Blackheath special areas.	28 days prior to exercising functions.

8. Sustainability

The Transport for NSW's environment and sustainability policy (2020) provides strategic direction to fulfil 'a duty to undertake our activities in the interest of the greater good, moving beyond compliance, and being a genuine leader in environment and sustainability performance'.

The Policy provides a clear commitment 'to delivering transport which contributes to economic prosperity and social inclusion in an environmentally responsible and sustainable manner, consistent with the Future Transport Strategy 2056'.

Supporting the policy is the Transport Sustainability Plan (Transport, 2021e) that sets out sustainability objectives relevant to transport projects. Table 8-1 details the sustainability themes and objectives of the plan and describes how the overall proposal meets those objectives.

Table 8-1: Sustainability Plan 2021 focus areas and goals

Sustainability focus area	Sustainability goal	Proposal response
Respond to climate change	• Net zero emissions by 2050 • Consider climate change risks in all decisions	Transport's G36 Environmental Protection specifications for construction will require contractors to demonstrate energy-efficient and time-efficient methods for handling and transporting materials and operation of plant. This would typically include reducing idling time, reducing the length of haulage routes by sourcing material locally and considering using a sustainable energy alternative for temporary lighting during night-work. This would minimise energy use and reducing greenhouse gas emissions during construction of the proposal. During operation, the proposal would reduce congestion during peak periods, thereby reducing idling time and consumption of fuels in vehicles. Ongoing energy consumption for the proposal would be for Intelligent Transport Systems and minimal street lighting. The provision of the improved active transport network would encourage more active transport users to travel between Katoomba and Blackheath. The proposed drainage system has been developed with sufficient capacity to account for any changed in localised flood intensity caused by higher intensity of rainfall due to climate change. Widening the highway would also improve access to natural disasters such as bushfire.
Protect and enhance biodiversity	• No net loss of biodiversity	The development of the design has avoided and minimised impacts on threatened biodiversity by largely remaining within the existing road infrastructure corridor. Ongoing design development will further investigate potential opportunities to reduce direct footprint impacts. Residual impacts on threatened biodiversity will be offset (refer to Section 6.3.5). Transport is considering a parcel of land which may be suitable to meet its biodiversity offset requirements as well as provide compensatory land for the national park revocation. This offset land could be protected as part of the Blue Mountains National Park in perpetuity.
Improve environmental outcomes	• Develop a circular economy for Transport by designing waste and pollution out and keeping products and materials in use	The proposal would minimise the environmental impacts identified in Chapter 6 through the proposed management measures identified in Section 7.2. The cut and fill earthwork requirements for this proposal are relatively minor. Transport's detailed design process under specification PS311 Environment Design and Compliance involves the development of a Material Re-Use and Management Plan to identify strategies of 'avoid', 'reduce', 'reuse' and 'recycle' materials.

Sustainability focus area	Sustainability goal	Proposal response
	• Reduce environmental impacts of projects and operations	The proposal would also rehabilitate the existing pavement, where possible rather than removing it to go to landfill. Re-use of other 'waste' materials could include reusing vegetation cleared on site in mulch or for re-snagging waterways. Re-use of recycled materials would support the development of a circular economy. Dust generation is common during construction and dust suppression management measures will be implemented by the construction contractor so that they comply with Transport's G36 Environmental Protection specifications. The operational drainage design would result in a beneficial effect to water quality. Operational water quality treatments would be further investigated during detailed design in accordance with Transport's Water Sensitive Urban Design guidelines and in consultation with Blue Mountains City Council.
Procure responsibly	• All suppliers meet the standards in Transport Supplier Sustainability Charter • Social and environmental outcomes included in all procurement decisions • Go beyond minimum compliance targets in Aboriginal Procurement Policy	Responsible procurement will be carried out adopting the following initiatives: • All tendered procurement would include non-price selection criteria that assesses relevant sustainability and social procurement measures. • Implementing the Aboriginal Participation in Construction Policy. • Where possible, procuring from small and medium-sized enterprises Aboriginal business and Australian Disability enterprises. • Monitoring the supply chain to identify and address issues related to poor labour practices. • Supporting local suppliers to minimise haulage distances of construction material when feasible.
Partner with communities	• Always leave a positive legacy for communities as a result of projects • Enable, apply and report on community engagement	When operational, the proposal would have positive impacts on the Blue Mountains community. The proposal includes improved active transport links for the community. The provision of the upgraded active transport trail between Katoomba and Medlow Bath and new active transport trail within the Medlow Bath to Blackheath section would improve active transport connectivity between these townships. This would also connect the bus stops within the proposal area with sites of recreational, cultural and heritage value. The proposal would also leave a positive legacy for the Blue Mountains community by: • improving road safety (by widening the Great Western Highway, upgrading intersections and improving the alignment) • improving freight productivity • reducing congestion • enhancing locations with Aboriginal and non-Aboriginal heritage value through interpretation and urban design features. Urban design has been integrated into the design development of the proposal and will continue through the detailed design process. Appendix G includes the Urban Design report for the concept design.
Respect culture and heritage	• Aboriginal culture is integrated and preserved • Acknowledging and incorporating culture through stories, examples, and best practice	The proposal would have an impact on several non-Aboriginal heritage items (refer to Section 6.4.3). However, the existing heritage interpretation area on Nellies Glen Road would be retained and enhanced to display the Aboriginal and non-Aboriginal heritage of the area. This would allow better connection between the disparate heritage items and story of the cultural significance of Pulpit Hill, not just focusing on the former Explorers Tree. This area would be developed as part of the Great Western Highway Upgrade Program

Sustainability focus area	Sustainability goal	Proposal response
		heritage interpretation strategy, in consultation with the Blue Mountains City Council, Heritage NSW, Aboriginal knowledge holders and the local community. Aboriginal cultural heritage has been assessed in consultation with Aboriginal representatives. The proposal is not expected to have an impact on Aboriginal cultural heritage. Urban design principles and objectives for the proposal include the acknowledgment and response to Aboriginal values and places in the broader landscape; and for the consideration of interpretation of the heritage areas along the corridor (refer to Section 2.3.3). Transport is currently engaging with specialist heritage consultants GML Heritage and Balarinji Indigenous Design and Strategy to engage stakeholders in developing a cultural interpretation strategy across the Great Western Highway Upgrade Program – Katoomba to Lithgow. This cultural interpretation strategy would look to interpret both Aboriginal and non-Aboriginal heritage along the highway alignment and recognise the Aboriginal cultural significance of the region. The Pulpit Hill heritage interpretation area would be further developed as part of the Great Western Highway Upgrade Program cultural interpretation strategy, in consultation with the Blue Mountains City Council, Heritage NSW, Aboriginal knowledge holders and the local community.
Align spend and impact	• All decisions consider value created from sustainability alongside financial analysis • Reduce whole of life costs for the transport network	The proposal would provide a four-lane divided carriageway with dedicated turn lanes, which would improve freight productivity and reduce congestion. As a result, it would improve the ability for regional economic development in the Blue Mountains and Central West and Orana regions through improved road and freight connection between these regions and Sydney. The proposal would improve traffic flow during traffic incidents and emergencies by providing safe, continuous access to transport services.
Empower customers to make sustainable choices	• Use customer journeys to inform, engage and inspire more sustainable practices and demonstrate Transport's progress	The proposal provides for active and public transport in accordance with Transport for NSW's draft Providing for Walking and Cycling in Transport Projects Policy. The proposal would re-establish and extend the existing shared use paths and provide appropriate access to existing bus stops in the study area. In doing so, it would encourage customers to use active and public transport when travelling between the townships of Katoomba, Medlow Bath and Blackheath.

9. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Section 193 of the Environmental Planning and Assessment Regulation 2021.

9.1 Justification

The proposal is consistent with a number of strategies and plans including:

- Premier's Priorities
- Future Transport Strategy 2056
- State Infrastructure Strategy 2018-2038: Building Momentum
- Regional NSW Services and Infrastructure Plan.

The proposal would meet the key strategic objectives within the above strategies and plans (refer to Section 2.1.1 for further detail).

The Great Western Highway East – Katoomba to Blackheath forms part of the broader upgrade of the Great Western Highway between Katoomba and Lithgow. The proposal, as part of the broader upgrade, is needed to provide a safer and more efficient link between Central West NSW and the Sydney Motorway network.

Without the proposal, the highway between Katoomba and Blackheath would continue to be constrained resulting in suboptimal traffic movement along the corridor and impacts to the local communities in the Blue Mountains, particularly in Katoomba, Medlow Bath and Blackheath.

In particular, without the proposal, the highway would continue to experience:

- slow travel speeds with limited overtaking opportunities and steep gradients (more than double the recommended maximum level)
- delays of up to 80 minutes in peak times and hours if there is an incident
- reduced freight efficiency by limiting access for safer and more sustainable high productivity vehicles
- limited access during incidents and natural disasters
- higher than state average crash rates, and
- socio-economic amenity impacts for local communities with high through traffic volumes and congestion.

The proposal comprises critical components of the broader Great Western Highway Upgrade Program and would adversely impact the realisation of the considerable local and regional benefits to be gained by the Upgrade Program if the proposal does not proceed.

The Upgrade Program would improve transport links for freight, commuters, travellers and tourists between the Central West and the east coast cities including Sydney, Newcastle and Wollongong. It would also better connect local communities in the Blue Mountains to jobs, health care, education and other services both within townships and in neighbouring regional cities and strategic centres.

On its own, the proposal would deliver the following benefits to the community and transport customer:

- increased road capacity from one lane either direction to two lanes either direction to improve travel speeds and reduce delays during peak times
- improved access during traffic incidents or other emergency incidents including natural disasters

- upgrading to latest road specifications could allow for improved freight access including use by higher productivity vehicles
- improved travel efficiency would result in improved amenity for local communities and improved access for the local community.

In conjunction with the broader Great Western Highway Upgrade Program, the proposal would result in beneficial impacts, including improved:

- resilience and emergency management conditions
- connectivity for all road users along and across the corridor
- active transport links
- consistency of travel conditions
- network efficiency and freight productivity
- safety for all road users
- quality of surface water run off to the surrounding environment
- local amenity through heritage interpretation.

9.1.1 Social factors

The proposal would result in positive long-term social impacts during operation through providing improved road capacity and safety on the Great Western Highway between Katoomba and Blackheath. These safety improvements would address the existing local community concern of congestion and safety.

While the proposal has been designed to minimise impacts to live traffic on the highway, there would be some short-term localised disruptions to highway traffic during construction. This could result in traffic delays and inconvenience to the local community. To minimise this potential disruption, further consultation with key stakeholders and the local community would be carried out.

Construction noise and vibration generated by the proposal may also temporarily impact the amenity of local residents. These potential noise impacts would be minimised and managed in accordance with Transport for NSW's CNVG.

The proposal would be constructed in an area with a rich Aboriginal and non-Aboriginal heritage value, which is of importance to the local community. A heritage interpretation strategy would be developed for the entire Great Western Highway Upgrade Program to reinterpret heritage along the length of the highway between Katoomba and Lithgow to tell the history of the area. This would include the heritage interpretation area at Pulpit Hill.

9.1.2 Biophysical factors

The proposal may result in some minor adverse biophysical impacts, which are largely limited to impacts during the construction phase of the proposal and are not expected to significantly impact the biophysical environment.

The proposal would involve removal of up to 47.56 hectares of native vegetation, which could lead to a reduction of threatened fauna habitat within the proposal area. There may also be a risk of fauna injury and mortality from construction movements. However, most of the vegetation likely to be affected by the proposal is located adjacent to the Great Western Highway and has been subject to historic clearing and edge effects. It is thinned in areas and some areas are dominated by a range of introduced species. It is also unlikely that any threatened fauna species would be reliant on the habitat within the proposal area considering the extensive high-quality habitat nearby within the Blue Mountains National Park.

Overall, the proposal is not likely to significantly impact threatened species, populations, ecological communities or their habitats.

As part of the proposal, Transport is seeking to acquire a parcel of land to provide biodiversity offsets for the project as well as compensatory land for the national park revocation. This offset land could be protected as part of the Blue Mountains National Park.

9.1.3 Economic factors

The proposal would improve road capacity and safety along the Great Western Highway. This would have an indirect positive impact on the local and regional economy, as it would reduce the likelihood of traffic delays from road incidents along the highway. The proposal would therefore contribute to improved productivity and reduced costs associated with traffic delays for road users.

In conjunction with the broader Great Western Highway Upgrade Program, the proposal would improve transport link for freight, commuters, travellers and tourists between the Central West and the east coast cities including Sydney, Newcastle and Wollongong. It would also better connect local communities in the Blue Mountains to jobs, health care, education and other services both within townships and in neighbouring regional cities and strategic centres.

9.1.4 Public interest

The proposal is justified to be in the public interest on the basis that it improves the capacity and safety of Great Western Highway to address current community concern without any significant negative long-term impacts on society, the biophysical environment or the local economy. The proposal is also aligned with several strategic policies and government strategies, such as Future Transport Strategy 2056 (Transport, 2018b) and Road Safety Plan 2021 (Transport, 2018d).

9.2 Objects of the EP&A Act

The objects of the EP&A Act provide a framework within which the justification of the proposal can be considered. A summary of this assessment is provided in Table 9-1.

Table 9-1: Objects 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 increase capacity and reduce delays, particularly through peak periods thereby improving movement and connectivity along the Great Western Highway between Katoomba and Blackheath. There would also be economic flow on benefits to economic productivity and growth for freight carriers and vehicles travelling to the industrial precincts in the broader study area, in addition to benefits for existing and future businesses in the surrounding area. In conjunction with the broader Great Western Highway Upgrade Program, the proposal would improve transport links for freight, commuters, travellers and tourists between the Central West and the east coast cities including Sydney, Newcastle and Wollongong. It would also better connect local communities in the Blue Mountains to jobs, health care, education and other services both within townships and in neighbouring regional cities and strategic centres. However, it is recognised that there would be some short-term socio-economic impacts during construction (particularly from amenity impacts and traffic delays). The overall proposal has been designed where possible to minimise impacts on the environment and the community. A number of management measures would be implemented to minimise any environmental impacts associated with the overall proposal.

Object	Comment
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development has been considered throughout the proposal and documented in Section 4.2.5 and Section 6.10.1. An options process was also undertaken for the proposal that has considered a range of constraints to identify the least environmental impact (refer Section 2.4). Mitigation measures are proposed to minimise impacts including vegetation clearing and water quality impacts. This includes preparation of a Construction Soil and Water Management Plan and Construction Flora and Fauna Management Plan to further identify opportunities to minimise impacts.
1.3(c) To promote the orderly and economic use and development of land.	The upgrade of the Great Western Highway between Katoomba and Blackheath is required to reduce congestion and support efficient movement of people and freight through the Blue Mountains.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
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.	While vegetation removal has been minimised, the proposal would still result in the removal of vegetation. To mitigate these impacts, offsets would be provided. The potential impacts on vegetation, threatened species, population and ecological communities are discussed in Section 6.3. It is also noted that a section of the Blue Mountains National Park would be revoked for the proposal. Where not required for the final footprint of the proposal, as much vegetation as possible would be retained to minimise potential indirect impacts on the national park. A survey and long-term monitoring program for the Eastern Pygmy-possum would be developed to survey the size and extent of the population within the surrounding area to assist in conservation efforts. The potential for water quality impacts to the surrounding sensitive environment area (both the national park and the Special Catchment Areas) has meant that a robust water quality strategy has been developed as part of the proposal. This includes the used of bio-retention basins, on site storage basins and Gross Pollutant Traps. Transport would continue to consult with Water NSW and Blue Mountains City Council to further develop the strategy through the detailed design phase.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal would not impact on any known Aboriginal heritage sites or items, however, is in an area of broader cultural value. The proposal would impact on non-Aboriginal heritage sites including the Bonnie Doon Reserve and Pulpit Hill area. The proposal would retain and upgrade the existing heritage interpretation area on Nellies Glen Road to interpret the heritage significance of the area. As part of the broader Great Western Highway Upgrade Program, a heritage interpretation strategy would be developed to display both the Aboriginal and non-Aboriginal heritage value along the project.
1.3(g) To promote good design and amenity of the built environment.	While the two proposals pass through large areas of natural environment and scattered rural residential areas, an urban design and landscape strategy would be developed to consider the surrounding built environment. The urban design and the landscape concept for the proposal has been developed to achieve an integrated outcome that helps fit the overall proposal as sensitively as possible into its context and to minimise the impacts of the overall proposal on the existing landscape character of the surrounding area. On the approaches to the villages of Katoomba and Medlow Bath, landscaping and urban design would be used to provide a change in environment for drivers to know that they are coming into a village. The proposal would also include the retention of existing active transport trails and would provide a new trail between Medlow Bath and Blackheath. Progressive landscaping would be undertaken throughout the construction, and Landscaping Plans will include revegetation with local native vegetation species, suitable for the riparian zone.

Object	Comment
	During construction and operation there would be impacts on amenity and community values. These are discussed in Section 6.7.5. Adverse amenity impacts during construction and operation would be mitigated through a range of mitigation measures.
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.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Section 5 outlines the community and stakeholder consultation carried out during various stages of the proposal. This REF will be placed on public display and further consultation will be carried out with the community if the proposal is determined to proceed.

9.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during route options development (refer to Chapter 2). The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures.

Stakeholder consultation considered issues raised by stakeholders and a range of specialist studies were undertaken for key issues to provide accurate and impartial information to assist in the evaluation of options. The concept design of the proposal has sought to minimise impacts on the natural environment, particularly to the Blue Mountains National Park and heritage values of the study area while maintaining engineering feasibility and safety for all road users.

A number of safeguards have been proposed to minimise potential impacts and to respond to stakeholder concerns and areas of scientific uncertainty. These safeguards include the commitment to further develop the water quality strategy and to undertake further biodiversity investigations during further stages of the proposal. Other safeguards are identified in this REF and these would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty. A CEMP would be prepared before construction starts. This requirement would ensure the overall proposal achieves a high-level of environmental performance. No safeguards and management measures would be postponed as a result of a lack of information.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The proposal would make sure that road and traffic conditions within the overall proposal area would not continue to worsen in the future. The key risks of 'do nothing' are that, without the proposal, the highway would continue to experience:

- slow travel speeds (of up to 80 minutes in peak times and hours if there is an incident) with limited overtaking opportunities and steep gradients (more than double the recommended maximum level)
- reduced freight efficiency by limiting access for safer and more sustainable high productivity vehicles
- limited access during incidents and natural disasters
- higher than state average crash rates.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a lower road condition which could involve substantial increases in travel times due to a lack of alternative routes. Section 2.4 also highlights the options that were considered for the proposal and the highly constrained environment that needed to be considered. As part of the proposal, potential compensatory land for the impact to the Blue Mountains National Park has also been identified in this REF.

Aboriginal heritage assessment and Non-Aboriginal heritage assessment was carried out for the proposal. As part of the broader Great Western Highway Upgrade Program, a heritage interpretation strategy would be undertaken for the entire upgrade to embed heritage along the route.

Conservation of biological diversity and ecological integrity

As stated earlier, the proposal has been designed to limit the removal of native vegetation and TEC's where practical. A thorough assessment of the existing biodiversity environment was undertaken to identify and manage any potential impacts of the proposal on local biodiversity. It is acknowledged that the proposal would result in impacts on biodiversity, largely due to the up to 47.56 hectares removal of vegetation that is the habitat to several native plant communities, TECs, flora and fauna species. The BAR determined that the proposal is unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, and a referral of this proposal for consideration as a controlled action under the EPBC Act is not required.

Where possible, design refinements and construction methodology would be refined to further minimise vegetation removal as part of the proposal. A landscaping or revegetation plan would be implemented as part of the proposal to revegetate areas using locally endemic species. A biodiversity offset strategy and National Park compensatory land package would be developed as part of the proposal to provide protection to further sections of vegetation.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

The REF has examined the environmental consequences of the proposal and identified safeguards and management measures to manage the potential for adverse impacts. The requirement to implement these safeguards and management measures would result in an economic cost to Transport. Some of these measures include:

- provision of surface water and groundwater quality monitoring during construction
- provision of operational water quality controls, including retention basins and scour protection
- further investigations into ancillary facilities to assess land suitability for proposed commercial/industrial land use to ensure the safety of future workers and to provide a baseline site condition
- retention and expansion of the existing Pulpit Hill heritage interpretation area
- further investigations into the archaeological significance of the Pulpit Hill and Environs and House and Orchards (former Glenara Cottage) heritage items
- further vibration assessments of identified heritage items (refer to Section 6.4.4)
- revegetation with local native vegetation species
- urban design and landscaping, including visual screening, where possible within impact areas identified as moderate or high impact
- biodiversity offsetting
- a national park compensatory land package
- provision of noise mitigation measures
- ongoing consultation with the community and stakeholders through detailed design and construction phases.

The implementation of safeguards and management measures would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation. The concept design has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the overall proposal is being developed with an environmental objective in mind.

9.3 Conclusion

The proposed upgrade of the Great Western Highway between Katoomba and Medlow Bath and Medlow Bath to Blackheath 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, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on biodiversity, heritage and socio-economic factors.

Transport has commenced the revocation process with National Parks and Wildlife Service for a portion of land reserved as national park. Transport intends to exclude from its determination any works requiring revocation until such time that a decision has occurred, via an Act of Parliament.

Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also result in increased capacity, reducing travel times and increasing access during traffic incidents or natural disasters. 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 and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement 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 *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of Agriculture, Water and the Environment is not required.

10. 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.

Lucia Coletta

Associate, Environment and Planning

Aurecon Australasia

Date: 28/04/2022

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.

Pete Styles

Project Development Manager – Great Western Highway Upgrade Program

Transport for NSW, Infrastructure & Place

Date: 28/04/2022

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Terms and acronyms used in this REF

Term / Acronym	Description
Aboriginal Land Rights Act	*Aboriginal Land Rights Act 1983* (NSW).
ACM	Asbestos containing material
AEP	Annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
AHMP	Aboriginal Heritage Management Plan
APEC	Area of potential environmental concern
AQMP	Air Quality Management Plan
ARD	Archaeological Research Design
ASS	Acid sulfate soil
BAM	Biodiversity Assessment Methodology
BAM-C	Biodiversity Assessment Method Calculator
BAR	Biodiversity assessment report
BC Act	*Biodiversity Conservation Act 2016* (NSW).
BCC	Blackheath Co-Design Committee
Biosecurity Act	*Biosecurity Act 2015* (NSW).
Blackheath to Little Hartley Upgrade	Great Western Highway Blackheath to Little Hartley. Part of the Great Western Highway Upgrade Program.
BMCC	Blue Mountains City Council
BOS	Biodiversity Offset Strategy
CEEC	Critically endangered ecological communities
CEMP	Construction Environmental Management Plan
CMP	Conservation Management Plan
CNVG	Construction Noise and Vibration Guidelines
CoPCs	Contaminants of Potential Concern
CP	Communication Plan
CSM	Conceptual Site Model
CSEP	Community and Stakeholder Engagement Plan
CT1	Waste Classification Guidelines Contaminant Threshold 1
Cut	Where the depth of excavation for the road pavement extends below the top of rock level, vertical or near vertical cut rock faces would be constructed.
DAWE	Department of Agriculture, Water and Environment
DECCW	Department of Environment, Climate Change and Water (now EPA)
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EES	Environment, Energy and Science
EIA	Environmental impact assessment
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (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 License
ESCP	Erosion and Sedimentation Control Plans
ESD	Ecologically Sustainable Development

Term / Acronym	Description
ESMR	Erosion and Sedimentation Management Report
Fill	Where the new road alignment sits above the existing ground levels, built up fill retaining walls would be required. Reinforced soil wall construction would be the recommended option where possible along the proposal.
FM Act	*Fisheries Management Act 1994 (NSW)*
GDE	Groundwater Dependent Ecosystems
GPT	Gross Pollutant Trap
Great Western Highway Upgrade Program	The upgrade of the Great Western Highway between Katoomba and Lithgow, comprising four projects: • Great Western Highway East – Katoomba to Blackheath (this proposal) • Great Western Highway Upgrade – Medlow Bath • Great Western Highway Blackheath to Little Hartley • Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section)
HAA	Historic (non-Aboriginal) Archaeological Assessment
Heritage Act	*Heritage Act 1977* (NSW)
HGL	Hydrogeological Landscapes
ICNG	Interim Construction Noise Guideline
Transport and Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
Katoomba to Blackheath Upgrade	Great Western Highway East – Katoomba to Blackheath (this proposal). Part of the Great Western Highway Upgrade Program.
Katoomba to Medlow Bath section	The section of the proposal between Rowan Lane, Katoomba and Bellevue Crescent, Medlow Bath (about 3.5 kilometres)
LALC	Local Aboriginal Land Council
Land Acquisition Act	*Land Acquisition (Just Terms Compensation) Act 1991* (NSW).
LCVIA	Landscape Character and Visual Impact Assessment
LCZ	Landscape Character Zone
LEP	Local Environmental Plan. A planning instrument made under Part 3 of the EP&A Act.
LGA	Local Government Area
Little Hartley to Lithgow Upgrade	Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section). Part of the Great Western Highway Upgrade Program.
LOS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
mAHD	Metres in Australian Height Datum
Medlow Bath to Blackheath section	The section of the proposal between Station Street, Medlow Bath and Tennyson Road, Blackheath (about 1.8 kilometres)
Medlow Bath Upgrade	Great Western Highway Upgrade – Medlow Bath. Part of the Great Western Highway Upgrade Program.
MNES	Matters of national environmental significance under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.
NAHMP	Non-Aboriginal Heritage Management Plan
Native Title Act	*Native Title Act 1993* (Commonwealth).
NorBE	Neutral or Beneficial Effect On Water Quality
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
OOHW	Out-of-hours work

Term / Acronym	Description
OSD	Onsite detention basin
PACHCI	Procedure for Cultural Heritage Consultation and Investigation
PACM	Potential Asbestos Containing Material
PCT	Plant Community Type
PESA	Preliminary Erosion and Sedimentation Assessment
PFAS	Per- and polyfluoroalkyl substances
POEO Act	Protection of the Environment Operations Act 1997
Proposal	Proposed upgrade to the Great Western Highway between Katoomba and Blackheath from one to two lanes in each direction, comprising the Katoomba to Medlow Bath section and the Medlow Bath to Blackheath section
Proposal area	The proposal area is the footprint required for the construction of the proposal (refer to Section 3.3.1)
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
REF	Review of Environmental Factors (this document)
Roads and Maritime	NSW Roads and Maritime Services, now known as Transport for NSW
Rural Fires Act	*Rural Fires Act 1997* (NSW).
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP (Biodiversity and Conservation) 2021	State Environmental Planning Policy (Biodiversity and Conservation) 2021
SHI	State Heritage Inventory
SOHI	Statement of Heritage Impact
SWMP	Soil and Water Management Plan
TEC	Threatened Ecological Community
TMP	Traffic Management Plan
TN	Total Nitrogen
TP	Total Phosphorus
Transport	Transport for NSW
Transport (Sydney Trains)	Part of the Greater Sydney division of Transport for NSW. Operates and maintains the heavy rail network and provides rail services for passengers and network control for freight.
TSS	Total Suspended Solids
VM workshop	Value management workshop
VP	Viewpoint
Water Management Act	*Water Management Act 2000* (NSW).
Water NSW Act	*Water NSW Act 2014* (NSW).
WMP	Waste Management Plan

Appendix A

Consideration of Section 171 factors and Matters of National Environmental Significance and Commonwealth land

Section 171 Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in Section 171 of the Environmental Planning and Assessment Regulation 2021, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
a) Any environmental impact on a community? Construction of the proposal would result in the following environmental impacts on the community: • potential noise and vibration impacts to surrounding sensitive receivers during construction and operation of the proposal • traffic delays and increased travel time during the construction of the proposal • temporary disruption to active transport facilities during construction • removal of vegetation during construction. However, operation of the proposal would result in improved road safety and network reliability during operation. The consolidation and improvement of the Pulpit Hill heritage interpretation area would enhance the connection of the community with local heritage. Environmental impacts on the community would be mitigated following the safeguards and mitigation measures within this REF (refer to Chapter 7).	Short term, minor negative impact Long term, minor positive impact
b) Any transformation of a locality? Most of the Katoomba to Medlow Bath section is unlikely to result in any broadscale transformation of a locality as it would not generally change the current land use within the proposal footprint. However, the cutting through Pulpit Hill and twin bridges across the valley from Explorers Road would transform the Pulpit Hill and Mount Mark locality. The impact of these changes would be limited to the road corridor and occur away from Pulpit Hill communities. Property that would be acquired for construction and not required for operation would be on-sold and returned to its previous land use where possible. The Medlow Bath to Blackheath section would transform the land which is currently reserved as national park into a road corridor. There would be positive impacts to the locality through the provision of a new publicly accessible connection between Medlow Bath and Blackheath to the east of the Great Western Highway.	Long term, minor negative impacts Long term, minor positive impacts
c) Any environmental impact on the ecosystems of the locality? The proposal would involve removal of up to 47.56 hectares of native vegetation, including: • up to 46.8 hectares of vegetation identified as plant community type (PCT 1248) Sydney Peppermint – Silvertop Ash • up to 0.76 hectares of vegetation identified as plant community type (PCT 967) Narrow-leaved Peppermint – Silvertop Ash. While the proposal design has avoided direct impact to the Blue Mountains Swamp TEC (PCT 1078) near the twin bridges in the Katoomba to Medlow Bath section, there may be indirect impacts to 0.12 hectares of the swamp. This is a TEC listed under the BC Act and EPBC Act. Indirect impacts to the swamp would be minimised through proposed additional mitigation measures. The proposal would increase the total area of impervious surfaces within the road corridor, which could lead to contamination of surrounding sensitive environments. However, if the proposed water quality treatments were implemented, the proposal would result in a beneficial effect on water quality, as per the neutral or beneficial effect on water quality (NorBE) assessment carried out for the proposal (refer to Appendix C).	Long term, minor negative impacts Long term, major positive impacts
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The proposal would result in a temporary reduction in the aesthetic and recreational quality of the area during the construction phase in the form of noise and visual impacts. The proposal may also result in temporary reduction environmental quality due to vegetation clearing and water quality/drainage impacts during construction.	Short term, minor negative impact

Factor	Impact
However, once operational, the proposal would improve the recreational quality of the proposal area through the provision of active transport trails and the enhancement of the Pulpit Hill heritage interpretation area. Safeguards and mitigation measures have been proposed in Chapter 7 to manage and minimise these impacts where possible.	Long term, minor positive impact
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? There are a number of listed heritage items located within the proposal area. The proposal would have a direct impact on several heritage items (refer to Section 6.4.2). The greatest impact would be a high partial physical impact on the Pulpit Hill and Environs and Stone Arrangements local heritage listed items due to the proposed road alignment. The proposal would enhance the Pulpit Hill heritage interpretation area to recognise the historical and cultural significance. This would also improve understanding and access to the significance of the Pulpit Hill area. Mitigation and management measures would be implemented during construction and operation of the proposal to minimise impacts to non-Aboriginal heritage due to the proposal (refer to Section 6.4.4). The proposal would not impact on any known Aboriginal heritage items or places.	Short term, major negative impact Long term, minor positive impact
f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974)?* The proposal would involve removal of up to 47.56 hectares of native vegetation, including: • up to 46.8 hectares of vegetation identified as plant community type (PCT 1248) Sydney Peppermint – Silvertop Ash • up to 0.76 hectares of vegetation identified as plant community type (PCT 967) Narrow-leaved Peppermint – Silvertop Ash. Safeguards and mitigation measures have been proposed in Section 6.3.4 to manage and minimise these impacts where possible. This would include development of a survey and long-term monitoring program for the Eastern Pygmy-possum to survey the size and extent of the population within the surrounding area and assist in conservation efforts of this species. Biodiversity offsets required for the proposal in accordance with the BAM have also been identified in Section 6.3.5.	Long term, minor negative impact Long term, minor positive impact
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal would require the removal of up to 47.56 hectares of native vegetation. Removal of this vegetation could lead to loss of fauna and flora habitat. However, because the proposal is surrounded by large areas of native vegetation, this impact is not large enough to endanger any species. The proposed increased width of the road corridor would impact wildlife connectivity. It may also result in increased potential for fauna injury or mortality. Safeguards to minimise potential impacts on threatened species have been outlined in Section 6.3.4.	Long term, minor negative impact
h) Any long-term effects on the environment? The proposal would have minor long-term impacts on the environment due to removal of vegetation and the increase in the road corridor footprint. This would have visual impacts for motorists using the Great Western Highway. Adverse environmental impacts have been minimised through the proposal design and would be refined further during detailed design, particularly through the minimisation of vegetation removal. The mitigation and management measures for the proposal are outlined in Chapter 7 to minimise environmental impacts due to the proposal.	Long term, minor negative impact
i) Any degradation of the quality of the environment? Construction of the proposal has the potential to degrade the quality of the environment through short-term minor noise impacts, visual impacts, water quality impacts due to erosion and sedimentation, air quality impacts and accidental spills during construction.	Short term, minor negative impact

Factor	Impact
The proposal would increase the total area of impervious surfaces within the road corridor, which could lead to contamination of surrounding sensitive environments. However, if the proposed water quality treatments were implemented, the proposal would result in a beneficial effect on water quality, as per the neutral or beneficial effect on water quality (NorBE) assessment carried out for the proposal (refer to Appendix C). Providing the other mitigation measures outlined in this REF are implemented (refer to Section 7.2), the proposal is not expected to result in noticeable degradation of the quality of the environment.	Long term, major positive impact
j) Any risk to the safety of the environment? Once operational, the proposal would improve safety of motorists through the provision of two lanes in either direction on a separated carriageway.	Long-term, major positive impact
k) Any reduction in the range of beneficial uses of the environment? The proposal would result in temporary disruptions to traffic flow, speed and local access. These traffic impacts would reduce the beneficial use of the Great Western Highway during the proposal area during the construction phase. During operation, the proposal would not result in a reduction in the range of beneficial uses of the environment. The provision of new and upgraded active transport trails would provide uninterrupted pedestrian and cyclist access between Katoomba and Blackheath and encourage more active transport users to travel between the villages.	Short-term, minor negative impact Long-term, minor positive impact
l) Any pollution of the environment? Providing the mitigation measures outlined in this REF are implemented (refer to Section 7.2), the proposal is not expected to result in any pollution of the environment.	Nil
m) Any environmental problems associated with the disposal of waste? The proposal is not likely to cause environmental problems associated with the disposal of waste. Standard mitigation measures have been proposed in Section 7.2.	Nil
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal is not likely to result in increased demands on resources which are or are likely to become in short supply.	Nil
o) Any cumulative environmental effect with other existing or likely future activities? The proposal forms part of the Great Western Highway Upgrade Program between Katoomba and Lithgow, which would deliver about 34 kilometres of four lane divided highway. There are potential cumulative impacts due to the upgrade program, including cumulative traffic delays, visual amenity impacts for motorists, and minor air impacts from plant and vehicle emissions during construction. Operation of the proposal would result in an overall positive cumulative impact due to the combined traffic and safety benefits of the upgraded transport corridor for the Blue Mountains community and motorists travelling along the Great Western Highway. Overall, a number of positive cumulative impacts would occur across the Great Western Highway Upgrade Program through completion of upgrades to the last section of the Great Western Highway between Sydney and Lithgow. There would not be significant cumulative assessed impacts of the Great Western Highway Upgrade Program. The impact of this proposal, when considered cumulatively with other projects within the Great Western Highway Upgrade Program, would not increase to the extent that would change a non-significant impact (identified in Sections 6.1 to 0) to a significant impact.	Short term, minor negative impact Long term, major positive impact
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal is not located within a coastal zone.	Nil

Factor	Impact
(q) Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1? Strategic plans relevant to the proposal which have been considered in this REF (refer to Section 2.1.1) include: • Central West and Orana Regional Plan 2036 • Western City District Plan • Blue Mountains Local Strategic Planning Statement.	Nil
(r) Any other relevant environmental factors? All relevant environmental factors to the proposal have been considered in this REF (refer to Chapter 6).	Nil

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act 1999, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Agriculture, Water and the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
a) Any impact on a World Heritage property? While part of the Blue Mountains National Park forms the Greater Blue Mountains World Heritage Area, the part of the national park within the Medlow Bath to Blackheath section is not part of the World Heritage Area.	Nil
b) Any impact on a National Heritage place? The Medlow Bath to Blackheath section of the proposal is within the Greater Blue Mountains Heritage Area – Additional Values. This is a nominated heritage item only, and not officially listed on the National Heritage List. It has been assessed for impacts due to the proposal to follow best practice (refer to Section 6.4.3).	Nil
c) Any impact on a wetland of international importance? There are no wetlands within the proposal area	Nil
d) Any impact on a listed threatened species or communities? Assessments of significance have been carried out for threatened species which were identified with potential to occur within the proposal area (refer to Section 6.3.3). These assessments found that the proposal would not have a significant impact on threatened biota. Significant impacts would be avoided through the implementation of mitigation measures (refer to Section 6.3.4).	Nil
e) Any impacts on listed migratory species? There are no impacts expected on listed migratory species.	Nil
f) Any impact on a Commonwealth marine area? There is no Commonwealth marine area in the proposal area	Nil
g) Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action	Nil
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land? The proposal would not result in any direct or indirect impact on the environment of Commonwealth land.	Nil

Appendix B

Statutory consultation checklists

Transport and Infrastructure SEPP

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	Transport and Infrastructure SEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	Local council and the occupiers of adjacent land	Transport and Infrastructure SEPP Section 2.110
Bus Depots	Does the project propose a bus depot?	No	Local council and the occupiers of adjacent land	Transport and Infrastructure SEPP Section 2.110
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	Local council and the occupiers of adjacent land	Transport and Infrastructure SEPP Section 2.110

Development within the Coastal Zone

Issue	Description	Yes / No	If 'yes' consult with	Transport and Infrastructure SEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Local council	Transport and Infrastructure SEPP Section 2.14

Note: See interactive map here: ***https://www.planning.nsw.gov.au/policy-and-legislation/coastal-management***. Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program

Council related infrastructure or services

Issue	Potential impact	Yes / No	If 'yes' consult with	Transport and Infrastructure SEPP clause
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	Local council	Transport and Infrastructure SEPP Section 2.10(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No	Local council	Transport and Infrastructure SEPP Section 2.10(1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	Local council	Transport and Infrastructure SEPP Section 2.10(1)(c)

Issue	Potential impact	Yes / No	If 'yes' consult with	Transport and Infrastructure SEPP clause
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No	Local council	Transport and Infrastructure SEPP Section 2.10(1)(d)
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No	Local council	Transport and Infrastructure SEPP Section 2.10(1)(e)
Road & footpath excavation	Will the works involve more than *minor* or *inconsequential* excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes	Local council	Transport and Infrastructure SEPP Section 2.10(1)(f)

Local heritage items

Issue	Potential impact	Yes / No	If 'yes' consult with	Transport and Infrastructure SEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than *minor* or *inconsequential?*	Yes	Local council	Transport and Infrastructure SEPP Section 2.11

Flood liable land

Issue	Potential impact	Yes / No	If 'yes' consult with	Transport and Infrastructure SEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	No	Local council	Transport and Infrastructure SEPP Section 2.12
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance	No	State Emergency Services Email: erm@ses.nsw.gov.au	Transport and Infrastructure SEPP Section 2.13

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled *Floodplain Development Manual: the management of flood liable* land published by the New South Wales Government.

Public authorities other than councils

Issue	Potential impact	Yes / No	If 'yes' consult with	Transport and Infrastructure SEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act*?*	Yes	Environment, Energy and Science, DPE	Transport and Infrastructure SEPP Section 2.15(2)(a)
National parks and reserves	Are the works on land in Zone C1 National Parks and Nature Reserves or in a land use zone equivalent to that zone, other than land reserved under the *National Parks and Wildlife Act 1974*?	Yes	Environment, Energy and Science, DPE	Transport and Infrastructure SEPP Section 2.15(2)(b)
Artificial light	Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	Transport and Infrastructure SEPP Section 2.15(2)(d)
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	Transport and Infrastructure SEPP Section 2.15(2)(e)
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Mine Subsidence Board	Transport and Infrastructure SEPP Section 2.15(2)(f)

Appendix C

Neutral or beneficial effect on water quality assessment

Neutral or Beneficial Effect Assessment

Chapter eight of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 relates to the use of land within the Sydney drinking water catchment. In accordance with Section 8.8 of the SEPP, Transport is required to consider whether or not an activity to which Division 5.1 of the EP&A Act applies will have a neutral or beneficial effect on water quality before carrying out the activity.

Factor	Impact
1. Are there any identifiable potential impacts on water quality? What pollutants are likely? During construction and/or post construction?	**Construction:** The primary potential impacts to surface water quality would be during construction activities and if not mitigated could result in: • increased sediment loads from exposed soil during rainfall events and dust blown off site causing high sediment loads to be washed or deposited into nearby creeks • increased sedimentation of downstream watercourses smothering aquatic life and affecting the ecosystems of downstream sensitive waterways, wetlands and floodplains • increased levels of nutrients, metals and other pollutants, transported via sediment to downstream water courses • chemical, heavy metal, oil and grease, and petroleum hydrocarbon spills from construction machinery directly polluting downstream waterways • increased levels of litter from construction activities polluting downstream watercourses. The potential construction pollutants include: 1. sediments (fine and coarse) and suspended solids 2. increased levels of nutrients transported via sediment to downstream water courses 3. chemical, heavy metal, oil and grease, and petroleum hydrocarbon spills from construction machinery directly polluting downstream waterways Increased levels of litter from construction activities polluting downstream watercourses. **Operation:** The potential operational impact of the proposal would be increased surface runoff from impervious surfaces and concentration of runoff in drains, channels and kerbs. During wet-weather events, contaminants would be transported into the drainage system and ultimately into the surrounding waterways or infiltrate into the groundwater system. The potential operational pollutants include: 1. suspended sediment from the paved surface and surrounding altered areas 2. heavy metals attached to particles washed off the paved surface 3. oil, grease and other hydrocarbon products 4. nutrients such as nitrogen and phosphorus in road runoff due to natural atmospheric deposition of fine soil particles.
2. For each pollutant, list the safeguards needed to prevent or mitigate potential impacts on water quality (these may be Water NSW endorsed current recommended practices and/or equally effective other practices)	**Construction**: 1. Sediments (fine and coarse), and 2. Suspended solids and increases levels of nutrients, metals and other pollutants, transported via sediment to downstream water courses Due to the high-risk nature of the location, an Erosion and Sedimentation Management Plan (ESMR) and Erosion and Sedimentation Control Plans (ESCP) have been developed. Construction will be undertaken in line with a Soil and Water Management Plan (SWMP) that includes progressive ESCPs for all stages of construction. The SWMP will be prepared and implemented in consultation with relevant government departments and councils as part of the Contractor Environmental Management Plan (CEMP).

Factor	Impact
	Construction activities will be sequenced and managed to minimise potential water quality degradation due to erosion. Mitigation and management measures are outlined in the ESMR/ESCP and discussed in Section 7 of the Soil, Surface water and groundwater working paper. 3. Chemical, heavy metal, oil and grease, and petroleum hydrocarbon spills from construction An Emergency Spill Plan will be developed and incorporated in the CEMP. This would include measures to avoid spillages of fuels, chemicals, and fluids into any waterways. **Operation:** 1. Suspended sediment from the paved surface and surrounding altered areas Treatment will be provided to the pavement runoff from the proposed road corridor by a treatment train of water quality controls to reduce the annual average load of suspended solids in line with the Transport Sustainable Design guidelines (Transport, 2020d). 2. Heavy metals attached to particles washed off the paved surface. Drainage design/treatment train will be designed to retain heavy metals on site. 3. Oil, grease and other hydrocarbon products. Treatment will be provided through a treatment train of water quality control that will reduce the annual average load of oil and grease in line with the WQOs. 4. Nutrients such as nitrogen and phosphorus in road runoff due to natural atmospheric deposition of fine soil particles. Treatment will be provided to the pavement runoff from the proposed road corridor by a treatment train of water quality controls to the annual average load of nitrogen and phosphorus in line with Transport Sustainable Design Guidelines (Transport, 2020d). For the operational phase of the project, where traffic loads are sufficient, rainfall runoff and accidental spills will be treated and contained through the proposed water quality treatment train, which has multiple stages and includes drainage basins. Specification for water quality management involves ongoing coordination with Blue Mountains City Council.
3. Will the safeguards be adequate for the time required? How will they need to be maintained?	The CEMP will include the regular maintenance of the construction stage water quality improvement measures. This includes roles and responsibilities for monitoring the quality and effectiveness of the measures at each stage of the construction. There will be regular inspection and cleanout of the mitigation measures which will capture varying loads of pollutants at stages of construction dependent on the current activities on-site. Operational phases of the project will include maintenance regimes to the stormwater reticulation network and water quality treatment basins. This includes the management of vegetation, removal of pollutant loads and system blockages. The management and maintenance procedures for sediment basins would be adopted to ensure effective functioning and compliance with the anticipated Environment Protection Licence conditions.
4. Will all impacts on water quality be effectively contained on the site by the identified safeguards (above) and not reach any watercourse, waterbody or drainage depression?	The proposal drains to controlled areas for water quality and as such MUSIC modelling has been undertaken to determine the impacts and treatment required to achieve a reduction of pollutants in line with Transport's *Sustainable Design Guidelines*. Runoff from external catchments that discharge through the road corridor are also proposed to be directed to these treatment areas where feasible to aim to provide a beneficial outcome to the surrounding environment.

Factor	Impact
Or will impacts on water quality be transferred outside the site for treatment? How? Why?	The impacts on water quality of the project will be managed on-site through collection of runoff, treatment of water in a treatment drainage and retention in drainage basins before discharge to the surrounding waterways.
5. Is it likely that a neutral or beneficial effect on water quality will occur? Why?	MUSIC modelling conducted as part of the NorBE assessment concludes that the proposal would have a beneficial effect on water quality. The existing highway does not incorporate spill containment or water quality treatment for pavement runoff (refer to Section 6 and 7 and Appendix E and F of the Soils, Surface Water and Groundwater Working Paper). Without the proposal, the receiving catchment would collect runoff from the steep, forested land, the existing highway and downstream forested land (including the Blue Mountains National Park). With the proposal, the receiving catchments would include similar forested areas but a larger road area. However, with the proposal, the road runoff would be collected and treated in water quality basins that would reduce TSS, TP, and TN in line with the *Sustainable Design Guidelines.* This would achieve a beneficial effect on water quality. In addition, the likelihood of a potential spill of hazardous substances would be reduced by the proposal. The impact of a potential spill would be reduced by inclusion of spill containment in the highway design, compared to the current situation where there is no existing spill containment present.

Appendix D

Surface Water and Groundwater Technical Assessment Working Paper

Appendix E

Biodiversity Assessment Report

Appendix F

Statement of Heritage Impact

Appendix G

Urban Design, Landscape Character and Visual Impact Assessment

Appendix H

Noise and Vibration Impact Assessment

Appendix I

Traffic and Transport Assessment Report

Appendix J

Socio-economic impact assessment

Appendix K

Great Western Highway Duplication – Katoomba to Lithgow Archaeological Survey Report

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