Transport
Roads & Maritime
Services

Katoomba to Lithgow
Great Western Highway Upgrade

Mount Victoria village safety upgrade

Review of Environmental Factors

Volume 1 Review of Environmental Factors
Appendix A - B

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Roads and Maritime Services

Mount Victoria village safety upgrade

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November 2013

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Executive summary

The proposal

Roads and Maritime Services is upgrading the Great Western Highway between Katoomba and Lithgow, west of Sydney. As part of this upgrade program, Roads and Maritime proposes to carry out safety upgrades along the highway through Mount Victoria village. The safety upgrades would extend for about 2.3 kilometres between Browntown Oval and Mount York Road. The main features of the proposal include:

- Widening the highway shoulders by up to about three metres on each side of the road.
- Moving the highway about 20 metres to the north east between Mount Piddington Road and Hooper Street to improve the road alignment.
- Upgrading seven intersections, including:
  - Dedicated right turn bays at Harley Avenue, Mount Piddington Road, Kanimbla Valley Road and Selsdon Street.
  - Dedicated left turn bay at Mount York Road with the use of line marking.
  - Basic right turn at Victoria Falls Road.
  - Left in /left out only at Hooper Street with the use of appropriate sign posting and line marking.
- Providing a new service road to improve and provide safe access to private properties on the southern side of the highway between Cecil Road and Mount Piddington Road.
- Providing a pedestrian refuge in the central median near Selsdon Street and improved connectivity through additional pedestrian pathways within the proposal area.
- Building four retaining walls up to 5.5 metres high and up to 230 metres long.
- Building two new culverts and upgrading existing drainage infrastructure.
- Providing water quality basins at potentially three locations.
- Temporary construction facilities, including construction compounds and stockpile sites along its length.
- Tie-ins with the existing pavement and highway levels at the end of each section.

Need for the proposal

The proposal is required to improve safety through Mount Victoria village by widening the highway shoulders, providing dedicated turn lanes and providing pedestrian infrastructure. The proposal is also required to continue supporting freight and tourism services that use the highway, and must cater for existing and future traffic flows.

Options considered

In 2012, Roads and Maritime considered 21 strategic options to improve traffic and pedestrian safety at nine locations within Mount Victoria village. All these options were located along the existing alignment of the Great Western Highway and included improvements to the highway alignment, intersections, pedestrian facilities and bus bays. In 2013, Roads and Maritime selected a preferred option, which comprised the favoured options at each of the nine locations within Mount Victoria village. This option was selected as it would best meet the proposal objectives in terms of safety and future traffic flows. The preferred option would also provide the best balance between technical, environmental, social and economic benefits and costs.

Statutory and planning framework

The State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State. Clause 94 of the ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. The proposal can therefore be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) by Roads and Maritime as both the proponent and the determining authority. Development consent from Blue Mountains City Council is not required. This review of environmental factors (REF) fulfils the requirements of Section 111 of the EP&A Act and has been prepared in accordance with Clause 228 of the *Environmental Planning and Assessment Regulation 2000* and matters of national environmental significance.

Community and stakeholder consultation

Roads and Maritime has managed the consultation for the proposal as part of the community and stakeholder engagement process for the wider program to upgrade the Great Western Highway between Katoomba and Lithgow. This process has included consultation with the general public, the Aboriginal community, Blue Mountains City Council, NSW Trains (formerly RailCorp), NSW Office of Environment and Heritage and other State government departments and utility providers.

Roads and Maritime has placed this REF on public display for community comment. It will consider and address all comments in a submissions report, which will be made publicly available on Roads and Maritime's website. Consultation will be ongoing during the detailed design and construction phases of the proposal.

Environmental impacts

Roads and Maritime has commissioned a number of technical experts to assess the potential impacts of the proposal and to identify safeguards and management measures. Main impacts as a result of the proposal have been summarised below.

Biodiversity

The proposal would have an impact on a total of about 1.33 hectares of native and modified vegetation. This would involve:

- The removal of about 0.55 hectares of 'Silvertop Ash – Narrow-leaved Peppermint open forest', which is a native vegetation community.
- The removal of about 0.78 hectares of cleared and highly modified habitats.

Assessments of significance found that the proposal would not have a significant impact on any threatened species, populations or ecological communities once the management and mitigation measures identified in this REF are implemented. Therefore, a Species Impact Statement is not required.

Land use, property and socio-economic issues

Roads and Maritime would need to acquire small portions of 18 properties to build the proposal. No buildings would need to be acquired.

Roads and Maritime has carried out consultation with property owners likely to be affected by these acquisitions. Final areas of acquisition would be determined during detailed design and in further consultation with these property owners. Property acquisition would be managed in accordance with the provisions of Roads and

Maritime's Land Acquisition Policy (Roads and Maritime, 2012) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

During construction, the community and local businesses would be likely to experience temporary traffic delays, property access restrictions and noise, air quality and visual amenity impacts. The short-term noise impacts would potentially include some night-time work. No land use would be permanently affected as a result of the proposal.

Some utility services (including power, water, sewage and telecommunications networks) would also need to be relocated and/or adjusted, and this may cause minor disruptions to services.

The construction contractor would notify property owners likely to be affected by any disruptions and access restrictions before work begins.

Non-Aboriginal heritage

The proposal passes through the Mount Victoria Urban Conservation Area, and past 13 heritage items which may potentially be affected by the proposal (two items listed on the Blue Mountains Local Environmental Plan 1991, 10 items listed on the Blue Mountains Local Environmental Plan 2005 and one unlisted item). The proposal would not have any direct impacts on listed heritage items within the study area. Indirect visual impacts and impacts from vibration may, however, occur during construction. These impacts are not considered to be significant and would be managed during construction through the application of mitigation measures identified in the REF.

Hydrology and water quality

The proposal is located in the headwaters of the Coxs River and Grose River catchments, with potential for run-off into the Sydney Drinking Water catchment and the Blue Mountains National Park. Potential water quality impacts arising from construction are expected to be managed through erosion and sediment control measures and sedimentation basins. Water quality during operation would be managed through the application of water quality treatment (including basins) along the proposal.

An increase in impervious surface from the proposal would result in increased peak flows and scouring downstream of three cross-drainage locations. These impacts would be managed through detention basins and localised scour treatments. The proposal would also result in an upgrade to cross drainage structures. At three of these cross-drainage structures there would be an improvement to upstream flooding conditions. At all other cross-drainage structures there would be negligible to minor impacts on flooding, and no further mitigation would be required.

Noise and vibration

A construction noise assessment was carried out for the three sections of the proposal. During construction, six noise catchments representing receivers within 100 metres of the road corridor would experience noise greater than the noise management levels. Fifty-eight residential receivers would also experience noise levels in the 'highly noise affected' range (greater than 75 dB(A). If construction activities outside normal working hours are required, it is likely to result in noise levels being exceeded at all locations. Additionally, 26 non-Aboriginal heritage items would be located between 10-50 metres from potential vibration generating activities.

It is expected that the potential impacts would be adequately managed through the implementation of feasible and reasonable management and mitigation measures.

An operational noise assessment was carried out for Section 2, as it would involve construction outside of the existing road corridor. There are 25 receivers in Section 2 that currently experience noise levels that exceed the NSW Government noise criteria during the daytime, and 24 during the night. Noise modelling of the no-build scenario against the build scenario for the opening year (2015) and design year (2025) has indicated that most receivers are predicted to experience a minor reduction in noise levels up to about 0.5 dB(A) with some receivers experiencing a reduction of up to 2 dB(A). This is due to an improvement in the road alignment and change in road levels drawing traffic away from receivers in Section 2. For residences that would experience an increase in noise levels, the increase would be below the 2 dB(A) threshold (therefore change in noise levels is unlikely to be perceptible to the human ear) and noise mitigation would not be required.

Justification and conclusion

The proposal as described in the REF best meets the proposal objectives in terms of improving safety and travel efficiency for this stretch of highway. This is achieved by providing more consistent intersections, providing continuous pedestrian facilities through Mount Victoria village, improving the road surface and widening the road shoulders.

This REF is based on thorough technical investigations that have examined and taken into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposal. These investigations have enabled Roads and Maritime to avoid or reduce a number of potential environmental impacts that would otherwise have occurred. In addition, Roads and Maritime has developed a range of measures to minimise and mitigate potential adverse impacts, and these are summarised in this REF.

This REF finds that the proposal would not have a significant impact on the environment and therefore an environmental impact statement and assessment under Part 5.1 of the EP&A Act is not required. In addition, there would be no significant impacts on matters of national environmental significance or the environment of Commonwealth land.

In conclusion, this REF finds that the adverse impacts of the proposal would be outweighed by the longer-term community benefits of improved traffic flow, reduced congestion and improved safety for all road users and the residents of Mount Victoria village. On balance, the proposal is therefore considered justified.

Display of the review of environmental factors

This review of environmental factors is on display for comment between 25 November 2013 and 7 February 2014. You can access the documents in the following ways:

Internet

The documents will be available as pdf files on Roads and Maritime's website http://www.rms.nsw.gov.au/roadprojects/projects/western_region/mt_victoria_lithgow/project_documents/safety_upgrade.html.

Display

The review documents can be viewed at the following locations:

- **Blue Mountains City Council**
  2-6 Civic Place
  Katoomba NSW 2780
  Open weekdays 8:30am to 5:00pm
- **Lithgow City Council**
  180 Mort Street
  Lithgow NSW 2790
  Open weekdays 8:15am to 4:00pm
- **Mount Victoria General Store and Newsagency**
  109 Great Western Highway
  Mount Victoria NSW 2786
  Open weekdays 7am to 6pm
  Open weekends 7am to 5pm
- **Hartley Valley Lolly Shop**
  2297 Great Western Highway
  Little Hartley NSW 2790
  Open weekdays 10am to 4pm
  Open weekends 8.30am to 5pm

Purchase

The review documents are available for purchase in hard copy ($25.00) or CD ($10.00) by contacting Katoomba to Lithgow project team on 1800 035 733.

How can I make a submission?

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

K2L Great Western Highway upgrade
PO Box 1406, Lane Cove NSW 1595
K2Lupgrade@rms.nsw.gov.au

Submissions must be received by close of business, 7 February 2014.

Privacy information

All information included in submissions is collected for the sole purpose of assisting in the assessment of this proposal. The information may be used during the environmental impact assessment process by relevant Roads and Maritime staff and its contractors.

Where the respondent indicates at the time of supply of information that their submission should be kept confidential, Roads and Maritime will attempt to keep it confidential. However there may be legislative or legal justification for the release of the information, for example under the *Government Information (Public Access) Act 2009* or under subpoena or statutory instrument.

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by that respondent but not to any identifying information provided by other respondents if a respondent has indicated that the representation should be kept confidential.

Any respondent may make a correction to the information that they have provided by writing to the same address the submission was sent.

The information will be held by the Katoomba to Lithgow project team at Level 4, 460 Pacific Highway, St Leonards NSW 2065.

What happens next?

Following the submissions period, Roads and Maritime will collate submissions. Acknowledgement letters will be sent to each respondent. The details of submission authors will be retained and authors will be subsequently advised when project information is released.

After consideration of community comments Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary. The community will be kept informed regarding this Roads and Maritime Services determination.

If the proposal goes ahead, Roads and Maritime proceeds with final design and tenders are called for construction of the project.

If you have any queries, please call the project information line on 1800 035 733 (toll free).

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1 Introduction

This chapter provides an overview of the proposal and outlines the purpose of this report.

1.1 Proposal identification

1.1.1 The proposal

The Great Western Highway is the major arterial road linking the Sydney metropolitan area to the Blue Mountains, Lithgow, Bathurst and other regional centres in the Central West region of New South Wales (NSW). The highway is:

- A key freight route between Sydney and the Central West region, including the timber industry in the Oberon area.
- A tourist route serving destinations such as the Blue Mountains, historic Hartley, Jenolan Caves, Mudgee and Bathurst.
- A connection between many towns and villages.
- A major route to Adelaide and Perth.

Roads and Maritime Services is currently upgrading sections of the Great Western Highway between Lapstone and Lithgow.

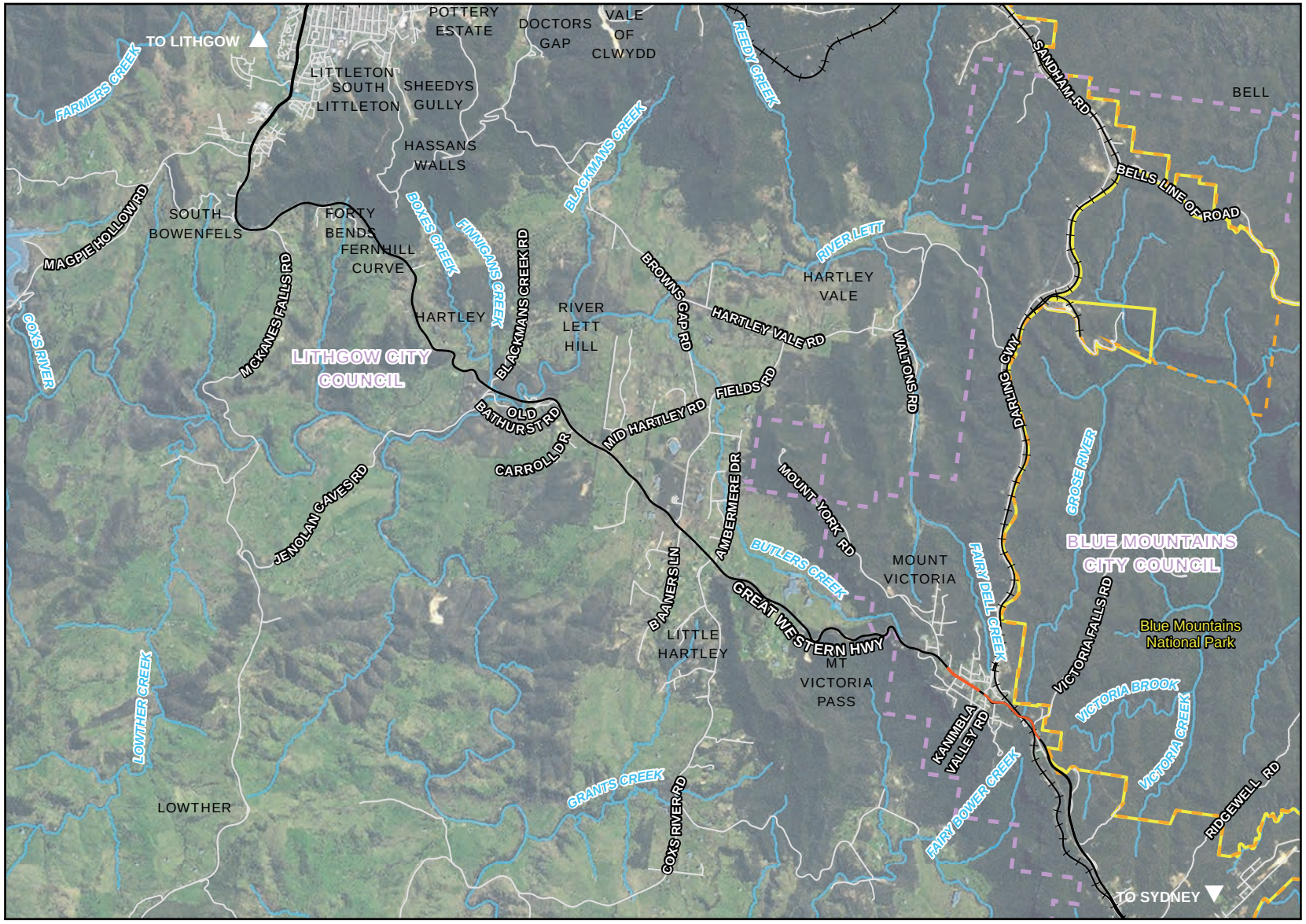
As part of the upgrade program, Roads and Maritime proposes to carry out safety upgrades along three sections of the highway through Mount Victoria village in the Blue Mountains, New South Wales. As shown in **Figure 1-1** and **Figure 1-2** these sections extend about 2.3 kilometres (in this report, this highway safety upgrade is referred to as 'the proposal'). The three sections are:

- Section 1: From 400 metres west of Browntown Oval to about 240 metres west of Victoria Falls Road.
- Section 2: From about 200 metres east of Harley Avenue to about 20 metres east of Station Street.
- Section 3: From about 90 metres west of Station Street in the centre of Mount Victoria village to immediately west of Mount York Road.

The proposal does not represent a major upgrade, but rather localised safety work. An overview of the proposal is shown in **Figure 1-2** and detailed drawings are included in **Appendix A**. The proposal is also described in further detail in **Chapter 3**. The key elements of the proposal include:

- Widening the highway shoulders by up to about three metres on each side of the road.
- Moving the highway about 20 metres to the north east between Mount Piddington Road and Hooper Street to improve the road alignment.
- Upgrading seven intersections, including:
  - Dedicated right turn bays at Harley Avenue, Mount Piddington Road, Kanimbla Valley Road and Selsdon Street.
  - Dedicated left turn bay at Mount York Road with the use of line marking.
  - Basic right turn at Victoria Falls Road.
  - Left in /left out only at Hooper Street and Cecil Road with the use of appropriate sign posting and line marking.
- Providing a new service road to improve and provide safe access to private properties on the southern side of the highway between Cecil Road and Mount Piddington Road.

FIGURE 1-1 | REGIONAL CONTEXT



LEGEND

- The proposal
- Existing highway
- Railway
- Primary waterway
- Road
- Blue Mountains World Heritage Area
- Blue Mountains National Park
- LGA boundary

Sinclair Knight Merz does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.

DATA SOURCES
ESRI Online 2013, Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001

0 2
Kilometres

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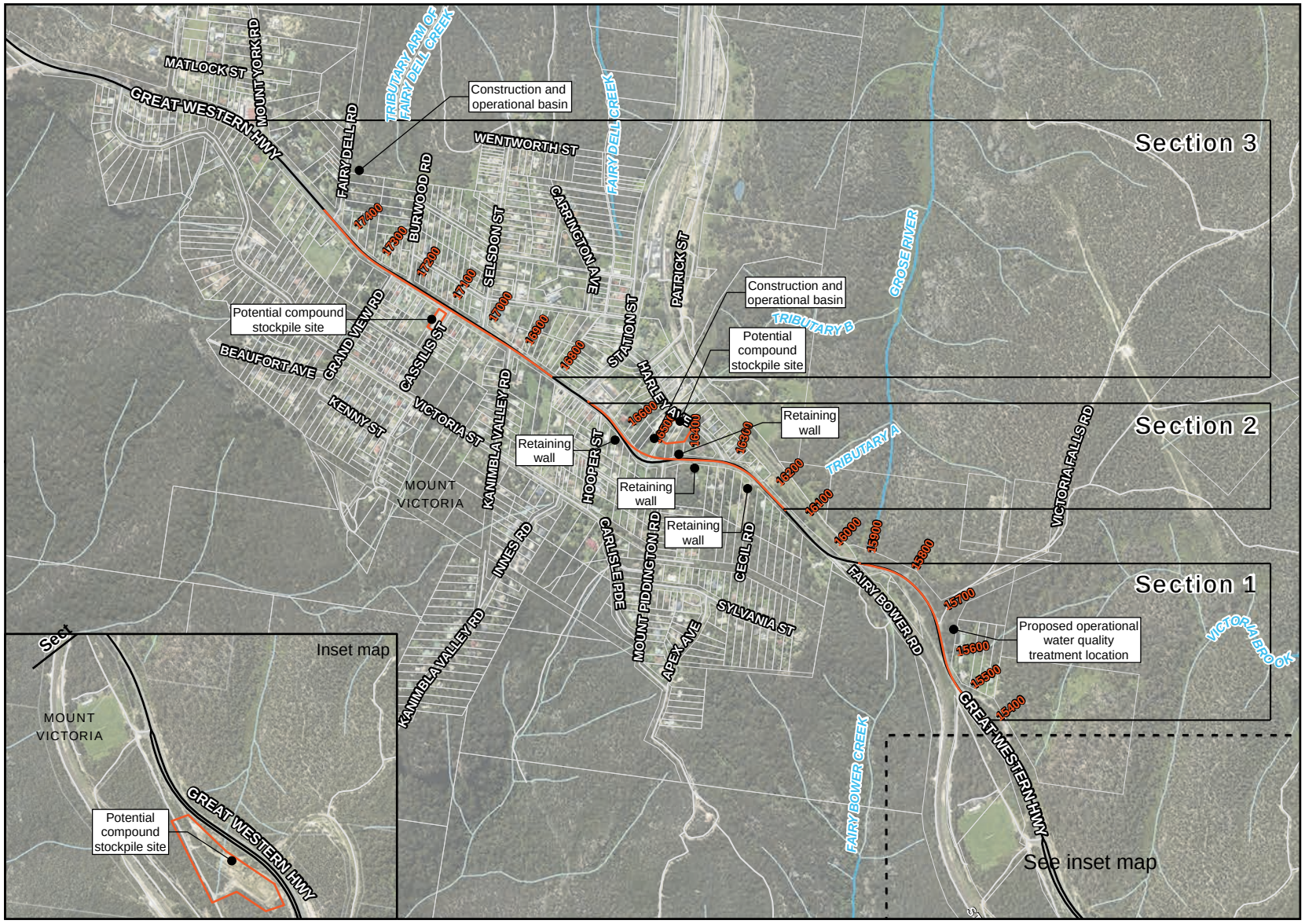
Newcastle Spatial Team - Prepared by : K0
Checked by : VC

FIGURE 1-2 | MOUNT VICTORIA VILLAGE SAFETY UPGRADE PROPOSAL



LEGEND

- The proposal
- Section boundary
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Property boundary

Sinclair Knight Merz does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.

DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001

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Metres

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Newcastle Spatial Team - Prepared by : KO
Checked by : VC

- Providing a pedestrian refuge in the central median near Selsdon Street and improved connectivity through additional pedestrian pathways within the proposal area.
- Building four retaining walls up to 5.5 metres high and up to 230 metres long.
- Building two new culverts and upgrading existing drainage infrastructure.
- Providing water quality basins at potentially three locations.
- Temporary construction facilities, including construction compounds and stockpile sites along its length.
- Tie-ins with the existing pavement and highway levels at the end of each section.

1.1.2 Timeframe and cost estimate

Roads and Maritime estimates that the proposal would take about 18 months to construct, with construction expected to start in late 2014. Roads and Maritime would stage construction to minimise overall impacts on vehicles that use the highway and on nearby residents and businesses.

The proposal would cost about $22 million to construct. The Australian and NSW governments would jointly fund the proposal as part of the Great Western Highway upgrade program.

1.1.3 Terms used in this report

The following terms are used in this review of environmental factors (REF):

- 'The highway' refers to the Great Western Highway.
- 'The proposal' refers to the concept design of a section of the Great Western Highway through Mount Victoria village in the Blue Mountains, NSW.
- 'The proposal area' refers to the area that would be directly impacted by the proposal. The proposal area encompasses the concept road design, including the realigned highway, batters, cuts and embankments. It also includes the total construction footprint, site compound locations, stockpile sites and any other areas that would be temporarily disturbed (such as construction basins and access tracks).
- 'The construction footprint' refers to the area that would be affected by construction of the proposal, assumed to be an area with a five-metre buffer from all design elements and known ancillary facilities.
- 'The study area' refers to the proposal area and the wider area that may be indirectly impacted by the proposal.

1.1.4 The locality

As shown in **Figure 1-1**, the proposal is located within Mount Victoria village, in the Blue Mountains City Council local government area (LGA). The area includes:

- Natural features such as Blue Mountains National Park, part of the Greater Blue Mountains World Heritage Area to the north and east (refer to **Section 6.8**).
- Urban land uses such as small businesses, residential development and community services. These include the Imperial Hotel, two schools, two churches and a Caltex service station.
- Heritage items on the local environmental plans for the Blue Mountains. There are 29 heritage items located along the highway next to or within the proposal area.
- Properties in Mount Victoria village that have direct access to the highway,

including residences.

- A range of vegetation, including remnant native vegetation, roadside plantings and disturbed areas dominated by exotic plants.
- Catchments of two rivers, including the Grose River which drains into the Greater Blue Mountains World Heritage Area and Blue Mountains National Park and the Coxs River catchment, which forms part of the Sydney Drinking Water Catchment. Together these catchments form part of the Hawkesbury-Nepean River catchment.

1.2 Purpose of the report

This REF has been prepared by Sinclair Knight Merz (SKM) on behalf of Roads and Maritime Services Sydney Region. Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The description of the proposal and associated environmental impacts have been carried out in the context of Clause 228 of the *Environmental Planning and Assessment Regulation 2000* (summarised in **Appendix B**), the *Threatened Species Conservation Act 1995* (TSC Act), *the Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of Section 111 of the EP&A Act, that Roads and Maritime examines and takes into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Roads and Maritime will consider the findings of the REF when assessing:

- Whether the proposal is likely to have a significant impact on the environment and, therefore, whether an environmental impact statement will be required, and approval sought, from the Minister for Planning and Infrastructure under Part 5.1 of the EP&A Act.
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in Section 5A of the EP&A Act and, therefore, the requirement for a Species Impact Statement.
- The potential for the proposal to significantly impact a matter of national environmental significance or Commonwealth land, and the need to make a referral to the Australian Government Department of 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 and the alternatives that Roads and Maritime considered in selecting the preferred option.

2.1 Strategic need for the proposal

The Great Western Highway is the principal road transport link connecting the Central West region of NSW, the Blue Mountains and Sydney. The highway is an important freight transport corridor; a vital connection to many popular tourist destinations within the region such as the Blue Mountains, historic Hartley, Jenolan Caves, Mudgee and Bathurst; and a key link between Sydney and the towns and villages to the west, such as Lithgow, Oberon, Mudgee, Orange and Bathurst.

Within this context, the proposal is required in order to:

- Cater for existing and future traffic flows.
- Improve safety on the highway by reducing the crash rate.
- Improve connectivity for pedestrians along the highway.
- Support freight and tourism services that use the highway.
- Support connectivity between local and regional areas.

2.1.1 Strategic planning and policy framework

A number of Commonwealth and State strategies and plans refer to the significance of the Great Western Highway and the need to improve its safety and efficiency. The proposal is consistent with these documents, which include:

- NSW 2021: A plan to make NSW number one (NSW Government 2011). NSW 2021 has identified a number of goals to improve the transport network. The goals of reducing travel times and improving road safety are relevant to the proposal. The proposal is consistent with NSW 2021 as it would help to meet these goals by upgrading a State Highway in the Central West to provide adequate road capacity for projected population growth and improve road safety.
- NSW Government State Infrastructure Strategy (2012-2032) (NSW Department of Premier and Cabinet, 2012). The Great Western Highway is identified as the main road freight corridor connecting Western NSW with Sydney and its ports. The Strategy identifies that the Great Western Highway suffers from constraints that limit freight movement, particularly for longer vehicles. The proposal is consistent with the Strategy as it would provide improved facilities for the movement of freight between Western NSW and Sydney.
- Sydney–Dubbo Corridor Strategy (Auslink, 2007). The strategic priorities of addressing crash risks, maintaining road pavements in a safe and efficient condition and managing operational flexibility for freight in the Blue Mountains are considered consistent with the objectives of the Mount Victoria village safety upgrade proposal (refer to **Section 2.3**).
- National Road Safety Strategy 2011–2020 (Australian Transport Council, 2011). The key targets identified within the Strategy focus on the reduction of casualties from road crashes. The key targets are considered consistent with the objectives of the Mount Victoria to Lithgow upgrade program (refer to **Section 2.3**) and the anticipated outcomes of the proposal.
- Central West Transport Needs Study (SKM, 2009). One of the major findings of the report was the identification of the improvement of the Great Western Highway between Mount Victoria and Lithgow as a short term (2009–2015)

candidate project for progression. This is consistent with the proposal which would improve the existing Great Western Highway through Mount Victoria village.

2.1.2 Great Western Highway upgrade program

The Australian and NSW governments are jointly funding the Great Western Highway upgrade program. The aim of the program is to improve travel times for freight transport and provide a safer environment for all road users.

Currently, 16 projects have either been completed or are in progress between Lapstone and Lithgow. The completed projects have led to faster travel for motorists and a safer road environment for all motorists, pedestrians and cyclists. These improvements support the position of the Australian and NSW governments to continue to upgrade the highway, including the section through Mount Victoria village, which is the subject of this report.

Mount Victoria to Lithgow upgrade project

As part of the Great Western Highway upgrade program, Roads and Maritime proposes to upgrade the section of highway between Mount Victoria and Lithgow to improve road safety and accessibility to communities in the Blue Mountains and Central West.

The Australian and NSW governments have committed $250 million to the upgrade. Since 2007, Roads and Maritime has been investigating the area between Mount Victoria and Lithgow to determine the preferred route for the upgrade. A preferred route was announced in May 2010, and a concept design was displayed in 2011–12.

NSW Government independent review

In September 2011, the NSW Government engaged Evans and Peck to undertake an independent review of the proposed upgrades of the Great Western Highway west of Katoomba. The review was initiated following concerns raised by some community members about environmental, cultural, social and economic impacts of the upgrade projects and to ensure that the best value for money would be obtained from the investment. The report of the independent review was released in January 2012.

In July 2012, the NSW and Australian governments announced a revised package of upgrades for the highway between Katoomba and Lithgow to address the recommendations of the independent review. The government investment remains at $250 million.

The revised package of upgrades will enhance safety and target specific deficiencies along the highway. Roads and Maritime will manage and deliver the upgrades, with work due to be completed by mid-2016.

Enhanced safety works program

The independent review recommended additional highway safety improvements between Mount Victoria and Lithgow, including at Mount Victoria village, Little Hartley, Hartley, River Lett Hill and Forty Bends. The revised package of upgrades for the Great Western Highway between Mount Victoria and Lithgow is the ‘enhanced safety works program’.

The purpose of the enhanced safety works program is to provide medium-term safety improvements throughout the corridor between Mount Victoria and Lithgow and to provide the most effective use of currently available funding.

This ‘enhanced safety works program’ includes existing commitments such as the completed roadwork at the top and bottom curves of Victoria Pass. These improvements were documented in the Mount Victoria to Lithgow Safety Review (NSW Centre for Road Safety, October 2010). The report identified key road safety measures required along the whole highway, including signage, delineation, line marking, junction treatments, road alignment, shoulder widening, safety barriers, clear zones, speed enforcement, and safe pedestrian and cycling facilities.

Roads and Maritime is currently carrying out the design development and environmental assessment of the enhanced safety works program through Mount Victoria village (as presented in this REF).

2.1.3 Traffic flow, level of service and crash data

Traffic flows

During March 2013, average annual two-way traffic on the Great Western Highway within Mount Victoria village ranged between about 11,000 and 12,000 vehicles per day. About 13.1 per cent of these vehicles were classified as heavy vehicles.

The two-way traffic volumes on local connecting roads were substantially lower. For example, about 950 vehicles per day were recorded on the Darling Causeway.

Based on previous traffic surveys and growth predictions, Roads and Maritime has adopted a linear traffic growth rate of 1.7 per cent per annum for light vehicles and 1.3 per cent per annum for heavy vehicles on the highway through Mount Victoria village. The forecast two-way traffic volumes are:

- Great Western Highway: Between 11,300 and 12,400 vehicles per day in 2015, and between about 13,200 and 14,500 vehicles per day in 2025.
- Darling Causeway: 1000 vehicles per day in 2015, and about 1200 vehicles per day in 2025.

Level of service

The ‘level of service’ (LoS) is a qualitative measure used to describe the potential for delay due to traffic, usually during peak demand periods. LoS ranges from A to F, where LoS A indicates free-flowing traffic and LoS indicates congested traffic.

Previous studies have identified LoS along the highway at Mount Victoria village as generally LoS A, with part of the highway LoS B in the PM peak period. LoS A reflects free-flowing traffic, which indicates that the highway has free-flowing traffic for most of the day.

Crash data

Crash data show there were 34 crashes on the highway between Browntown Oval and Victoria Street at Mount Victoria in the five-year period between July 2007 and June 2012. There was one fatal crash and 12 injury crashes on the length of road that is the subject of this report. The overall crash rate is 46.5 crashes per 100 million vehicle kilometres travelled (MVKT), which is about 350 per cent higher than the target in the NSW State Plan, and up to 50 per cent higher than the State average of 30.4 per 100 MVKT for a two-lane two-way roadway (RTA, 2008a).

The proposal aims to reduce the crash rate by:

- Improving the road geometry both horizontally and vertically (that is, making the road straighter and flatter).

- Improving intersections between the highway and local connecting roads and reducing conflict points.
- Widening the road shoulders.

2.2 Existing road and infrastructure

2.2.1 Great Western Highway

The Great Western Highway through Mount Victoria village is a classified State Highway. The road was constructed during the late 1950s to early 1960s. Key elements of this highway section are listed in **Table 2-1**.

Table 2-1 Key elements of the highway through Mount Victoria village

Key element	Description
Speed limit	• 60 km/h. • 40 km/h speed limit at school zones (Mount Victoria Public School and the M.E.T. School).
Vertical alignment	• Mostly undulating. The majority of the highway has a grade less than 4%; the maximum grade is 7.5%.
Length	• 2.3 km.
Road width	• 2-lane, mainly undivided two-way carriageway. • Lanes: 3.5 m wide. • Road shoulder: from 0.5 m to 2 m wide.
Residential access	• 41 properties have direct access onto the highway. • No formal refuges for cars are provided along the highway, but informal parking occurs
Bus stops	• Bus stops are located at the intersection of the highway and Selsdon Street, on both sides of the highway.
Local roads which intersect with the highway	• Victoria Falls Road. • Cecil Road (an unformed road). • Harley Avenue. • Mount Piddington Road. • Hooper Street. • Kanimbla Valley Road. • Selsdon Street. • Cassilis Street. • Burwood Road. • Grandview Road. • Fairy Dell Road. • Mount York Road.
Safety barriers	• W-Beam barriers are used intermittently along the highway, predominantly on the eastbound carriageway.
Retaining walls and cuttings	• Cuttings are located: – Between Mount Piddington Road and Cecil Road. – Near Victoria Falls Road. • A fill embankment is located opposite Mount Piddington Road next to the eastbound lane.

Typical sections of the highway are shown in **Photo 2-1** to **Photo 2-3**.

Photo 2-1 The highway through Section 1, showing narrow shoulders

Photo 2-2 The highway through Section 2, showing the tight curve opposite Mount Piddington Road and narrow uneven shoulders

Photo 2-3 The highway through Section 3, showing the uneven shoulders and large number of properties with direct access to the highway

2.2.2 Local roads and intersections

The proposal area includes 12 local roads, six to the north and six to the south of the highway.

Most of these roads are narrow, unmarked two-way undivided roads that are typically only used for access to private properties. The exceptions are Victoria Falls Road, which is an unsurfaced gravel road, Cecil Road, which is an informal road, and Harley Avenue, which is a State road and attracts significant heavy vehicle traffic. Most of these roads are currently not signposted for speed but would have a speed limit of 50 kilometres per hour consistent with Blue Mountains City Council requirements.

All of the local roads within the study area have low traffic volumes relative to the highway (refer to **Section 2.1.3**).

None of the intersections in the proposal area have traffic signals or dedicated turning lanes (the intersection at Station Street has traffic signals, but this intersection is outside the proposal area). At most of these intersections (with the exception of Fairy Dell Road), through traffic would have a short delay while waiting for cars to turn off the highway. All vehicle movements are permitted at all intersections in the proposal area. A description of these local roads and associated intersections is provided in **Table 2-2**.

A number of properties, including 41 residences, have direct access onto the highway. No formal refuges for cars are provided along the highway.

Table 2-2 Local roads that intersect the highway in the proposal area

Intersection	Description	Intersection treatment
Victoria Falls Road	An unsealed road providing access to Blue Mountains National Park, walking tracks,	Priority/ give way to vehicles on the highway

Intersection	Description	Intersection treatment
	other points of interest, one property and Mount Victoria cemetery.	
Cecil Road	An unformed road used to access a nearby property.	Priority/ give way to vehicles on the highway
Harley Avenue	Provides access to the public hall, theatre, NSW Trains substation, water treatment plant, volunteer bush fire brigade, and residential properties. It also serves as a heavy vehicle route to the Darling Causeway.	Priority/ give way to vehicles on the highway
Mount Piddington Road	Connects to a large proportion of the village's residential area, and Mount Victoria Public School, and also provides access to a water pumping station, and is part of the local bus and school bus route.	Priority/ give way to vehicles on the highway
Hooper Street	Provides access to residential streets and Mount Victoria Public School, and is part of the local bus and school bus route.	Priority/ give way to vehicles on the highway
Kanimbla Valley Road	Provides access to residential streets and Mount Victoria Public School via Victoria Street.	Priority/ give way to vehicles on the highway
Selsdon Street	Provides access to the MET School, Barker College (The Grange) and residential streets.	Priority/ give way to vehicles on the highway
Cassilis Street	Provides access to residential streets.	Priority/ give way to vehicles on the highway
Burwood Road	Provides access to residential streets.	Priority/ give way to vehicles on the highway
Grand View Road	Provides access to residential streets, Sunset Rock lookout and bushwalking tracks, and is part of the local bus and school bus route.	Priority/ give way to vehicles on the highway
Fairy Dell Road	Provides access to residential streets and a sewage pumping station.	Priority/ give way to vehicles on the highway
Mount York Road	Provides access to the Caltex service station, residential streets, hospitality businesses, lookouts and bushwalking tracks.	Priority/ give way Dedicated right turn lane off the highway.

2.2.3 Other infrastructure

The Blue Mountains railway line links the Sydney metropolitan area with the Blue Mountains area. The railway line traverses the study area in a north–south direction, and passes under the highway rail overbridge directly to the west of Section 1. Mount Victoria train station is located on Station Street, about 350 metres north-east of the highway.

Pedestrian access in the study area is limited and often informal, and there are no marked pedestrian crossings on the highway (there is a crossing at Station Street, but this is outside the proposal area). **Section 2.2.3** outlines existing pedestrian facilities in the study area.

Table 2-3 Existing pedestrian facilities

Section	Northern verge	Southern verge
1	No formal facilities.	No formal facilities.
2	No formal facilities.	No formal facilities. Pedestrians can use the shoulder or the drain for access, but these are not separated from traffic.
3	There is a footpath between Kanimbla Valley Road and Selsdon Street, and an unpaved track between Selsdon Street and Mount York Road. Pedestrians are required to walk on the road shoulder in front of the guard rail for about 40 metres at Fairy Dell Road.	There is a footpath between Kanimbla Valley Road and about 20 metres east of Fairy Dell Road. Overgrown vegetation on the verge forces pedestrians onto the road shoulder for about 40 metres. Pedestrians can use a grassed verge between Fairy Dell Road and Mount York Road.

2.2.4 Drainage

Road pavement drainage collects run-off from low-density residential catchments nearby. These catchments are located on medium to steep terrain on both sides of the highway. The catchments generally discharge to undefined roadside channels via formal and informal roadside channels. In addition, some areas are subject to run-off from external catchments that slope towards the highway. Stormwater from the road surface flows through cross-drainage culvert pipes that discharge to drainage lines to the north of the highway. There is currently no treatment for stormwater run-off or spill containment infrastructure for run-off from the existing highway.

The existing drainage network includes a mix of open channels and swales, with some pit and pipe systems that discharge untreated stormwater to the Grose River and Coxs River catchments. Existing culverts along the highway within the proposal area are listed in **Table 2-4**.

Table 2-4 Location of drainage culverts

No.	Approximate chainage	Size and type
1	15530	600 x 600 mm heritage stone box culvert
2	15590	375 mm diameter reinforced concrete pipe
3	16170	600 mm diameter reinforced concrete pipe
4	16490	600 mm diameter reinforced concrete pipe
5	16780	600 mm diameter reinforced concrete pipe
6	17370	450 mm diameter reinforced concrete pipe

2.3 Proposal objectives

The objectives of the proposal flow directly from the strategic need. The objectives are to:

- Improve safety for all road users in Mount Victoria village and cater for a mix of

motorists, cyclists and pedestrians.
- Be sensitive to the area's natural environment, heritage and local communities.
- Maintain the integrity and qualities of Mount Victoria as a village in the Greater Blue Mountains World Heritage Area.

These objectives are consistent with the overall objectives for the Great Western Highway upgrade program, which are to:

- Improve road safety.
- Improve freight efficiency.
- Cater for the mix of through, local and tourist traffic.
- Be sensitive to the area's natural environment, heritage and local communities.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of options

In 2012, following the identification of the need for the proposal, Roads and Maritime developed various strategic options to improve traffic and pedestrian movements throughout Mount Victoria village. The options incorporated community feedback from 2011. These options included the 'do nothing' option, new lane configurations between Grandview Road and Kanimbla Valley Road and between Station Street and just east of Harley Avenue, and various safety and traffic management improvements. The Mount Victoria village safety upgrade feasibility report (Roads and Maritime Services, 2012a) presents these options in more detail.

Following a detailed review of these options, which included community consultation (refer to **Chapter 5**), Roads and Maritime identified a preferred option. The 'do nothing' option was rejected as it would not address the strategic need; it would not address the recommendations of the independent review by Evans & Peck; and it would not fulfil the proposal objectives. The various options and the preferred option are outlined in the following sections.

2.4.2 Options identified for Mount Victoria village

Roads and Maritime developed 21 strategic options to address safety considerations at nine locations within Mount Victoria village. All of these options were located along the existing alignment of the Great Western Highway through Mount Victoria village, and entailed various localised treatments to achieve the proposal objectives. These options are listed in full in the Mount Victoria village safety upgrade feasibility report (Roads and Maritime, 2012a).

The shortlisted options that were considered feasible at each location are summarised in **Table 2-5**. Feasible options were identified by the design team and entailed those options that would make the road geometry for the section of the Great Western Highway through Mount Victoria village conform to a 60 km/h speed limit, whilst effectively managing pedestrian and cyclist movements within the village.

The strategic options outlined in **Table 2-5** were presented at a technical review workshop in July 2012. Each option was assessed to gauge how well it would satisfy the proposal objectives.

Table 2-5 Summary of shortlisted options for the Mount Victoria village safety upgrades (October 2012)

Location	Option ID	Description
Browntown Oval	-	• Relocate the 'overtaking lane ahead' sign to the batter bench. • This would minimise the likelihood of confusing the line markings for a right-turn for an overtaking lane.
Victoria Falls Road	1	• Provide a basic right-turn treatment, involving pavement widening and cutting into an existing batter. • Enclose the existing culvert and headwall.
Railway overpass	1	• Widen the curve for 60 km/h, but undertake no improvements to the bridge. • Provide a 2 m shared path behind the Gatekeepers Cottage.
	4	• Construct a two-lane railway overpass north of existing overpass, with shoulders and shared path.
	5	• Construct a two-lane railway overpass south of the existing overpass. • Straighten this section of carriageway.
Harley Avenue	1, 2, 3 and 5	• Provide a shortened protected right-turn treatment to a parking area on Harley Avenue where two 19 m articulated vehicles can park. • Provide a splitter island in Harley Avenue.
	4, 4a and 4b	• Increase the curve radii on the highway to improve geometry at Mount Piddington Road. • Provide a shortened channelised right-turn treatment, with a pedestrian refuge and 1.2 m footpath into Harley Avenue.
Mount Piddington Road to Hooper Street	3	• Provide a shortened channelised right-turn treatment at Mount Piddington Road. • Provide a 2 m shared path on the southern side of the highway extending to Hooper Street, and a pedestrian refuge for cyclists to cross east of Hooper Street.
	4	• Increase the curve radii on the highway at Harley Avenue to improve geometry at Mount Piddington Road. • Provide a basic right-turn treatment at Mount Piddington Road. • Provide a 2 m shared path on the southern side of the highway extending to Hooper Street, and a pedestrian refuge for cyclists to cross east of Hooper Street.
	4a	• Increase the curve radii on the highway at Harley Avenue to improve geometry at Mount Piddington Road. • Provide a shortened channelised right-turn treatment at Mount Piddington Road. • Provide a 2 m shared path extending to Hooper Street, and a pedestrian refuge for cyclists to cross east of Hooper Street.
	4b	• Increase the curve radii on the highway at Harley Avenue to improve geometry at Mount Piddington Road. • Provide a Type-F barrier to restrict right-in/ right-out traffic movements at Mount Piddington Road. • Provide a 2 m shared path on the southern side of the highway extending to Hooper Street, and a pedestrian refuge for cyclists to cross east of Hooper Street.
Mount Piddington Road to Hooper Street	5	• Provide a non-conforming Type-F barrier to restrict right-in/ right-out traffic movements at Mount Piddington Road. • Provide a 2 m shared path on the southern side of the highway extending to Hooper Street, and a pedestrian refuge for cyclists to cross east of Hooper Street.

Location	Option ID	Description
Station Street	1	• Provide a bus bay west of Station Street.
Kanimbla Valley Road to Grandview Road	1	• Provide successive basic right-turn treatments, without full pavement widening. • Provide a 2 m shared path next to the eastbound lane.
	1a	• Widen the highway to provide successive basic right-turn treatments, with kerb and gutter. • Provide a 2 m shared path next to the eastbound lane.
	2	• Widen the highway to provide a median turning lane, with kerb and gutter. • Provide a 2 m shared path next to the eastbound lane.
	3	• Widen the highway to provide successive channelised right-turn treatments with kerb and gutter. • Provide a 2 m shared path next to the eastbound lane.
Fairy Dell Road	1	• Provide an indented right-turn treatment. • Provide a 2 m shared path and 1.2 m footpath throughout.
Mount York Road	1	• Retain the existing indented right-turn treatment. • Provide a U-turn bay west of the Caltex Station, widen the shoulder and introduce a kerb.

Following the review of these shortlisted options, Roads and Maritime selected preferred options, which are listed in **Table 2-6**. The following criteria were used in the selection of the preferred options:

- Environmental issues.
- Provision for pedestrian/ cyclist access.
- Road safety considerations.
- Design considerations (including pavement design).
- Traffic management implications.
- Property impacts.
- Constructability issues.
- Maintenance and operation considerations.
- Community expectation.
- Implication for village character.
- Strategic cost estimate.

Table 2-6 The preferred options for the safety upgrades

Location	Favoured option	Description and benefit
Browntown Oval	-	• Relocate the 'overtaking lane ahead' sign to the batter bench. • This would minimise the likelihood of confusing the line markings for a right-turn for an overtaking lane.
Victoria Falls Road	1	• Provide a basic right-turn treatment to allow through vehicles to safely pass waiting right-turning vehicles. • This would directly address the road safety issues at this intersection.
Railway overpass	1	• Widen the curve, provide shoulders and a 2 m wide shared path. No change to the bridge is proposed. • This would have the least impact on the village character and environment, provide access for pedestrians and cyclists, and represent a value for money solution.
Harley Avenue	4a	• Widen the curve, and provide a painted median, a dedicated right turn lane, a pedestrian refuge, a 1.2 m wide footpath, and concrete islands in the road median. • This would improve road safety by providing wide separation of opposing traffic, improving conditions for turning vehicles, and improving the approach to the Mount Piddington Road intersection.
Mount Piddington Road to Hooper Street	4a	• Widen the curve, and provide a painted median, a dedicated right turn lane, and a pedestrian refuge; and a concrete island in the road median to restrict right turns at Hooper Street. • This would improve road safety by having a wide separation of opposing traffic and improving conditions for turning vehicles.
Station Street	1	• Install a pedestrian phase at the eastern side of the intersection, improve the westbound footpath between Station Street and Kanimbla Valley Road and formalise a westbound bus stop in a shop access (driveway). • This would have the least impact in terms of heritage items and property acquisition, particularly for the Mount Victoria Memorial Park.
Kanimbla Valley Road to Grandview Road	2	• Widen the highway to provide a median turning lane, with kerb and gutter and a 2 m wide shared path next to the eastbound lane. • This would provide continuity of urban intersection treatments on the highway west of Katoomba, with dedicated right turns.
Fairy Dell Road	1	• Provide a dedicated right-turn bay from the highway and a concrete island in the Fairy Dell Road median. • This would formalise traffic movement at the intersection.

Location	Favoured option	Description and benefit
Mount York Road	Modified 1	• Install a raised median in front of the Caltex Station on the highway, as well as a concrete island at the kerb and in the median of Mount York Road; improve line marking; and provide formalised truck parking next to the eastbound carriageway. • This would restrict unsafe movements in front of the Caltex Station, improve guidance and delineation of traffic and formalise the urban approach to the village.

Roads and Maritime placed the strategic concept designs and feasibility report on public display in October 2012.

Roads and Maritime then further developed the concept design and reviewed cost estimates. This work indicated that the designs presented in the feasibility report did not necessarily align with the original intent of the enhanced safety works program or the project objectives. Roads and Maritime also considered issues and concerns raised during the public display and presented a revised scope of work to Roads and Maritime's Project Control Group in April 2013. The Project Control Group endorsed this revised scope of work and adjusted the design.

As a result of these revisions, the favoured options as described in **Chapter 3** were consolidated into a single preferred option that focuses on three core sections in Mount Victoria village:

- Section 1: From 400 metres west of Browntown Oval (chainage 15400) to about 240 metres west of Victoria Falls Road (chainage 15880).
- Section 2: From about 200 metres east of Harley Avenue (chainage 16130) to about 20 metres east of Station Street (chainage 16660).
- Section 3: From about 90 metres west of Station Street (chainage 16790) to immediately west of Mount York Road (chainage 17760).

2.4.3 Design refinements

In July 2013, Roads and Maritime held a planning review workshop to review the project development process and confirm the preferred option. The workshop resulted in a number of refinements to the concept design. These refinements included:

- Covering the heritage-listed culvert in Section 1. This would protect the culvert from damage during construction and operation of the proposal.
- Providing a traffic safety barrier and pedestrian fence near the Gatekeepers Cottage to improve the safety of pedestrians.
- Delineation of left-in/left-out turns at the Hooper Street intersection. This would improve the safety of vehicles entering and exiting Hooper Street, and reduce congestion at the intersection as a result of turning vehicles.
- Providing a pedestrian refuge at the painted island between Kanimbla Valley Road and Cassilis Street, near Selsdon Street. This would improve safety for pedestrians and cyclists crossing the highway at this location.

During concept design development, retaining walls were added to the proposal to limit property and environmental impact. The retaining walls are located at:

- Chainage 16230 to 16454.
- Chainage 16227 to 16320 and chainage 16380 to 16454.

- Chainage 16340 to 16540.
- Chainage 16560 to 16623.

Further detail on these retaining walls is provided in **Section 3.2.3**.

2.5 Preferred option

The preferred option is outlined in detail in **Section 3.1**. This option satisfies the intent of the enhanced safety works program and the proposal objectives, and responds to the issues raised by the Mount Victoria community. The preferred option would:

- Improve safety and help reduce the crash rate through Mount Victoria village.
- Improve traffic efficiency for all road users.
- Cater for traffic growth expected over the next 20 years.
- Provide a solution that represents value for money and is able to accommodate planned developments in the area.
- Maintain the unique visual and heritage qualities of Mount Victoria village.

3 Description of the proposal

This chapter describes the proposal, the design parameters and major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

Roads and Maritime proposes to enhance safety along a 2.3 kilometre section of the Great Western Highway through Mount Victoria village. The work would be carried out in three sections, from 400 metres west of Browntown Oval (east of Mount Victoria village) to just west of Mount York Road (refer to **Figure 3-1a** to **3–1c**).

The proposal is based on a concept design that has been prepared using the available information and current design standards and criteria for the Great Western Highway upgrade program, which is currently underway. Some elements of the design may be further refined during detailed design. The main features of the proposal are summarised in **Table 3-1**.

Table 3-1 Key elements of the proposal

Section	Proposed safety improvements
Section 1: Between 400 m west of Browntown Oval and 240 m west of Victoria Falls Road (chainage 15400 to chainage 15880)	• Widen the road shoulders up to about 2.5 m on both sides of the road. • Provide a basic right turn into Victoria Falls Road. • Provide a concrete safety barrier, new pedestrian footpath (about 80 m long) and pedestrian fence next to the Gatekeepers Cottage. • Provide a pedestrian pathway about 160 m long next to the westbound lane between about chainage 15400 and 15600 • Upgrade drainage, with kerb and guttering along the length of Section 1, including underground pipes to convey stormwater. • Water quality treatment next to the eastbound lane, near Victoria Falls Road. • Incorporation of underground utilities within the proposed pedestrian pathway about chainage 15490 and 15560.
Section 2: Between 200 m east of Harley Avenue and 20 m east of Station Street (chainage 16130 to chainage 16660)	• Widen the road shoulders up to about 3 m on both sides of the road. • Build a 6 m wide and 230 m long two-way service road. This road would provide safe access to private properties on the southern side of the highway between Cecil Road and Mount Piddington Road. This service road would have shared vehicle and pedestrian use. • Provide a pathway about 170 m long between Mount Piddington Road and Hooper Street, next to the westbound lane. • Provide dedicated right-turn bays into Harley Avenue and Mount Piddington Road. • Provide a left-in and left-out turning control at Hooper Street with signposting and line marking. • Moving the road about 20 m to the north between Mount Piddington Road and Hooper Street to improve the road alignment by easing the sharp curve. • Upgrade drainage, with kerb and guttering along the length of Section 2, including underground pipes to convey stormwater. • Provide 4 retaining walls to minimise environmental and property impacts. • Build a water quality and detention basin next to the eastbound lane, opposite Mount Piddington Road. • Relocation of underground utilities within the new service road.
Section 3: Between 90 m west of Station Street and immediately west of Mount York Road (chainage 16790	• Widen the road shoulders up to about 2.5 m on both sides of the road. • Provide dedicated right-turn bays at Kanimbla Valley Road and Selsdon Street. • Line marking improvements on the highway immediately west of Mount York Road to create a dedicated left turn lane into Mount York

Section	Proposed safety improvements
to chainage 17760)	Road. • Install a raised island in the median of Fairy Dell Road. • Remove the eastbound steel guardrail west of Grandview Road and relocate electrical poles and the pole-mounted transformer. • Provide a pedestrian refuge in the central median of the highway near Selsdon Street. • Provide a pedestrian pathway along both sides of the highway, for the length of Section 3. • Upgrade drainage, with kerb and guttering along the entire length of Section 3, including underground pipes to convey stormwater. • Build a water quality and detention basin on Fairy Dell Road. • Incorporate underground utilities into the proposed pedestrian pathway on both sides of the highway for the length of the section.
All sections	• Design speed would remain at 60 km/h. • Highway would remain a two-laned road (one lane in each direction). • Partial acquisition of 18 properties. • Install kerb and guttering south of the highway in all sections. • Improve the road surface by providing new pavement to tie-in to the vertical levels of the existing highway.

Construction of the proposal would be staged to minimise impacts on traffic using the Great Western Highway and nearby residents and businesses (staging is detailed in **Section 3.3**). An overview of the proposal showing key features and sections is shown in **Figure 3-1a** to **3–1c**. A detailed description of the concept design is included below and concept design plans are provided in **Appendix A**.

3.2 Design

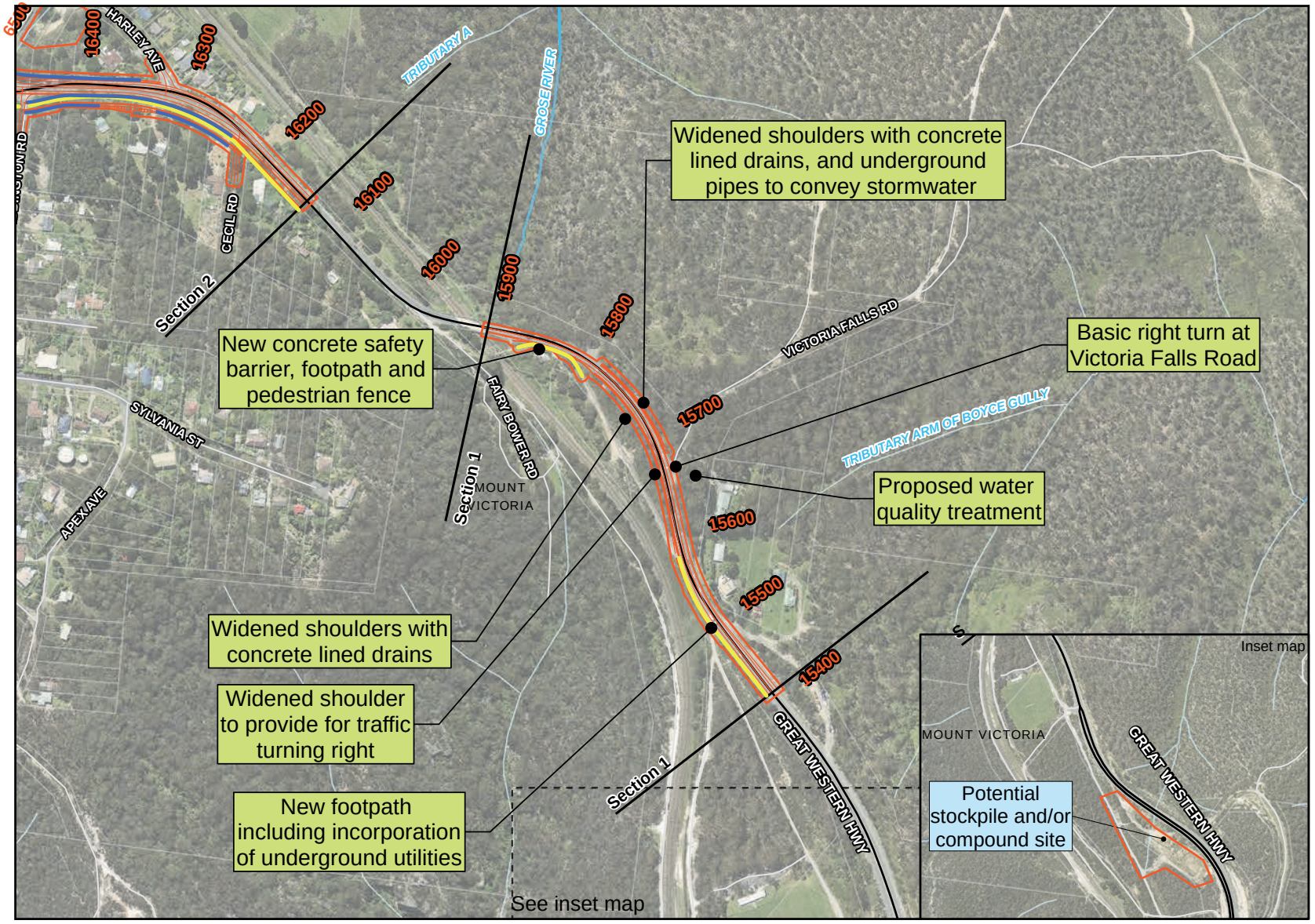
The concept design was prepared to provide road geometry with a design speed of 60 kilometres per hour, and help to safely and effectively manage pedestrian and cyclist movements in Mount Victoria village. The concept design is described below. It would be further refined during detailed design.

3.2.1 Design criteria

The concept design for the proposal was prepared in accordance with a Design Management System certified under AS/NZS ISO 9001:2008 Quality Management Systems (Standards Australia, 2008). Roads and Maritime also referred to the following design guides and policies during the development of the proposal:

- Austroads Guide to Road Design (Austroads, 2009) and Roads and Maritime supplements to the Austroads Guide.
- Austroads Road Safety Audit Manual (Austroads, 2009).
- Roads and Maritime's Road Design Guide (Roads and Maritime, undated).
- Roads and Maritime's Delineation Guidelines (Roads and Maritime, undated).
- Great Western Highway Urban Design Framework – Blue Mountains – Lapstone to Katoomba (RTA, 2006).
- NSW Bicycle Guidelines (Roads and Maritime, 2005) and Planning Guidelines for Walking and Cycling, as mandated by Roads and Maritime Services Core Business Policy Number PN027.
- Soils and Construction – Managing Urban Stormwater, Volume 1 (Landcom, 2004) and Volume 2D (DECC, 2008b).
- NSW Trains (formerly RailCorp) Engineering Standards.

FIGURE 3-1a | OVERVIEW OF THE DESIGN



LEGEND

- The proposal
- Proposal area
- Retaining wall
- Pedestrian footpath
- Section boundary
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Property boundary
- Design feature
- Construction activity

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DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001

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Metres

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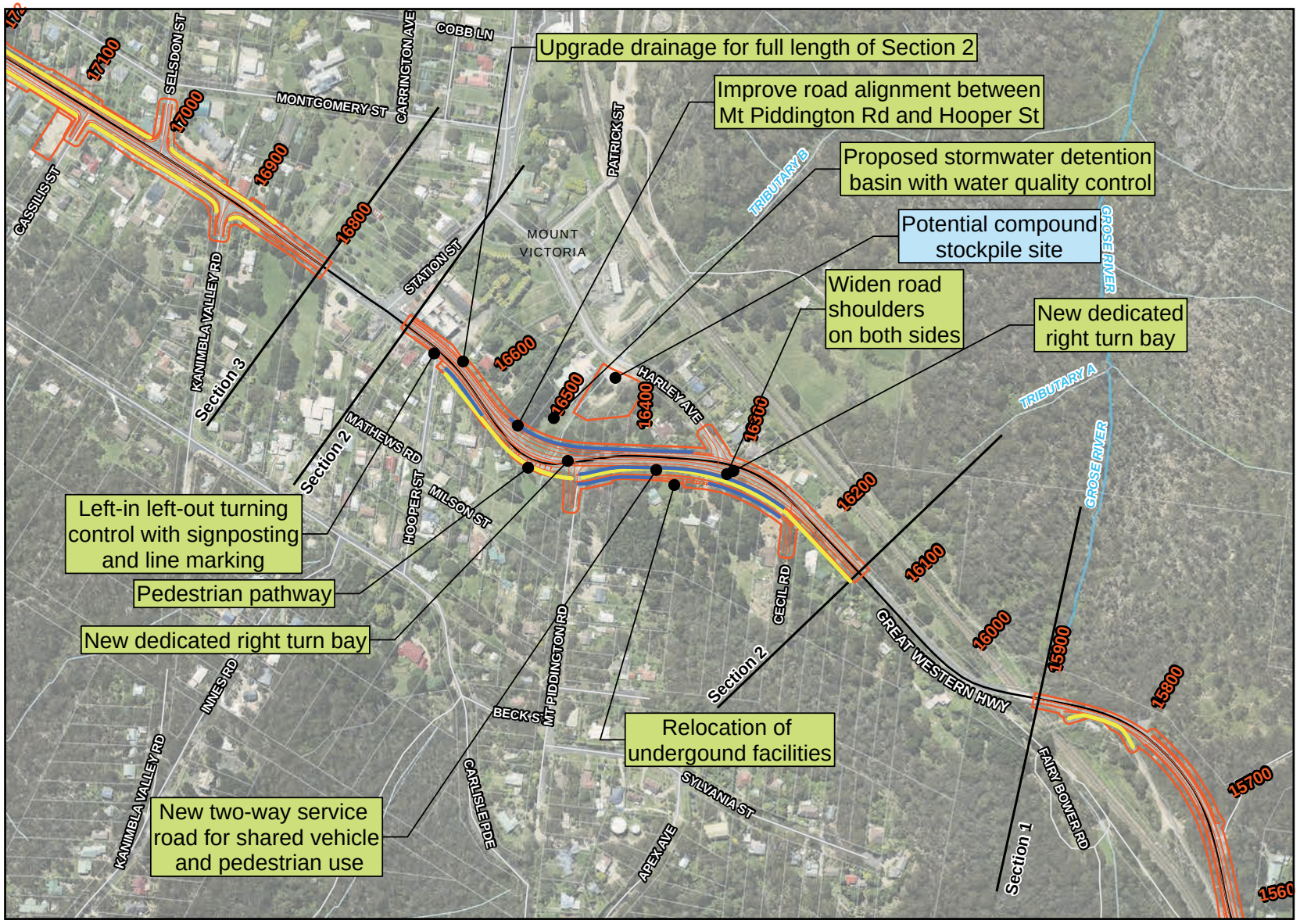
Newcastle Spatial Team - Prepared by : KM
Checked by : JWC

FIGURE 3-1b | OVERVIEW OF THE DESIGN



LEGEND

- The proposal
- Proposal area
- Retaining wall
- Pedestrian footpath
- Section boundary
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Property boundary

Design feature

Construction activity

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DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001

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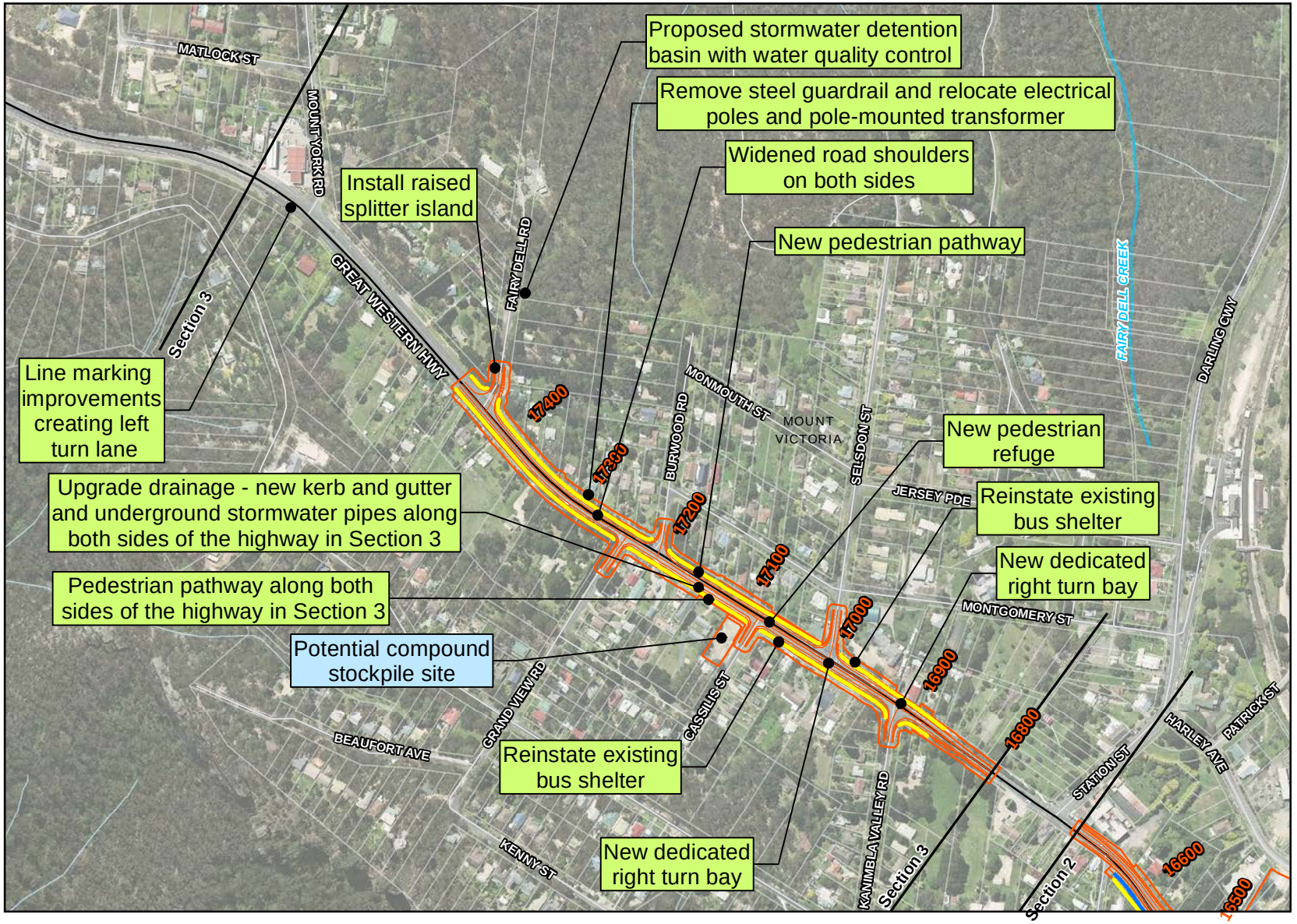
Newcastle Spatial Team - Prepared by : KM
Checked by : JWC

FIGURE 3-1c | OVERVIEW OF THE DESIGN



LEGEND

- The proposal
- Proposal area
- Retaining wall
- Pedestrian footpath
- Section boundary
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Property boundary

Design feature

Construction activity

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DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001

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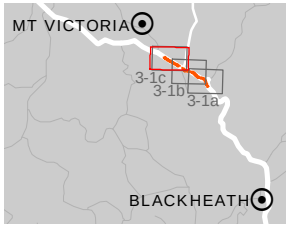
Metres



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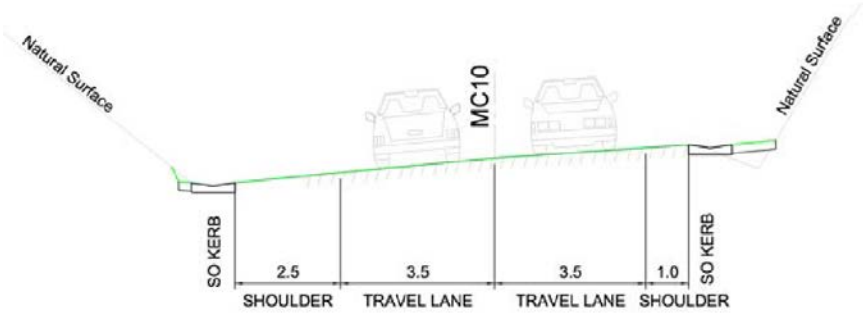
Newcastle Spatial Team - Prepared by : KM
Checked by : JWC

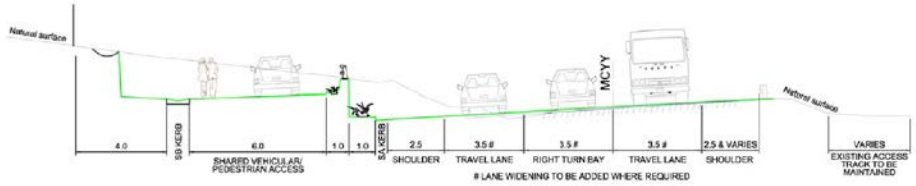
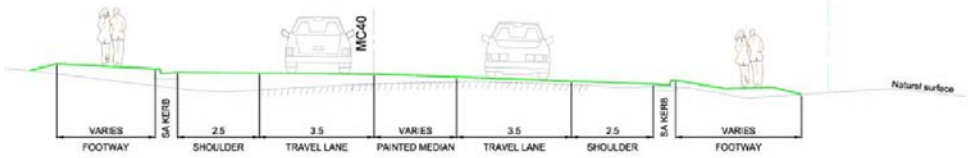
The adopted design criteria for the proposal are summarised in **Table 3-2**.

The concept design also reflects the following considerations:

- Urban and landscape design objectives (refer SMM, 2013a):
  - Objective 1: Develop an integrated concept design that fits sensitively with the existing qualities and characteristics of Mount Victoria and its setting at the western end of the Blue Mountains World Heritage Area.
  - Objective 2: Provide a good urban design outcome, taking into account the existing amenity, visual character and cultural landscapes at Mount Victoria.
  - Objective 3: Maintain the integrity of cultural and historic buildings, structures, elements and spaces of Mount Victoria.
  - Objective 4: Improve safety and connectivity for motorists, pedestrians and cyclists.
- The need to minimise environmental impacts by selecting an alignment that requires minimal vegetation removal and complements the road design.
- The need to minimise land acquisition and disruption to residents.
- The needs of pedestrians and cyclists, as presented in the Blue Mountains City Council Pedestrian Access and Mobility Plan and Blue Mountains Bike Plan 2020.

Table 3-2 Design criteria

Requirement	Criteria
Design speed	Design speed horizontal 60 km/h. Design speed vertical 60 km/h. Posted speed limit 60 km/h.
Shoulder width	Typically 2.5 m.
Grade	0.5% minimum. 7.5% maximum.
Stopping sight distance	Reaction time: 1.5 seconds.
Cross-section / lane width	Through lanes – 3.5 m with lane widening added where required. Auxiliary lanes – 3.0 m minimum. New service road (Section 2) – 2.5 m with no line marking.
Cross-section / lane width	 Typical cross section for Section 1

Requirement	Criteria
	 Typical cross section for Section 2
	 Typical cross section for Section 3
Pavement	Preliminary pavement design comprises a 150 mm lean mix concrete base, 200 mm asphalt and 300 mm selected material sub-base.
Tie-ins	Provided at the start and end of each of the 3 sections of the proposal (as described in **Table 3-1**).
Property access	Property access would be available throughout the length of the proposal from both directions of travel. Access to properties to the south of the Great Western Highway, between Cecil Road and Mount Piddington Road would be provided via a new service road.
Footpath	Width typically between 1.2 m and 1.5 m.
Lighting	V3 lighting category.
Drainage	New pavement drainage systems are to be designed for a minimum of a 10 year ARI event.
Batter slope	Fill batter 4:1. Cut batter 2:1.

3.2.2 Engineering constraints

Roads and Maritime has identified a number of engineering issues and constraints for the design and construction of the proposal. The main issues and constraints are:

- Natural features: These include topography (there is medium to steep terrain on both sides of the highway) and drainage. Although watercourses and drainage lines (specifically Fairy Dell Creek) are some distance from the proposal, care would be required to manage drainage to avoid indirect impacts.
- Tie-ins to the existing highway: The eastern and western extents of each section are required to tie in to existing curves on the highway, which would constrain the design speed at these locations.
- Existing utility infrastructure: This includes electricity, telecommunications, gas, water and sewerage services, which may need to be moved.
- Access: Construction would affect access to 41 properties, particularly to the south of the highway between Cecil Road and Mount Piddington Road and on both sides of the highway between Kanimbla Valley Road and Fairy Dell Road. Access to these properties would need to be maintained during construction (refer to **Section 3.2.3**).

- Existing road connections: 10 local roads, one State road and one unformed road intersect the highway, and their vertical and horizontal alignments may need to be adjusted to tie in with the proposal.
- Environmental considerations, in particular:
  - Non-Aboriginal heritage: Twenty-nine heritage items are located along the highway within the proposal area. Of these, there are 13 heritage items with the potential to be affected by the proposal (12 of these are listed on the local environmental plans for the Blue Mountains). Moreover, parts of Sections 2 and 3 are located within the Mount Victoria Urban Conservation Area.
  - Biodiversity: Potential constraints include existing vegetation in Section 1, in particular the Silvertop Ash, which is of moderate conservation value. The proposal is also located within 100 metres of the Blue Mountains National Park and Blue Mountains World Heritage Area. Care would be required to avoid direct and indirect impacts from stormwater run-off.
  - Noise: A number of residences and other sensitive receivers are located next to the highway within Mount Victoria village.
  - Urban design: The proposal needs to 'fit' with the surrounding visual and heritage landscape.
- Staging of the proposal: The proposal would be generally constructed on the same alignment as the existing highway. This would pose staging challenges, as traffic flows in both directions and access to local roads and properties would need to be maintained.

3.2.3 Major design features

Intersection improvements

Dedicated right-turn bays, 35 to 40 metres long and 3.5 meters wide, would be provided on the Great Western Highway at the following intersections:

- Harley Avenue.
- Mount Piddington Road.
- Kanimbla Valley Road.
- Selsdon Street.

These right-turn bays would provide safer conditions for motorists turning onto these roads from the highway.

A basic right turn would be provided at Victoria Falls Road. Hooper Street would be converted to left in/left out access through the use of signposting and linemarking.

Shoulder widening

Widening would occur throughout the proposal area, up to three metres on both sides of the highway in sections. The road shoulders would be widened at Victoria Falls Road, Cassilis Street, Burwood Road and Grand View Road. The wider shoulders would provide drivers and on-road cyclists with safer road conditions.

Service road

A new service road about 6 metres wide and about 230 metres long would be provided to the south of the highway between Cecil Road and Mount Piddington Road. The road would provide properties on the southern side of the highway with safe access onto the highway and would be shared by vehicles and pedestrians. It would be separated from the highway via a retaining wall, and would be up to five metres higher than the highway.

During construction, a temporary service road would be provided to maintain access for residents. The temporary service road would be in use while the new permanent service road, retaining walls and widening work is being constructed.

Drainage

Cross-drainage

The proposal would involve the retention and extension of four cross-drainage culverts to accommodate the width of the upgraded highway. A heritage listed box stone culvert (refer to **Section 6.3**) currently provides cross drainage under the highway near Browntown (a heritage listed item). The culvert would be left undisturbed during construction. A pedestrian safe grate would be placed over the top of the culvert inlet to ensure safe access across the culvert. Final management measures relating to this culvert would be determined during detailed design (refer to **Section 6.3.4**).

The proposal would involve installation of two new culverts in the following locations:

- Culvert X4 between Mount Piddington Road and Hooper Street: A 1050 millimetre diameter cross-drainage structure would be installed at chainage 16490.
- Culvert X6 east of Fairy Dell Road: A 600 millimetre diameter cross-drainage structure would be installed at chainage 17370.

Pavement drainage

The pavement drainage strategy for the proposal involves a new pit and pipe drainage system along the highway to convey stormwater run-off from the realigned and widened sections of highway pavement, and from the proposed access road between Cecil Road and Mount Piddington Road. SO kerb (shallow v-shaped dish drains) and SA kerb (standard kerb and gutters) would replace the existing formed table drains in most locations. This system would be designed to capture and convey run-off generated by short-duration storms with ARIs of up to 10 years (refer to **Section 6.4**).

No new concentrations of flow would be anticipated as a result of the proposal. Flow collected in the new pavement drainage system would discharge through existing outlet points. The increase in flow would be managed through the construction of basins (refer to **Section 3.4.2**) and other pavement drainage such as an upgraded surcharge pit downstream of culvert X1.

Measures to manage scour

Scour can occur due to the force of run-off during storms. Investigations have shown that scour is a risk at Lot 3 in DP 1140103, at the northern end of Fairy Dell Road near chainage 17460. The proposal includes three options to reduce the risk of scour at this location:

- Option A: Construct a minor stormwater detention basin near Lot 3 in DP 1140103.
- Option B: Extend the proposed drainage pipe along Fairy Dell Road to the base of the slope, and construct a channel at the outlet.
- Option C: Install a drainage pipe along Burwood Road in addition to the drainage pipe along Fairy Dell Road (described in Option B).

These options will be investigated further during detailed design, and scour management measures would be implemented during construction of the proposal.

Cut and fill

The proposal includes cut batters generally with a slope of 2:1 and fill batters with a slope of 4:1. The most substantial work is between Harley Avenue and Hooper Street where retaining walls are proposed. The maximum cut in this location would be 4.1 metres and the maximum fill would be five metres (refer to **Appendix A**).

Finishing materials for the cut batters would be confirmed during detailed design and consider materials recommended in the Landscape Character and Visual Impact Assessment Technical Paper (SMM, 2013) (**Appendix I**), as follows:

- The cutting would retain the natural rock surface where feasible.
- Shotcrete would be avoided. If shotcrete is necessary, visibility of the shotcrete would be minimised.
- Cutting angles would be as steep as possible.
- Top batters of the cutting would be 'rounded' over.
- Sides of cuttings would be shaped back into the existing landform.
- A space would be provided at the base of the cutting for grassing, where feasible.

Retaining walls

No retaining walls would be required in Section 1 and 3 of the proposal. Four retaining walls would be required in Section 2 to facilitate the shift in the road alignment while minimising property and environmental impact. These retaining walls are listed in **Table 3-3** and shown on **Figure 3-1a** and **Figure 3-1c**.

Table 3-3 Proposed retaining walls

No.	Chainage	Location description	Maximum height (metres)	Typical height (metres)
RW01	16230 to 16454	Between the new service road and highway, next to the westbound lane.	4.8	3
RW02	16227 to 16320 16380 to 16454	Between the new service road and residences.	2.1	1.25
RW03	16340 to 16540	Next to the eastbound lane, on the northern side of the highway.	5.5	4
RW04	16560 to 16623	Directly east of Hooper Street, next to the westbound lane.	1.8	1.5

Finishing materials for these retaining walls would be confirmed during detailed design and would consider materials recommended in the Landscape Character and Visual Impact Assessment Technical Paper (SMM, 2013), as follows:

- Reinforced concrete or soldier piled walls with facing panels.
- Grey concrete, with heavy horizontal ribbing and dark exposed aggregate (eg basalt) for facing panels.
- A matching precast concrete capping unit at the top of all reinforced soil walls, except where a road safety barrier is required to be integrated with the wall.

Pedestrian and cyclist facilities

The proposal includes footpaths along the highway to improve pedestrian connectivity in Mount Victoria village. Pedestrian footpaths between 1.2 and 1.5 metres wide would be provided as part of the proposal at:

- Section 1:
  - About 80 metres of footpath between the Gatekeepers Cottage and the highway, next to the westbound lane.
  - About 160 metres of footpath would be provided next to the westbound lane of the highway.
- Section 2:
  - About 400 metres of pedestrian pathway between Cecil Road and Hooper Street, next to the westbound lane of the highway. About 200 metres of this pathway would be on the service road, which is for shared pedestrian and vehicle use.
- Section 3:
  - About 550 metres of pedestrian pathway along the westbound lane, and about 420 metres of pedestrian pathway along the eastbound lane between Kanimbla Valley Road and Fairy Dell Road.

A refuge island would be provided in the central median near Selsdon Street to provide safer crossing for pedestrians. Lighting in the proposal area is currently poor, and would be upgraded to V3 standard (Australian Standard 1158.1.1 Lighting for Roads and Public Spaces).

The two existing bus stops in the proposal area would be reinstated after construction to fit in with the widened shoulders of the proposal.

Consistent widened shoulders between 2.5 metres and 3 metres wide would be provided along the proposal for cyclist use.

Urban design and landscaping

An Urban and Landscape Design Concept Plan has been prepared to meet Roads and Maritime urban design objectives and principles (SMM, 2013). The plan considers three landscape character zones (refer to **Section 6.6**):

- Landscape character zone 1: Eastern approach. This section generally has the character of a semi-enclosed country road.
- Landscape character zone 2: East village. This section has an urban character, with residences along the highway.
- Landscape character zone 3: West village. This section has an urban character with a range of heritage and more contemporary buildings.

The key design elements of the landscape and urban design in Mount Victoria village include:

- Providing landscaping to enhance the village experience for both the local community and for motorists passing through, including landscape vegetation work on cut and fill batters, roadside areas, along the highway and at intersections.
- Improving street lighting and pathways for pedestrians along the highway.
- Designing walls, including retaining walls, to minimise visual impacts and take into account the visual character of Mount Victoria village.

- The installation of roadside elements such as safety barriers, fencing and signage.

3.3 Construction activities

This section provides a summary of the likely construction methodology, staging, work hours, plant and equipment that would be used to construct the proposal and associated activities. For the purpose of this REF, an indicative construction plan and methodology are provided.

The detailed construction staging plans and methods would be determined by the construction contractor(s) after completion of the detailed design. The actual construction method may vary from the description in this chapter due to:

- The identification and location of underground utilities and services.
- On-site conditions identified during pre-construction activities.
- Ongoing refinement of the detailed design.
- Community consultation and submissions.

The final Construction Environmental Management Plan (CEMP) and methods used for construction would be consistent with statutory requirements, including any work, health and safety (WH&S) regulations and all conditions of approval issued following determination of the proposal.

A contractor environmental management framework to manage and mitigate impacts is presented in **Chapter 7**. The final construction plan and methods would be consistent with this framework.

3.3.1 Work methodology

The likely construction activities and sequencing are presented in **Table 3-4**.

Table 3-4 Proposed construction phases and activities

Construction phase	Activities
Environmental management system (EMS)	• Prepare EMS. • Prepare environmental management plans. • Obtain statutory approvals and licences.
Early work	• Undertake land acquisition. • Survey the construction site. • Notify residents of the start of work. • Undertake site establishment. • Develop the site compounds. • Fence the site boundaries and areas to be used for stockpile sites. • Fence the sensitive environmental and heritage areas. • Install erosion and sediment control outside identified environmental constraint areas, and temporary sedimentation control basins. • Undertake other activities determined by the environmental representative (construction contractor or Roads and Maritime) to have minimal environmental impact.
Service relocations	• Adjust utility infrastructure (water, electricity, gas and telecommunications) where required.
Site preparation	• Remove and mulch vegetation in stages, and grub along the new section of the alignment and along the section of the highway to be widened. • Strip and stockpile topsoil in stages. • Prepare the surface using graders, dozers, scrapers and other equipment. • Establish access tracks.

Construction phase	Activities
	• Establish temporary and permanent crossovers. • Erect traffic barriers. • Undertake temporary pavement widening.
Earthworks	• Excavate cuttings. • Create fill embankments. • Place select materials. • Construct roadside cuts and fill batters. • Prepare batter treatments. • Create temporary service road parallel to the highway between Cecil Road to Mount Piddington Road. • Erect retaining walls.
Drainage	• Install culverts. • Install catch drains. • Install drainage blankets. • Install permanent water quality/retention basins.
Pavement	• Lay concrete/sub-base layers and asphaltic concrete paving. • Apply asphaltic concrete pavement using pavers and rollers. • Remove redundant highway pavement and rehabilitate.
Other work	• Provide access to properties. • Formalise the permanent access road and carry out tie in work to local roads. • Tie in the proposal to adjoining highway sections.
Finishing work	• Install safety barriers and safety screens (if/where required). • Install kerbs, gutters and verges. • Install street lighting. • Landscape and revegetate the work sites. • Install line marking, signs and guide posts. • Decommission temporary facilities (eg compound sites). • Clean up the site and dispose of all surplus waste materials.
Drainage	
• Extension of pipe culverts	• Establish sediment and erosion controls downstream of the culvert. • Remove existing headwalls. • Excavate for new pipe. • Compact subgrade. • Place and compact bedding material. • Place pipe. • Place headwalls. • Fill and compact material around the pipe. • Place erosion protection at the entry/exit of pipe.
• Basins (construction and operation)	• Establish sediment and erosion controls downstream of the culvert. • Clearing and grubbing of the area. • Excavation of basin and overflow channel. • Placement of erosion and sediment controls in the overflow channel.

Construction staging and program

The proposal would be constructed in three stages along the length of the proposal:

- Stage 1: Construction of the westbound shoulder and footway.
- Stage 2: Construction of the eastbound shoulder and footway.
- Stage 3: Construction of the raised islands and pavement resurfacing.

This staging strategy is proposed because the majority of the widening and construction would be to be south of the existing carriageway. The widening work would require the removal of earth at several locations, which could be used for the fill wall proposed during Stage 2. Some temporary pavement would also be required. Access for affected residences would be maintained during construction. In addition,

undertaking construction along one side of the highway at a time would enable efficiencies during paving and in the laying of utility pipes and cables.

Construction staging would be confirmed during detailed design by the construction contractor, which could result in an alternative approach being adopted. Irrespective of the proposed approach, access for affected residences would be maintained during construction.

3.3.2 Construction hours and duration

Roads and Maritime expects construction to start in late 2014 and take up to 18 months to complete.

The construction workforce would be expected to fluctuate, depending on the stage of construction and associated activities. The workforce would be expected to peak at about 80 personnel per day across all construction locations. On either side of this peak period, daily workforce numbers would fluctuate between about 40 and 80 personnel across all construction sites along the proposal at any given time during the construction period. The final number of workers would be determined by the construction contractor following the detailed design of the proposal. Construction would be carried out during standard construction working hours in accordance with the Interim Construction Noise Guideline (DECC, 2009) as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- Sunday and public holidays: No work.

To minimise disruption to daily traffic and disturbance to surrounding landowners and businesses, it may be necessary to undertake some work outside these standard working hours, including at night. If any work needs to be carried out outside of standard working hours it would be in accordance with the Interim Construction Noise Guideline (DECC, 2009) and Roads and Maritime's Environmental Noise Management Manual: Practice Note vii – Road works outside normal working hours (RTA, 2001).

The contractor would give the community prior notice of any roadwork to be carried out outside normal construction hours.

Where practical, materials and plant would be removed outside of peak traffic periods to minimise delays. Traffic control measures would be used to manage general earthworks and the import and export of material.

3.3.3 Plant and equipment

An indicative list of plant and equipment that would typically be required is provided below. (Additional equipment requirements would be determined during detailed design by the construction contractor.)

- Asphalt pavers
- Asphalt profiling machines
- Back hoes
- Bobcats
- Bulldozers
- Cherry pickers
- Chipping machines
- Compactors
- Elevated work platforms
- Excavators
- Front-end loaders
- Generators
- Graders
- Hand tools
- Hydraulic hammers
- Hydraulic jacks

- Compressors
- Compressed air machinery
- Concrete pavers
- Concrete saws
- Concrete trucks
- Concrete pumps
- Concrete mixers
- Cranes
- Dewatering pumps
- Drill/boring rigs
- Dump trucks
- Lighting units
- Line markers
- Mobile cranes
- Piling plant
- Roadheaders
- Rock breakers
- Road rollers
- Road sweepers
- Scrapers
- Vibratory rollers
- Water carts.

3.3.4 Earthworks

The proposal would require minimal earthworks (most would occur in Section 2). The earthworks would involve 13,000 cubic metres of cut, most of which would be reused on site for fill. An additional 12,000 cubic meters of fill would also be required for construction. The additional fill would be imported from nearby road safety upgrades, or off-site local quarries (refer 'Quarry products', below).

Detailed earthwork requirements would be determined during detailed design. The final batters would be assessed after completion of the geotechnical investigation and design to minimise their overall size and, therefore, the impact of the proposal.

3.3.5 Source and quantity of materials

The source and quantity of materials required to construct the proposal would be finalised during detailed design through the development of a Construction Materials and Resources Plan.

About 12,000 cubic metres of additional material would be required to meet the requirements for fill embankments and retaining walls across the proposal. It should be noted that the accuracy of fill required is subject to variations in bulking factors for excavated material, the relative compaction achieved for placed material, and the volume of usable material once it has been excavated.

Where feasible, excavated materials would be reworked (if necessary) and used to meet general fill material needs, such as the foundations for fill embankments.

The major resource requirements for the proposal are described below.

Quarry products

The proposal would reuse material from nearby road safety upgrades where possible. The proposal would also require 5,000 cubic metres of 'select materials' (that is, backfill materials specially selected and segregated from excavated materials). These materials would be sourced from local quarries and commercial suppliers in the region wherever possible. The nearest quarries to the proposal are:

- Austen Quarry (Hy-Tec), about 11 kilometres south of Hartley.
- Marrangaroo (Metromix), about seven kilometres west of Lithgow.

Water

About 30 to 50 megalitres of water would be required for earthworks and dust control. The water would be sourced from the local potable water supply. The quantity and

quality of the water is readily available in the local area. Actual water sources would be confirmed by the construction contractor before construction.

Concrete, reinforcement, asphalt and bitumen

Roads and Maritime estimates that construction would require the following materials:

- 2,000 cubic metres of concrete for retaining walls and culverts/pipes. Due to the size and location of the proposal, on-site concrete batching facilities would not be required; ready-mix concrete would be supplied from established local sources.
- 650 tonnes of steel reinforcement.
- Manufactured items, including stormwater pipes and pits, which would be sourced from commercial providers.
- Asphalt and bitumen to construct the road surface. This work would require about 2000 cubic metres of lean mix concrete sub-base, 4000 cubic metres of dense graded asphalt, and 5000 cubic metres of select material. Due to the size and location of the proposal, on-site asphalt batching facilities would not be required; asphalt would be supplied from established local sources.

Surplus materials

Surplus materials that cannot be used on site as part of the proposal would be re-used or disposed of in the following order of priority:

- Transfer to other nearby Roads and Maritime projects for immediate use.
- Transfer to an approved Roads and Maritime temporary stockpile site for future use during projects or routine maintenance.
- Transfer to a Roads and Maritime approved site for reuse on concurrent private/local government projects (with appropriate approvals as required).
- Disposal at an approved materials recycling or waste disposal facility.
- As otherwise provided for by the relevant waste legislation.

The process for managing excess materials would be detailed in a Waste Management Plan (WMP) that would form part of the CEMP.

3.3.6 Traffic management and access

Construction traffic

Construction traffic would comprise light and heavy trucks transporting equipment, materials and spoil, and cars driven by workers to the work sites. Construction traffic would be greatest during the main earthworks and civil construction.

Construction vehicles would generally access the work sites from the highway and Darling Causeway, which would result in a temporary increase in heavy vehicle movements along the highway and nearby local roads. The estimated number of construction vehicle movements per day is provided in **Table 3-5**.

Table 3-5 Estimated construction vehicle movements

Type of vehicle	Movements per day	Duration (months)
Light vehicles	100–300	20
Trucks – external earth	30–80	16
Trucks – internal earth	30–80	16

Type of vehicle	Movements per day	Duration (months)
Water trucks	0–10	16
Trucks – external pavement	30–80	16
Concrete trucks	10–70	16
Delivery trucks	0–10	20

The main construction car park would be at the main compound site (refer to **Section 3.4.1**). Limited car parking would also be provided within the road corridor, near nominated access gates, where this would not interfere with highway traffic or access to properties.

During construction it would be necessary to move a large amount of on-site excavated materials from cuttings to fill areas. Any haulage across or along the highway would be in accordance with an approved Traffic Management Plan (TMP).

As a proportion of the required fill material would be sourced from outside the proposal area, major material truck haulage routes would be required between the proposal area and the sourced material. Material being imported from local quarries would use the highway and access work sites from established and designated access points.

Traffic management, control and signage

Where possible, construction would be programmed to minimise impacts on traffic.

Standard traffic management measures would be used to minimise short-term traffic impacts, and ensure that traffic flow along the highway is maintained throughout construction. These measures would be documented in a Traffic Management Plan (TMP) for the proposal and developed in accordance with Roads and Maritime's Traffic Control at Works Sites Manual (RTA, 2010) and Specification G10 – Control of Traffic. Roads and Maritime would review the TMP before implementation.

Access to properties along the alignment would be maintained during construction and temporary property access would be provided to residences where required. The management of property access would be considered by the construction contractor and detailed in the final staging plan for the proposal.

Alternative pathways and/or walking routes would be provided during construction to maintain pedestrian and cyclist access within the proposal area.

Road and lane closures

Construction would be staged to ensure two-lane traffic flow is maintained throughout the construction period (that is, one lane each way). Some short-term work under traffic control or lane closure would be required during traffic switches, barrier work and asphalting. However, it is expected that traffic delays would be minimal during construction due to the reasonably low traffic volumes on the highway and local roads, and because work at the intersections would be limited to the shortest possible duration. Any potential impacts on parking would also be managed through measures identified in the TMP.

Construction parking impacts would be managed through measures identified in the TMP, which would form part of the CEMP. Impacts to traffic would be kept to a minimum through the management measures outlined in **Section 6.9**.

3.4 Ancillary facilities

3.4.1 Compound and stockpile sites

Construction compound and stockpile sites of varying sizes would be required to construct the proposal. The main construction compound would typically include a combination of demountable offices, meal rooms, toilets/showers and parking facilities (where possible). Other stockpile facilities would typically allow for lay down facilities, equipment storage, maintenance sheds, chemical/fuel stores and stockpile of earth and construction materials.

The potential sites are identified in **Figure 3-1a** to **Figure 3-1c**. Three locations have been identified as potential compounds and/or stockpile sites near the proposal area. These are at:

- Former construction site at Soldiers Pinch, about 500 metres south of Browntown Oval.
- Harley Avenue.
- Cassilis Street.

The most suitable location for the main compound site has been identified as being the site at Soldiers Pinch because it has a safe entry and exit at Browntown Oval. In addition, it is generally remote from residences. None of these sites would require additional clearing, as they have all been previously disturbed.

Stockpile sites would store materials, such as spoil, stripped topsoil, excavated rock and building materials. The location of the stockpile sites would be subject to the site location criteria set out in Roads and Maritime's Stockpile Site Management Guideline (RTA, 2011). To minimise impacts, the compound sites would ideally be located:

- On relatively level ground.
- In a place accessible to construction traffic and deliveries.
- Away from areas of ecological and heritage conservation value.
- In areas previously disturbed within the proposal area that do not require the clearing of native vegetation.
- Away from residential buildings or heritage items.
- In plain view of the public to deter theft and illegal dumping.
- Close to key construction activities (eg bridge construction) to minimise transport of materials and equipment.
- Within the area of potential impact (to minimise impacts on private and public property).
- In areas not prone to flash flooding and more than 40 metres from a watercourse.
- Outside the drip line of trees.

The location of the compound, stockpile and storage sites would be confirmed during detailed design. Once the contractor has a preferred location for these sites, they would consult with Roads and Maritime's Senior Environmental Officer (Sydney) before any work in those locations to determine if any additional environmental assessment is required.

Each site would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of construction, the contractor would remove the temporary compound sites, work areas and stockpiles, clear all rubbish and materials, and rehabilitate the sites.

3.4.2 Water quality facilities

Construction of the proposal has the potential to affect water quality through erosion of exposed or disturbed areas and subsequent sedimentation of watercourses. To mitigate these effects, temporary sedimentation control basins and sumps would be installed throughout the proposal area to trap sediments and other pollutants from disturbed areas. Additional soil and water management measures would be developed during detailed design and included in the CEMP.

In addition, the proposal would result in some changes to the local hydrology. The realignment and widening of the highway would increase impervious areas, and also result in some modifications to subcatchments within the study area. To mitigate the impacts of any increased flows, to manage flows in subcatchments and to mitigate potential impacts on water quality, permanent measures are proposed including drains, culverts and detention basins to capture and direct stormwater (refer to **Section 3.2.3**). It is proposed that two basins would be installed in Section 2 and 3 during construction (refer to **Figure 3-1**) and retained as permanent basins to manage ongoing water quality and detention once the proposal is operational. One water quality measure at Section 1 would also be installed to manage water quality during construction. These are outlined below.

Downstream of culvert X2 in Section 1 (chainage 15600)

A measure to manage water quality is proposed downstream of culvert X2. The nature of this measure is yet to be confirmed, although the Water Quality Technical Report (**Appendix H**) has recommended a basin. This measure will be confirmed as part of detailed design. This measure would provide water quality treatment before construction and operational run-off is discharged into the Blue Mountains National Park and Greater Blue Mountains World Heritage Area. If a basin is installed, a spill containment provision of 20,000L would be incorporated into the water quality measure through an underflow baffle arrangement at the outlet side of the basin.

Downstream of culvert X4 in Section 2 (chainage 16500)

A basin is proposed downstream of culvert X4. This basin would incorporate capacity to provide stormwater and water quality treatment before run-off is discharged into the Grose River catchment, Blue Mountains National Park and Greater Blue Mountains World Heritage Area (but outside of the drinking water catchment). Spill containment would be provided by the inclusion of an emergency gate valve at the drainage collection pit located at the downstream end of the basin. Water quality treatment would be provided by a biofiltration layer. The basin would be sized to provide a 500 square metre biofiltration layer. The size and location of this basin would be confirmed during detailed design.

Downstream of culvert X6 in Section 3 (at the northern end of Fairy Dell Road)

A basin is proposed downstream of culvert X6 to treat run-off from a substantial length of highway, before it is discharged into the Sydney Drinking Water Catchment. The potential site is located on the western portion of Lot 8, DP2028 and the south-eastern corner of Lot 3, DP1140103. The water quality treatment would be provided through a biofiltration layer, as well as an inline gross pollutant trap for pre-treatment of run-off to remove litter, debris and coarse sediments. Spill containment would be

provided by the inclusion of an emergency gate valve at the drainage collection pit located at the downstream end of the basin. The basin would be sized to provide a 200 square metre biofiltration layer. The size and location of this basin would be confirmed during detailed design.

3.5 Public utility adjustment

Roads and Maritime has consulted with public utility authorities as part of the development of the concept design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. **Chapter 5** provides a summary of the consultation carried out to date.

Preliminary investigations identified that public utility assets would be affected by the proposal. Preliminary information was obtained from Dial Before You Dig searches and utilities surveys from Roads and Maritime's and Endeavour Energy's geographical information systems. Assets owned by the following utilities would be affected by the proposal:

- Electrical supply and street lighting: Endeavour Energy.
- Gas pipes and infrastructure: Jemena.
- Telecommunications (optic fibre and telephone): Telstra.
- Telecommunications (optic fibre): Optus.
- Water supply infrastructure: Sydney Water.
- Sewer infrastructure: Sydney Water.
- Rail services: NSW Trains (formerly RailCorp).

Proposed utility relocations for each section of the proposal are described below.

- Section 1: Underground utilities would be incorporated within the proposed pedestrian pathway between chainage 15490 and chainage 15560.
- Section 2: Underground utility relocations are limited within this section, where utilities would be located into the access road between Cecil Road and Mount Piddington Road. Utilities would also be incorporated in the new service road between Mount Piddington Road and Hooper Street.
- Section 3: Underground utilities would be incorporated into the proposed pedestrian pathway on both sides of the highway for the length of the section.

Roads and Maritime is currently undertaking fieldwork and surveys to confirm the locations of utilities at key conflict areas. Confirmation of the relocation of utilities and associated strategies would be carried out in consultation with utility authorities during detailed design.

3.6 Property acquisition

The proposal would require partial acquisition of 18 properties. **Table 3-6** lists the properties that would be partially acquired as part of the proposal.

Roads and Maritime has carried out consultation with affected landowners informing them of the area of acquisition that would be required as a result of the proposal. These acquisition areas would be finalised during detailed design.

Some additional land may be required to be leased by Roads and Maritime during the construction period for use as compound and stockpile sites. These areas would be confirmed during detailed design. Areas that are leased by Roads and Maritime during construction would be returned to the landowner following the completion of work.

All property acquisition would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, the *Roads Act 1993* and Roads and Maritime's Land Acquisition Information Guide February 2012 (Roads and Maritime, 2012b).

Table 3-6 Properties to be acquired as part of the proposal

Property (Lot and DP)	Area to be acquired (square metres)
Lot 1/DP256358	360
Lot 1/Section 2/DP1948	25
Lot 6/DP656400	310
Lot 5/DP656399	320
Lot 4/DP656398	285
Lot 21/DP813107	250
Lot 2/Section 1/DP1948	240
Lot B/DP338486	890
Lot A/DP338486	295
Lot 4/Section 1/DP311	75
Lot 3/Section 1/DP311	155
Lot 2/Section 1/DP311	130
Lot 1/Section 1/DP914368	15
Lot 100/DP1067318	50
Lot 5/DP666077	165
Lot 2/DP650593	150
Lot 1/DP663613	70
Lot 1/DP536240	10
TOTAL (square metres)	**3,795**

3.7 Conclusion

The concept design is based on available information and current design standards and criteria for the overall Great Western Highway upgrade program. The key elements of the proposal are to provide safety upgrades through Mount Victoria village by improving the road geometry, widening the carriageways, upgrading intersections with local roads and improving footpaths and drainage. Some elements of the design may be further refined during detailed design.

The next chapter presents the statutory and planning framework for the proposal.

4 Statutory and planning framework

This chapter provides the statutory and planning framework for the proposal and considers provisions of relevant State and Commonwealth legislation, plans and policies.

4.1 State Environmental Planning Policies

4.1.1 State Environmental Planning Policy (Infrastructure) 2007

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

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

As the proposal is for a road and is to be carried out on behalf of Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessmen*t *Act 1979* (EP&A Act). Development consent from Blue Mountains City Council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by State Environmental Planning Policy No. 14 – Coastal Wetlands, State Environmental Planning Policy No. 26 – Littoral Rainforests, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (Transitional Major Projects) 2005.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities before the start of certain types of development. Consultation, including consultation as required by ISEPP, is discussed in **Chapter 5** of this REF.

4.1.2 State Environmental Planning Policy 55 – Remediation of Land

The objective of State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) is to provide a statewide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. In accordance with Clause 7(1) of SEPP 55, a consent authority must not consent to the carrying out of any development on land unless it has considered whether the land is contaminated.

A number of potential areas of environmental interest have been identified in the proposal area. These include:

- The existing Great Western Highway.
- The Caltex service station located immediately west of Mount York Road.

The potential areas of environmental interest identified were considered to be a negligible to low constraint on the design and construction of the proposal. It is considered that the proposal would not trigger any requirements to undertake any site remediation.

4.1.3 State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (SEPP [Sydney Drinking Water Catchment]) aims to secure the environmental, economic and social future of drinking water catchments for the greater Sydney region, including the Blue Mountains and the Illawarra. The area of these catchments extends from north of Lithgow to the Shoalhaven River north of Cooma.

As Section 3 is located within the boundary of the Warragamba Drinking Water Catchment, the SEPP (Sydney Drinking Water Catchment) is applicable to the proposal.

Clause 9 of the SEPP states that any development or activity within this catchment should incorporate the Sydney Catchment Authority's (SCA) current recommended practices and performance standards that relate to the protection of water quality. Clause 12 of the SEPP states that: 'A public authority must, before it carries out any activity to which Part 5 of the Act applies, consider whether the activity would have a neutral or beneficial effect on water quality.'

Once the proposed mitigation measures (refer to **Section 6.5.5**) are implemented, it is anticipated that the proposal would not have an adverse impact on the quality of water being discharged into Mid Coxs River catchment. In accordance with Clause 9 of the SEPP, the mitigation measures for the proposal would also take into account the relevant SCA recommended practices and performance standards.

A qualitative Neutral or Beneficial Effect (NorBE) water quality assessment has been carried out and is included in Section 7 of the Water Quality Report (SKM, 2013d), which is provided in **Appendix G**.

4.2 Local Environmental Plans

The proposal is located within the Blue Mountains City Council LGA. Consequently, the principal relevant local environmental planning instruments under the EP&A Act are the Blue Mountains Local Environmental Plan 2005 (Blue Mountains LEP 2005), Blue Mountains Local Environmental Plan 1991 (Blue Mountains LEP 1991) and Blue Mountains Local Environmental Plan No 4 (gazetted 3 December 1982).

The Blue Mountains LEP 2005 is specifically relevant to the proposal area. A substantial proportion of the proposal area is within the existing road corridor, so the proposal would not substantially impact on other land uses. However, the land zonings (under the LEP) would be affected by the proposal in some sections and are outlined with their objectives in **Table 4-1**.

Table 4-1 Local environmental plan 2005 zones affected by the proposal

Zone	Objective
Village – Neighbourhood Centre zone	To encourage a range of commercial, residential and retail land uses while ensuring a distinct village identity is created.
Village – Tourist zone	To allow tourism related land uses and enhancing the visual character, including traditional streetscapes, gardens and vegetation and built form.
Living – General zone	To allow for residential development that is accessible to services and facilities.
Living – Bushland	To preserve and re-establish native bushland and restrict

Zone	Objective
Conservation zone	residential development in bushland conservation areas.
Recreation – Open Space zone	To enhance the quality of life of residents and visitors to the Blue Mountains through the provision and management of open space.
Regional Transport Corridor zone (rail and road)	To ensure land is provided for major transportation networks and facilities, and that work contributes to the safe and effective operation of classified roads for pedestrians, cyclists, public transport and motorists.

The proposal has considered these objectives and has sought to be consistent with them. In particular, the proposal supports the objective of providing a safer route within the Blue Mountains local government area on the highway.

The Blue Mountains LEP 2005 zones are shown in **Figure 4-1**. The impacts to land use are discussed in **Section 6.10**. Roads are permissible with development consent under all of the above zonings. However, as discussed in **Section 4.1.1**, ISEPP operates to remove the otherwise applicable consent requirement.

Roads and Maritime has consulted Blue Mountains City Council, particularly regarding potential impacts on locally listed heritage items and council infrastructure. Details of this consultation are provided in **Chapter 5**.

4.3 Other relevant legislation

4.3.1 Heritage Act 1977

The *Heritage Act 1977* aims to protect and preserve items of non-Aboriginal heritage significance. The Act provides for the protection of items of local, regional and State heritage significance. It establishes a list of State Heritage Items and outlines processes for approving development that may impact items of heritage significance.

A number of historic items listed on the Blue Mountains LEP 2005 as being of local and State significance have been identified near the proposal (refer to **Section 6.3** of this REF). An assessment for this REF found that the proposal would not have adverse impacts on any non-Aboriginal heritage items. The assessment is provided in **Section 6.3** and **Appendix F**.

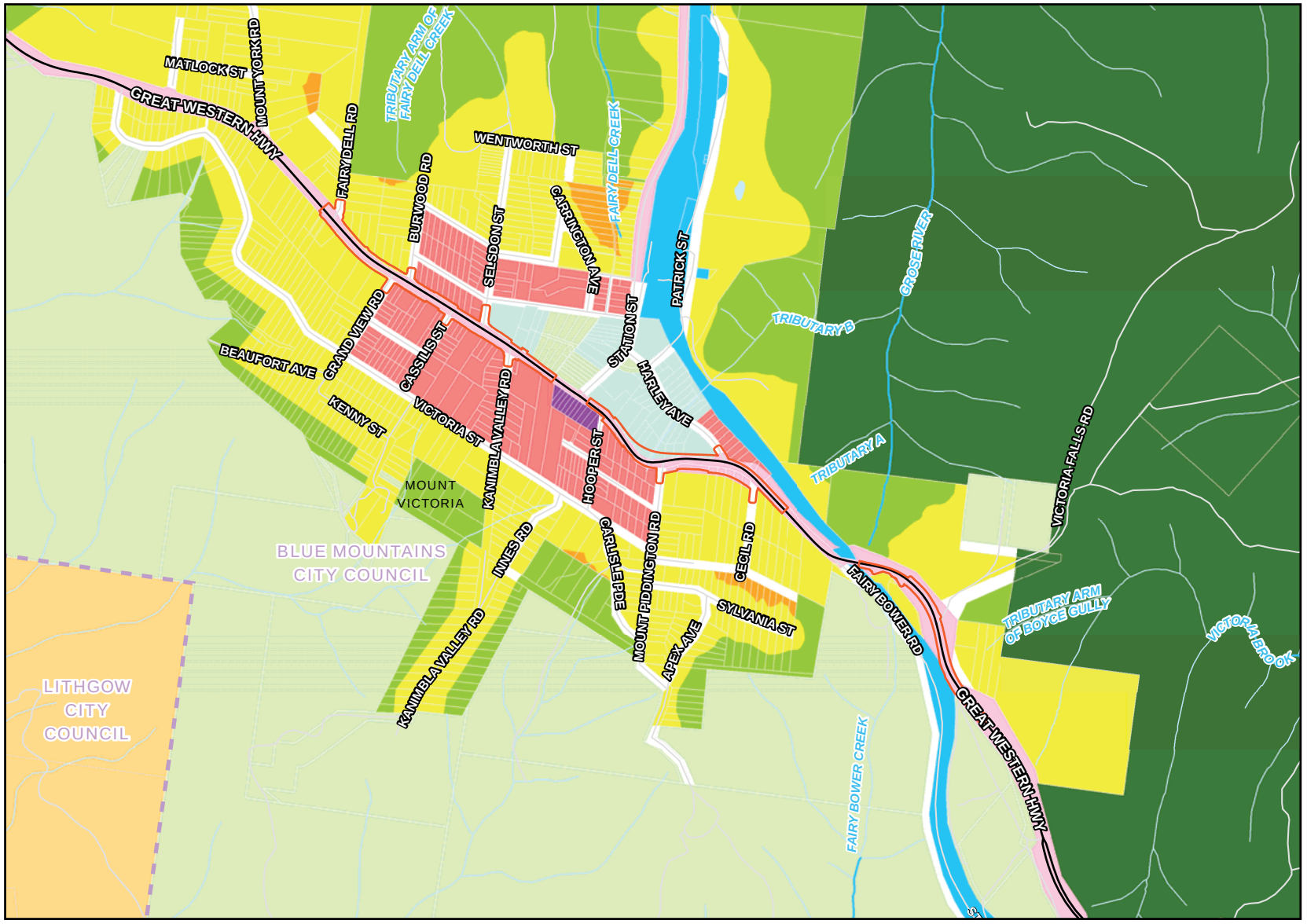
4.4 Commonwealth legislation

4.4.1 Environment Protection and Biodiversity Conservation Act 1999

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

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 these issues. Accordingly, the proposal has not been referred to the Australian Government Department of Environment.

FIGURE 4-1 | LAND USE ZONINGS



LEGEND

- Construction footprint (5 m buffer)
- Existing highway
- Road
- Primary waterway
- Minor waterway
- Property boundary
- LGA boundary

Blue Mountains LEP 2005

- Village - Neighbourhood Centre
- Village - Tourist
- Living - General
- Living - Bushland Conservation
- Regional Transport Corridor (Road)
- Regional Transport Corridor (Rail)
- Recreation - Open Space
- Environmental Protection - Private
- Environmental Protection - Open Space
- National Park

Lithgow City LEP 1994

- Zone 1a Rural (general)

Sinclair Knight Merz does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.

DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001, SKM 2011, BMCC 1991, 2005, LCC 1994

0 500
Metres

18/11/2013 | I:\ENVR\Projects\EN04213\Technical\Spatial\GIS_Directory\ArcMap\Figures\REF\MountVic\EN04213_GIS_Zn_F014_MV_LEP_r3v1.mxd
Newcastle Spatial Team - Prepared by : KO
Checked by : VC

4.5 Confirmation of statutory position

Roads and Maritime is both the proponent and the determining authority for the proposal. Clause 94 of the ISEPP provides that the proposal may be carried out without development consent and is therefore subject to assessment under Part 5 of the EP&A Act. Development consent from Blue Mountains City Council is not required. Additional permits and approvals are also required for this proposal in addition to the Part 5 determination, and these are detailed in **Section 7.3**.

4.6 Conclusion

This chapter finds that there are no statutory or planning impediments to constructing the proposal, although certain permits would need to be obtained.

The next chapter presents stakeholder and community consultation that has been carried out for the proposal, as well as proposed consultation activities.

5 Stakeholder and community consultation

This chapter presents consultation carried out for the proposal with the local community, the Aboriginal community and relevant government agencies and stakeholders.

5.1 Consultation strategy

Consultation has been managed as part of the community and stakeholder engagement strategy for the wider Great Western Highway upgrade program between Katoomba and Lithgow. A communications plan was developed and implemented to guide consultation activities. The communications plan identifies key objectives and outcomes of consultation activities with the community, stakeholders and government agencies.

The consultation objectives are to:

- Identify all potentially interested stakeholders and providing opportunities to include and engage them in the project development process.
- Obtain input from the community during the key development phases of the project.
- Build relationships and resolving issues during planning.
- Provide good information to assist the community to understand the planning process.

The following sections outline the consultation that has been carried out specifically for the proposal. For further information on the consultation carried out as part of the Great Western Highway upgrade program between Katoomba and Lithgow, see http://www.rms.nsw.gov.au/roadprojects/projects/great_western_hway/index.html.

5.2 Community involvement

The Mount Victoria village safety upgrade feasibility report (Roads and Maritime, 2012a) was placed on display for community comment from 8 October to 26 October 2012. During that time staffed displays were held in Lithgow, Hartley and Mount Victoria. The draft design plans were displayed on Roads and Maritime's website and a community update newsletter was distributed to about 7500 local households and businesses between Mount Victoria and Lithgow.

The outcomes of this consultation (which accompanied the display of the feasibility report) are detailed in the Mount Victoria Safety Upgrade Community Feedback Report (Roads and Maritime 2013). Roads and Maritime received 41 responses via emails, feedback forms and written submissions. A range of issues was also recorded at the staffed displays. Over 60 per cent of written responses were received from residents of Mount Victoria. No responses were received from government agencies.

The most frequently raised issues are summarised in **Table 5-1** below.

Table 5-1 Main issues raised by the community (October 2012)

Issue category	Description of issue category	Summary of issues raised	Relevant REF section
Access	This category refers to issues regarding access to private property	Respondents raised concerns about local access, pedestrian access and vehicle access during road work. A number of respondents made suggestions regarding the proposed footpath upgrade. Some respondents raised concerns about access to driveways and access for emergency vehicles. One resident raised a concern about access during recent roadwork on Victoria Pass. Two respondents raised the issue of access for cyclists.	**Section 3.2.3**, **Section 3.3.6**, **Section 6.9**
Design engineering	This category refers to technical aspects and specific design issues related to the proposal	Concerns were raised by many respondents about the safety of a number of intersections along the highway throughout Mount Victoria. A number of respondents raised concerns about the existing road shoulders being poorly maintained and unsafe. It was noted that cars and trucks often throw up clouds of dust when pulling into the shoulder or accessing driveways. Two respondents raised concerns about the operation of the median turning lane and one respondent requested the introduction of more raised medians to deter overtaking. Two respondents made suggestions about reducing the speed limit to 50 km/h or less.	**Section 3.2**, **Section 6.12**
Road user concerns	This category refers to issues that impact upon stakeholders travelling on the highway and surrounding local roads	A number of respondents made suggestions or comments about safety improvements in Mount Victoria village including a need for street lighting, improved signage, problems with gravel on shoulders, and the need for a road safety barrier. A number of respondents raised concerns about the impact of heavy vehicles within the village. Concerns include speed, parking, and impacts on visual amenity and access. Other concerns include maintenance of the highway, the bridge over the railway and the gravel shoulders, and the safety of Victoria Pass.	**Section 6.6**, **Section 6.9**

Issue category	Description of issue category	Summary of issues raised	Relevant REF section
Project justification	This category refers to reasons why the community supports or opposes the proposal	A number of respondents expressed strong support for the Mount Victoria safety upgrade while one respondent expressed opposition. Other respondents expressed concern about the value of funding the upgrade.	**Section 8.1**
Property impacts	This category refers to concerns about impacts on private property and the property acquisition process	A number of respondents expressed concern about property impacts (such as reduction in property size). One respondent commented that the road widening would result in loss of property value.	**Section 3.6** **Section 6.11**

5.3 Aboriginal community involvement

Comber Consultants undertook consultation with local Aboriginal heritage stakeholders in accordance with Roads and Maritime's Procedure for Aboriginal Cultural Heritage Consultation and Investigation (Roads and Maritime, 2011a) and Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010). They undertook the following consultation activities:

- Public advertising in regional and local newspapers to seek registration of interested Aboriginal parties (the closing date was April 2010). Aboriginal land councils and individuals were invited to register their interest in being involved in the assessment of Aboriginal archaeology and cultural heritage.
- Identification of potential knowledge-holders in consultation with the Office of Environment and Heritage (OEH) (April to May 2011).
- Invitation to registered parties to participate in the consultation process and attend Aboriginal focus group meetings.
- Participation of Aboriginal representatives in the ongoing field investigations.

The Aboriginal focus group provides a forum for the registered Aboriginal stakeholders to identify and manage Aboriginal cultural issues at an early stage of the proposal. The group facilitates ongoing community involvement throughout the life of the Mount Victoria to Lithgow project, ensures appropriate care and control of Aboriginal artefacts identified during the Aboriginal heritage investigations, and comments on all aspects of Aboriginal heritage management.

Twenty-nine Aboriginal stakeholders were registered for the Mount Victoria to Lithgow project, including members of the following groups:

- Bathurst Local Aboriginal Land Council (LALC).
- Darug Land Observation.
- Darug Aboriginal Cultural Heritage Assessment.
- Deerubbin LALC.
- Gundungurra Aboriginal Heritage.
- Gundungurra Tribal Council Aboriginal Corporation.
- Mingaan Aboriginal Corporation.
- Muru Mittagar Aboriginal Group.
- Wargon and Bura Aboriginal Centre Inc.

- Wiradjuri Traditional Owners.
- Yarrawalk (a division of Tocomwall Pty Ltd).

Two focus group meetings (related to this proposal) were held. Stakeholders at the meetings determined that:

- The work carried out as part of the ongoing Aboriginal investigations for the Mount Victoria to Lithgow project was appropriate and that the results and recommendations were suitable.
- There had been appropriate care and control of the identified Aboriginal artefacts (no Aboriginal heritage artefacts or sites have been identified within the vicinity of the proposal area).

Data was gathered from previous Aboriginal heritage surveys (carried out for the Mount Victoria to Lithgow upgrade project) and an updated AHIMS search (carried out on 3 July 2013). This data informed two clearance letters that were issued by Roads and Maritime's Aboriginal Heritage Advisor (Sydney) on 8 November 2012 and 18 July 2013. The letters confirm that the proposal is unlikely to have an impact on Aboriginal cultural heritage (refer to **Appendix J**).

5.4 Consultation required by ISEPP

Clause 13 of the ISEPP (refer **Section 4.1**) requires consultation with Blue Mountains City Council for development that would impact on council-related infrastructure or services. The proposal would intersect with 12 roads in the proposal area: Victoria Falls Road, Cecil Road, Mount Piddington Road, Hooper Street, Kanimbla Valley Road, Selsdon Street, Cassilis Street, Burwood Road, Grand View Road, Fairy Dell Road and Mount York Road. Roads and Maritime is therefore required to consult with Council regarding roadwork at these intersections. Consultation was carried out on 24 July 2013.

In addition, Clause 14 of the ISEPP requires consultation with council for a development that would have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item). As outlined previously, a number of heritage items listed on the Blue Mountains LEP 2005 (as local and State significant) are next to the proposal. The non-Aboriginal heritage investigation (refer to **Section 6.3**) found that neither the construction nor the operation of the proposal would directly impact on any non-Aboriginal heritage listed items. However, there would a potential indirect impact during construction to a number of heritage items listed on the Blue Mountains LEP 1991 and Blue Mountains LEP 2005. As such, consultation was carried out with the Blue Mountains City Council in accordance with Clause 14 of the ISEPP on 23 August 2013.

Clause 15 of the ISEPP states that a public authority must not carry out a development on flood-liable land that would change flood patterns other than to a minor extent, unless the authority has given written notice of the intention to carry out the development to the relevant council. The proposal would not involve development in an area that is considered to constitute flood-liable land. Therefore, Roads and Maritime is not required to undertake formal consultation with Blue Mountains City Council under this clause.

Clause 16 of the ISEPP states that a consent authority must not carry out any of the following development without giving written notice to the specified authority and taking their responses into consideration:

(a) development adjacent to land reserved under the National Parks and

Wildlife Act 1974 – the Office of Environment and Heritage,

(b) *development adjacent to a marine park declared under the Marine Parks Act 1997 – Marine Parks Authority,*

(c) *development adjacent to an aquatic reserve declared under the Fisheries Management Act 1994 – the Office of Environment and Heritage,*

(d) *development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998 – the Sydney Harbour Foreshore Authority,*

(e) *development comprising a fixed or floating structure in or over navigable waters – the Roads and Maritime Services (maritime branch),*

(f) *development for the purposes of an education establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act) – the NSW Rural Fire Services.*

No part of the proposal would be located in land reserved under the NP&W Act, next to a declared marine park, declared aquatic reserve or foreshore area. Further, the proposal would not involve development over navigable waters or for the purposes of an educational establishment, health services facility, correction centre, group home or for residential purposes. However, the proposal is located next to the Blue Mountains National Park. As such, consultation under Clause 16 of ISEPP was carried out on 24 July 2013 with the Office of Environment and Heritage.

Comments received from Blue Mountains City Council are provided in **Appendix C** and summarised in **Table 5-2**. No response was received from the Office of Environment and Heritage.

Table 5-2 Summary of ISEPP issues raised by Blue Mountains City Council

Issue category	Issues raised	Relevant REF section
Heritage	The proposal area passes through an area of heritage sensitivity. Multiple individual heritage listed items and the Mount Victoria Heritage Conservation zone occur within the proposal area. Precinct vision statements outlined in the Blue Mountains LEP 2005 should be reviewed, considered and incorporated into the proposal as part of the REF process. Key considerations include: • Conservation of the established pattern of trees and shrubs that contribute to the heritage value of buildings or to the precinct's character. • Encouraging pedestrian movement along footpaths that are protected from the undesirable impacts of through traffic.	**Chapter 3**, **Section 6.3**, **Section 6.6**, **Section 6.11**
Street planting	Street planting through Mount Victoria is significant and any upgrades must make allowance for the maintenance or restoration of street planting.	**Section 6.6.4**
	Any impacts on vegetation within Mount Victoria Park should be carefully considered.	The proposal would not affect Mount Victoria Park.

Issue category	Issues raised	Relevant REF section
Roadside signage	The size, location and number of signs can adversely impact on the character of Mount Victoria village. Council would like a copy of the outcomes of the review of existing road signage after it is complete.	Noted.
Water quality devices	No adverse impacts should occur on any natural water systems as a result of either the detention basins (opposite Mount Piddington Road and at Fairy Dell Road).	**Section 6.5**
REF review	Council would like to review the REF after it is complete.	**Section 5.6**

5.5 Government agency and stakeholder involvement

Consultation with government authorities and agencies has been carried out throughout the proposal's development. This has involved regular correspondence and one-on-one meetings and briefings.

In July 2013, relevant government authorities and agencies were contacted by letter detailing the proposal and providing an opportunity to comment. The agencies and stakeholders contacted were:

- NSW Environment Protection Authority (EPA).
- NSW Department of Primary Industries (DPI) (Agriculture).
- NSW Department of Human Services.
- DPI (Crown Lands Division).
- DPI (Fisheries).
- NSW Department of Primary Industries (Office of Water).
- NSW Office of Environment and Heritage (OEH) (Parks and Wildlife; and Heritage Branch).
- Sydney Catchment Authority/ Hawkesbury Nepean Catchment Authority.
- NSW Trains (formerly RailCorp).
- NSW Fire & Rescue.
- NSW Police.
- Rural Fire Service.

In addition, in July 2013, utility service providers whose services occur within or next to the proposal area were sent letters detailing the proposal and providing an opportunity to comment. Letters were sent to:

- Endeavour Energy.
- Jemena.
- Telstra.
- Sydney Water.

Roads and Maritime received responses from Jemena and NSW EPA. The issues raised in their submissions have been addressed in the REF, and are provided in **Table 5-3**. Copies of the responses (and meeting minutes where meetings were held) are provided in **Appendix C** of this REF.

Table 5-3 Summary of issues raised by agencies and stakeholders

Agency/ stakeholder	Issue category	Issues raised	Relevant REF section
Jemena	Location of assets	Gas infrastructure is located in the road reserve, including: • 160 mm polyethylene high risk gas main. • 75 mm nylon gas main. • 32 mm gas main. A Jemena Pipeline Patrol Officer would be required on site during any construction work in the vicinity of the 160 mm gas main.	**Section 3.5**
	Location of assets	No heavy machinery should be used directly over gas mains.	**Section 3.5**
	Location of assets	Existing cover levels should not be reduced on completion of any work.	**Section 3.5**
	Review of proposal documents before construction	Jemena requires a copy of the design package, drawings and work methods statements before any construction activity starts.	Noted.
NSW EPA	Potential impacts associated with the upgrade	All activities must comply with the requirements of the *Protection of the Environment Operations Act 1997* (POEO Act) including: • Section 115 and 116 (disposal of waste and leaks, spillages and other escapes). • Section 120 (pollution of waters). • Section 124 and 126 (operations that result in air pollution). • Section 139 (noise pollution). • Section 167 (appropriate maintenance and operation of plant and equipment).	**Section 6.5**, **Appendix H** **Section 6.2, Appendix E** **Section 6.14**
	Water quality impacts during construction	The REF should identify potential impacts on surface water from construction activities.	**Section 6.5, Appendix H**
	Mitigating water quality impacts during construction and operation	The REF should detail appropriate pollution control systems such as erosion and sediment controls during construction and the rehabilitation stage, as well as the use of permanent erosion and sediment controls where required.	**Section 6.5, Appendix H**
	Location within the Sydney Drinking Water Catchment and proximity to sensitive receiving environments.	Priority should be given to achieving a high standard of erosion and sediment control and general site management, given the proposal's proximity to sensitive receiving environments and location within the Sydney Drinking Water Catchment.	**Section 6.5, Appendix H**

Agency/ stakeholder	Issue category	Issues raised	Relevant REF section
	Potential noise impacts	The REF should identify all noise-sensitive receivers and provide a risk ranking of potential noise impacts during construction and operation of the project. The REF should also identify noise mitigation strategies to ensure compliance with relevant noise guidelines and legislation.	**Section 6.2** **Appendix E**
	Potential odour and air impacts	The REF should identify impacts from dust during construction and detail mitigation measures to minimise dust emissions.	**Section 6.12**
	Potential contaminated land within the proposal area	The REF should identify potential areas of soil or groundwater contamination and detail appropriate remediation actions.	**Section 6.8**
	Waste management	The REF should assess all reasonable and feasible options and strategies for waste minimisation, reuse and recycling.	**Section 6.14**
	Storage of chemicals/fuels	The REF should detail the proposed control measures for storage to appropriately manage the risk of spills contaminating waterways and land.	**Section 6.5**, **Section 6.8**
	Incident management procedures	The REF should provide details for ensuring that incidents that cause material harm to the environment are notified to the appropriate regulatory authorities within required timeframes.	**Section 7.1**

5.6 Ongoing or future consultation

This REF will be placed on public display for comment. Following the submissions period, Roads and Maritime will collate submissions. After consideration of community comments Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary.

Roads and Maritime will maintain a toll-free information line (1800 035 733) for any queries that the community or affected road users may have during the public display period and during construction. Roads and Maritime will also continue to update the project website http://www.rms.nsw.gov.au/roadprojects/projects/western_region/mt_victoria_lithgow/project_documents/safety_upgrade.html) and issue newsletters during the display of this REF and during construction.

5.6.1 Consultation with affected landowners

If the project is determined, Roads and Maritime will consult with all directly affected landholders before the start of construction activities. Roads and Maritime will consult with:

- Landowners whose access could be affected.
- Landowners whose land would be acquired, to ensure their concerns are clearly understood and can be addressed wherever possible.
- Landowners affected by construction noise impacts (to discuss individual noise mitigation treatments) and any night time work (consultation would occur before and during construction).

5.6.2 Consultation with government agencies and service providers

Roads and Maritime will continue to consult with government agencies such as OEH, SCA, NSW Trains and Blue Mountains City Council before and during construction, specifically in regard to staging plans, traffic management and road shut-downs (if required).

Roads and Maritime will also continue to consult with service and utility providers to ensure the design adheres to their requirements and that no services are inadvertently impacted by the proposal.

5.7 Conclusion

Roads and Maritime has consulted with the local community, the Aboriginal community, government agencies and stakeholders since 2010. Consultation has included meetings, displays, newsletters, items in the local media, and a project website. As a result, Roads and Maritime is confident that the proposal has been well publicised, and that all interested individuals and stakeholders have had an opportunity to learn about the proposal and to comment on it. Feedback received has been generally supportive of the proposal. Roads and Maritime will continue to consult with the local community, the Aboriginal community, government agencies and stakeholders.

The next chapter presents the environmental assessment of the proposal.

6 Environmental assessment

This chapter provides a detailed description of all potential environmental impacts associated with the construction and operation of the proposal. This environmental assessment includes consideration of the factors specified in the guideline, is an EIS required? (DUAP, 1999), as required under clause 228(1)(b) of the *Environmental Planning and Assessment Regulation 2000*. The factors specified in clause 228(2) of the Regulation are also considered in **Appendix B**. This chapter also includes site-specific safeguards to ameliorate the potential impacts.

6.1 Biodiversity

An assessment was carried out to identify the extent and magnitude of potential impacts of the proposal on biodiversity. The assessment is documented in the Biodiversity Assessment Technical Paper (SKM, 2013), which is provided in **Appendix D**, and summarised below.

6.1.1 Methodology

Study area

The following terms are used as part of this assessment:

- The 'locality': This refers to the broader bioregional context defined by Thackway and Cresswell (1995) as the Sydney Bioregion.
- The 'study locality': This refers to the area within 10 kilometres of the study area.
- The 'proposal area', 'study area' and 'construction footprint' are as per the definition provided in **Section 1.1** of this REF.

Review of literature, mapping and government databases

A desktop review was carried out of background reports pertaining to the biodiversity of the bioregion and the study locality. These reports included:

- Great Western Highway Upgrade: Forty Bends – Biodiversity (MV2L Alliance, 2012).
- Great Western Highway Upgrade: Biodiversity Corridor Studies (MV2L Alliance, 2011).
- Great Western Highway Upgrade: Biodiversity Survey Results – Sections 2 to 6 (MV2L Alliance, 2012).
- Great Western Highway Upgrade: Route Options – Biodiversity Working Paper (RTA, 2009).

Databases and mapping were consulted during all literature reviews, up to October 2013. The following government databases and mapping were reviewed to identify potential threatened species, populations and ecological communities of the study locality:

- GIS data layer of the Regional Biodiversity Corridors in the Hawkesbury-Nepean Catchment Management Authority Area (DECC, 2005).
- Vegetation types database [Biometric] (OEH, 2013).
- Threatened species database (OEH, 2013).
- Native Vegetation of South-east NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer, et al, 2010).
- The Vegetation of the Western Blue Mountains (DEC, 2006).

- Atlas of NSW Wildlife Database (OEH, July 2013).
- EPBC Act Protected Matters Search Tool (accessed June 2013).

Field investigations

Detailed ecological data in the study area were collected for previous studies (RTA 2009, 2011, 2012), which formed the basis of baseline information used in this assessment and informed the identification of key areas for investigation.

Additional field surveys focused on the construction footprint along the length of the proposal. The surveys were carried out on 10–11 July 2013. The surveys involved:

- Identifying biodiversity values within the vicinity of the proposal, within areas of known high ecology sensitivity and in areas where existing data was limited.
- Capturing qualitative data on flora and fauna diversity.
- Recording additional vegetation distribution and habitat associations.
- Undertaking road traverses for any threatened flora and fauna species and their habitat, particularly those identified during the database reviews. Identifying habitat for threatened fauna and important resources such as hollow-bearing trees, logs, large rocks and nectar-producing plants.
- Identifying key Koala habitat.
- Recording all opportunistic sightings and evidence of fauna presence (this included listening for bird calls; occasional searches in leaf litter, fallen timber, and under rocks for reptiles; and inspecting droppings and tracks).

Biodiversity assessment

The biodiversity assessment has identified and assessed the impacts associated with the construction footprint of the highway upgrade and the proposed basin at Section 3 of the proposal. The proposed compound and stockpile sites have been assessed as part of the proposal (no vegetation clearing is required for these sites and therefore no biodiversity impact is anticipated). The design and extent of the water quality treatment and basin at Sections 1 and 2 (respectively) of the proposal are yet to be finalised. The biodiversity assessment would be completed for these elements of the proposal during detailed design (refer to **Section 6.1.4**).

6.1.2 Existing environment

The study area is located within the South Eastern Highlands and Sydney Basin bioregions (DSEWPaC, 2012). The proposal traverses the Mid Coxs River subcatchment and the Grose River subcatchment, which together make up part of the Hawkesbury-Nepean Catchment Management Area (HNCMA). The region is important for biodiversity because it provides a transition from the mountains in the east to the western slopes and the plains.

The Blue Mountains National Park surrounds the study area and is part of the Greater Blue Mountains Area, which is listed on the National Heritage List and the World Heritage List under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The study area supports a variety of land uses and is bisected by the Great Western Highway. Modified bushland is located in the north-west of the study area, while areas of more intact bushland occur at the south-eastern end of the study area. The remainder of the study area is made up of landholdings and residential properties along the highway. The majority of the construction footprint is in maintained roadsides with planted exotic trees and shrubs and on private land (front verges of residential properties).

Vegetation communities and habitats

Four native vegetation communities and one exotic community occur within the study area. These were identified and mapped during the previous corridor studies (MV2L Alliance, 2011), and are listed in **Table 6-1** along with the equivalent map units identified in regional vegetation community mapping projects. Also listed are the conservation status of each community according to information provided by Tozer et al (2010), DEC (2006) and the TSC Act and EPBC Act. The distribution of these communities within the study area is displayed in **Figure 6-1a** and **Figure 6-1b.**

Table 6-1 Vegetation communities and habitats

Vegetation community	Equivalent map units	Conservation status	Fauna habitat attributes
Map Unit 1 Silvertop Ash – Peppermint Forest	Biometric: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner Tozer *et al* (2010): DSF p136 Blue Mountains Ridgetop Forest Douglas 2001: 11A *Eucalyptus sieberi – E. piperita* Open-Forest/Woodland	Tozer *et al* (2010) estimate about 80–90% of the pre-clearing area of this vegetation community (DSF p8) remains, and 40–60% of the pre-clearing area is in conservation reserves. Community not listed under EPBC Act or TSC Act.	Dry sclerophyll forest – potential hollow-bearing trees and rocky outcrops
Map Unit 2 Hard-leaved Scribbly Gum Open Forest	Biometric: Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Tozer *et al* (2010): DSF p136 Blue Mountains Ridgetop Forest Douglas 2001: 11A *Eucalyptus sieberi – E. piperita* Open-forest/Woodland	This community is regarded as being relatively common. An estimated 80–95% of the pre-European extent remains and an estimated 55–70% of the pre-European extent occurs in conservation reserves. Community not listed under EPBC Act or TSC Act.	Dry sclerophyll forest– potential hollow-bearing trees and rocky outcrops
Map Unit 3 Blue Mountains Ash Open Forest	Biometric: Narrow-leaved Peppermint – Mountain Gum – Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands; and/or Blaxland's Stringybark – Blue Mountains Ash – Blackwood moist open forest on basalt caps of the Blue Mountains, Sydney Basin Tozer *et al* (2010): DSF p136 Blue Mountains Ridgetop Forest	This is identified as a sensitive vegetation unit under the Blue Mountains Local Environment Plan 2005. Community not listed under EPBC Act or TSC Act.	Dry sclerophyll forest – potential hollow-bearing trees and rocky outcrops

Vegetation community	Equivalent map units	Conservation status	Fauna habitat attributes
	Douglas 2001: 2G *Eucalyptus oreades* Open-forest/Tall Open-forest		
Map Unit 4 Hanging Swamps (Threatened ecological community)	Biometric: Prickly Tea-tree – sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion Tozer *et al* (2010): FrW p130 Blue Mountains – Shoalhaven Hanging Swamps. Douglas 2001: 5B Blue Mountains Swamps	This is listed as endangered under the EPBC Act (Temperate Highland Peat Swamps on Sandstone) and vulnerable under the TSC Act (Blue Mountains Swamps). It has also been identified as a sensitive vegetation unit under the Blue Mountains LEP 2005.	Freshwater wetlands (hanging swamps) – contains Sphagnum moss and wet environment for threatened fauna habitat
Map Unit 5 Horticultural plantings	Nil	Nil	Modified habitat

Threatened ecological communities

One threatened ecological community (TEC), the Hanging Swamp community, was identified in the study locality (refer to Map Unit 4 in **Figure 6-1a**). This community was considered to be characteristic of the vulnerable Blue Mountains Swamps TEC in the Sydney Basin Bioregion under the TSC Act and the Temperate Highland Peat Swamps on Sandstone endangered ecological community under the EPBC Act.

The hanging swamp community occurs on Crown land to the north east of Section 1. Three individual patches are located on the Grose River about 50 metres to the north of the highway, downstream of the proposal (refer to **Figure 6-1a**). This community was observed in high condition.

Fauna habitats

Three fauna habitats were identified in the study area and are discussed in **Table 6-2**, which also lists their association with native vegetation communities. The distribution of these habitats is mapped in associated vegetation types in **Figure 6-2a** and **Figure 6-2b**. Large tree hollows are non-existent within the proposal area habitats; this limits suitability of these fauna habitats for hollow-dependent fauna. Fourteen habitat trees with small hollows (nine trees to the south east and five trees) are located in dry sclerophyll forest, to the north and south of Victoria Falls Road intersection (near Section 1). These habitat trees are not located within the proposal area and are not expected to be affected by the proposal.

Table 6-2 Fauna habitats in the study area

Fauna habitat	Habitat description
Dry sclerophyll forest	This habitat dominates the native vegetation communities of the study area, with a varied understory of shrubs, grasses and herbs. The grassy groundcover is scattered throughout with a sparse distribution of medium and large rocks as well as logs, providing some shelter for small reptiles. These areas support a moderate cover of large and mid-sized trees and shrubs such as Wattles (*Acacia* spp.) and Tea tree (*Leptospermum* spp.). It is likely to

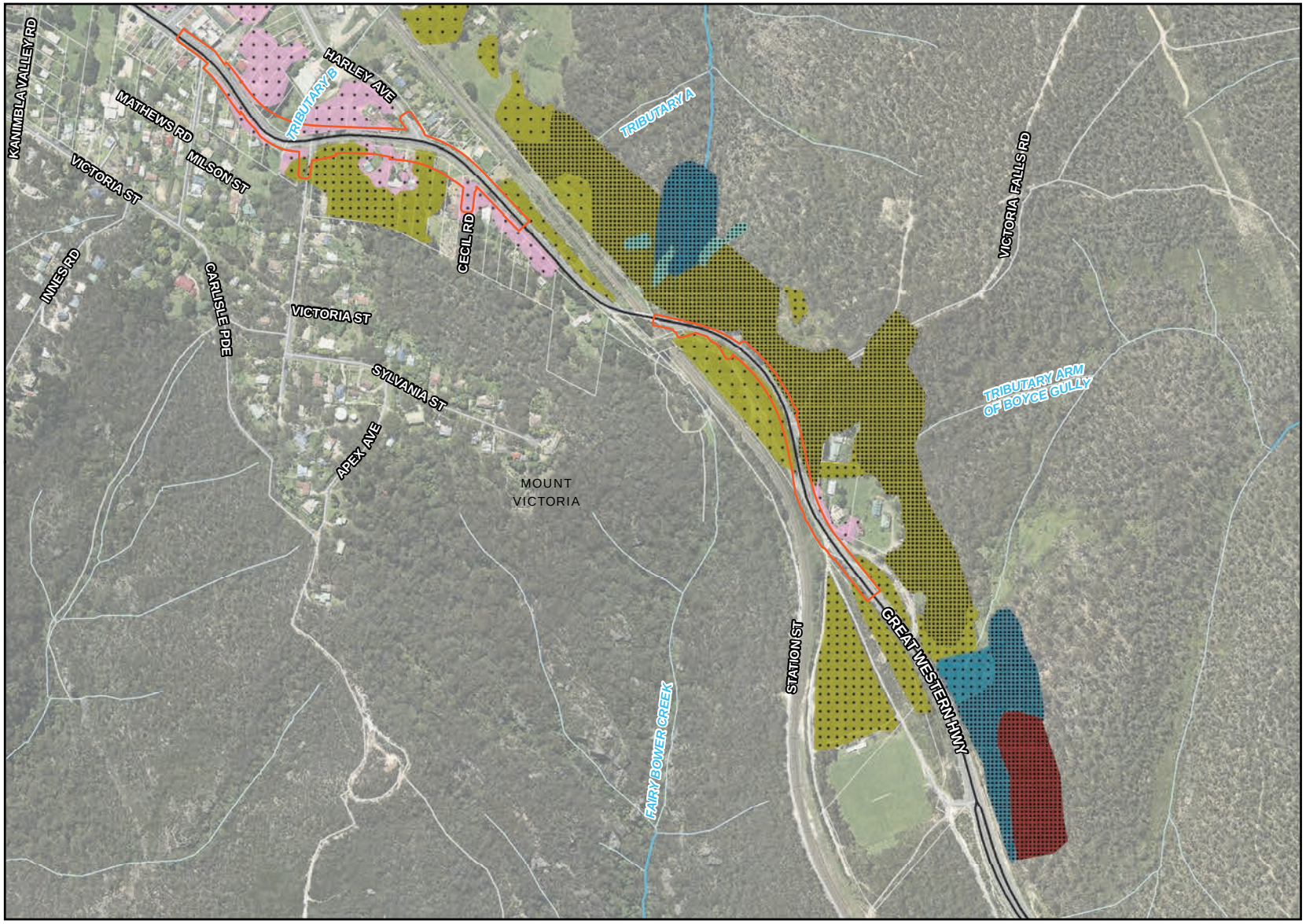
Fauna habitat	Habitat description
	provide important habitat for fauna such as arboreal mammals and nectivorous birds. It also provides a range of food sources for fauna including a diversity of eucalypt species, providing a seasonal supply of nectar and pollen. Secondary and supplementary food trees (*Eucalyptus mannifera* and *Eucalyptus blaxlandii*) are also present for Koala (listed vulnerable under the EPBC Act and TSC Act) and *Allocasuarina* spp. are present for Glossy Black-cockatoo (listed vulnerable under the TSC Act).
Hanging swamp wetlands (freshwater wetlands)	Small pockets of this habitat are located on steep slopes within dry sclerophyll forests. This habitat typically occurs on seepage zones with little tree cover and is known to provide habitat for threatened fauna species such as Blue Mountains Water Skink (*Eulamprus leuraensis*), Red-crowned Toadlet (*Pseudophryne australis*) and Giant Dragonfly (*Petalura gigantea*). The intact nature and high condition of these areas would suggest that such species could be expected to occur in these habitats. The habitat also provides foraging substrates and cover for the Scarlet Robin and Gang Gang Cockatoo (listed vulnerable under the TSC Act).
Modified habitat	This habitat mainly consists of landscaped residential frontages along the highway, roadside verges and parklands. These areas are dominated by exotic trees and there is limited native vegetation cover. These areas could be utilised by a range of local native fauna such as macropods and Spotted-tail Quoll (listed vulnerable under the TSC Act), for foraging and dispersal.

Threatened flora

A search of threatened flora database records for the study locality (that is, the area within 10 kilometres of the study area), was carried out in July 2013 (refer to **Figure 6-3**). The search found that 20 threatened flora species and one threatened fungi species have been recorded within the study locality. All of these species were considered to have a low likelihood of occurrence within the proposal area, considering their habitat preferences. No threatened flora species were identified during field investigations for the proposal.

There are database records of threatened flora species Flockton Wattle (*Acacia flocktoniae*), Smooth Bush-pea (*Pultenaea glabra*) and Bynoe's Wattle (*Acacia bynoeana*) occurring 80 to 300 metres from the proposal area, in semi-disturbed areas and residential backyards. Although these species may have once occurred within the study locality, the recorded locations are questionable now given they are 50–100 years old and the sites are likely to have changed considerably over that time. They are considered unlikely to currently occur within the proposal area as the majority of vegetation is low condition.

FIGURE 6-1a | VEGETATION COMMUNITIES



LEGEND

- Construction footprint (5 m buffer)
- Existing highway
- Road
- Primary waterway
- Minor waterway

Vegetation communities

- Map Unit 1: Silvertop Ash – Peppermint Forest
- Map Unit 2: Hard-leaved Scribbly Gum Open Forest
- Map Unit 3: Blue Mountains Ash Open Forest
- Map Unit 4: Hanging Swamps (TEC)
- Map Unit 5: Horticulture plantings

Vegetation condition

- High
- Moderate
- Low

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DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001, SKM 2013, 2011

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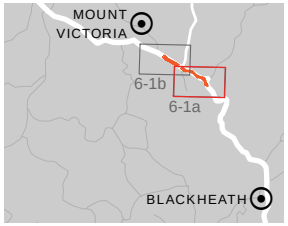

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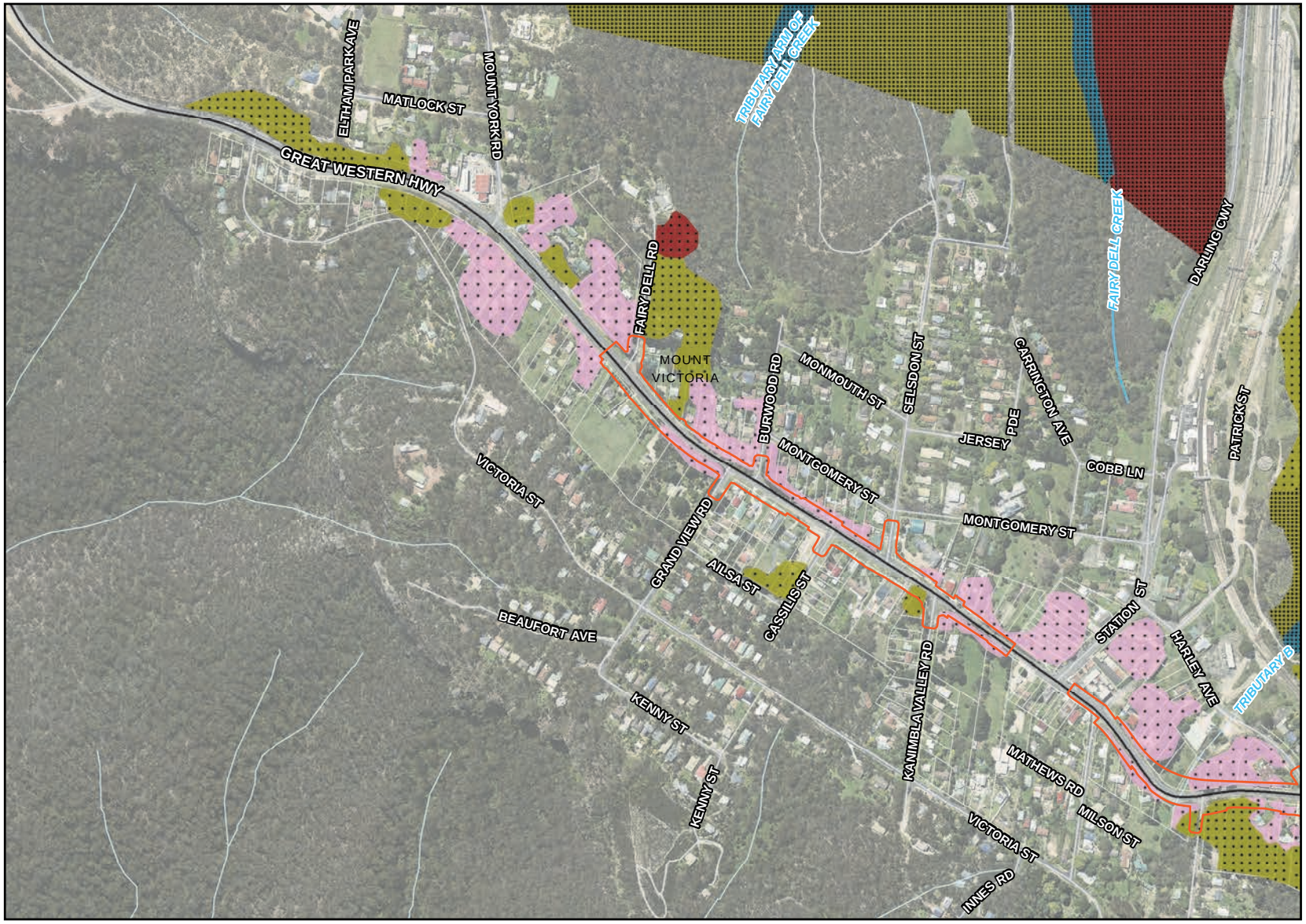
Newcastle Spatial Team - Prepared by : KO
Checked by : JWC

FIGURE 6-1b | VEGETATION COMMUNITIES



LEGEND

- Construction footprint (5 m buffer)
- Existing highway
- Road
- Primary waterway
- Minor waterway

Vegetation communities

- Map Unit 1: Silvertop Ash – Peppermint Forest
- Map Unit 2: Hard-leaved Scribbly Gum Open Forest
- Map Unit 3: Blue Mountains Ash Open Forest
- Map Unit 4: Hanging Swamps (TEC)
- Map Unit 5: Horticulture plantings

Vegetation condition

- High
- Moderate
- Low

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DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001, SKM 2013, 2011

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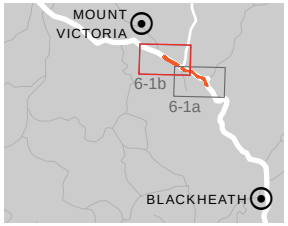

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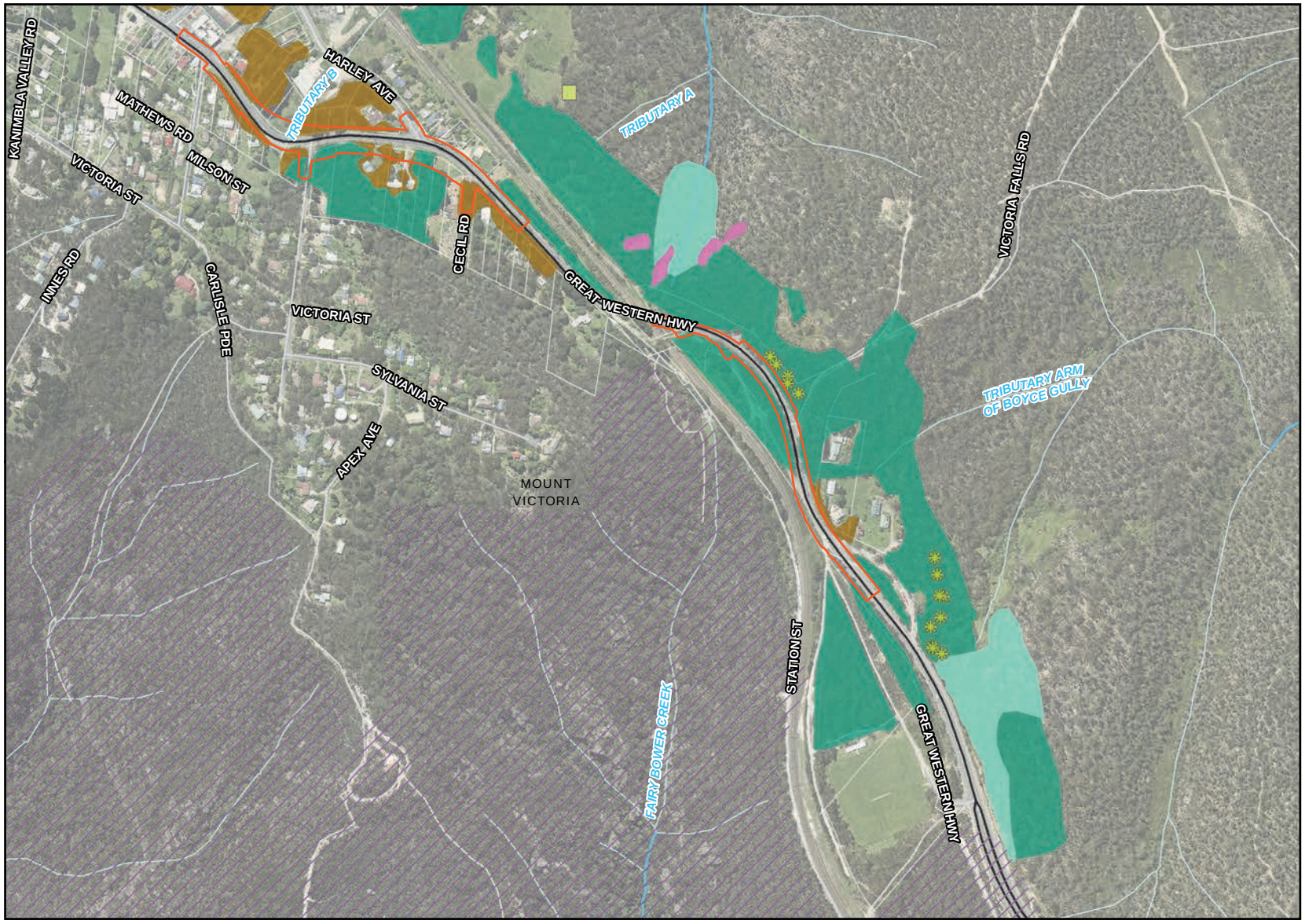
Checked by : JWC

FIGURE 6-2a | THREATENED FAUNA, HABITATS AND CORRIDORS



LEGEND

- Existing highway
- Road
- Primary waterway
- Minor waterway
- Construction footprint (5 m buffer)
- Wildlife corridors - Blue Mountains Western Escarpment
- Habitat tree

Threatened fauna

- Gang-gang Cockatoo
- Scarlet Robin

Fauna habitat

- Dry sclerophyll forest
- Farm dam
- Hanging swamp wetlands
- Sheltered dry sclerophyll forest
- Modified habitat

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DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001, SKM 2013, 2011

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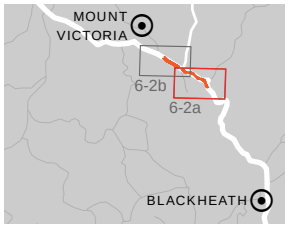

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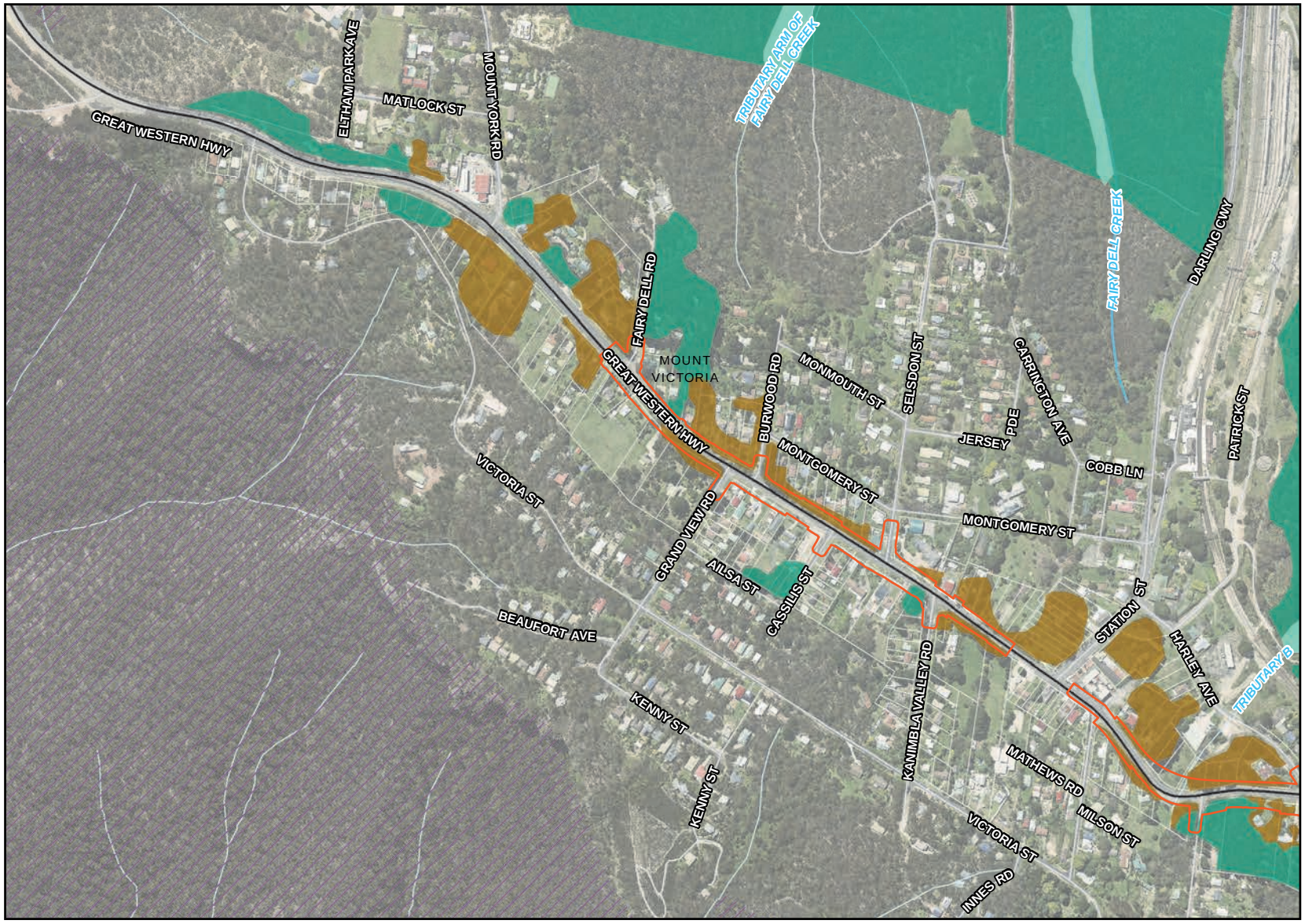
Newcastle Spatial Team - Prepared by : KO
Checked by : VC

FIGURE 6-2b | THREATENED FAUNA, HABITATS AND CORRIDORS



LEGEND

- Existing highway
- Road
- Primary waterway
- Minor waterway
- Construction footprint (5 m buffer)
- Wildlife corridors - Blue Mountains Western Escarpment
- Habitat tree

Threatened fauna

- Gang-gang Cockatoo
- Scarlet Robin

Fauna habitat

- Dry sclerophyll forest
- Farm dam
- Hanging swamp wetlands
- Sheltered dry sclerophyll forest
- Modified habitat

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DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, STREETWORKS 2001, SKM 2013, 2011

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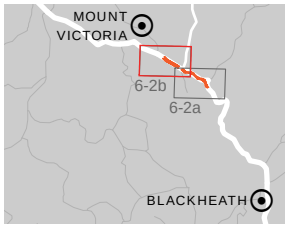

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Newcastle Spatial Team - Prepared by : KO
Checked by : VC

Threatened fauna

A search of threatened fauna database records for the locality was carried out in July 2013 (refer to **Figure 6-4**). The search found that 27 threatened fauna species potentially occur in the study area. Of these, four birds and eight mammals were considered to have a high likelihood of occurring within the study area (refer **Table 6-3**). A further three mammal, one amphibian, two reptile and one invertebrate species have a moderate likelihood of occurring within the study area.

Table 6-3 Threatened fauna with a high or moderate likelihood of occurring within the study area

Scientific name	Common name	Status		Potential habitat in the study area	Likelihood of occurrence in the construction footprint
		EPBC	TSC		
Birds					
Petroica phoenicea	Flame Robin	-	V	Dry sclerophyll forests and woodlands	High
Callocephalon fimbriatum	Gang-gang Cockatoo	-	V	Wet and dry sclerophyll forests	High, confirmed in the study area
Glossopsitta pusilla	Little Lorikeet	-	V	Wet and dry sclerophyll forests, woodlands and riparian areas	High
Petroica boodang	Scarlet Robin	-	V	Dry sclerophyll forest and woodlands, agricultural areas with scattered tree remnants	High, confirmed in the study area
Mammals					
Miniopterus schreibersii oceanensis	Eastern Bent-wing-bat	-	V	Dry sclerophyll forests, woodlands and derived grasslands, agricultural areas	High
Falsistrellus tasmaniensis	Eastern False Pipistrelle	-	V	Sclerophyll forests and woodlands	High

Scientific name	Common name	Status EPBC	TSC	Potential habitat in the study area	Likelihood of occurrence in the construction footprint
Mormopterus norfolkensis	Eastern Freetail-bat	-	V	Dry sclerophyll forests, woodlands and derived grasslands, agricultural areas	High
Scoteanax rueppellii	Greater Broad-nosed Bat	-	V	Wet and dry sclerophyll forests	High
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Dry sclerophyll forests and woodlands	High
Myotis macropus	Southern Myotis	-	V	Freshwater wetlands, swamps, creeks and next to forest and woodland habitats	High
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	V	Wet and dry sclerophyll forests	High
Petaurus norfolcensis	Squirrel Glider	-	V	Wet and dry sclerophyll forests, woodlands and heaths.	Moderate
Petaurus australis	Yellow-bellied Glider	-	V	Wet and dry sclerophyll forest.	Moderate
Dasyurus maculatus	Spotted-tailed Quoll	E	V	Extensive areas of suitable habitat, and a considerable number of records in the corridor.	High
Phascolarctos cinereus	Koala	V	V	Suitable foraging habitat present.	Moderate
Amphibians					
Pseudophryne australis	Red-crowned	-	V	Dry sclerophyll forest in steeper terrain with	Moderate

Scientific name	Common name	Status EPBC	TSC	Potential habitat in the study area	Likelihood of occurrence in the construction footprint
	Toadlet			exposed, boulders, and rocky slopes.	
Reptiles					
Eulamprus leuraensis	Blue Mountains Water skink	E	E	Densely vegetated swamps.	Moderate
Hoplocephalus bungaroides	Broad-headed Snake	V	E	Dry sclerophyll forests on steep escarpments with exposed sandstone rocks, boulders and platforms.	Moderate
Invertebrates					
Petalura gigantea	Giant Dragonfly	-	E	Vegetated swamps and wetlands.	Moderate

V: Vulnerable, E: Endangered

Previous studies included detailed fauna surveys within and outside the study area (MV2L Alliance, 2011). These surveys confirmed the presence of two threatened bird species (refer to **Table 6-4**). The potential for Koala to occur within the proposal area is discussed below.

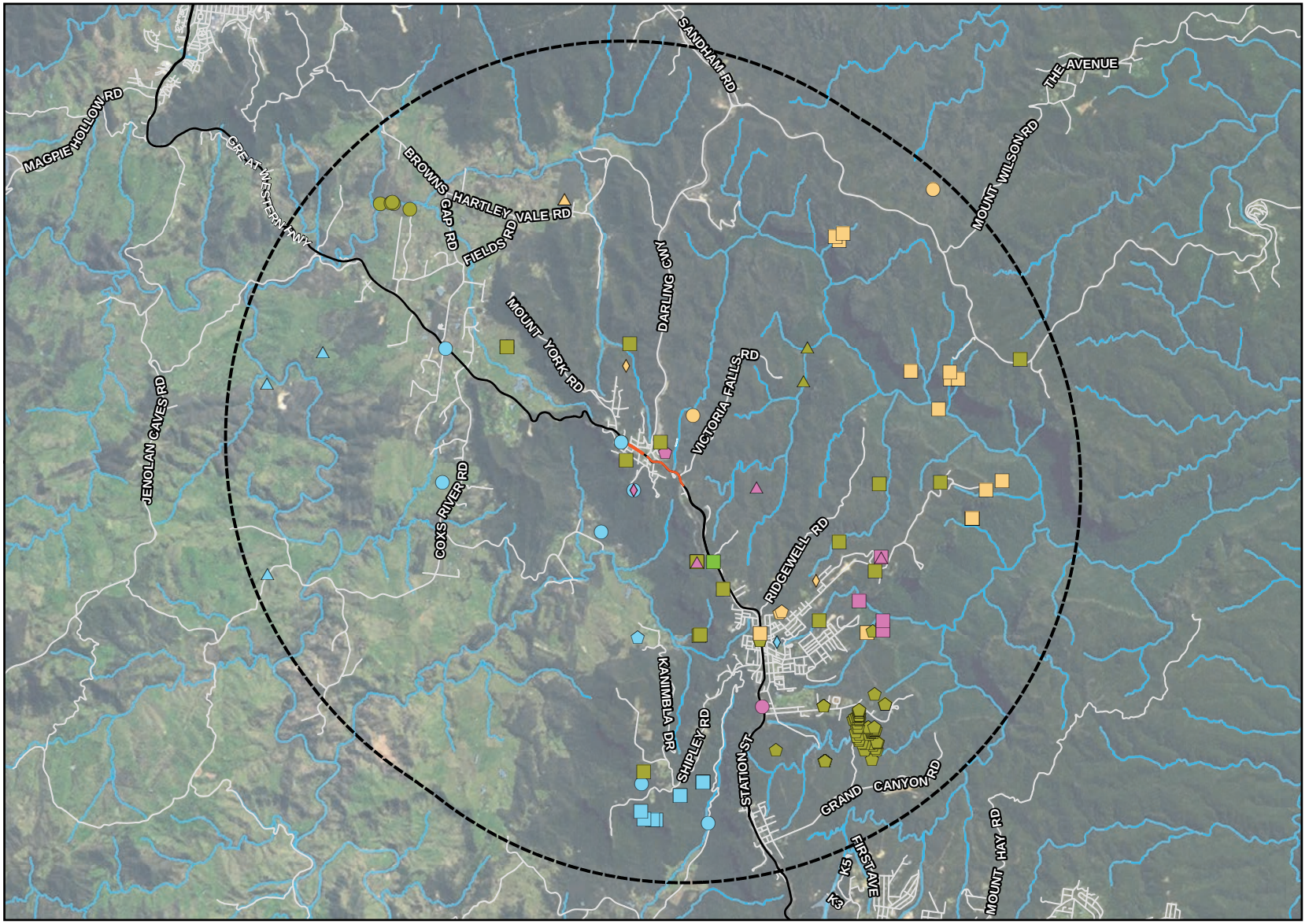
Table 6-4 Threatened species recorded in previous surveys

Species	Status	Fauna habitat type	Habitat condition	Location
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	Vulnerable (TSC Act)	Grassy woodlands	Moderate – high	In habitat with hollow-bearing trees. Recorded 160 metres north-east of Section 2.
Scarlet Robin (*Petroica boodang*)	Vulnerable (TSC Act)	Dry eucalypt forests and woodlands	Low – moderate	In a disturbed, vegetated area of old golf course. Recorded 460 metres north of Section 2.

Koala

No evidence of Koala was found during surveys for this proposal, nor in previous surveys (MV2L Alliance, 2011). During field investigations and the habitat assessment, 'habitat critical to the survival of the Koala' (DSEWPaC, 2012) was considered, but no evidence was found to support Koala activity in the study area.

FIGURE 6-3 | THREATENED FLORA IN THE LOCALITY



LEGEND

- The proposal
- Existing highway
- Road
- Primary waterway
- Proposal 10 km radius

OEH Atlas - threatened flora (2013)

- *Acacia bynoeana*
- *Acacia flocktoniae*
- *Acrophyllum australe*
- *Asterolasia buxifolia*
- *Carex klaphakei*
- *Derwentia blakelyi*
- *Diuris aequalis*
- *Epacris hamiltonii*
- *Eucalyptus aggregata*
- *Eucalyptus pulverulenta*
- *Euphrasia bowdeniae*
- *Grammitis stenophylla*
- *Isopogon fletcheri*
- *Leionema lachnaeoides*
- *Lepidosperma evansianum*
- *Persoonia acerosa*
- *Persoonia nutans*
- *Prasophyllum fuscum*
- *Pultenaea glabra*
- *Velleia perfoliata*

DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, OEH 2013, SKM 2013, 2011, STREETWORKS 2001

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Kilometres

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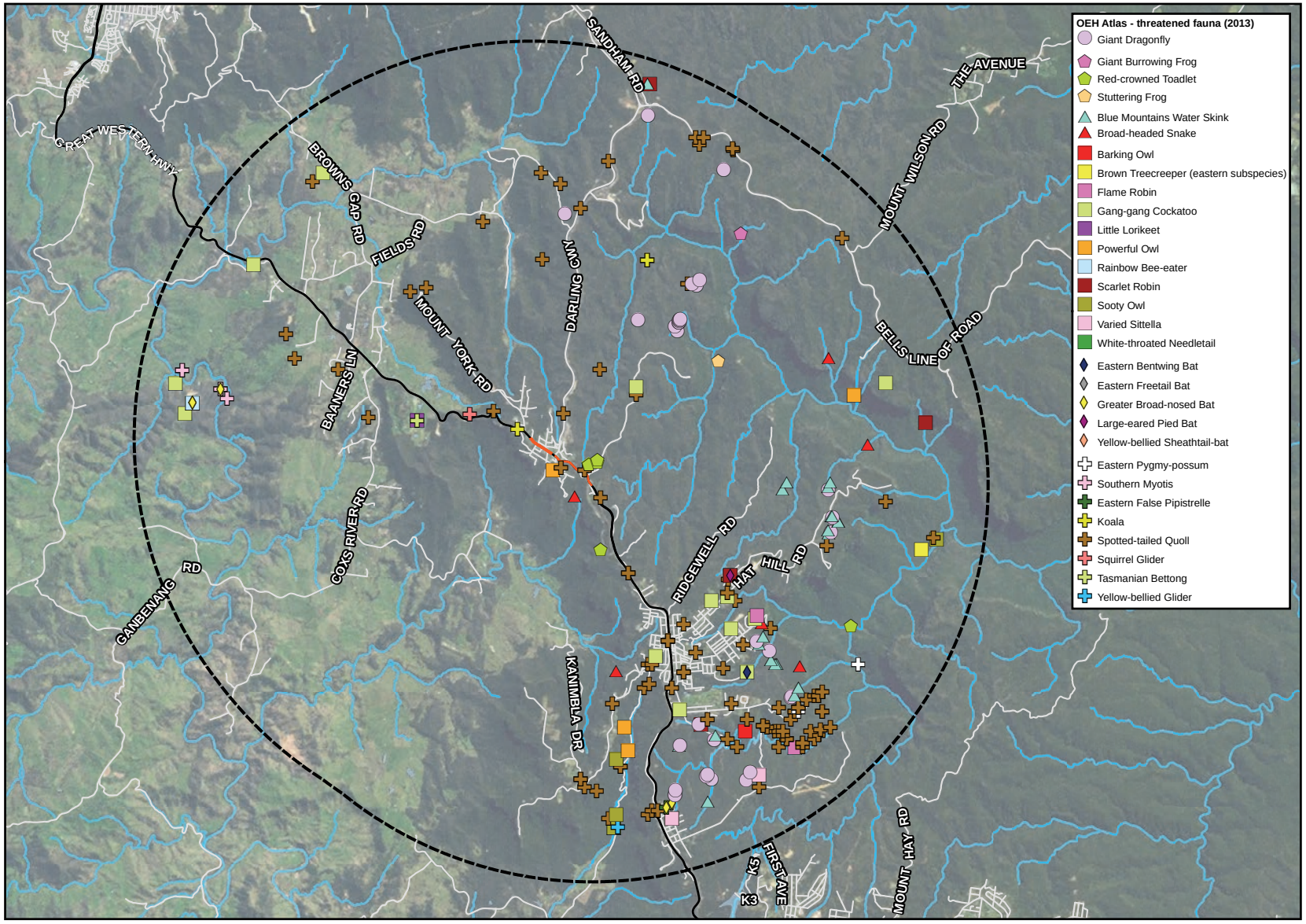
Newcastle Spatial Team - Prepared by : KO
Checked by : VC

FIGURE 6-4 | THREATENED FAUNA IN THE LOCALITY



LEGEND

- The proposal
- Existing highway
- Road
- Primary waterway
- Proposal 10 km radius

DATA SOURCES
Roads and Maritime Services 2013, OEH 2013, STREETWORKS 2001, SKM 2013, 2011, LPMA 2010

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Kilometres

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Newcastle Spatial Team - Prepared by : KO
Checked by : VC

Although there were three scattered records in the locality during the last 20 years and there are known populations in Wollemi National Park, there are no known populations in the study area. The study area provides marginal foraging opportunities with uncommon secondary food trees such as the Brittle Gum (*Eucalyptus mannifera*) and supplementary food tree Blaxland's Stringybark (*Eucalyptus blaxlandii*). The proportion of food trees is considered to only provide tertiary habitat (DECC, 2008).

Migratory species

Fifteen migratory fauna species were identified as potentially occurring in the study locality. All species have a low potential for occurring in the study area. These migratory species and assessments of occurrence are listed in **Appendix D**. Field investigations found no evidence to suggest that an area of important habitat for migratory species exists, or that the study area is occupied by an ecologically significant proportion of the populations of these migratory species.

Wildlife connectivity corridors

The Blue Mountains Western Escarpment is identified as a wildlife corridor for fauna movement and is an important connection linking a south–north passage through the Great Western Highway (DECC, 2005). It exists outside of the Mount Victoria township, extending along the southern boundary of the study area and passing through Victoria Pass in the north-eastern extent of the locality. Vegetation on the southern side of Section 1 forms part of this corridor.

Groundwater-dependent ecosystems

The hanging swamp wetland habitat is highly dependent on groundwater for sustaining function and productivity. This wetland habitat regulates flows, which reduces turbidity and stabilises or improves water quality. It is restricted to specific topographic locations where water-bearing sandstone and permeable claystone bands allow partial waterlogging by moisture seepage on steep valley slopes (Keith et al, 2006 and Holland et al*,* 1991).

Weeds

Weeds are already prevalent along the roadsides within the study area, particularly in areas next to cleared land. The urban environment within the proposal area consists of landscaped gardens and exotic plantings. Four noxious weeds are recorded in the study area, including:

- Montpellier Broom (*Genista monspessulana*), which is recorded in low abundance in disturbed roadside areas.
- Asparagus Fern (*Asparagus aethiopicus*), which is widespread throughout the study area in residential gardens, recorded in low abundance.
- St Johns Wort (*Hypericus perforatum*), which is of moderate to high abundance in disturbed roadside easements, disturbed areas of remnant vegetation and agricultural areas.
- Blackberry (*Rubus fruticosus*), which is of moderate to high abundance in unmaintained road easements and disturbed areas of remnant vegetation.

6.1.3 Potential impacts

Construction

Construction of the proposal would result in a number of impacts and potential impacts on native flora and fauna. These impacts are presented below.

Loss of vegetation/habitat

The construction footprint associated with the proposal would impact on a total of about 1.33 hectares of native and modified vegetation. Of this, 0.55 hectares (about 41 per cent) is remnant vegetation (refer to **Table 6-5**). The remaining vegetated lands are modified fauna habitat of exotic plantings and disturbed land in the form of residential gardens and maintained roadsides.

Table 6-5 Direct impacts on vegetation and fauna habitat

Vegetation community type	Fauna habitat type	Biometric vegetation type	Conservation status/ percentage cleared (Tozer, 2010)	Condition	Area (ha)
Construction footprint					
Map Unit 1: Silvertop Ash – Peppermint Forest	Dry sclerophyll forest	Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner	10–20% of original extent estimated to be cleared	High	0.08
				Moderate	0.23
				Low	0.13
Sub-total				**0.44 hectares**	
Sedimentation basin (Fairy Dell Road)					
Map Unit 1: Silvertop Ash – Peppermint Forest	Dry sclerophyll forest	Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands and South East Corner	10–20% of original extent estimated to be cleared	Moderate	0.11
Sub-total				**0.11 hectares**	
TOTAL				**0.55 hectares**	

The direct impacts would have a small effect on these native vegetation types as the impacts represent only very minor percentage losses. The direct impacts also represent a minor loss of remnant canopy cover, habitat and native seed bank in the topsoil.

Threatened ecological communities

The hanging swamps threatened ecological community would not be directly impacted during construction of the proposal. An assessment of significance was carried out for the Blue Mountains Swamps in the Sydney Basin Bioregion threatened ecological community. The assessment concluded that a significant impact on this threatened ecological community is unlikely. Indirect impacts may potentially occur if any alterations to hydrology such as lowering the water table and diverting surface water into creeks, rather than infiltrating the soil to recharge

swamps, would interrupt ecosystem processes and cause species decline (NPWS, 2001). However, the hydrological assessment has identified no indirect hydrologic impacts to the hanging swamps as a result of the proposal. This is because the hanging swamps are not hydrologically connected to the basins which would collect water for the proposal (refer to **Section 6.4** and **Appendix G**).

There is also a potential indirect impact from surface water contamination from sediment-laden run-off during construction. This potential impact would be managed through the implementation of erosion and sedimentation measures during construction, particularly at construction work next to Gatekeepers Cottage (refer to **Section 6.5.5**). These measures would prevent polluted surface water entering the hanging swamps, as well as reduce the potential for changes to the composition of plant species within the hanging swamps community. Impacts to hanging swamps would be limited, as the majority of roadwork in Section 1 would be on the southern side of the highway, whereas the hanging swamps are located on the northern side.

Threatened flora

No threatened flora was recorded during field surveys. Given the poor condition of vegetation within the proposal area, it is unlikely for threatened flora to be affected by the proposal.

Threatened fauna

There is a high likelihood of threatened fauna species using habitats in the study area due to the presence of extensive suitable habitat. However, the majority of habitat within the proposal footprint is generally of low value to all the potentially occurring threatened fauna. In addition, the lack of hollow-bearing trees within the proposal area and structural diversity for refuge reduces the likelihood of threatened fauna occurring. Nevertheless, the proposal would have the following potential impacts on threatened fauna:

- There may be a minor impact on the Spotted-tailed Quoll (listed vulnerable under the TSC Act and endangered under the EPBC Act), which may visit roadside habitat on an occasional basis. The proposal would result in the removal of about 0.42 hectares of moderate to high condition dry sclerophyll forest, therefore reducing available foraging area. The proposal, would however avoid large areas of high condition dry sclerophyll forest where possible, for example to the north of Section 1.
- Additional roadside edge effects may increase competition from Noisy Miner (*Manorina melanocephala*) against native birds in remaining disturbed areas. Noisy Miner aggression is considered a Key Threatening Process in a recent Preliminary Determination by the Scientific Committee of the TSC Act.
- There would be an impact on about 0.42 hectares of moderate to high condition dry sclerophyll habitat. The magnitude of this impact is considered to be low due to the modified nature of the habitats present in the construction footprint and lack of important habitat features such as hollow-bearing trees, rocky outcrops and hollow logs.

Significance assessments were conducted for threatened fauna that have been positively identified or that have a high or moderate likelihood of occurring in the study area (refer to **Appendix D**). These assessments found that the proposal would not be likely to cause a significant impact on any of the threatened species.

Loss of hollow-bearing trees and habitat trees

The fourteen habitat trees with small hollows (nine trees to the south east and five trees to the north east) near Section 1 (but outside of the proposal area) would not be directly impacted. A loss of habitat is not expected during construction of the proposal. However, branches on overhanging trees would need to be inspected before lopping or removal, during pre-clearing surveys, to check for potential hollows where microbats such as the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) may be taking refuge.

Loss of foraging habitat

The loss of habitat is a Key Threatening Process listed as 'Clearing of native vegetation' under Schedule 3 of the TSC Act.

The proposal would result in the clearing of about 1.33 hectares of native and modified habitat, which would potentially affect areas of habitat for fauna. There would also be impacts on areas of cleared land with some value for mostly common species of fauna that have adapted to disturbed areas. The loss of dry sclerophyll forest habitat (0.55 hectares) would reduce the area available for native fauna. This would not decrease the occurrence of any fauna species, as the proposal would avoid large areas of high condition dry sclerophyll forest.

Koala habitat

The current surveys confirmed the limited habitat suitability for Koala. There were no Koala scats detected and no primary feed trees recorded during field surveys. There is also little evidence to support the presence of a local breeding population of Koalas. Vegetation within the study area is considered to provide only marginal habitat which may provide some foraging opportunities, from secondary food tree Brittle Gum (*Eucalyptus mannifera*) and supplementary food tree Blaxland's Stringybark (*Eucalyptus blaxlandii*). Individual food trees that have been listed such as Brittle Gum and Blaxland's Stringybark may need to be removed from within the construction footprint. However, the loss of marginal habitat for Koala within the proposal area is considered to be only a minor impact to the species.

Injury and mortality

Vegetation clearing has the potential to result in the injury or death of fauna, particularly those species that take refuge in trees, are ground-dwelling, or are less mobile. These include ground-dwelling mammals, microbats, possums, reptiles, birds (particularly fledglings) and frogs. Larger, more mobile species, such as macropods, larger reptiles and adult birds, are less likely to be affected as they are able to flee to unaffected areas of suitable habitat.

Weeds

During construction, there is potential to disperse weed seeds or other propagules into areas of remnant vegetation where weeds do not currently occur. Clearing vegetation, stockpiling of contaminated mulch and topsoil during earthworks and the movement of soil and attached seeds and propagules to construction vehicles and machinery are activities that can disperse weeds.

Pests and pathogens

The proposal is not likely to increase the invasion of pest species. Foxes (*Vulpes vulpes*) and Rabbits (*Oryctolagus cuniculus*), are known to occur in the study area

but are not expected to increase in numbers as a result of the proposal. The study area is susceptible to the pathogen root rot (*Phytophthora cinnamomi)*, which results in native plant dieback. It is known to occur in specific areas around Mount Victoria and the upper Blue Mountains plateau. To reduce the potential for impacts, infected soil or plant material from local affected areas should not be transported to the study area (refer to **Section 6.1.4**).

Changed hydrology

The proposal is not expected to change the current stream flow regime, velocities or depths of the waterway (refer to **Section 6.4** for further detail regarding hydrology).

Groundwater-dependent ecosystems

There are three areas of hanging swamp community, listed under the EPBC Act and TSC Act, downslope of the proposal footprint, north of the highway, east of Mount Victoria village. As earthworks would not cut slopes during construction, there is not expected to be a risk to the existing groundwater regime. However, a Water Quality Monitoring Plan and erosion control measures would need to be implemented during construction and operation of the proposal (refer to **Section 6.5.5** and **Section 6.8.3**). Additionally, basins for the proposal would incorporate water quality measures in the form of in-line trash racks and biofiltration layers, which would serve to improve the quality of runoff. These measures would ensure that hanging swamp communities are not affected by poor water quality run-off from the construction site.

Aquatic impacts

The only wetland habitats in the study area are the threatened hanging swamp communities. Construction activities that may affect water quality can impact the health of the wetland environment, which could also have an impact on the associated species of invertebrates, frogs, reptiles and birds. Increased particulates in the water column can reduce water infiltration, which could impact the hydrology of hanging swamp areas. Water quality measures to be carried out to preserve the hanging swamps are addressed in the Water Quality Technical Report (**Appendix H**).

A Water Quality Monitoring Plan would be implemented to manage these conditions. Management measures (including erosion control measures) would be designed to minimise potential impacts on hanging swamps from poor water quality and altered hydrology (refer to **Section 6.5.5**).

Noise, vibration and light

Construction noise, vibration and light could result in fauna temporarily avoiding habitats in the proposal area.

Impact on relevant key threatening processes

A threat can be listed under the TSC Act as a 'Key Threatening Process' if it adversely affects threatened species, populations or ecological communities or if it could cause species, populations or ecological communities that are not threatened to become threatened.

The Key Threatening Process associated with the proposal is vegetation clearing. There is also potential for other key threatening processes to increase as a result of the proposal. These processes include weed invasion, introduction of pests and diseases and alteration of hydrological regimes.

This report includes mitigation measures to minimise the extent of vegetation clearing and habitat disturbance (refer to **Section 6.1.4**), and to relocate important fauna habitat elements where possible.

Operation

The biodiversity impact of the upgraded highway would mainly relate to vehicle strike and habitat fragmentation.

Injury and mortality from vehicle strike

Vehicles travelling on the highway have the potential to strike fauna species, leading to injury and death. This has the potential to affect fauna species at the sub-population level. In general, rates of vehicle strike mortality are likely to be directly proportional to the distance that animals need to cross the road to reach native vegetation/fauna habitat (Forman et al, 2000).

Since the proposal generally involves the marginal widening of an existing road corridor, with no large areas of native vegetation occurring next to the highway, it is not anticipated that the rate of vehicle strike would increase as a result of the proposal.

Wildlife connectivity and habitat fragmentation

Habitats within the study area vary in size from large forested areas to small roadside patches that may extend into private holdings. In general, the proposal would impact areas closest to the existing roadside and would not bisect vegetated areas that form wildlife pathways or broader movement corridors.

The road widening and associated clearing of roadside vegetation required along parts of the proposal would increase the distance for any wildlife crossing the road. This would create a greater barrier to some terrestrial fauna movements. The main species potentially impacted by the increased width of the road would be terrestrial species such as Spotted-tail Quoll, reptiles and macropods, as well as arboreal species such as possums.

6.1.4 Safeguards and management measures

Safeguards and management measures to manage the proposal's potential impacts on biodiversity are summarised in **Table 6-6**.

Table 6-6 Safeguards and management measures for biodiversity and water quality where relevant to biodiversity

ID	Impact	Environmental safeguards	Responsibility	Timing
BI-1	General impacts on threatened species and ecological communities	Potential impacts will be avoided and minimised through the application of these general principles: • Avoiding broad scale vegetation clearing. • Minimising vegetation/habitat clearing where possible to reduce impacts on threatened fauna species that rely on these habitats. • Minimising impacts on threatened ecological communities and habitat features (particularly habitat trees) through appropriate refinements to the	Roads and Maritime	Detailed design

ID	Impact	Environmental safeguards	Responsibility	Timing
		road design. • Minimising habitat fragmentation and reduced connectivity and avoiding the use of barriers to fauna movement.		
BI-2	Impacts associated with ancillary facilities and water facilities (including basins and treatments)	An assessment of the impacts on biodiversity from ancillary facilities, basins and other water quality treatment devices will be carried out following finalisation of their location and design. Appropriate safeguards will be identified to mitigate these impacts.	Roads and Maritime	Before or during detailed design
BI-3	Vegetation and habitat removal	Pre-clearance surveys will be carried out by an experienced ecologist to: • Identify and mark fauna habitat features (including roosting sites, if any) to be protected during construction in retained dry sclerophyll forest areas and gardens/ plantings if habitat features are identified. • Identify nearby habitats on both sides of the existing highway, along the length of the proposal, suitable for the release of fauna that may be encountered during the pre-clearing process or habitat removal. These are likely to be the large areas of dry sclerophyll forest close to the highway, including the wildlife corridor area.	Construction contractor	Pre-construction
BI-4	Vegetation and habitat removal	The following safeguards will be included in the Construction Environmental Management Plan (CEMP): • Maps identifying the location of microbat roosting sites (if any) and drainage areas that run towards the hanging swamps TEC. • A clearing procedure, which will specify the requirements for pre-clearing, prepared in accordance with Roads and Maritime's Biodiversity Guidelines (RTA, 2011a). • The location of exclusion zones to be installed before clearing, to avoid damage to native vegetation and fauna habitats and prevent the distribution of pests, weeds and disease. Temporary fencing will be installed to indicate the limits of clearing. The location of exclusion fencing to be installed will be identified on plans in the CEMP and the function and importance of the exclusion zones communicated to construction personnel. • A staged habitat removal process will be implemented consistent with procedures in the Biodiversity Guidelines and communicated to construction personnel. This process will consider the safe and ethical handling of fauna.	Construction contractor	Pre-construction Pre-construction Pre-construction Pre-construction Pre-

ID	Impact	Environmental safeguards	Responsibility	Timing
		• An unexpected threatened species finds procedure, as outlined in the Biodiversity Guidelines (RTA, 2011a). • Prevention of parking of vehicles or plant and the stockpile or storage of materials under the dripline of any trees.		construction Construction
BI-5	Vegetation and habitat removal	A Vegetation Management Plan will be developed as part of the CEMP. It will provide specific details for the re-establishment of native vegetation on batters, cut faces and other areas disturbed during construction as appropriate. These details will be in accordance with the Biodiversity Guidelines (RTA, 2011a) and will be consistent with the landscape and urban design strategy (refer to **Section 6.6**).	Construction contractor	Pre-construction, construction
BI-6	Injury and mortality of fauna during the clearing of vegetation	A licensed wildlife carer and/or ecologist will be present to supervise native forest vegetation clearing, to capture and relocate fauna where required. Fauna handling and vegetation clearing will be carried out in accordance with the procedures in the Biodiversity Guidelines (RTA, 2011a).	Roads and Maritime/ Construction contractor	Pre-construction, construction
BI-7	Spread of weeds	Actions for weed management will be developed as part of the Vegetation Management Plan. The plan will detail the following to ensure that weeds are managed during construction: • Weed management priorities and objectives. • Sensitive environmental areas (high condition native vegetation) next to the site. • The location of weed-infested areas. • Mechanical weed control methods such as slashing or mowing, as well as a range of herbicides to avoid the development of herbicide resistance. • Measures to prevent the spread of weeds. • The appropriate disposal of weed-infested materials and soils.	Construction contractor	Pre-construction, construction
BI-8	Introduction or spread of pests and disease	Measures to confirm the presence of pathogens and disease-causing agents will be carried out before construction. Should pathogens or disease-causing agents be found, measures will be implemented to prevent their introduction and/or spread to the proposal area. These measures are provided in the Biodiversity Guidelines and will include, where appropriate: • The provision of vehicle and boot wash-down facilities to ensure vehicles and footwear are free of soil before entering or exiting the site. • Ensuring that the risk of spreading	Construction contractor	Pre-construction Construction

ID	Impact	Environmental safeguards	Responsibility	Timing
		pathogens and the mitigation measures required on site are regularly communicated to staff and contractors during inductions and toolbox talks. • Programming construction activities so they move from uninfected areas to any known infected areas. • Restricting vehicles to designated roadsides and parking areas.		Construction Construction Construction

6.2 Noise and vibration

An assessment was carried out to identify the extent and magnitude of potential noise and vibration impacts associated with the proposal. The assessment is documented in the Noise and Vibration Technical Paper (SKM, 2013b), which is provided in **Appendix E** and summarised below.

6.2.1 Methodology

The study area for noise assessment

The Road Noise Policy (DECCW, 2011) requires assessment of noise impacts of up to 600 metres from the proposal. As most impacts would be associated with construction work and the scale of work for the realignment of the bend in Section 2 is minor, the study area for the noise and vibration assessment was limited to 250 metres either side of the proposal.

All three sections have the potential to generate noise impacts during construction. A construction noise impact assessment was carried out for all sections of the proposal. The proposed work in Section 2 includes straightening of a curve and as such, only this section has been assessed for operational noise impacts resulting from the proposal.

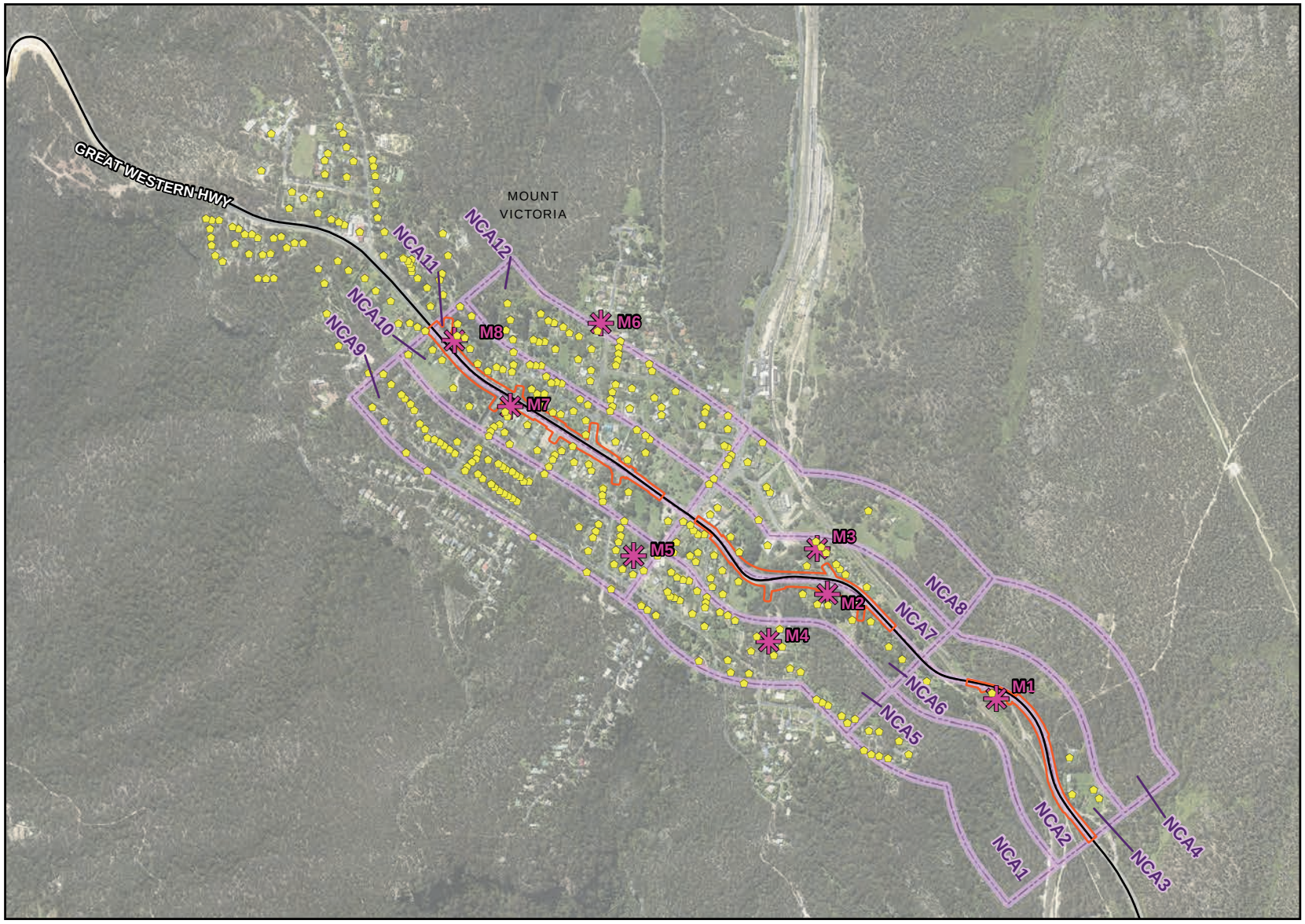
Noise monitoring

Existing background noise was monitored in July 2013. The monitoring locations are listed in **Table 6-7** and shown on **Figure 6-5**.

Table 6-7 Monitoring locations

ID	Monitoring location	Distance from existing highway
M1	Gatekeepers Cottage, Mount Victoria	20 m
M2	143–145 Great Western Highway, Mount Victoria	30 m
M3	12 Harley Avenue, Mount Victoria	85 m
M4	6 Mount Piddington Road, Mount Victoria	150 m
M5	57 Victoria Street, Mount Victoria	150 m
M6	26 Selsdon Street, Mount Victoria	250 m
M7	71A Great Western Highway, Mount Victoria	15 m
M8	54 Great Western Highway, Mount Victoria	18 m

FIGURE 6-5 | SENSITIVE RECEIVERS, NOISE CATCHMENTS AND MONITORING LOCATIONS



LEGEND

- Sensitive receiver
- Noise monitoring location
- Construction footprint (5 m buffer)
- Existing highway
- Road
- Property boundary
- Noise catchment

Sinclair Knight Merz does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.

DATA SOURCES
Roads and Maritime Services 2013, LPMA 2010, SKM 2011, SKM 2013, STREETWORKS 2001

0 400
Metres

11/11/2013 | I:\ENVR\Projects\EN04213\Technical\Spatial\GIS_Directory\ArcMap\Figures\REF\HartleyValley\EN04213_GIS_Ac_F016_MV_NoiseReceiversMonitors_r3v1.mxd
Newcastle Spatial Team - Prepared by : KO
Checked by : VC

The measured noise levels were analysed to provide more detail of the character of the noise environment over each of the 24-hour periods monitored. This information was separated into representative noise levels for the daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am) periods, and used in the assessment of potential noise impacts. The traffic data used to predict noise impacts was adapted from profiles for the average daily traffic (ADT) flows collected by TTM Pty Ltd between 16–26 July 2013.

6.2.2 Criteria

Construction noise criteria

Construction noise for this proposal has been assessed in accordance with the Interim Construction Noise Guideline (ICNG) (DECC, 2009). The guideline was developed to assist with the management of noise impacts, rather than to present strict numeric noise criteria for construction activities.

The ICNG identifies a Noise Management Level (NML), which is the project specific noise criteria used to assess the level of impact at a receiver location. The NML is derived from the existing background noise levels at representative monitoring locations. The NML is also categorised for non-residential receivers with recommended noise criteria for both standard construction hours and for work to be carried out outside of standard hours.

Residential receivers

Management levels for construction noise for residential receivers, and how they are applied to the proposal are outlined in **Table 6-8**, as are the standard and non-standard construction hours (or 'out-of-hours' work). The table identifies a category of 'highly noise affected' receivers that may be affected by significant noise levels during construction. Construction hours may need to be restricted to minimise these impacts.

Table 6-8 Construction noise management levels (NML) and working hours

Hours	NML	Description
Recommended standard hours: Monday to Friday 7am–6pm Saturday 8am–1pm No work on Sundays or public holidays)	Noise affected RBL +10 dB(A)	The noise affected level represents the point above, which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.

Hours	NML	Description
	Highly noise affected >75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences). 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours ('out-of-hours' work)	Noise affected RBL + 5 dB(A)	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should then undertake negotiations with the community. For guidance on negotiating agreements refer to Section 7.2.2 of the guideline (DECC, 2009).

Source: Table 2, Interim Construction Noise Guideline (DECC, 2009)
RBL: Rating background level

Non-residential receivers

For other relevant land uses within the proposal area, the following noise criteria would apply:

- Industrial premises: External $L_{Aeq(15min)}$ 75 dB(A).
- Offices, retail outlets: External $L_{Aeq(15min)}$ 70 dB(A).
- Classrooms: Internal $L_{Aeq(15min)}$ 45 dB(A).
- Places of worship: Internal $L_{Aeq(15min)}$ 45 dB(A).
- Passive recreational areas: External $L_{Aeq(15min)}$ 60 dB(A).

Receivers have been separated into residential and non-residential and therefore the criteria outlined in **Table 6-8** are used in conjunction with the criteria for offices/retail outlets identified within the proposal area. Schools and churches have been identified in the proposal area, and are shown in **Table 6-9**.

Table 6-9 Schools and churches in the proposal area

Receiver ID	Description	Designation	Section	Distance to alignment
108	Mount Victoria Public School	School	3	100 m
117	Possum's Patch Children's Hub	Pre-school	3	170 m
-	St Peters Anglican Church	Church	3	28 m
136	Meadowbank Education Trust	School	3	28 m

Receiver ID	Description	Designation	Section	Distance to alignment
	(MET) School			
251	St Pauls Catholic Church	Church	3	45 m

Vibration assessment criteria (human comfort)

Vibration from construction activities must comply with Assessing Vibration – A Technical Guideline (DECC, 2006) and British Standard BS 6472-1992*,* Evaluation of Human Exposure to Vibration in Buildings (1-80Hz). For the purpose of this assessment, vibration can have a continuous, impulsive or intermittent character, which are defined as follows:

- Continuous: Where vibration occurs uninterrupted for a defined period. This can include sources such as machinery and steady road traffic.
- Impulsive: Where vibration occurs over a short duration (typically less than two seconds) and occurs less than three times during the assessment period, which is not defined. This may include activities such as occasional dropping of heavy equipment or loading/unloading activities.
- Intermittent: Where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, pile driving, heavy vehicle traffic or trains.

Preferred and maximum values for continuous and impulsive vibration are defined in **Table 6-10**.

Table 6-10 Preferred and maximum values for continuous and impulsive vibration (m/s^2) 1-80 Hz

Location	Assessment period [1]	Preferred values		Maximum values	
		z-axis	x and y axis	z-axis	x and y axis
Continuous vibration					
Critical areas[2]	Day or night	0.0050	0.0036	0.010	0.0072
Residences	Day	0.010	0.0071	0.020	0.014
	Night	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night	0.020	0.014	0.040	0.028
Workshops	Day or night	0.04	0.029	0.080	0.058
Impulsive vibration					
Critical areas[2]	Day or night	0.0050	0.0036	0.010	0.0072
Residences	Day	0.30	0.21	0.60	0.42
	Night	0.10	0.071	0.20	0.14

Location	Assessment period [1]	Preferred values		Maximum values	
		z-axis	x and y axis	z-axis	x and y axis
Offices, schools, educational institutions and places of worship	Day or night	0.64	0.46	1.28	0.92
Workshops	Day or night	0.64	0.46	1.28	0.92

[1] Daytime is 7am to 10pm. Night-time is 10pm to 7am

[2] Refers to hospital operating theatres or precision laboratories.

Intermittent vibration is assessed using vibration dose values (VDV). Preferred and maximum VDVs are defined in Table 2.4 of Assessing Vibration – A Technical Guideline (DECC, 2006) and reproduced in **Table 6-11**.

Table 6-11 Preferred and maximum values for intermittent vibration ($ms^{-1.75}$)

Locations	Daytime (7am–10pm)		Night-time (10pm–7am)	
	Preferred values	Maximum values	Preferred values	Maximum values
Critical areas[1]	0.10	0.20	0.10	0.02
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

[1] Includes operating theatres, precision laboratories and other areas where vibration-sensitive activities may occur.

Construction vibration criteria for structural damage

The Australian Standard AS2187.2-2006 Explosives – Storage, Transport and Use provides guidance for the assessment of structural damage to buildings caused by vibration. This section of the standard is based on the British Standard 7385: Part 2 Evaluation and Measurement of Vibration in Buildings and is used as a guide to assess the likelihood of building damage from ground vibration caused by piling, compaction, construction equipment and road and rail traffic. **Table 6-12** presents the vibration criteria levels from BS 7385 above which cosmetic damage might occur for residential and commercial structures.

Table 6-12 British Standard BS 7385: Structural damage criteria

Group	Type of structure	Peak particle velocity (PPV), mm/s		
		4 Hz to 15 Hz	15 Hz to 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50		
2	Un-reinforced or light-framed structures Residential or light commercial type buildings	15 to 20	20 to 50	50

The levels set by this standard are considered 'safe limits' up to which no damage due to vibration effects has been observed for particular types of buildings. These values relate to intermittent vibration. Continuous vibration can give rise to magnifications due to resonances and may need to be reduced by up to 50 per cent.

The German Standard DIN 4150-3 Structural Vibration, Part 3: Effects of Vibration on Structures identifies more stringent vibration levels for building damage and includes a category specifically for heritage buildings. This standard commends frequency-dependent values for peak particle velocity (PPV) for different building categories, which are reproduced in **Table 6-13**. DIN 4150-3 is to be used to assess potential vibration impacts at heritage buildings locations, or other sensitive heritage structures identified for the proposal.

Table 6-13 DIN 4150-3 Vibration guidelines for heritage buildings (mm/sec)

Type of structure	Guideline values for velocity			
	Vibration at the foundation at a frequency of			Vibration at the horizontal plane of the highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	
Heritage buildings	3	3–8	8–10	8

Operational noise criteria

Operational noise is assessed in accordance with the Road Noise Policy (DECCW, 2011) and Roads and Maritime's Environmental Noise Management Manual (RTA, 2001). These documents work together to enable feasible and reasonable noise mitigation options where the operational noise levels associated with the proposal exceed the Road Noise Policy assessment criteria.

The Road Noise Policy (DECCW, 2011) classifies road developments as a "new road" or a "redevelopment of an existing road". Each road classification has base criteria for both daytime and night-time assessment periods. However, for safety upgrades, where the proposed work includes straightening of curves and are not designed to alter the traffic mix, carrying capacity or speed of the traffic stream, road upgrades are not classified as new or redeveloped roads and as such no traffic noise criteria applies.

Where no criteria are applicable for a proposal, the ENMM requires that the proposed works do not increase noise levels at receiver locations by more than 2 dB(A). The RNP operational noise criteria are then used as a threshold to evaluate when a 2 dB(A) increase should be considered for mitigation measures. Below the threshold for day or night time noise levels, no mitigation is recommended. The operational threshold for the proposal is adopted from the redeveloped road criteria listed in **Table 6-14**.

Table 6-14 Road traffic noise assessment threshold

Road category	Type of project/land use	Daytime noise	Night-time noise
Freeway/arterial/ sub-arterial roads	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads	$L_{Aeq\ (15hour)}$ 60 dB(A)	$L_{Aeq\ (9hour)}$ 55 dB(A)

To determine the potential for an increase in road traffic noise from the proposal, all receivers identified within the Section 2 of the proposal were screened using the threshold values for redeveloped road receivers due to the existing road noise influence.

Where the base criteria are exceeded a comparison of the 'build' and 'no build' levels is undertaken to determine the change in the noise environment (refer to **Table 6-21**). If the difference between the build and no build noise level exceeds a minimum value of 2 dB(A), mitigation is assessed in accordance with guidance in the ENMM practice note (iv).

The Environmental Noise Management Manual (RTA, 2001) states that where the proposed work includes straightening curves and is not designed to alter the traffic mix, carrying capacity, or speed of the traffic stream, road upgrades are not classified as new or redeveloped roads and as such no traffic noise criteria applies. In this instance, the manual requires that the proposed work do not increase noise levels at receiver locations by more than 2 dB(A).

However, to determine the potential impacts of road traffic noise associated with the proposal, all the receivers identified within Section 2 were screened using the base criteria for redeveloped road receivers (due to the existing road noise influence), as listed in **Table 6-14**.

Therefore, where the proposal exceeded the base criteria (ie 60 db(A) during daytime and 55 dB(A) during night time a comparison of the 'build' and 'no build' levels was carried out to quantify the change in the noise environment. If the difference between the 'build' and 'no build' noise level exceeded 2 dB(A), mitigation would be applied in accordance with guidance in the Environmental Noise Management Manual practice note (iv).

The Road Noise Policy and the Environmental Noise Management Manual practice note (iii) recognise the need to identify maximum noise level events for road projects when there is a potential for sleep disturbance from traffic noise. These disturbances are identified as a noise event that substantially exceeds the continuous ambient noise environment. If substantially greater than the ambient noise in an area, these events may give rise to awakenings and generate annoyance within a community. Once identified as an event the number and associated levels of all events are compared to the current guidelines for these impacts to identify the potential for the above constraints to be exceeded.

6.2.3 Existing environment

The proposal is largely surrounded by residences, with some commercial premises in the town centre. Residences next to the highway generally have a setback of 15 to 30 metres.

There are 351 sensitive receivers in the study area (as identified by aerial photography and site visits). These are shown in **Figure 6-5**. Only buildings identified as potential receiver locations, which include residential and commercial properties, have been included in the assessment.

The environmental and traffic noise information is extracted from the same monitoring data at each location. The monitoring data is differentiated for use as environmental background noise levels or traffic noise levels using acoustic parameters specific to each type of assessment.

The daily environmental noise measurement profiles for each monitoring location are shown in **Table 6-15**. The rating background level (RBL) in the table is the median of the background noise levels for the site and is used in determining the construction noise management level, while the L_{max} and L_{Aeq} levels provide information on the existing environment.

Table 6-15 Summary of monitoring results – environmental noise descriptors (dB(A))

Monitoring location	Day			Evening			Night		
	L_{Amax}	L_{Aeq}	RBL	L_{Amax}	L_{Aeq}	RBL	L_{Amax}	L_{Aeq}	RBL
M1	87.2	64.1	46.4	82.3	61.3	39.7	84.5	60.7	33.8
M2	88.6	64.1	44.8	81.4	61.5	39.3	87.3	60.7	33.8
M3	87.1	57.1	43.2	78.8	52.9	39.5	83.0	54.0	33.6
M4	81.1	53.1	43.4	71.9	49.1	40.5	71.3	48.1	35.3
M5	78.2	50.6	39.5	66.0	46.0	35.2	69.2	44.7	32.4
M6	83.5	50.3	40.1	66.4	44.7	33.9	68.8	44.9	30.5
M7	89.6	65.9	46.0	84.3	63.6	39.3	85.5	62.7	31.7
M8	86.9	63.3	46.8	84.2	61.3	43.3	82.3	60.4	33.6

As shown in **Table 6-15**, all receiver locations experience noise from road traffic on the highway, which dominates the ambient noise environment.

To establish a baseline of traffic noise influence, two monitoring locations were selected for their proximity to the proposal area in Section 2. The correlation of traffic volumes and noise monitoring are provided in **Table 6-16**.

Table 6-16 Summary of monitoring results (traffic noise descriptors)

ID	Receiver	L_{A10} 18 hour dB(A)	L_{A10} 1 hour dB(A)	L_{Aeq} 15 hour dB(A)	L_{Aeq} 9 hour dB(A)	L_{Amax} 15 hour dB(A)	L_{Amax} 9 hour dB(A)
M2	143–145 Great Western Highway	66.1	61.8	63.7	60.9	82.1	81.5
M4	6 Mount Piddington Road	52.2	49.3	51.8	47.7	75.1	69.7

As well as identifying individual receivers, sensitive receivers were also grouped into noise catchment areas based on their location in the study area. The study area was split into 12 noise catchment areas that cover sensitive receivers within bands of 0 to 100 metres of the highway (shown in dark grey in **Table 6-17**) and 100 to 250 metres (shown in light grey). All receivers within a noise catchment area were assigned a construction noise management level based on their distance from the proposal. The noise catchment areas are shown in **Figure 6-5** and a summary of noise management levels for each catchment is presented in **Table 6-17**.

Table 6-17 Noise catchment areas and noise management level (dB(A))

Noise catchment areas	Daytime (7am–6pm)	Evening (6pm–10pm)	Night-time (10pm–7pm)
	NML dB(A)	NML dB(A)	NML dB(A)
NCA 1	53	46	40
NCA 2	56	45	39
NCA 3	56	45	39
NCA 4	50	39	36
NCA 5	53	46	40
NCA 6	55	44	39
NCA 7	55	44	39
NCA 8	53	45	39
NCA 9	50	40	37
NCA 10	56	44	37
NCA 11	57	48	39
NCA 12	50	39	36

6.2.4 Potential impacts

Construction

The majority of the proposal activity is within the existing road boundary, which would require construction activities to be carried out simultaneously with normal road use. To minimise impacts on traffic, some activities may need to be scheduled during the non-peak traffic periods and, possibly, outside standard construction hours outlined in **Table 6-8**.

The assessment of construction noise impacts was based on the construction activities outlined in **Section 3.3** and anticipated equipment (refer to Table 4-7 of Noise and Vibration Technical Paper (SKM, 2013b). Noise emissions were then predicted for each NCA to determine the potential for noise goals to be exceeded at these locations.

The predicted noise level for each NCA is presented in **Table 6-18,** along with the adopted day, evening and night time NML for each receiver location. The predicted levels in **Table 6-18** indicate potential for noise goals to be exceeded within each of the NCA when assessed against the modelled scenario. Levels in red indicate where daytime NML are anticipated to be exceeded.

Table 6-18 Predicted noise level in noise catchment areas during construction (dB(A))

NCA ID	NML dB(A)			Predicted range of construction noise at receiver locations within NCA L_{Aeq} dB(A)					
	Day	Evening	Night	Site prep	Earthworks	Road prep	Asphalting	Line marking	Landscaping
1	53	46	40	49–35	55–41	41–52	52–38	44–30	49–35
2	56	45	39	83–58	89–64	64–86	86–61	78–53	83–58
3	56	45	39	76–65	82–71	71–79	79–68	71–60	76–65
4	No receivers			–		–	–	–	–
5	53	46	40	61–51	67–57	57–64	64–54	56–46	61–51
6	55	44	39	76–65	82–71	71–79	79–68	71–60	76–65
7	55	44	39	73–70	79–76	76–76	76–73	68–65	73–70
8	53	45	39	62–54	68–60	60–65	65–57	57–49	62–54
9	50	40	37	56–45	62–51	59–51	59–48	51–40	56–45
10	56	44	37	79–61	85–67	67–82	82–64	74–56	79–61
11	57	48	39	79–63	85–69	69–82	82–66	74–58	79–63
12	50	39	36	61–50	67–56	64–56	64–53	56–45	61–50

As shown in **Figure 6-5**, noise catchment areas 2, 3, 6, 7, 10 and 11 represent the closest group of receivers within 100 metres of the road corridor. For standard daytime construction hours as well as out-of-hours work, these receivers are expected to exceed the proposal NML. During the more intensive earthworks and road preparation phases, 58 of these receivers may experience noise levels in the 'highly noise affected' range (greater than 75 dB(A)), which would require Roads and Maritime to implement measures to mitigate and manage noise impacts.

Noise catchment areas 1, 4, 5, 8, 9 and 12 represent the furthest group of receivers from the road corridor, located 250 metres on each side of the highway within the proposal area. These receivers would experience noise from construction activities that are closer to the NML during standard working hours (refer to **Table 6-18)**, but may still exceed the NMLs.

Noise from out-of-hours construction activities is likely to exceed the NML at all locations. Accordingly, where out-of-hours construction is required, a detailed assessment would be carried out to identify specific impacts and mitigation measures.

Noise impacts on non-residential receivers

Non-residential receivers next to the proposal area include Mount Victoria Public School, Possums Patch Children's Hub, St Peters Anglican Church, St Pauls Catholic Church and MET School. An assessment of predicted internal noise levels for these receiver locations was carried out using the highest predicted noise from

construction activities and estimates of the different noise reduction offered by the building facade.

The estimated internal noise levels for Mount Victoria Public School and Possums Patch Children's Hub indicate that the noise criterion for the proposal of 45 dB(A) is likely to be met where the building's windows and doors remain closed. These predicted levels would be further assessed to confirm compliance with the noise criterion during construction.

The internal noise levels within St Peters and St Pauls churches are likely to exceed the noise criterion of 45 dB(A) during the loudest phase of work activities, including the more intensive earthworks and road preparation phases. However, the expected use of these places of worship during Sunday would be outside standard construction hours and therefore impacts would only be apparent during occasional weekday, daytime use.

General mitigation and construction noise management measures would be implemented for the proposal and additional consideration would be given to the category of 'highly noise affected' receivers.

Impacts of stockpiles and compound sites

An assessment of noise impacts was carried out for the three proposed compound and stockpile sites at Cassilis Street, Harley Avenue and the construction site at Soldiers Pinch (refer to **Section 3.4.1**). The assessment has been based on typical operations during standard construction hours and found that that the predicted noise levels at the nearest receivers were 71 dB(A) and 65 dB(A) for the Cassilis Street and Harley Avenue sites respectively. These levels would be about 10-15 dB(A) higher than the daytime NML for the proposal but would be lower than the highly affected noise criteria. The use of the stockpile sites is not expected to occur for extended durations and therefore the predicted noise levels are representative of loading and unloading operations only. Should night works be required, operation of these sites would exceed the project criteria at the nearest receiver locations by up to about 25-30 dB(A) and therefore access to and operation of these sites is not recommended during these times. The site at Soldiers Pinch is about 850 metres from the closest residence and therefore would not generate noise impacts at that location. General measures to mitigate the potential noise associated with the sites at Cassilis Street and Harley Avenue are outlined in **Section 6.2.5**.

Impacts of construction work outside of working hours

As detailed in **Section 3.3.2**, work would be conducted during standard construction hours wherever possible (refer to **Table 6-8**). However, to minimise traffic impacts, some work would be required to be carried out outside of the standard working hours, including:

- Deliveries and demobilisation of plant and large construction equipment.
- Emergency work.
- Relocation of utilities.
- Major traffic diversions, including full or partial road closures.
- Road tie-in work, including paving and asphalting.

The assessment of the noise implications for work outside of working hours is presented in **Table 6-19**. Levels in red indicate where the sleep disturbance criterion is exceeded.

Table 6-19 Predicted noise levels outside standard construction hours

NCA ID	Night time NML dB(A)	Sleep disturbance criterion dB(A)	Predicted range of construction noise L_{Aeq} dB(A)			Maximum construction noise level L_{Amax} dB(A)
			Utility adjustments	Asphalting	Line marking	
1	40	50	49-35	52-38	44-30	60
2	39	49	83-58	86-61	78-53	94
3	39	49	76-65	79-68	71-60	87
4	No identified receivers					
5	40	50	61-51	64-54	56-46	72
6	39	49	76-65	79-68	71-60	87
7	39	49	73-70	76-73	68-65	84
8	39	49	62-54	65-57	57-49	73
9	37	47	56-45	59-48	51-40	67
10	37	47	79-61	82-64	74-56	90
11	39	49	79-63	82-66	74-58	90
12	36	46	61-50	64-53	56-45	72

The predicted levels in **Table 6-19** confirm that all NCAs are likely to experience noise levels in excess of the night time NML and the sleep disturbance criteria for the proposal. The potential for sleep disturbance impacts would be highest where receivers are situated close to the road and any potential night time work. Management of potential work outside of working hours and sleep disturbance noise would be a priority consideration and would be further detailed in the Construction Noise and Vibration Management Plan (CNVMP). General considerations for work outside of working hours are also presented in **Section 6.2.6**.

Vibration impacts

While the specific geological characteristics of the area might vary from location to location, typical vibration levels for the proposal have been predicted based on assumed ground conditions. The predicted levels in **Table 6-20** are indicative only at this stage.

Table 6-20 Estimated vibration levels – vertical axis

Equipment	Distance from activity (m)					
	5	10	20	30	40	50
Structural damage (peak particle velocity) (mm/s)						
High impact vibratory roller	10	6	2.5	1	0.5	0.2
Heavy hydraulic hammer (1.5 t)	4.5	3	1.5	0.4	0.35	0.3
Medium hydraulic hammer (0.6 t)	0.2	0.06	0.02	0.01	-	-

Equipment	Distance from activity (m)					
	5	10	20	30	40	50
Structural damage (peak particle velocity) (mm/s)						
Human comfort[1] m/s^2						
High impact vibratory roller	8.2	4.9	2.05	0.82	0.4	0.16
Heavy hydraulic hammer	2.9	1.9	1.0	0.3	0.2	0.2
Medium hydraulic hammer	0.1	-	-	-	-	-

[1] Based on an equivalent 2-hour exposure time.

Vibration impacts in relation to both structural damage and human comfort were assessed against the typical activities and equipment identified in **Section 3.3** at varying distances from the construction area. The shaded figures in **Table 6-20** indicate that maximum proposal criteria for daytime impacts related to heritage structures (refer to **Table 6-12**) and human comfort (refer to **Table 6-10** and **Table 6-11**) are exceeded. Where structures that do not have a heritage rating are considered, structural damage limits may be increased to 15 millimetres/second.

Table 6-20 shows that:

- Vibration would have potential adverse impacts on human comfort within 30 metres of the vibration-generating activity.
- Vibration would have potential adverse impacts on structures within 10 metres of the vibration-generating activity. Non-Aboriginal heritage items within 10 to 50 metres of potential vibration generating activities are listed in **Table 6-26**. To manage potential impacts, where vibration-generating activities are to be carried out within about 50 metres of buildings, a building condition survey would be carried out before construction, and vibration would be monitored during construction.

Operation

Operational traffic noise impacts were predicted for Section 2 for the 'build' and 'no build' options for the year of opening (2015) and 10 years after opening (2025). These scenarios include a traffic linear growth rate of one per cent per annum. This provides a comparison of noise impacts for the proposal and the 'do nothing' option and includes natural growth in traffic volumes over this time. The comparison does not consider the effects of noise mitigation potentially associated with the proposal.

The receiver locations identified within 250 metres of the highway were included in the assessment. The traffic data used for the prediction of noise impacts for the proposal was based on a traffic study carried out by Roads and Maritime in July 2013 and is representative of the average daily traffic flows.

The results of the noise modelling are shown in **Table 6-21** and reflect the minor nature of the proposal, as the predicted noise levels for the 'build' and 'no build' options are similar. In general, most receivers in Section 2 are predicted to experience a minor reduction in noise levels up to about 0.5 dB(A) with some receivers experiencing a reduction of up to 2 dB(A). This is due to an improvement in the road alignment and a change in road levels drawing traffic away from sensitive receivers.

Table 6-21 Predicted noise levels, impacts and mitigation considerations for Section 2 (dB(A))

ID	Year opening 'no build' scenario dB(A)		Year opening 'build' scenario dB(A)		Design year 'no build' scenario dB(A)		Design year 'build' scenario dB(A)		RNP threshold, dB(A)		Is the RNP threshold exceeded?		Change in noise level dB(A)				Consider mitigation
													Opening year		Design year		
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
R15	68	62	68	63	68	62	68	63	60	55	YES	YES	0.1	0.0	0.1	0.0	NO
R18	69	63	70	63	69	63	69	63	60	55	YES	YES	-0.5	-0.4	-0.5	-0.4	NO
R21	63	57	64	58	63	57	63	58	60	55	YES	YES	-0.3	-0.3	-0.3	-0.3	NO
R23	69	62	69	63	67	61	68	61	60	55	YES	YES	-1.7	-1.5	-1.6	-1.5	NO
R25	66	60	67	61	65	59	66	60	60	55	YES	YES	-1.1	-1.1	-1.1	-1.1	NO
R26	64	58	65	59	63	57	64	58	60	55	YES	YES	-0.8	-0.7	-0.8	-0.8	NO
R27	64	58	64	58	62	57	63	57	60	55	YES	YES	-1.5	-1.5	-1.5	-1.5	NO
R29	63	57	64	58	63	57	63	57	60	55	YES	YES	-0.3	-0.3	-0.3	-0.3	NO
R31	62	56	62	57	62	56	62	57	60	55	YES	YES	-0.1	-0.1	-0.1	-0.1	NO
R32	63	57	63	57	61	55	62	56	60	55	YES	YES	-1.5	-1.6	-1.5	-1.5	NO
R34	60	55	61	55	60	55	61	55	60	55	YES	YES	0.1	0.0	0.1	0.0	NO
R35	68	62	68	62	67	61	68	62	60	55	YES	YES	-0.4	-0.4	-0.4	-0.4	NO
R36	66	60	66	60	64	58	64	59	60	55	YES	YES	-1.6	-1.6	-1.6	-1.6	NO
R37	57	51	57	52	57	51	58	52	60	55	NO	NO	0.2	0.1	0.2	0.1	NO

ID	Year opening 'no build' scenario dB(A)		Year opening 'build' scenario dB(A)		Design year 'no build' scenario dB(A)		Design year 'build' scenario dB(A)		RNP threshold, dB(A)		Is the RNP threshold exceeded?		Change in noise level dB(A)				Consider mitigation
													Opening year		Design year		
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
R38	57	51	57	51	57	51	57	51	60	55	NO	NO	-0.5	-0.5	-0.4	-0.5	NO
R39	58	52	58	52	57	51	58	52	60	55	NO	NO	-0.5	-0.5	-0.5	-0.5	NO
R40	59	53	59	54	59	53	59	53	60	55	NO	NO	-0.5	-0.5	-0.5	-0.5	NO
R41	56	51	57	51	56	50	56	51	60	55	NO	NO	-0.5	-0.5	-0.5	-0.5	NO
R42	59	54	59	54	59	54	59	54	60	55	NO	NO	-0.1	-0.1	0.0	-0.1	NO
R43	61	56	62	56	62	56	62	56	60	55	YES	YES	0.3	0.3	0.3	0.3	NO
R44	59	54	59	54	59	53	59	54	60	55	NO	NO	-0.1	-0.1	-0.1	-0.1	NO
R46	60	54	60	54	60	54	60	54	60	55	YES	NO	0.1	0.0	0.1	0.1	NO
R47	57	51	57	52	57	51	57	51	60	55	NO	NO	-0.5	-0.5	-0.5	-0.5	NO
R48	55	49	55	50	55	49	55	49	60	55	NO	NO	-0.4	-0.4	-0.4	-0.4	NO
R49	53	47	53	48	52	47	53	47	60	55	NO	NO	-0.6	-0.6	-0.5	-0.6	NO
R51	52	46	52	47	52	46	52	46	60	55	NO	NO	-0.5	-0.6	-0.5	-0.6	NO
R52	69	63	70	64	70	64	70	64	60	55	YES	YES	0.6	0.7	0.6	0.7	NO
R53	69	63	70	63	67	61	68	62	60	55	YES	YES	-1.8	-1.7	-1.8	-1.7	NO
R54	58	52	58	53	57	52	58	52	60	55	NO	NO	-0.6	-0.7	-0.6	-0.7	NO
R56	68	62	68	62	68	62	69	63	60	55	YES	YES	0.2	0.2	0.3	0.2	NO

ID	Year opening 'no build' scenario dB(A)		Year opening 'build' scenario dB(A)		Design year 'no build' scenario dB(A)		Design year 'build' scenario dB(A)		RNP threshold, dB(A)		Is the RNP threshold exceeded?		Change in noise level dB(A)				Consider mitigation
													Opening year		Design year		
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
R57	51	45	51	45	50	44	50	45	60	55	NO	NO	-0.5	-0.6	-0.5	-0.6	NO
R60	59	53	59	54	58	52	59	53	60	55	NO	NO	-0.7	-0.8	-0.7	-0.8	NO
R61	51	45	51	46	51	45	51	46	60	55	NO	NO	-0.1	-0.2	-0.1	-0.2	NO
R66	62	56	63	57	61	56	62	56	60	55	YES	YES	-0.9	-0.9	-0.9	-0.9	NO
R67	67	61	67	61	66	60	67	61	60	55	YES	YES	-0.2	-0.4	-0.2	-0.4	NO
R68	59	53	59	53	58	52	58	53	60	55	NO	NO	-0.8	-0.8	-0.8	-0.8	NO
R70	67	62	68	62	68	62	68	62	60	55	YES	YES	0.1	0.0	0.1	0.0	NO
R72	61	55	62	56	61	55	62	56	60	55	YES	YES	-0.1	-0.1	-0.1	-0.1	NO
R73	62	56	63	57	62	56	63	57	60	55	YES	YES	-0.1	-0.3	-0.1	-0.2	NO
R76	59	53	60	54	58	53	59	53	60	55	NO	NO	-0.7	-0.7	-0.7	-0.7	NO
R78	58	52	58	53	57	51	58	52	60	55	NO	NO	-0.6	-0.6	-0.6	-0.6	NO
R80	57	51	58	52	57	51	57	51	60	55	NO	NO	-0.5	-0.6	-0.5	-0.6	NO
R81	55	49	55	50	55	49	55	49	60	55	NO	NO	-0.5	-0.5	-0.4	-0.5	NO
R84	51	45	52	46	51	45	51	45	60	55	NO	NO	-0.6	-0.6	-0.6	-0.7	NO
R86	63	57	63	58	63	57	63	57	60	55	YES	YES	0.0	-0.1	0.0	-0.1	NO
R87	58	52	58	52	58	52	59	53	60	55	NO	NO	0.4	0.4	0.4	0.4	NO

ID	Year opening 'no build' scenario dB(A)		Year opening 'build' scenario dB(A)		Design year 'no build' scenario dB(A)		Design year 'build' scenario dB(A)		RNP threshold, dB(A)		Is the RNP threshold exceeded?		Change in noise level dB(A)				Consider mitigation
													Opening year		Design year		
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
R88	62	56	62	56	61	55	62	56	60	55	YES	YES	-0.1	-0.2	-0.1	-0.2	NO
R90	55	49	55	49	54	48	55	49	60	55	NO	NO	-0.4	-0.4	-0.4	-0.4	NO
R93	59	53	60	54	59	53	59	53	60	55	NO	NO	-0.2	-0.4	-0.2	-0.4	NO
R95	58	52	59	53	58	52	58	52	60	55	NO	NO	-0.2	-0.3	-0.2	-0.3	NO
R96	56	50	56	51	55	50	56	50	60	55	NO	NO	-0.5	-0.5	-0.5	-0.6	NO
R97	57	51	58	52	57	51	57	51	60	55	NO	NO	-0.4	-0.5	-0.4	-0.4	NO
R100	56	50	56	50	55	49	56	50	60	55	NO	NO	-0.5	-0.5	-0.5	-0.5	NO
R103	55	49	56	50	55	49	55	49	60	55	NO	NO	-0.6	-0.6	-0.6	-0.6	NO
R105	55	50	56	50	55	49	55	49	60	55	NO	NO	-0.6	-0.6	-0.5	-0.6	NO
R109	45	39	45	40	44	38	44	38	60	55	NO	NO	-1.2	-1.3	-1.2	-1.3	NO

Minor increases of up to 0.5 dB(A) are predicted for about nine receivers next to Section 2 of the proposal. As this increase is below the 2 dB(A) threshold, further consideration of mitigation is not required.

The proposal also includes a new service road for the residences on the south-western side of the highway between Cecil Road and Mount Piddington Road. There is potential for an increase in noise from road traffic due to noise reflecting from the retaining wall in this location. This increase is anticipated to be below the 2 dB(A) threshold. Nevertheless, where possible, noise-absorbent or noise-diffusive finishes would be used to mitigate the potential noise impacts.

As the proposal does not considerably alter the alignment or increase the current traffic volume on the road, the level and frequency of maximum noise events are expected to remain similar to the current situation following the completion of the proposal.

6.2.5 Safeguards and management measures

Safeguards and management measures that would be implemented to control the proposal's potential noise and vibration impacts are summarised in **Table 6-22**.

Table 6-22 Safeguards and management measures for noise and vibration

ID	Impact	Environmental safeguards	Responsibility	Timing
NV-1	Noise impacts on sensitive receivers from the retaining walls during operation	During detailed design, noise impacts as a result of retaining walls would be determined. Consideration will be given to using noise-absorbent or noise-diffusive finishes on the retaining walls where possible.	Detailed design contractor	Detailed design
NV-2	Noise impacts on sensitive receivers from operation of stockpile and compound sites	• Activities at the site at Harley Avenue will be limited to daytime hours only, where possible. • Activities at the site at Cassilis Street will be limited to daytime hours, during weekdays only, where possible. • Should construction activities at night be required, stockpile and compound activities will be limited to the Soldiers Pinch site, where possible. • All work outside of standard working hours would be in accordance with the Interim Construction Noise Guideline (DECC, 2009) and Roads and Maritime's Environmental Noise Management Manual (RTA, 2001).	Roads and Maritime	Detailed design
NV-3	Noise and vibration impacts on sensitive receivers during construction	A Construction Noise and Vibration Management Plan (CNVMP) will be prepared as part of the CEMP before construction. The CNVMP will address all stages of construction. It will include actions relating to: • The use of alternative low-noise processes and equipment. • The placement of work compounds, parking areas, equipment and material stockpile sites away from noise-sensitive locations. • The use of screening or enclosures for noise-generating equipment. • Restrictions on times when noisy work	Construction contractor	Pre-construction

ID	Impact	Environmental safeguards	Responsibility	Timing
		can be carried out. • A process for assessing maximum noise levels for each project phase. • Consultation with affected residents. • The temporary relocation of residents: Where short-term or out-of-hours activities are predicted to have a substantial impact on a small number of receivers, their temporary relocation will be considered. • A process for handling and responding to noise or vibration related complaints. • The maintenance and operation of construction plant and equipment. All plant and equipment will be: – Fitted with properly maintained noise suppression devices in accordance with the manufacturer's specifications. – Maintained in an efficient condition. – Operated in a proper and efficient manner.		
NV-4	General vibration during construction	Building condition surveys will be carried out at receivers within specified distances of certain construction activities and plant, as below: • Vibratory compaction: 25–50 m. • Demolition works: 50 m. • Excavation works: 10 m.	Construction contractor	Pre construction and during construction as required
NV-5	General vibration during construction	Heritage structures such as culverts and walls may not be adequately addressed by the building vibration criteria outlined in this report. Where these structures are identified, a condition assessment survey will be required to assess and identify appropriate construction vibration levels and mitigation measures.	Construction contractor	Construction
NV-6	General vibration during construction	Appropriately sized equipment will be selected to minimise vibration emissions where required.	Construction contractor	Construction
NV-7	General vibration during construction	To avoid or reduce the impact of vibration during construction: • Vibratory compacters will be replaced with normal compactors where vibration issues have been identified, and where their use is considered feasible and reasonable. • Where vibration is found to exceed project criteria, management measures will be implemented to control vibration. In terms of human comfort criteria, measures will include modifications of construction methods and respite periods. For potential structural damage impacts, modification of construction methods will be necessary.	Construction contractor	As required during construction