Transport
Roads & Maritime
Services

Great Western Highway Upgrade

Forty Bends

Review of Environmental Factors
Volume 1 - Main Report

October 2012

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Roads and Maritime Services

Mount Victoria to Lithgow
Great Western Highway – Forty Bends upgrade

Review of Environmental Factors – Main Report

October 2012

Prepared by:
Mount Victoria to Lithgow Alliance
Level 9, 100 Christie Street
St Leonards NSW 2065
PO Box 164, St Leonards 1590
Email mv2l@mv2l.com.au

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Executive summary

Background

The Great Western Highway is the main road link between Sydney and Lithgow and beyond to the Central West of New South Wales. The Great Western Highway serves as:

- A key freight route between Sydney and the central west of NSW, including the timber industry in the Oberon area.
- A tourist route with destinations including the Blue Mountains, historic Hartley, Jenolan Caves, Mudgee and Bathurst.
- A connection between the many towns and villages along its length.

In order to improve travel times for freight transport and provide a safer environment for all road users, the Australian and NSW Governments are jointly funding the Great Western Highway upgrade program. Sixteen projects have either been completed or are currently in progress between Lapstone and Lithgow. This proposal forms the next stage of the overall Great Western Highway upgrade program. To date, the completed projects for the Great Western Highway upgrade program have led to improved travel times 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.

The proposal

Roads and Maritime Services propose to upgrade and widen about 2.8 kilometres of the Great Western Highway at Forty Bends to three lanes with a central median along the majority of its length. The proposed upgrade extends from a point about 470 metres east of the eastern end of Forty Bends Road to a point about 250 metres west of McKanes Falls Road (the proposal).

The key elements of the proposal include the following:

- Construction of a new road alignment consisting of generally three lanes with two lanes eastbound to the east of Whites Creek and two lanes westbound to the west of Whites Creek. Lane widths would be 3.5 metres with shoulder widths typically varying between 1.0 metres and 2.5 metres. The upgrade alignment would diverge up to 40 metres south of the existing Great Western Highway in the vicinity of Whites Creek.
- The design speed for the alignment would be 100 kilometres per hour east of McKanes Falls Road and 80 kilometres per hour west of McKanes Falls Road. The posted speed limit for the whole of the new highway alignment would be 80 kilometres per hour
- Widening of the existing alignment predominantly to the south of the Great Western Highway. The total proposal footprint of the widening works would vary from about 40 metres to 90 metres.
- A central median along the length of the proposal of varying widths, ranging up to 9.5 metres. Carriageways would be separated by a combination of vegetated, depressed and paved medians.

- Construction of new twin, five-span bridges, about 150 metres in length across Whites Creek. The new bridges would comprise four lanes, each 3.5 metres in width, with two lanes carrying traffic in each direction. The total width of the two bridges would be about 30 metres. Shoulders on the bridges would be between 2.5 and 3.25 metres (off-side) and 1.0 metres on the near side.
- Rehabilitation works along the existing alignment of Whites Creek following the removal of the redundant section of the existing Highway. This would include creating a rehabilitated, natural creek bed in this location linking the existing alignment of Whites Creek prior to passing under the new Whites Creek bridge.
- Upgrades to four existing local road intersections, including two intersections with Forty Bends Road, Daintree Close and McKanes Falls Road, to provide connection to the upgraded highway and property access points. Upgrades would include minor widening and u-turn facilities located along the western end of Forty Bends Road and about 150 metres south of the intersection of the Great Western Highway and McKanes Falls Road.
- New or improved access from the existing highway to nine properties along the length of the proposal. The proposal includes provision of new or reconstructed driveways to retain existing property access.
- Closure and relocation of two intersections of Forty Bends Road with the Great Western Highway. These include:
    - Closure of the existing intersection at the eastern end of Forty Bends Road to general traffic (except for emergency vehicles) and a new cul-de-sac constructed on Forty Bends Road.
    - Relocation of the existing intersection at the western end of Forty Bends Road to a point about 200 metres west of the existing intersection.
- Five major cuts 14 metres to 19 metres in height located on the northern side of the proposed alignment.
- Five major fill embankments 10 metres to 15 metres in height located predominantly on the southern side of the proposed alignment.
- Three retaining walls would be required at the following locations
    - Retaining wall 1 – between approximate chainages 32080 and 32190 (about 110 metres long and up to 7.0 metres high).
    - Retaining wall 2 – between approximate chainage 32560 and 32725 (about 165 metres long and up to 5.6 metres high).
    - Retaining wall 3 – between approximate chainage 33040 and 33240 (about 200 metres long and up to 7.0 metres high).
- Removal of about 300 metres of redundant Great Western Highway pavement from about 100 metres east of Whites Creek to about 200 metres west of Whites Creek, and associated culvert. This would include rehabilitation works to link this area to the existing alignment of Whites Creek.
- Construction of three temporary and five permanent construction basins in addition to temporary access tracks along the length of the proposal.
- Construction of nine new culverts along the length of the proposal to manage cross-drainage flows and six new culverts across access roads and service roads as part of the proposal. One existing culvert would be retained at the western end of the proposal. A total of 23 existing drainage culverts under the Great western Highway would be either decommissioned or removed.

- Measures to mitigate the formation of black ice, including the relocation of the road alignment to the south away from the Hassans Walls escarpment in key locations and an active maintenance program.
- A main compound site located east of the western end of Forty Bends Road, in addition to smaller stockpile areas along the length of the proposal during construction.
- A combination of wildlife crossing structures, which would include two fauna underpasses (box culverts), canopy rope bridges at Whites Creek and glider poles located at Whites Creek and near the western fauna underpass.
- Relocation and/or temporary diversion of existing underground utilities including water, powerlines and telephone cables.

Construction of the proposal would be staged to ensure that continued use of the Great Western Highway can be maintained throughout the construction period which is anticipated to be up to 24 months.

Need for the proposal

The proposal is needed to improve the road safety and traffic and freight efficiency along this section of road and would be consistent with other road improvement activities along the Great Western Highway. The existing alignment has a limited number of opportunities for passing.

Safety and reduction of hazards

One of the main safety issues associated with this section of the Great Western Highway is the number of motor vehicle accidents that have occurred. Historical crash data between January 2004 and December 2010 has recorded 38 crashes, of which two were fatal and 19 were injury crashes (refer to Section 6.7of this REF for further details). The crash history for the section of the Great Western Highway between Mount Victoria and Lithgow (including the section subject to this proposal) is about three and a half times higher than the State Plan target, and up to 50 per cent higher than the state average of 30.4 per 100 million vehicle kilometres travelled for a two lane two way roadway (RTA, 2008a).

Black ice formation has also been identified as a hazard, and linked with the above crash statistics, along the highway at Forty Bends. The formation of black ice is associated with specific meteorological conditions when to cold airflow descending from Hassans Walls, known as katabatic drainage. Realigning the highway at Forty Bends would assist in reducing crashes that occur in adverse weather conditions and potential road closures in winter months due to the formation of black ice.

Strategic planning

The Great Western Highway is the principal road transport link connecting the central west region of New South Wales the Blue Mountains and Sydney. The highway is an important freight transport corridor and is also used by thousands of road users per day travelling between Sydney and the towns and villages along its length. The highway provides a vital connection to many popular tourist destinations within the region and further west to towns such as Oberon, Mudgee, Orange and Bathurst.

The proposal has been reviewed against, and is found to be consistent with, relevant strategic plans including the following:

- NSW State Plan.
- NSW State Infrastructure Strategy.
- Sydney–Dubbo Corridor Strategy.
- Penrith to Orange Transport Strategy.
- Central West Transport Needs Study.
- National Road Safety Strategy 2011–2020.
- National Land Freight Strategy discussion paper February 2011.

Options considered

A number of options and sub options were considered for the proposal. Six alternative design options for the main alignment of the Great Western Highway have been investigated over the life of the proposal. The preferred option, as considered in this report, was determined by considering a design that offered a reduced footprint with minimal heritage, biodiversity and visual impacts. In conjunction with the preferred highway alignment design, two alternative options were also considered in relation to the crossing of Whites Creek and the management of black ice.

The preferred option, which is the subject of this Review of Environmental Factors, would best achieve each of the proposal objectives and assessment criteria identified to assess the various proposal options. In particular, the development of an improved alignment that is further away from Hassans Walls in combination with the development of a black ice active maintenance program would improve the safety of this section of the Great Western Highway and reduce the likelihood of the formation of black ice during cold weather events, assisting in the reduction of crashes.

Statutory and planning framework

The potential environmental impacts of the proposal have been identified through this Review of Environmental Factors and will be assessed by the Roads and Maritimes Services under Part 5 of the *Environmental Planning & Assessment Act 1979*.

In accordance with Clause 94(1) of the *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP), development consent under Part 4 of the *Environmental Planning & Assessment Act 1979* is not required. Clause 94 of the Infrastructure SEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

In determining the proposal and degree of impact, the Roads and Maritimes Services will consider Sections 111 and 112 of the *Environmental Planning & Assessment Act 1979* and Clause 228 of the *Environmental Planning and Assessment Regulation 2000* (refer to **Appendix A** for assessment under Clause 228). Key agencies, in particular Lithgow City Council, have been consulted during design development and the environmental assessment process and consultation will continue throughout detailed design and construction.

Community and stakeholder consultation

Throughout the development of the proposal, the Roads and Maritime Services has undertaken a range of consultation activities with the community and stakeholders, including meetings and correspondence with Lithgow City Council, the community and other key stakeholders. In addition, the proposal has been through public display, as part of the concept design display of the wider Mount Victoria to Lithgow upgrade. The current proposal has been developed based on feedback received from the community and stakeholders over the history of the proposal.

During preparation of the Review of Environmental Factors, Roads and Maritime Services also consulted with government agencies including Office of Environment and Heritage (Parks and Wildlife), Office of Environment and Heritage (Heritage Branch), Lithgow City Council, Environmental Protection Agency, NSW Department of Primary Industries (Agriculture), NSW Department of Primary Industries (Crown Lands Division), NSW Department of Primary Industries (Fisheries), NSW Department of Primary Industries (Office of Water) and the Sydney Catchment Authority.

Future community and stakeholder consultation would include a community update, information provided on the Roads and Maritime Services website and public exhibition of the proposal and REF seeking public feedback (refer to Chapter 5).

Environmental impacts

A number of detailed technical investigations were undertaken to assess the potential impacts of the proposal and associated works, and to identify safeguards and management measures to mitigate these impacts. Key issues investigated included biodiversity, Aboriginal and non-Aboriginal heritage, noise and vibration, water quality, urban design and landscape and traffic and transport.

Beneficial effects of the proposal would include:

- Improved road safety along the Great Western Highway through an improved road geometry and proposed strategies to mitigate the formation of black ice.
- Improved traffic and freight efficiency through improved road geometry and alignment.
- Provision of safety access to the Great Western Highway for properties that adjoin the highway.

These improvements would result in benefits to the local community and motorists travelling along the Great Western Highway in general.

A number of negative environmental impacts have been identified as being likely to occur during construction. These include:

- Removal of up to 7.39 hectares of native vegetation and up to 15.27 hectares of cleared and modified habitat.
- Temporary disturbance to residential receivers from the generation of noise and vibration during construction.
- Temporary reduction in air quality during construction, mainly due to dust emissions.

- An increase in vehicle movement and traffic noise.
- An increased risk of erosion and sedimentation.
- An increased risk for spills and contamination from contaminants such as fuels and oils.
- The potential dispersal of weed propagules.
- The potential spread of soil-borne pathogens.

Implementation of the safeguards and mitigation measures identified in this REF would effectively limit these negative impacts.

Negative environmental impacts from the proposal include residual impacts such as the removal of up to 7.39 hectares of native vegetation and up to 15.27 hectares of cleared and modified habitat, permanent acquisition of about 17.7 hectares of land (including the full acquisition of three private properties) and the construction of three new retaining walls in addition to other cuttings that would affect the existing visual amenity of the local area.

Negative environmental impacts would be minimised through the implementation of mitigation measures outlined in this Review of Environmental Factors. This would include the implementation of various management plans including the following:

- Vegetation management plan.
- Weed management plan.
- Soil and water management plan.
- Erosion and sediment control plan.
- Construction traffic management plan.
- Noise and vibration mitigation measures.
- Waste management Plan.

These plans would be included as part of the overall Contractor Environmental Management Plan for the proposal.

Assessment of the potential impacts as they relate to matters of national environmental significance (NES matters) (as defined under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) determined that the proposal would not significantly impact any NES matter (refer to **Appendix A**). Furthermore, impact assessments determined that the proposal would not have a significant effect on threatened plants, animals, populations and communities, given the safeguards and management measures identified in this REF are implemented.

The Roads and Maritime Service has considered the need for the proposal against its potential benefits and impacts, and has determined that the beneficial outcomes outweigh the potential negative outcomes, provided adequate mitigation is implemented and the key sustainability goals are achieved.

Greater detail regarding the potential environmental impacts associated with the proposal is provided in Chapter 6 of this Review of Environmental Factors.

Justification and conclusion

A number of options for the proposal have been considered and the options consideration process included input from various stakeholders including Government agencies, council and the community. The identification of the preferred option took into account all relevant social, environmental and economic factors. The potential impacts of the proposal have been further assessed against the principles of ecologically sustainable development.

The assessment of the proposal and associated environmental impacts are in accordance with Clause 228 of the *Environmental Planning and Assessment Regulation 2000*, Section 111 of the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994*, and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The proposal would result in both positive and negative impacts, however the safeguards identified in this Review of Environmental Factors would allow for the proposal to be developed whilst managing the identified negative impacts. The beneficial impacts of the proposal, including improvements to the safety and efficiency and of the existing road network, are considered to outweigh the negative impacts associated with the proposal.

This Review of Environmental Factors has determined that the proposal is unlikely to have a significant impact on the environment and therefore the preparation of an Environmental Impact Statement under Part 5.1 of the *Environmental Planning and Assessment Act 1979* is not required. The proposal would not result in any significant impacts on threatened species, as listed under the *Threatened Species Conservation Act 1995* and/or *Fisheries Management Act 1994*, and would therefore not require a Species Impact Statement to be prepared in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*.

The proposal would not significantly impact on a matter of national environmental significance or Commonwealth land. However, based on the assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land, the Roads and Maritime has submitted a referral to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities to determine whether or not the proposal constitutes a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999*. If the proposal is determined to be a controlled action, the approval of the Australian Government Minister for the Environment would be sought prior to commencement of construction of the proposal.

Display of the review of environmental factors

This Review of Environmental Factors will be placed on public exhibition and community comments invited. The proposal will be on public exhibition from 8 October 2012 to 26 October 2012. Information about the proposal can be accessed in the following ways.

Internet

Details of the proposal (including all proposal documents) would be provided on the Mount Victoria to Lithgow webpage to allow members of the community to find more information about the proposal, exhibition period and how to make a submission. (http://www.rta.nsw. gov.au/road projects/index.html).

Public exhibition

During the public exhibition period, static display locations would be established which would include a copy of the Review of Environmental Factors documentation, details of the proposal's design and community updates.

Public displays would be located at the following locations (open during working hours):

- Blue Mountains Council office – 2-6 Civic Place, Katoomba.
- Katoomba library – Town Centre Arcade, Katoomba Street, Katoomba.
- Lithgow City Council office – 180 Mort Street, Lithgow.
- Lithgow Library – 157 Main Street, Lithgow.
- RMS Motor Registry Lithgow – Shop 51, Valley Plaza, Corner of Lithgow and Bent Streets, Lithgow.

A staffed display would also be held as part of the public display period. This would provide an opportunity for the community to look at the proposal in more detail. Members of the proposal team would be available to discuss any matters the community and stakeholders may have regarding the proposal at the following location.

- 10.00 am to 2.00 pm, 17 October 2012, Bowen Inn Motel, 5 Col Drewe Drive, Lithgow.

Purchase

The review documents are available for purchase in hard copy ($25.00) or CD ($10.00) by contacting the proposal team on the details provided below.

How can I make a submission?

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

Roads and Maritime Services Project Manager:
Chris Barnett
Mount Victoria to Lithgow Alliance
PO Box 164
St Leonards NSW 2065
Email: MV2Linformation@MV2L.com.au

Submissions must be received by 26 October 2012. Submissions can also be made by contacting the proposal team through the community information line on 1800 035 733.

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 Services 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 Services 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 would be held by the Roads and Maritime Services (Western Region Roads Office) located at 51-55 Currajong Street Parkes NSW 2870.

What happens next?

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

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

If the proposal is approved, Roads and Maritime Services proceeds with final design and tenders are called for construction of the proposal. If you have any queries, please contact the proposal team at the above addresses or by calling the community information line on 1800 035 733.

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1.1 Proposal identification

Roads and Maritime Services (RMS) proposes to upgrade and widen about 2.8 kilometres of the Great Western Highway at Forty Bends to three lanes with a central median along the majority of its length. The proposed upgrade extends from a point about 470 metres east of the eastern end of Forty Bends Road to a point about 250 metres west of McKanes Falls Road (the proposal). An overview of the proposal is shown in Figure 1-1.

The proposal forms part of a series of ongoing upgrades of the Great Western Highway. The Great Western Highway is the main road link between Sydney and Lithgow and beyond to the Central West of New South Wales. The Great Western Highway serves as:

- A key freight route between Sydney and the central west of NSW, including the timber industry in the Oberon area.
- A tourist route with destinations including the Blue Mountains, historic Hartley, Jenolan Caves, Mudgee and Bathurst.
- A connection between the many towns and villages along its length.

The proposal is needed to improve the road safety and traffic and freight efficiency along this section of road and would be consistent with other road improvement activities along the Great Western Highway. The existing alignment has a limited number of opportunities for passing.

The key features of the proposal are:

- Construction of a new road alignment consisting of generally three lanes with two lanes eastbound to the east of Whites Creek and two lanes westbound to the west of Whites Creek. Lane widths would be 3.5 metres with shoulder widths typically varying between 1.0 metres and 2.5 metres. The upgrade alignment would diverge up to 40 metres south of the existing Great Western Highway in the vicinity of Whites Creek.
- The design speed for the alignment would be 100 kilometres per hour east of McKanes Falls Road and 80 kilometres per hour west of McKanes Falls Road. The posted speed limit for the whole of the new highway alignment would be 80 kilometres per hour
- Widening of the existing alignment predominantly to the south of the Great Western Highway. The total proposal footprint of the widening works would vary from about 40 metres to 90 metres.
- A central median along the length of the proposal of varying widths, ranging up to 9.5 metres. Carriageways would be separated by a combination of vegetated, depressed and paved medians.
- Construction of new twin, five-span bridges, about 150 metres in length across Whites Creek. The new bridges would comprise four lanes, each 3.5 metres in width, with two lanes carrying traffic in each direction. The total width of the two bridges would be about 30 metres. Shoulders on the bridges would be between 2.5 and 3.25 metres (off-side) and 1.0 metres on the near side.

- Rehabilitation works along the existing alignment of Whites Creek following the removal of the redundant section of the existing Great Western Highway and associated existing culvert. This would include creating a rehabilitated, natural creek bed in this location that would link to the existing alignment of Whites Creek prior to passing under the new Whites Creek bridge.
- Upgrades to four existing local road intersections, including two intersections with Forty Bends Road, Daintree Close and McKanes Falls Road, to provide connection to the upgraded highway and property access points. Upgrades would include minor widening and u-turn facilities located along the western end of Forty Bends Road and about 150 metres south of the intersection of the Great Western Highway and McKanes Falls Road.
- Closure and relocation of two intersections of Forty Bends Road with the Great Western Highway. These include:
    - Closure of the existing intersection at the eastern end of Forty Bends Road to general traffic (except for emergency vehicles) and a new cul-de-sac constructed on Forty Bends Road.
    - Relocation of the existing intersection at the western end of Forty Bends Road to a point about 200 metres west of the existing intersection.
- New or improved access from the existing highway to nine properties along the length of the proposal. The proposal includes provision of new or reconstructed driveways to retain existing property access.
- Five major cuts about 14 metres to 19 metres in height located on the northern side of the proposed alignment.
- Five major fill embankments about 10 metres to 15 metres in height located predominantly on the southern side of the proposed alignment.
- Three retaining walls up to about 200 metres long and seven metres high.
- Removal of about 300 metres of redundant Great Western Highway pavement from about 100 metres east of Whites Creek to about 200 metres west of Whites Creek, and associated culvert. This would include rehabilitation works to link this area to the existing alignment of Whites Creek.
- Construction of three temporary and five permanent construction basins in addition to temporary access tracks along the length of the proposal.
- Construction of nine new culverts along the length of the proposal to manage cross-drainage flows and six new culverts across access roads and service roads as part of the proposal. One existing culvert would be retained at the western end of the proposal. A total of 23 existing drainage culverts under the Great western Highway would be either decommissioned or removed.
- Measures to mitigate the formation of black ice, including the relocation of the road alignment to the south away from the Hassans Walls escarpment in key locations and an active maintenance program.
- A main compound site located east of the western end of Forty Bends Road, in addition to smaller stockpile areas along the length of the proposal during construction.

- A combination of wildlife crossing structures, which would include three fauna underpasses (box culverts), canopy rope bridges at Whites Creek and the western underpass and glider poles located at Whites Creek and near the western fauna underpass.
- Relocation and/or temporary diversion of existing underground utilities including water, powerlines and telephone cables.

Construction of the proposal would be staged to ensure that continued use of the Great Western Highway can be maintained throughout the construction period (detailed further in Section 3.3).
A concept design for the proposal is provided in **Appendix B** and a detailed description of the proposal is provided in Chapter 3. The start and end points of the proposal as indicated on the concept design includes the tie ins to the existing alignment of the highway. Activities to tie the proposal into the existing alignment of the Great Western Highway would be determined during detailed design and may include milling and resheeting where required to create consistent levels between existing and new pavement.

The proposal is located within the Lithgow local government area (LGA) and is part of the RMS Western Services region. The proposal site is about five kilometres south of Lithgow. Refer to **Figure 1-2** for the regional context of the proposal.

The region is characterised by its natural features including the Hassans Walls Reserve to the north of the proposal and the Blue Mountains National Park and the Blue Mountains World Heritage Area about 14 kilometres to the east (refer to **Figure 1-2**). The region includes a large variety of land uses that include residential and rural residential villages, agriculture and a number of tourist attractions.

One main drainage line, Whites Creek, crosses the Great Western Highway in addition to a number of other ephemeral drainage lines that occur off Hassans Walls escarpment (refer to **Figure 1-1**). Whites Creek and the other drainage lines are part of the Whites Creek catchment, a sub-catchment of Sydney's drinking water supply hydrologic catchment that flows to Warragamba Dam. Whites Creek is the main ephemeral water course flowing through the study area whose junction with the Coxs River is approximately 3.5 kilometres downstream of the Great Western Highway. The proposal is also located within the Sydney Drinking Water Catchment (refer to Section 4.2.4).

The proposal passes through a variety of different vegetation types, including native open forest communities (generally to the north of the proposal at the base of the escarpment) and cleared/modified land (generally to the south of the proposal). Scattered private residences are located generally to the south of the existing highway. An electricity easement also crosses the existing and proposed alignment of the highway towards the western end of the proposal (refer to **Figure 1-1**).

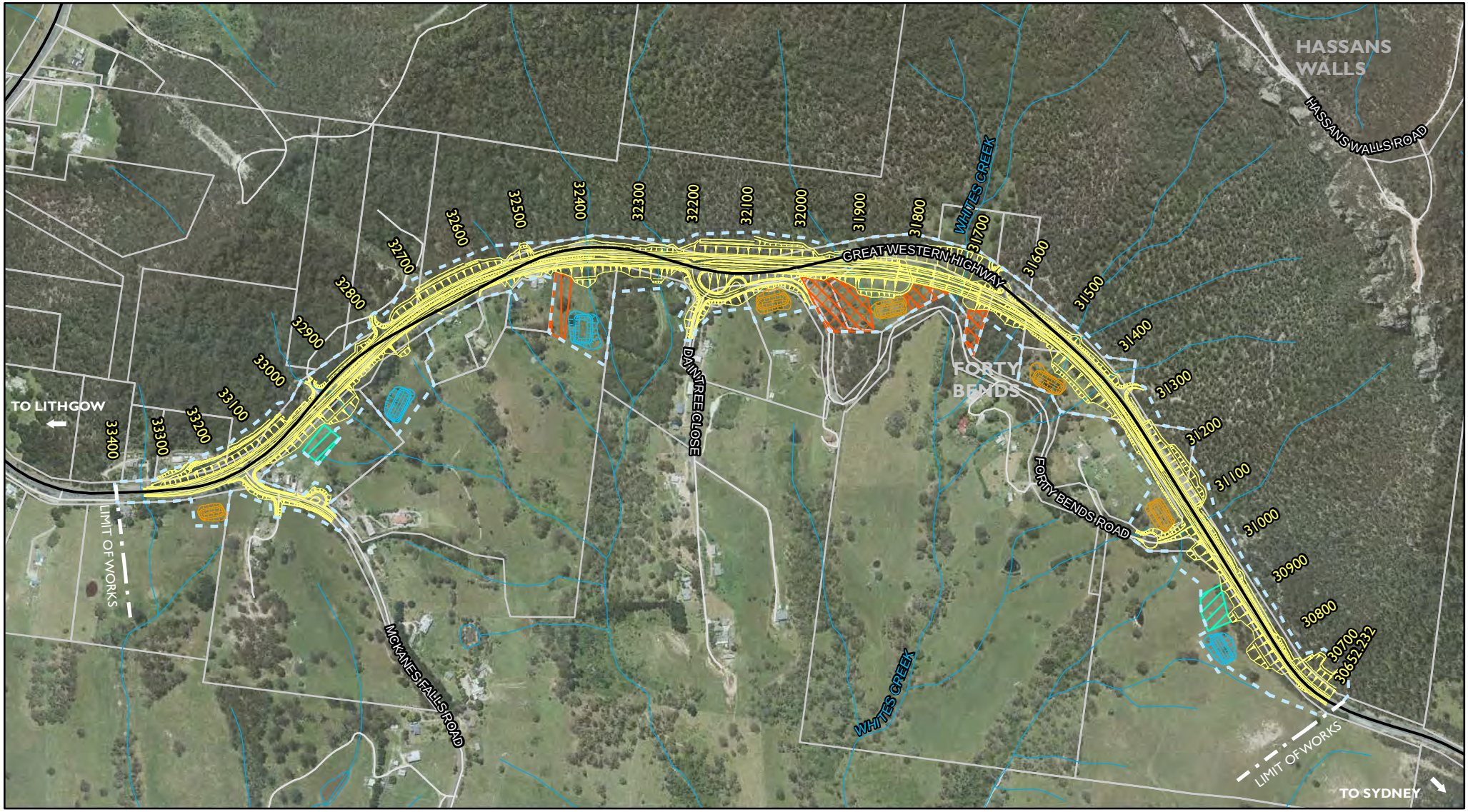

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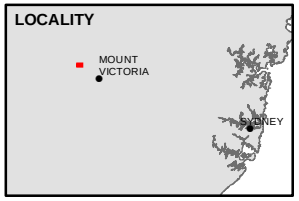
Figure 1-1 Forty Bends project area

Mt Victoria to Lithgow: Great Western Highway Forty Bends upgrade

LEGEND

- 30300 Chainage
- Proposal
- Proposal site
- Existing highway
- Waterways
- Property boundary
- Permanent sedimentation basins
- Temporary sedimentation basins
- Compound site and stockpile locations
- Potential compound
- Potential stockpile
- Potential stockpile and compound



GDA 94 | MGA 56

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Metres

Aerial Photograph:AUSIMAGE/SKM 2011

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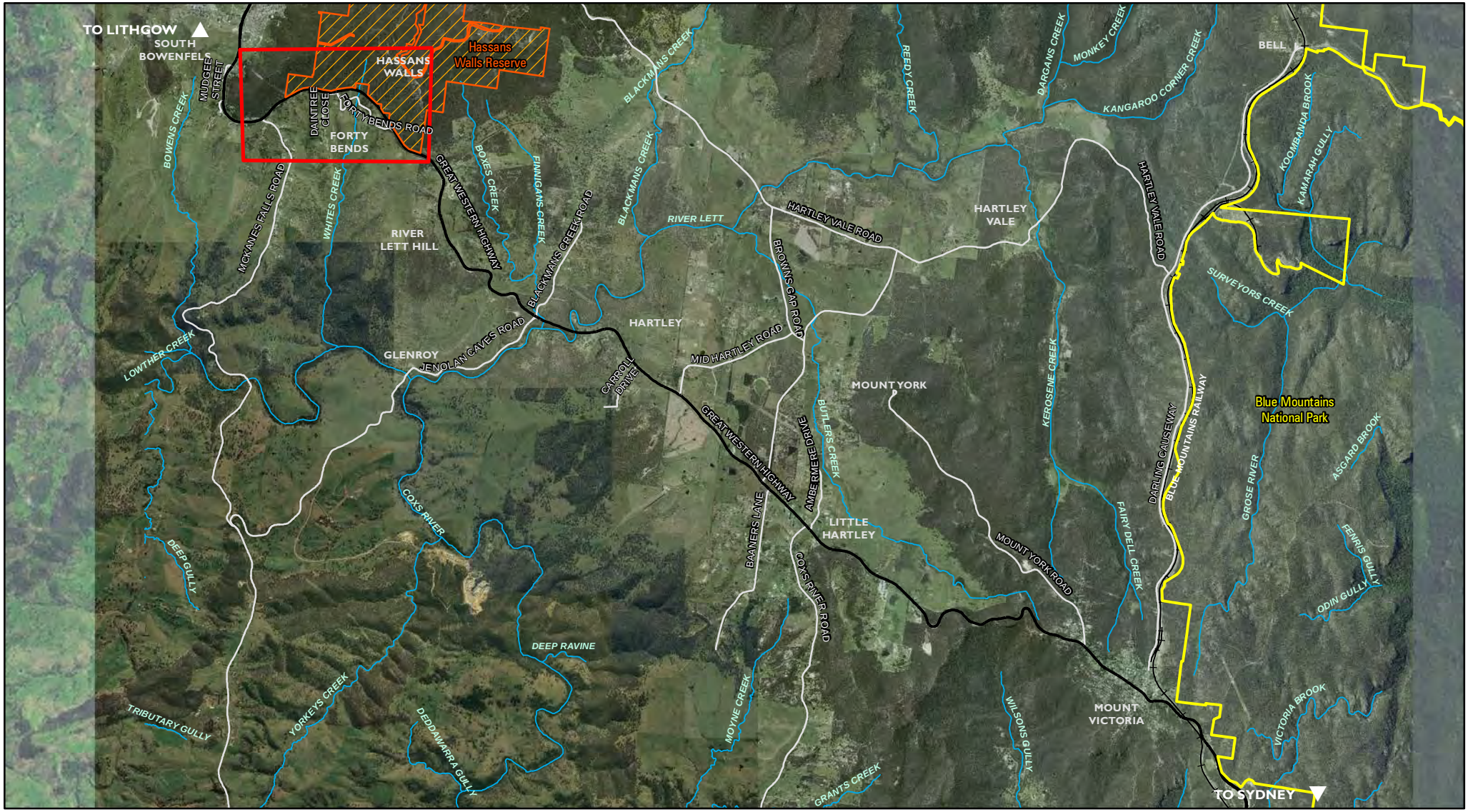

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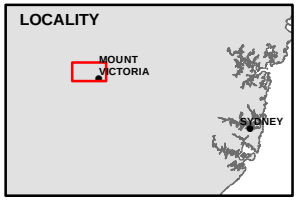
Figure 1-2 Regional plan

Mt Victoria to Lithgow: Great Western Highway Forty Bends upgrade

LEGEND

- Existing highway
- Railway
- Waterways
- Forty Bends locality
- Hassans Walls Reserve
- Blue Mountains National Park



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Kilometres

Aerial Photograph:AUSIMAGE/SKM 2011

For the purposes of this assessment, the following definitions are used:

- The 'proposal site' refers to the area that would be directly impacted by the proposal. The proposal site encompasses the concept road design, including the realigned highway, batters, cuts, embankments, and new bridge across Whites Creek (the proposal). 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 location of the proposal site is shown on **Figure 1-1**.
- The 'study area' encompasses the proposal site and the area that may be indirectly impacted by the proposal.

The Australian and NSW Governments would jointly fund the proposal as part of the Great Western Highway upgrade program.

The construction cost for the proposal is about $85 million. It is anticipated that the proposal would take up to 24 months to construct, with construction expected to commence in late 2013.

1.2 Purpose of the report

This Review of Environmental Factors (REF) has been prepared by the Mount Victoria to Lithgow Alliance (referred to hereafter as 'the Alliance') on behalf of RMS. For the purpose of these works, the RMS 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 (Chapter 3), to document the likely impacts of the proposal on the environment (Chapter 6), and to detail protective measures to be implemented (Chapter 7).

The description of the proposal and associated environmental impacts have been undertaken in context of clause 228 of the *Environmental Planning and Assessment Regulation 2000* (summarised in **Appendix A**), 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 the RMS examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposal.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and 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 (SIS).
- The potential for the proposal to significantly impact a matter of national environmental significance (NES) or Commonwealth land and the need to make a referral to the Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) 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

2.1 Strategic need for the proposal

The Great Western Highway is the principal road transport link connecting the central west region of New South Wales (NSW), the Blue Mountains and Sydney. The highway is an important freight transport corridor and is also used by thousands of road users per day travelling between Sydney and the towns and villages along its length. The highway provides a vital connection to many popular tourist destinations within the region and further west to towns such as Oberon, Mudgee, Orange and Bathurst.

2.1.1 Strategic planning and policy framework

The proposal has been reviewed against and is found to be consistent with relevant strategic plans as summarised below.

NSW State Plan

NSW 2021 (NSW Government, 2011) is a 10 year plan to rebuild the economy, return quality services, renovate infrastructure, restore accountability to government, and strengthen local environment and communities.

This plan sets immediate priorities for action and guides NSW Government resource allocation in conjunction with the NSW Budget. It includes 32 goals and 180 targets relating to services such as transport, health, family and community services, education and police and justice.

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 State Infrastructure Strategy

The *NSW State Infrastructure Strategy* (NSW Treasury, 2008) is a 10 year program (2008 to 2018) that provides a strategic direction for the planning and delivery of infrastructure in NSW to support the State's growing population.

This plan sets out the drivers of infrastructure demand for NSW, the strategic framework in which the development of infrastructure sits (including the NSW State Plan and the Sydney and regional metropolitan strategies) and the management of funding for NSW infrastructure. The Strategy identifies five main Agency Infrastructure Plans that cover Human Services, Justice, Transport, Electricity and Water.

Regionally, the upgrade of the Great Western Highway between Mount Victoria and Lithgow is identified as one of the main planned road projects within the Strategy (Road Transport Project Number 16).

Sydney–Dubbo Corridor Strategy

The *Sydney – Dubbo Corridor Strategy* (Auslink, 2007) is a report that outlines the primary role of the Sydney to Dubbo corridor, serving east–west transport demand between central west NSW and Sydney. The Strategy identifies the key challenges and short term strategic priorities for the corridor including

- Continuing to address crash risks:
    - On and accessing the highway in urban areas.
    - On sections of road with poor alignment and narrow bridges.
    - At intersections and access roads in rural locations.
    - On road sections subject to ice, frost and fog.
- Maintaining road pavements in a safe and efficient condition.
- Managing operational flexibility for freight and passenger trains in the Blue Mountains.

The key challenges identified within the Strategy are considered consistent with the objectives of the Mount Victoria to Lithgow upgrade program (refer to Section 2.3).

Penrith to Orange Transport Strategy

The *Penrith to Orange Transport Strategy* (SKM, 1998) was prepared to develop a strategy for the Penrith to Orange transport corridor which specified both short and long term management actions. One of the recommendations of the Strategy was to continue the Great Western Highway program that had been commenced at the time of preparing the Strategy including widening the highway to three or four lanes between Mount Victoria and Lithgow.

This is consistent with the proposal which would increase the existing Great Western Highway at Forty Bends to three lanes as the first part of a wider concept design proposal to widening the highway to three or four lanes between Mount Victoria and Lithgow.

Central West Transport Needs Study

The *Central West Transport Needs Study* (SKM, 2009) is focused on the road and rail transport needs for passengers and freight between the Central West region of NSW and Sydney, Newcastle, and Port Kembla. 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 at Forty Bends as the first part of a wider concept design proposed to improve the existing highway between Mount Victoria and Lithgow.

National Road Safety Strategy 2011–2020

The *National Road Safety Strategy 2011-2020* (ATC, 2011) was released on 20 May 2011 by the Australian Transport Council (ATC). The strategy outlines broad directions for the future of Australian road safety, planned initiatives for the first three years and a range of options for further consideration as the strategy progresses. The initiatives and options are set out in four key areas – Safe Roads, Safe Speeds, Safe Vehicles and Safe People.

Of particular relevance to the proposal is the key area of Safe Roads. Within this area, a series of key directions have been identified that aim to achieve the objectives of the strategy. These directions include:

- Adoption of improved standards for road design, construction and operation.
- All new roads and upgrades of existing roads will be designed, built and operated in accordance with Safe System principles.
- A substantial reduction in serious casualties due to run-off road, head-on and intersection crashes.

The key directions identified within the Strategy 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.

National Land Freight Strategy discussion paper February 2011

In February 2011, Infrastructure Australia released the *National Land Freight Strategy discussion paper* (Infrastructure Australia, 2011). The discussion paper provides an outline for a potential national freight network and priorities for a national land freight network strategy, and an indicative list of projects and programs that Infrastructure Australia has identified for inclusion in a long term national land freight network plan.

One of the key objectives of the proposal is to minimise travel times for vehicles using the highway, including improving the efficiency of freight vehicles that utilise the highway to bring freight and other produce from west of the Great Dividing Range to Sydney. This is consistent with the intention of the *National Land Freight Strategy discussion paper* which aims to create an integrated freight network across Australia including the integration of road, rail, air and port services.

Summary of relevant strategies and plans

In summary, the upgrade of the Great Western Highway at Forty Bends, as part of the wider proposed upgrade of the Great Western Highway between Mount Victoria to Lithgow, is specifically identified within these strategies as an area for improvement under the NSW State Plan and is identified as a priority investment under the NSW State Infrastructure Strategy. The Central West Transport Needs Study also identified the upgrade of the Great Western Highway between Mount Victoria and Lithgow (including the proposal for the Forty Bends upgrade) as a candidate project for improving transport efficiency.

The objectives of the Mount Victoria to Lithgow upgrade program (refer to Section 2.3) are consistent with the goals and targets of each of the plans identified above by seeking improvement in the efficiency and safety of the existing road network, whilst also improving the efficiency of freight movements within the region.

2.1.2 Great Western Highway upgrade program

In order to improve travel times for freight transport and provide a safer environment for all road users, the Australian and NSW Governments are jointly funding the Great Western Highway upgrade program. The Great Western Highway upgrade program is needed to:

- Improve road safety.
- Improve travel speeds and improve level of service.
- Improve freight efficiency.
- Improve access to the Central West of NSW to support growth in this region.
- Reduce road-user costs.
- Better cater for the mix of local, through and tourist traffic.
- Address the social and environmental impacts of through traffic.
- Fully realise the value of public investment in the Great Western Highway upgrade program to date.

The objectives for the proposal are provided in Section 2.3 of this REF.

Sixteen projects have either been completed or are in progress between Lapstone and Lithgow. An overview of the Great Western Highway upgrade program is provided in **Figure 2–1.**

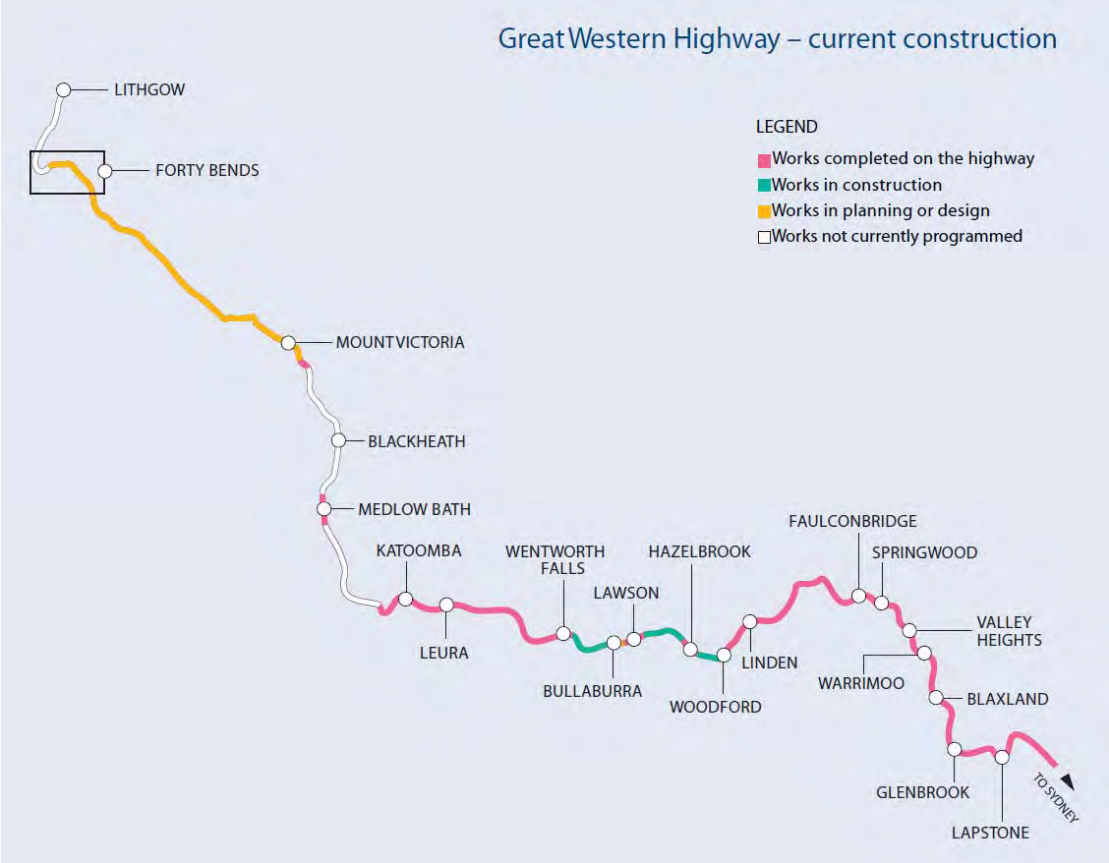


Figure 2-1: Overview of the Great Western Highway upgrade program

The completed projects for the Great Western Highway upgrade program have led to improved travel times 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.

The proposal is consistent with the Great Western Highway upgrade program because it is consistent with the governments' strategic priorities of improving the highway's safety performance and efficiency, and would help meet road network needs.

Mount Victoria to Lithgow program

As part of the Great Western Highway upgrade program, the section of highway between Mount Victoria and Lithgow is proposed to be upgraded to improve road safety and accessibility to communities in the Blue Mountains and Central West. The Australian Government in partnership with the NSW Government has committed $250 million as part of the *Nation Building Program* to commence an upgrade of the Great Western Highway between Mount Victoria and Lithgow. The current total Australian Government commitment to the Mount Victoria to Lithgow program, including the upgrade the Forty Bends section, is $200 million. The NSW Government is providing an additional $50 million to assist with the ongoing development of this program.

Between October 2007 and August 2012, the Australian and NSW Governments have been investigating the area between Mount Victoria and Lithgow to determine the preferred route for the Great Western Highway upgrade. The project objectives for the Mount Victoria to Lithgow program are:

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

The investigations to identify a preferred route included community input at the study area, corridors and route option stages. The preferred route was announced in May 2010 and a concept design displayed in 2011-2012. The proposal is consistent with the Mount Victoria to Lithgow program and has the same project objectives (refer to section 1.3 of this REF).

NSW Government independent review

In September 2011 the New South Wales Government engaged Evans and Peck to undertake an independent review (the NSW Government Review) of the proposed upgrade of the Great Western Highway west of Katoomba. The NSW Government Review was initiated following concerns raised by the some members of the local community about environmental, cultural, social and economic impacts of the upgrade projects and to ensure that the best value for money is obtained from the investment.

The NSW Government Review recommended that the current funding should be allocated to directly improving road safety for road users and the community. This was supported through consultation carried out as part of the review which identified that the community desires action to address safety in the short term combined with certainty about the future likelihood and strategic justification of the upgrade.

The proposal is consistent with the conclusions of the NSW Government Review. The review found that the section of the Great Western Highway at Forty Bends was the most critical to upgrade as it would provide safety and reliability improvements through an enhanced horizontal alignment and overtaking lanes, as well as improving freight efficiency by mitigating road closure risk on this section of the highway. Realigning the highway to the south away from Hassans Walls at Forty Bends would also assist in reducing crashes that occur in adverse weather conditions and potential road closures in winter months due to the formation of black ice.

Enhanced safety works program

The NSW Government Review also recommended that additional highway safety improvements between Mount Victoria and Lithgow, including Mount Victoria Village, Little Hartley and Hartley be developed. The enhanced safety works program includes existing commitments such as the completed works at the top and bottom curves of Victoria Pass. Proposed safety improvements along the Great Western Highway for the Mount Victoria township would comprise intersection, pavement and pedestrian safety improvements. New safety works throughout Hartley Valley including intersection upgrades and pavement works were also recommended in the NSW Government Review

The purpose of the enhanced safety program would be to provide medium term solutions for safety improvements throughout the corridor between Mount Victoria and Lithgow and provide the most effective use of currently available funding. Design development and environmental assessment of the enhanced safety works program is currently underway.

2.1.3 Road network and historical crash data

Road network

Traffic on the Great Western Highway at Forty Bends was recorded as about 7900 vehicles per day (two way), calculated using automatic tube counts during May 2011. Existing Levels of Service (LoS) on the Great Western Highway have been assessed as generally being LoS A, with part of the highway assessed as LoS B in the PM peak period. Of the 7900 vehicles per day, about 14.7 per cent were classified as heavy vehicles. The recorded traffic volumes on the local connecting roads were substantially lower, with about 370 vehicles per day (two way) on McKanes Falls Road and about 100 vehicles per day on Forty Bends Road per day (two way).

Based on previous traffic surveys and growth predictions, a linear traffic growth rate of 1.7 per cent per annum has been adopted for light vehicles and 1.3 per cent per annum for heavy vehicles. The forecasted traffic volumes and road performance for the Great Western Highway predicts about 8400 vehicles per day (two way) in 2015 and about 9900 vehicles per day (two way) in 2025.

The forecasted traffic flows on the local roads are predicted to be between about 380 and 400 vehicles per day (two way) on McKanes Falls Road in 2015 and 2035 respectively and between about 100 and 110 vehicles per day on Forty Bends Road per day (two way) in 2015 and 2035 respectively.

Historical crash data

Crash data between January 2004 and December 2010 recorded 38 crashes, of which two were fatal crashes and 19 were injury crashes (refer to Section 6.7 and Figure 6-18 for further details). Analysis of the crash data indicates that the majority of crashes occurred east of Forty Bends Road (western intersection with Great Western Highway). Out of the 38 crashes, over 60 per cent were the result of vehicles leaving the carriageway on a curve or while turning. The two fatalities occurred in 2004 in wet conditions, both involving heavy vehicles and within the vicinity of McKanes Falls Road and Forty Bends Road intersections. One fatality was the result of the vehicle leaving the carriageway while the other involved a head on collision.

The crash history for the section of the Great Western Highway between Mount Victoria and Lithgow (including the proposal site) is about three and a half times higher than the State Plan target, and up to 50 per cent higher than the state average of 30.4 per 100 million vehicle kilometres travelled (MVKT) for a two lane two way roadway (RTA, 2008a).

The Sydney – Dubbo Corridor Strategy (refer to Section 2.1.2) also identifies that the section of the Great Western Highway between Mount Victoria and Lithgow has the highest crash rate per 100 MVKT (Auslink 2007).

Twenty five crashes occurred between 2004 and 2008, of which 80 per cent of the crashes occurred in conditions of poor visibility (raining, overcast or snow/ice). Crash data between 2009 and 2010 did not provide the conditions for the crashes.

The proposal is expected to improve these crash rates by:

- Improving the existing road geometry from the series of bends to a single large radius curve.
- Improving intersections between the highway and local connecting roads and reducing conflict points.
- Moving the alignment of the highway to the south further away from Hassans Walls to allow additional sunlight to reach the road surface, reducing the likelihood of black ice forming.

Further details regarding the existing road network and historical crash data is provided in Section 6.7 of this REF.

2.2 Existing road and infrastructure

2.2.1 Great Western Highway

The Great Western Highway at Forty Bends is a classified State Highway which provides an important link in the NSW regional road network by providing a key freight transport link over the Blue Mountains. The operational speed limit of this section of the highway is currently 80 kilometres per hour and has an annual average daily traffic (AADT) of about 7900 vehicles per day (two way) and about 8200 vehicles per day at South Bowenfels, to the west of McKanes Falls Road. Vertically, the alignment is generally undulating with a maximum grade of 7.8 per cent.

The existing road is about 2.8 kilometres in length and operates predominantly as a three lane, undivided two-way carriageway. This existing road was constructed in the late 1950's/early 1960's with the existing overtaking lanes provided in the 1980's. At the eastern and western extents of the proposal the existing road operates as a two lane, undivided carriageway. Additionally, a concrete (F-Type) central barrier separates the carriageways east and west of Whites Creek for a total distance of 400 metres. This barrier was installed in 2004.

The carriageway is currently comprised of two to three lanes (both eastbound and westbound) with typical lane widths of about 3.5 metres. Along the Forty Bends section, the existing carriageway width varies from about 11 metres to 19 metres. A shoulder generally runs parallel to both the eastbound and westbound lanes for the length of the existing highway length of the proposal. Shoulder widths vary from 0.5 metres to 2.0 metres and narrow in locations adjacent to safety barriers.

The existing highway does not contain any pedestrian paths or dedicated bus lanes. One bus stop is located at the intersection of the Great Western Highway and the western end of Forty Bends Road. Guardrails are currently provided intermittently along the existing alignment where steep gullies or drop offs from the existing road level are present.

Examples of the existing highway design are shown in **Photo 2-1** and **Photo 2-2** below.

Source: Spackman Mossop Michaels, 2012

Photo 2-1: Example of the existing highway east of Whites Creek showing the concrete (F-Type) barrier

Source: Spackman Mossop Michaels, 2012

Photo 2-2: Typical example of the existing highway west of Whites Creek

There are currently three unsignalised intersections along the Great Western Highway within the proposal site as described below:

- Forty Bends Road eastern end – this intersection provides full vehicle movement with no dedicated turning lanes provided.
- Forty Bends Road western end – this intersection provides full vehicle movements with a short (about 50 metres) eastbound, right turning lane from the existing highway.
- McKanes Falls Road – This intersection provides full vehicle movements with left and right turning lanes (about 120 metres) from the existing highway.

Examples of the existing highway intersections are shown in **Photo 2-3** to **Photo 2-5** below.

Source: Mount Victoria to Lithgow Alliance, 2011

Photo 2-3: Example of the existing highway at the intersection with Forty Bends Road (eastern end)

Source: Spackman Mossop Michaels, 2012

Photo 2-4: Example of the existing highway at the intersection with Forty Bends Road (western end)

Source: Mount Victoria to Lithgow Alliance, 2011

Photo 2-5: Example of the existing highway at the intersection with McKanes Falls Road

There are a number of properties along the existing highway which have direct access onto the highway, five of which are residential. Additionally, Daintree Close does not intersect directly with the highway, but joins Forty Bends Road near its western extent. No formal refuges for cars are provided along the existing highway, however two information refuges are located on the southern side of the highway west of Whites Creek.

Existing pavement drainage at this section of the Great Western Highway is limited to the collection of runoff from Hassans Walls and stormwater from the road surface in cross drainage culvert pipes which discharge to existing drainage lines to the south of the existing highway alignment. The existing highway has some gutters (dish drains) which conveys stormwater runoff from the road edge to the cross drainage culverts under the existing alignment.

These generally lie on the northern side of the highway and are present when the cross fall of the highway drains in that direction. A table of all of the existing culverts located along the existing alignment of the Great Western Highway are provided in **Table 2-1** below.

Table 2-1: Existing drainage culverts and locations

No.	Approximate chainage	Size
1	30800	2 x 525mm
2	30920	600mm
3	31040	450mm
4	31060	900mm
5	31061	900mm
6	31230	450mm
7	31360	1050mm
8	31460	1050mm
9	31700	2 x 1200mm
10	31780	2 x 450mm
11	31800	2 x 600mm
12	31920	600mm
13	32040	450mm
14	32080	450mm
15	32240	2 x 600mm
16	32300	2 x 600mm
17	32380	2 x 750mm
18	32540	2 x 600mm
19	32720	450mm
20	32760	2 x 600mm
21	32780	375mm
22	32960	600mm
23	33100	600mm
24	33200	2 x 300mm
25	33340	900mm
26	33120	600mm

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

- Highway draining to the south – Stormwater runoff from the existing highway is allowed to drain over the edge and down the embankment. The runoff is collected in natural channels and gullies before connecting to the minor creek lines draining to the south.
- Highway draining to the north – Stormwater runoff from the existing highway collected in dish drain type gutters at the road edge and conveyed to the existing culvert locations. The dish drains discharge the runoff to these culverts which convey the stormwater to the minor drainage lines which join Whites Creek.

There are no defined longitudinal drainage pits and pipes on the existing highway as the stormwater drainage system is integrated with the cross drainage system as outlined above.

A high voltage, 132 kV power line easement also crosses the existing alignment near Chainage 32700 (refer to **Figure 1-1**). This easement consists of a generally north–south easement with a cleared vegetation width of about 30 metres. A number of underground utilities have been identified within the proposal site including telecommunications, electricity and water. Further information regarding existing utilities is provided in Section 3.5.1 of this REF.

2.2.2 Local roads

The proposal site includes three local roads, all to the south of the proposal alignment. These roads include Forty Bends Road (located towards the eastern end of the proposal site), Daintree Close (which connects to the western end of Forty Bends Road) and McKanes Falls Road (located towards the western end of the proposal site).

Forty Bends Road and Daintree Close are narrow unmarked two-way undivided roads that are typically only used for access to private properties along these roads. Both of these roads are currently not signposted for speed but would have a speed limit of 50 kilometres per hour consistent with Lithgow City Council requirements. McKanes Falls Road is a two-lane two-way undivided road with no shoulders and provides access between the Great Western Highway and Jenolan Caves Road approximately seven kilometres to the south. McKanes Falls Road is signposted at 80 kilometres per hour.

All of the local roads within the proposal site have been identified as having low traffic volumes (between about 100 vehicles per day (two way) on Forty Bends road and about 370 vehicles per day (two way) on McKanes Falls Road).

Examples of the existing local roads within the proposal site are shown in **Photo 2-6** and **Photo 2-7** below.

Source: Mount Victoria to Lithgow Alliance, 2012

Photo 2-6: Typical view of Forty Bends Road

Source: Mount Victoria to Lithgow Alliance, 2012

Photo 2-7: Typical view of McKanes Falls Road

2.3 Proposal objectives

The objectives for the proposal are:

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

These objectives are consistent with the overall objectives for the Great Western Highway upgrade program as described previously in Section 2.1.2.

2.4 Alternatives and options considered

2.4.1 Consideration of alternatives

A series of investigations were initiated in June 2008 in order to assist in the identification of feasible route options for the upgrade of the Great Western Highway between Mount Victoria and Lithgow. These investigations included constraints mapping, workshops, and environmental investigations. The identified corridors were presented in the *Mount Victoria to Lithgow Great Western Highway Upgrade – Study area investigations and Corridors identification* report (RTA, 2008b).

As part of the corridor identification process, the following alternatives were identified and considered:

- Do nothing (base case).
- Upgrade the Great Western Highway within the identified Mount Victoria to Lithgow study area. Four main corridors were identified within the study area:
    - Purple corridor.
    - Green corridor.
    - Red corridor.
    - Orange corridor.
- Alternative route (Newnes Plateau corridor).

Alternative 1: Do nothing (base case)

The 'do nothing' or base case option would retain the existing alignment and seek to only undertake maintenance activities when required. The main advantages of a 'do nothing' option would include no environmental disturbance and no amenity impacts as a result of construction activities that would occur during an upgrade scenario. Disadvantages of a 'do nothing' option would include ongoing safety issues and increased travel times. The number of accidents would be expected to increase along this section of the highway as the volume of traffic increases over time.

This option would not meet the objectives of the NSW State Government's Great Western Highway upgrade program, the objectives of the Mount Victoria to Lithgow upgrade or improve the overall safety along this section of the highway. Accordingly, the 'do nothing' option was discounted as a feasible option and was not considered further.

Alternative 2: Upgrade the Great Western Highway

Purple corridor

The purple corridor extended along Darling Causeway before dropping into the Hartley Valley in the vicinity of the Hartley Vale Road. It then extended along the northern boundary of the identified study area, to the north of the River Lett before rejoining the existing alignment of the Great Western Highway in the vicinity of Forty Bends.

By following the topographical constraints of the investigation area, an advantage of the Purple corridor would be that it would not result in the severance of the Hartley Valley, minimising potential impacts on the associated social and heritage constraints. However, despite avoiding the constraints associated with the existing highway at Victoria Pass and River Lett Hill, there would still be topographical constraints associated with entering the valley.

From a noise perspective, this corridor would impact upon currently unaffected sensitive receivers, although the numbers of such receivers would be relatively low. From a heritage perspective, the Purple corridor would minimise impacts on the heritage constraints of the investigation area. Additionally, the Purple corridor would not provide convenient connection for residents of the Hartley Valley. In terms of environmental considerations, the Purple corridor would generally follow the alignment of the wildlife corridor and has to potential to result in severance impacts upon this fauna passageway (RTA, 2008b).

Of the four corridors identified, the Purple corridor would have a direct impact on the fewest number of residential dwellings. The Purple Corridor would not considerably affect the development of the rural residential land between Little Hartley and Hartley, although access to these areas would generally be via the existing highway.

Green corridor

The Green corridor extended along Darling Causeway before dropping into the Hartley Valley and passing to the north of Collits Inn (Hartley Vale)and extending south of the River Lett before crossing the river. The corridor then followed the same route as the Purple Corridor along the north-eastern boundary of the investigation area before rejoining the existing alignment in the vicinity of Forty Bends.

The Green corridor predominantly bypassed Mount Victoria and would therefore avoid the social and heritage issues associated with the highway through this township. In addition the Green Corridor would generally avoid the heritage items located along the existing highway throughout the valley. The Green corridor would also avoid the large extent of rural residential development between Little Hartley and Hartley, although some potential impacts on residential dwellings and sensitive noise receivers would still occur. The Green corridor would also not provide convenient connection for residents of the Hartley Valley.

The Green corridor would be located in close proximity to two recorded Aboriginal heritage sites and would have the potential to encounter unrecorded sites due to its proximity to the River Lett and its tributaries. The close proximity to these waterways would also increase the potential for the Green Corridor to impact upon priority fauna habitat and endangered ecological communities, particularly Tableland Grassy Box-Gum Woodland. As with the Purple corridor, the development of feasible route options within the Green corridor considered the potential to fragment the Blue Mountains western escarpment wildlife corridor and the subsequent need for fauna crossing structures.

Red corridor

Red corridor extended through Mount Victoria and down into the Hartley Valley in the region of Berghofers Pass. It would then extend in a north-westerly direction to join the Purple Corridor along the north-western boundary of the investigation area before rejoining the existing alignment in the vicinity of Forty Bends.

From a social perspective, the Red Corridor would involve travelling across the valley floor, between Hartley and Hartley Vale, resulting in potential community severance issues. The Red Corridor would have the potential to have the greatest impact on rural residential development where it travels across the northern portions of the large extent rural residential land situated between Hartley, Little Hartley and Hartley Vale. As such, there is also the potential to directly and indirectly affect a greater number of residents than the other corridors.

Water quality and hydrological impacts would also be an important consideration for this corridor due to the potential number of river and creek crossings. In addition, a number of recorded Aboriginal heritage sites have been recorded within the Hyde Park Reserve that may be impacted by the corridor. From a non-Aboriginal heritage perspective, the main areas for consideration for the Red Corridor would include the township of Mount Victoria and in the vicinity of Forty Bends. By travelling to the north of the existing highway, the Red Corridor would avoid the heritage constraints located within Little Hartley and Hartley.

The Red Corridor would also have the potential to directly affect and potential fragment areas of endangered ecological communities to the north of Hartley, particularly the Tableland Granite Grassy Woodland. The Red corridor also currently passes in close proximity to the recorded site of the endangered *Asterolasia buxifolia*. The Red corridor would provide some improved connectivity for residents of the Hartley Valley over the Purple and Green corridors.

Orange corridor

Orange corridor would essentially follow the existing alignment of the Great Western Highway, with various sub-options allowing for deviations to improve safety, minimise impact on the natural environment, heritage and local communities.

As with the Red Corridor, the Orange corridor would bypass to the north of the township of Mount Victoria and provide the most convenient connection for residents of the Hartley Valley. By following the alignment of the existing highway, the Orange corridor would not involve the generation of impacts in areas currently unaffected by a highway and, from a noise perspective, would therefore not impact upon currently unaffected sensitive receivers.

The Orange corridor would however be constrained by the European heritage items that currently straddle the Great Western Highway through Hartley Valley, including the State heritage listed Hartley Historic Site and the Fernhill property in addition to a number of LEP listed heritage items. The Orange corridor would also potentially affect Aboriginal heritage items recorded within the Hartley Valley.

In terms of environmental considerations, there would be a large number of threatened flora and fauna species recorded in the vicinity of Mount Victoria and three different types of endangered ecological communities are encountered by the Orange corridor, predominantly to the west of Hartley.

Alternative 3: Alternative route (Newnes Plateau corridor)

The Newnes Plateau alternative study (Cardno, 2008) was commissioned by the RMS (then Roads and Traffic Authority) in response to requests from members of the community to consider alternative options to the corridor studies discussed above. The Newnes Plateau alternative study investigated the viability of an alternative corridor from Marrangaroo to Newnes Plateau (including the Department of Defence site at Marrangaroo), across the Darling Causeway and to the east of Mount Victoria.

As with the development of the four corridor options identified above, the environmental, heritage and social constraints within the Newnes Plateau study area were identified and mapped. A corridor selection program was then used to identify the least constrained path across the Newnes Plateau. A broad evaluation of advantages and constraints of this corridor was carried out to ensure the engineering and economic viability of the alignment. The outcome of this process was the identification of the Newnes Plateau alternative corridor (Cardno, 2008).

The Newnes Plateau alternative corridor was considered to be feasible and result in similar impacts in terms of engineering, environmental and other factors to those of the other identified corridors. However, the RTA received correspondence from the Department of Defence that indicated the Department had a long-term need to retain its Marrangaroo facility. Routes to the north and south of the Department of Defence land were then considered, but found not to be viable due to increased road length, steep grades, and associated impact on travel speeds (factors that would make these routes unattractive to road users). For these reasons, the RTA was not able to further consider the Newnes Plateau alternative corridor and this option was not taken forward (RTA, 2009).

Summary

Following the assessment of all the potential route options identified above, the Minister for Road announced on 27 August 2009 that following community inputs and in light of the considerations identified, the preferred option for the upgrade of the Great Western Highway between Mount Victoria and Lithgow was the Orange Corridor. Accordingly, the Orange Corridor option was further developed as the preferred option as part of the *Great Western Highway Preferred Route Report* (RTA, 2010) and the *Great Western Highway Concept Design – Concept Report* (RMS, 2012a).

2.4.2 Methodology for selection of preferred option

Six main options were developed for the proposal. Due to the narrow road corridor and residential, heritage and other environmental constraints to the north and south of the highway, the alignment investigated generally followed the existing road corridor.

Two sub-options were also developed for the crossing of Whites Creek (bridge or fill embankment) and three sub-options were developed for black ice mitigation measures. These sub-options were considered in parallel with each of the six options.

Additional criteria

The options and the sub-options developed were evaluated against the following criteria as part of a multi-criteria analysis (MCA) of each option:

- Consistency with the proposal objectives – being improved road safety, improved road freight efficiency, catering for a mix of through, local and tourist traffic and sensitivity to the natural environment, including heritage and local communities.
- Value for money – including capital costs and maintenance and operational costs.
- Engineering constraints – including road geometry, geotechnical constraints, structure requirements, utility impacts, traffic performance impacts, local road connections, constructability and traffic management constraints, drainage and hydrology impact and impacts on urban design.
- Community and stakeholders – including minimising impacts to properties, accessibility, community acceptance and community benefits.
- Environmental – including impacts to Aboriginal heritage, non-Aboriginal heritage, biodiversity, noise and vibration, urban design, the community and businesses.

The black ice mitigation measure sub-options were also considered against the following additional criteria:

- Cold air drainage – Restrict the amount of cold air drainage down the slope onto the road surface.
- Cold air pooling – Prevent cold air from pooling on the road surface.
- Heat radiation – Minimise loss of heat from the road surface during winter nights.
- Microclimate – Consider the influence of microclimate associated with vegetation close to the road.

General methodology

Three options were considered at a value engineering workshop held in January 2012. Workshop participants included RMS and Alliance staff including representatives from the environment and design teams as well as other specialists including heritage, biodiversity, urban design, water quality and constructability.

The objective of this workshop was to review the various road alignment options that had been developed with the aim of selecting a preferred alignment option for further refinement. Option 1, Option 2 and Option 3 were assessed at this workshop as described in Section 2.4.3.

It was agreed at the meeting that there were advantages and disadvantages associated with both Option 2 and Option 3. It was agreed at the conclusion of the value engineering workshop that a combination of these options should be further refined. Following the workshop in January 2012, three additional options were developed, to further reduce the footprint of the preliminary preferred option. The options analysis was undertaken against the project objectives and using the assessment criteria detailed above. These were Option 4, Option 5 and Option 6 (refer to Section 2.4.3 below).

Since the display of the overall Mount Victoria to Lithgow Concept Design, some design refinements have been made based on community, stakeholder and agency feedback and the results of ongoing technical investigations (refer to Section 2.6).

2.4.3 Identified options

Six options (plus a 'do nothing' option) were considered for the alignment of the Great Western Highway through Forty Bends. The options do not involve any substantial deviation from the existing highway alignment and seek to use the preferred route corridor identified as part of the route options phase (May 2008). Each option comprises three lanes with provision for a future fourth lane when required.

The six main options and the 'do nothing' option considered for the alignment of the Great Western Highway through Forty Bends are briefly described below. All options would function in a similar manner operationally. Options considered generally included alignment variations, varying earthworks balances and different design speed limits.

'Do nothing' option

The do nothing option for the proposal has been considered previously in Section 2.4.1. As this option would not meet the objectives of the NSW State Government's Great Western Highway upgrade program, the objectives of the Mount Victoria to Lithgow upgrade or improve the overall safety along this section of the highway, the 'do nothing' option was discounted as a feasible option and was not considered further.

Highway alignment option 1

This option would provide a three lane, 90-kilometre per hour design speed (east of McKanes Falls Road). This option would also provide a side road off Forty Bends Road parralell to the proposal that provides access to two properties to the west of Daintree Close. The design would require about 231,000 cubic metres of imported fill and include two retaining walls of 4.0 metres and 4.5 metres in height. The bridge at Whites Creek (refer to sub-options below) would be 150 metres long.

Highway alignment option 2

This option would provide a three lane, 100-kilometre per hour design speed (east of McKanes Falls Road). All proposed property access for this option would be similar to the property access that is provided from the current highway design. The design would require about 163,000 cubic metres of imported fill and include two retaining walls of six metres and seven metres in height. The bridge at Whites Creek would be 150 metres long.

Highway alignment option 3

This option would provide a three lane, 100-kilometre per hour design speed (east of McKanes Falls Road). This option would slightly augment the alignment of the western end of Forty Bends Road. The design would result in about 4000 cubic metres of excess fill (balanced earthworks) and would require two retaining walls of 4.5 metres and seven metres in height. The bridge at Whites Creek would be 120 metres long.

Highway alignment option 4

This option would provide a three lane, 100-kilometre per hour design speed (east of McKanes Falls Road). This option would also provide an amended alignment of the western end of Forty Bends Road including relocation of the western intersection with the main highway alignment about 200 metres west of the existing intersection. The design would require about 40,000 cubic metres of imported fill and would require three retaining walls with a maximum height of eight metres. The bridge at Whites Creek would be 150 metres long.

Highway alignment option 5

This option would provide a three lane, 100-kilometre per hour design speed (east of McKanes Falls Road). This option would also provide an amended alignment of the western end of Forty Bends Road including relocation of the western intersection with the main highway alignment about 200 metres west of the existing intersection. The design would require about 166,000 cubic metres of imported fill and would require three retaining walls of 3.7 metres, 4.5 metres and seven metres in height. The bridge at Whites Creek would be 150 metres long.

Highway alignment option 6

This option would provide a three lane, 100-kilometre per hour design speed (east of McKanes Falls Road). This option would also provide an amended alignment of the western end of Forty Bends Road including relocation of the western intersection with the main highway alignment about 200 metres west of the existing intersection. The design would require about 72,000 cubic metres of imported fill and would require three retaining walls of 5.6 metres, two of seven metres in height. The bridge at Whites Creek would be 150 metres long.

The various options for the alignment of the proposal are provided in **Figure 2-2** to **Figure 2-7**.

An analysis of the six main options considered for the alignment of the proposal is provided in Section 2.4.4 below.

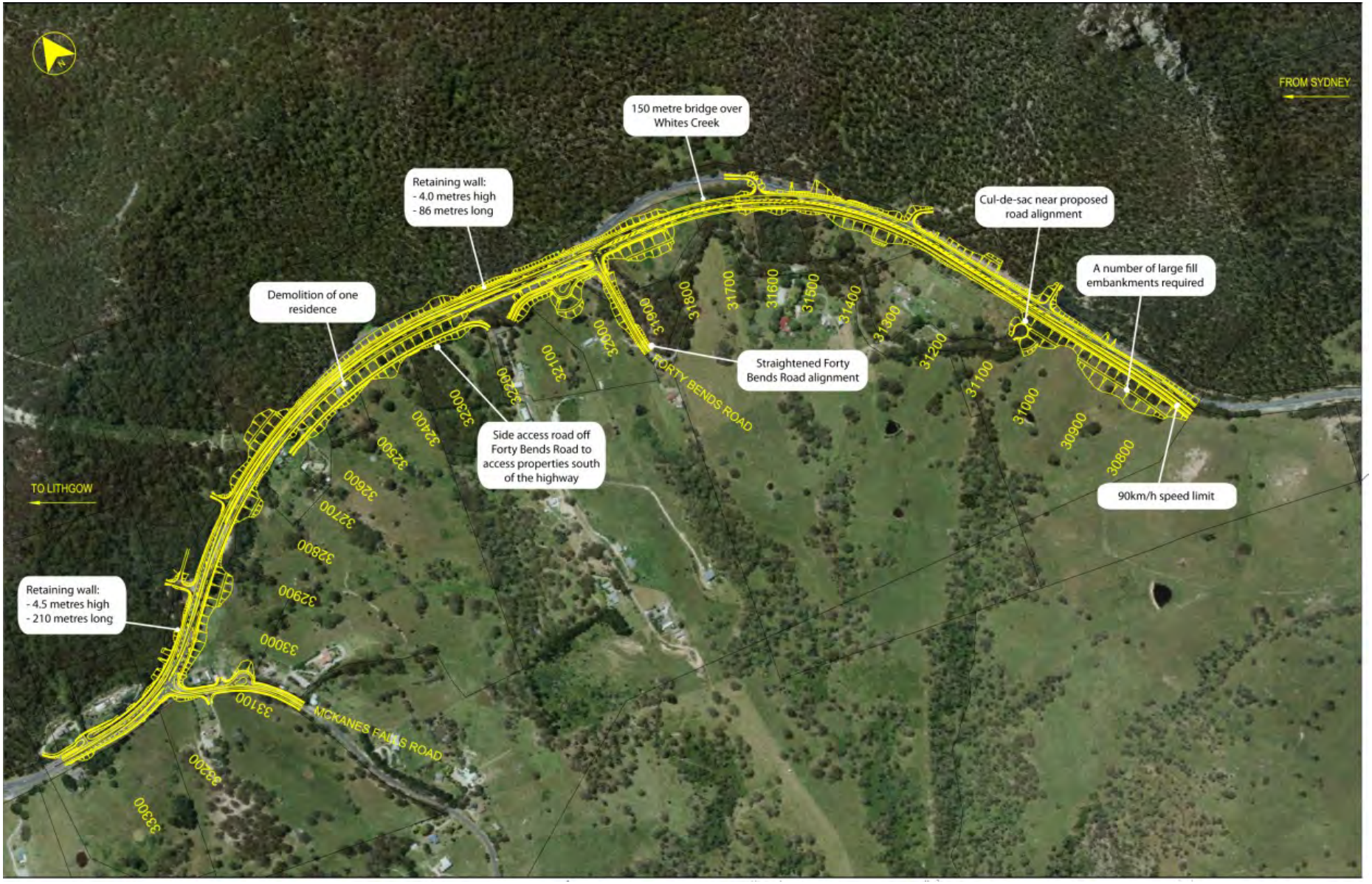


Figure 2-2: Highway alignment Option 1 (base case)

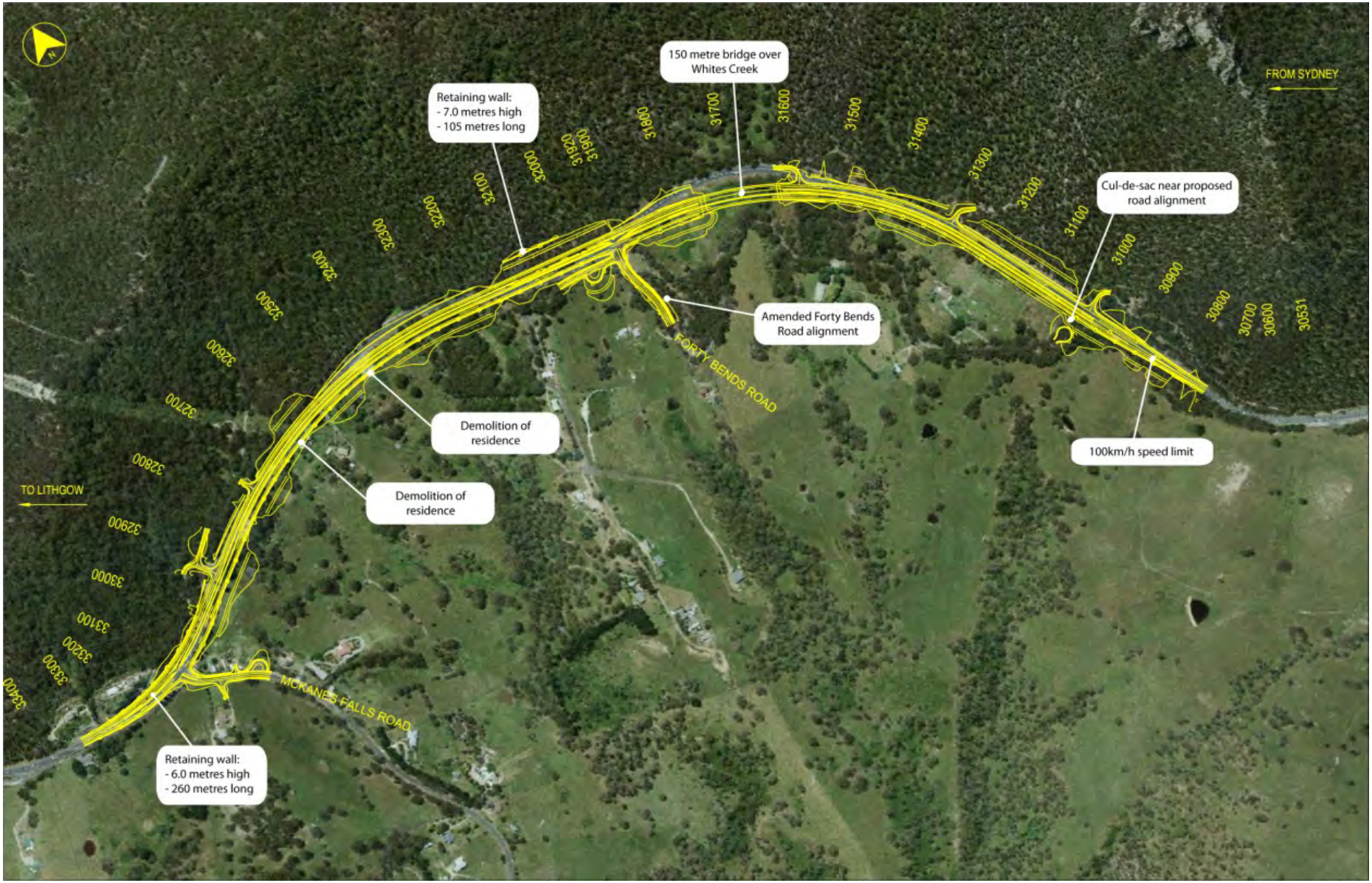


Figure 2-3: Highway alignment Option 2

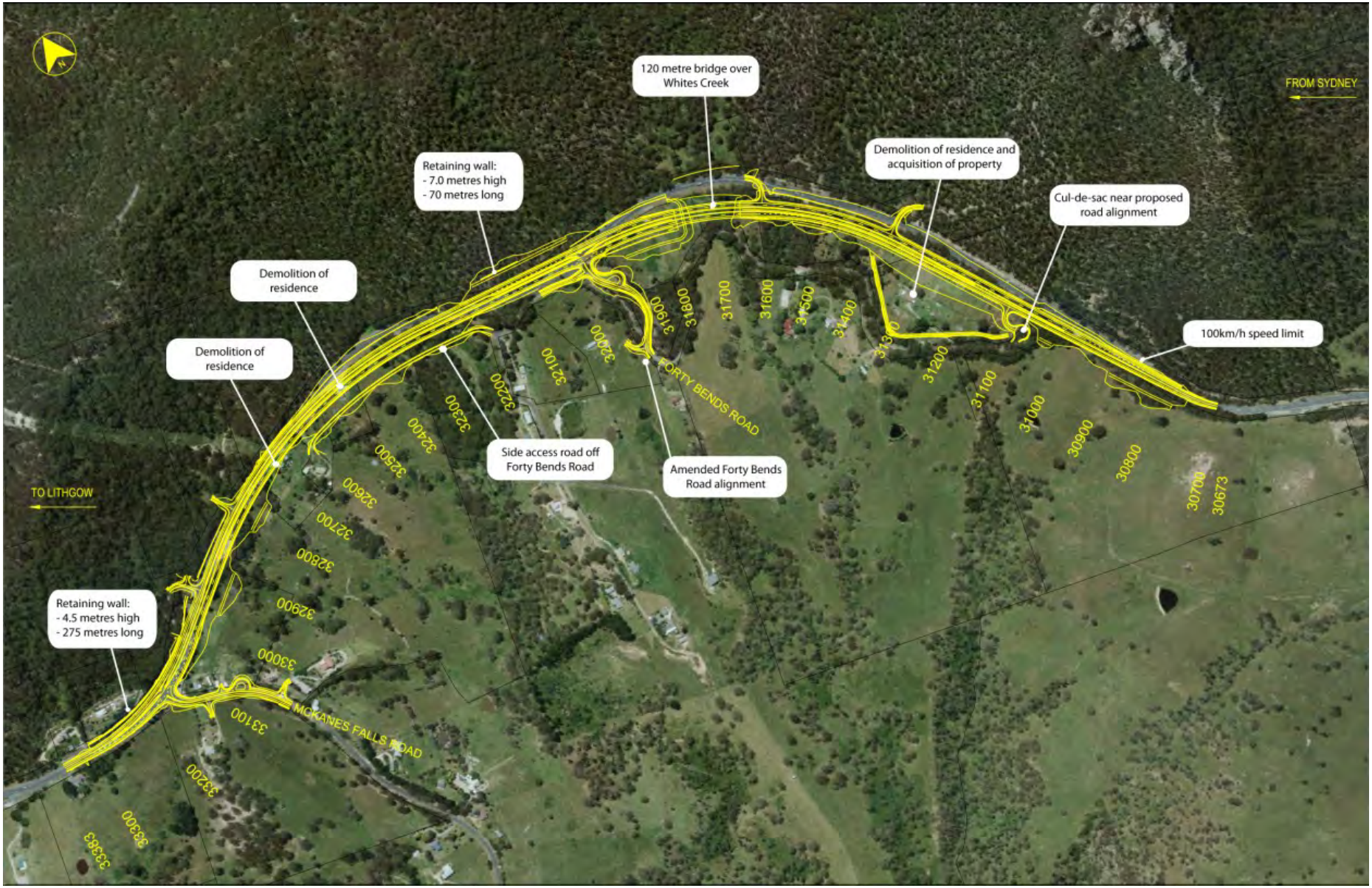


Figure 2-4: Highway alignment Option 3

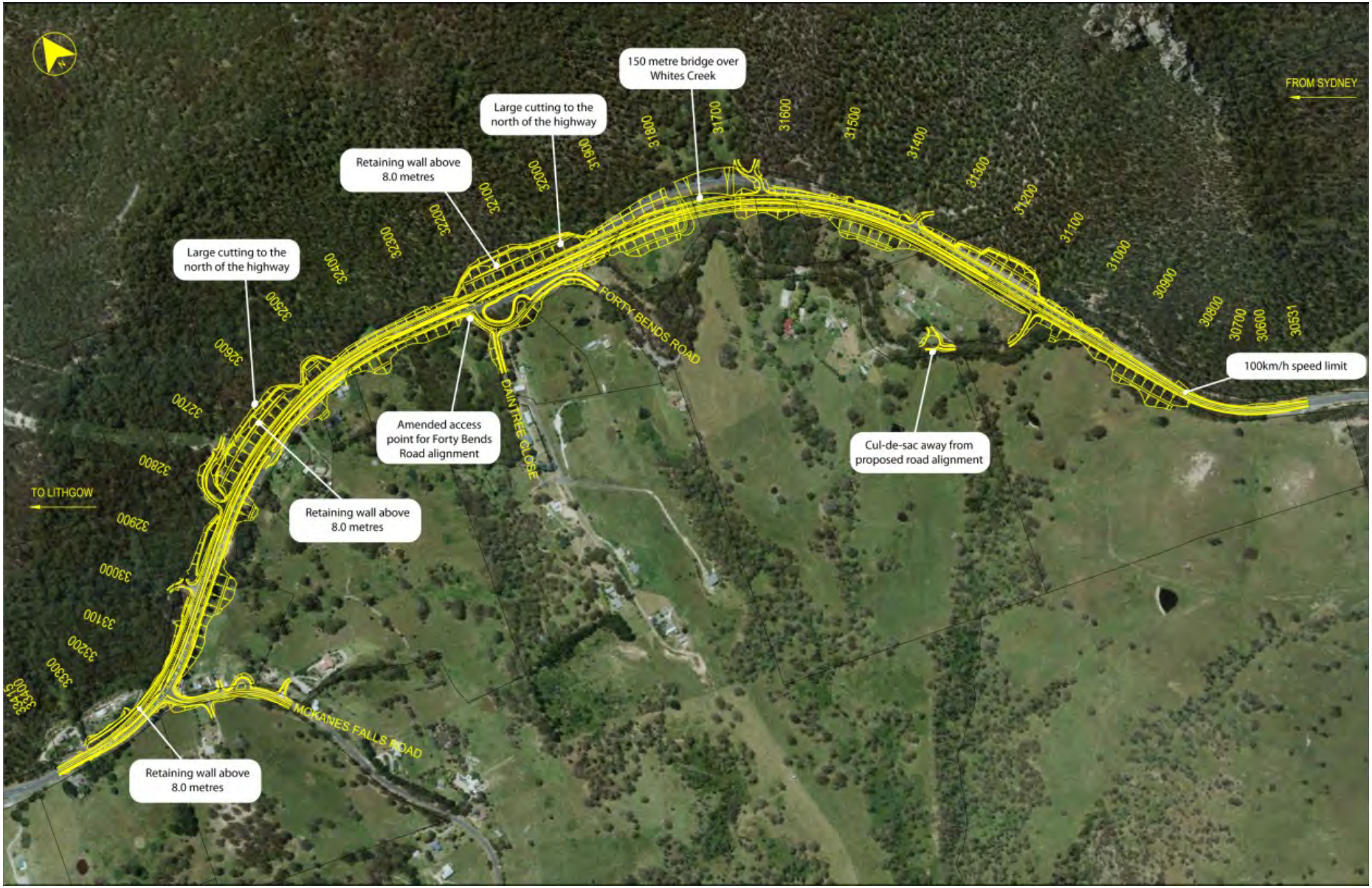


Figure 2-5: Highway alignment Option 4

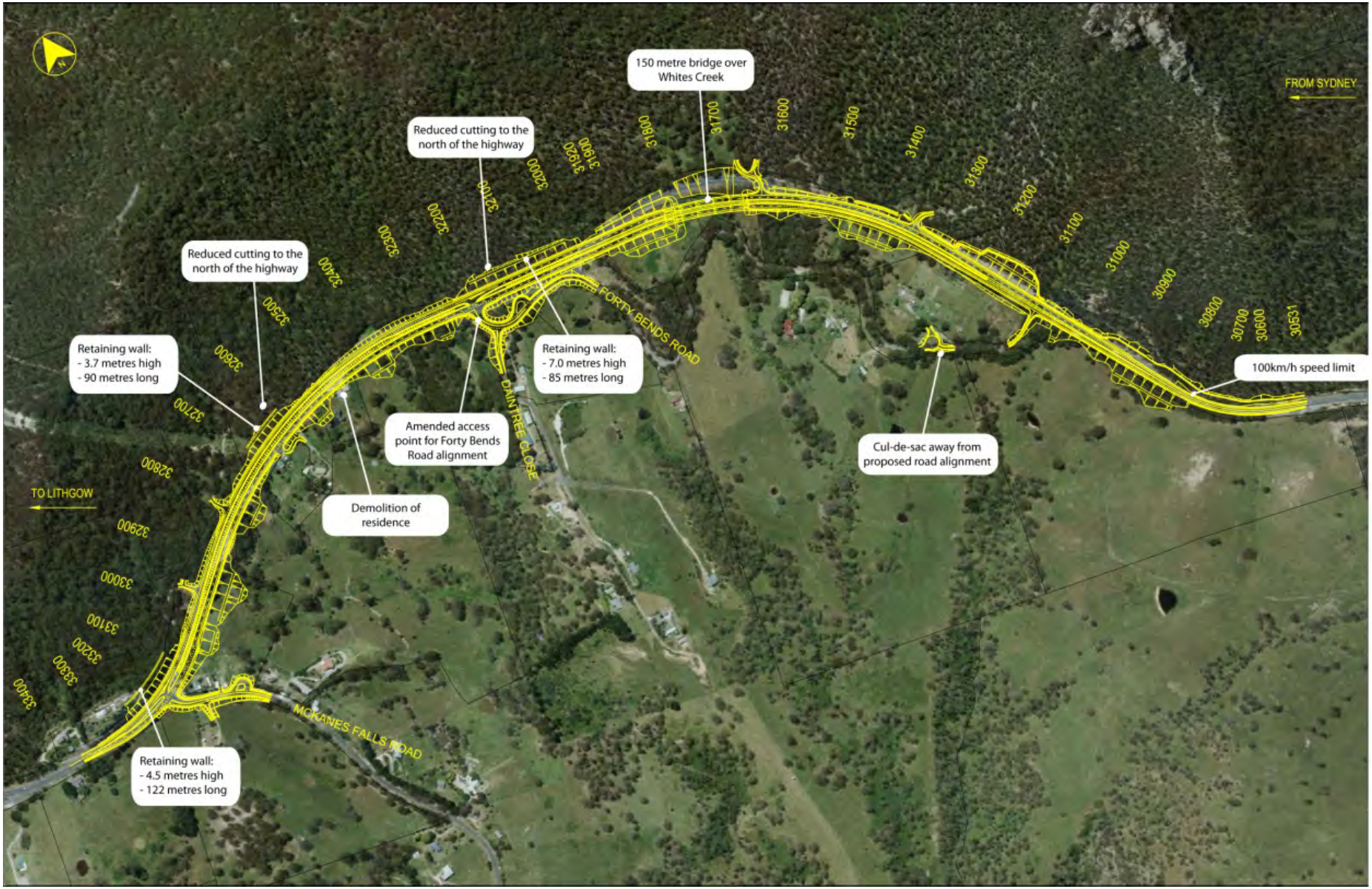


Figure 2-6: Highway alignment Option 5

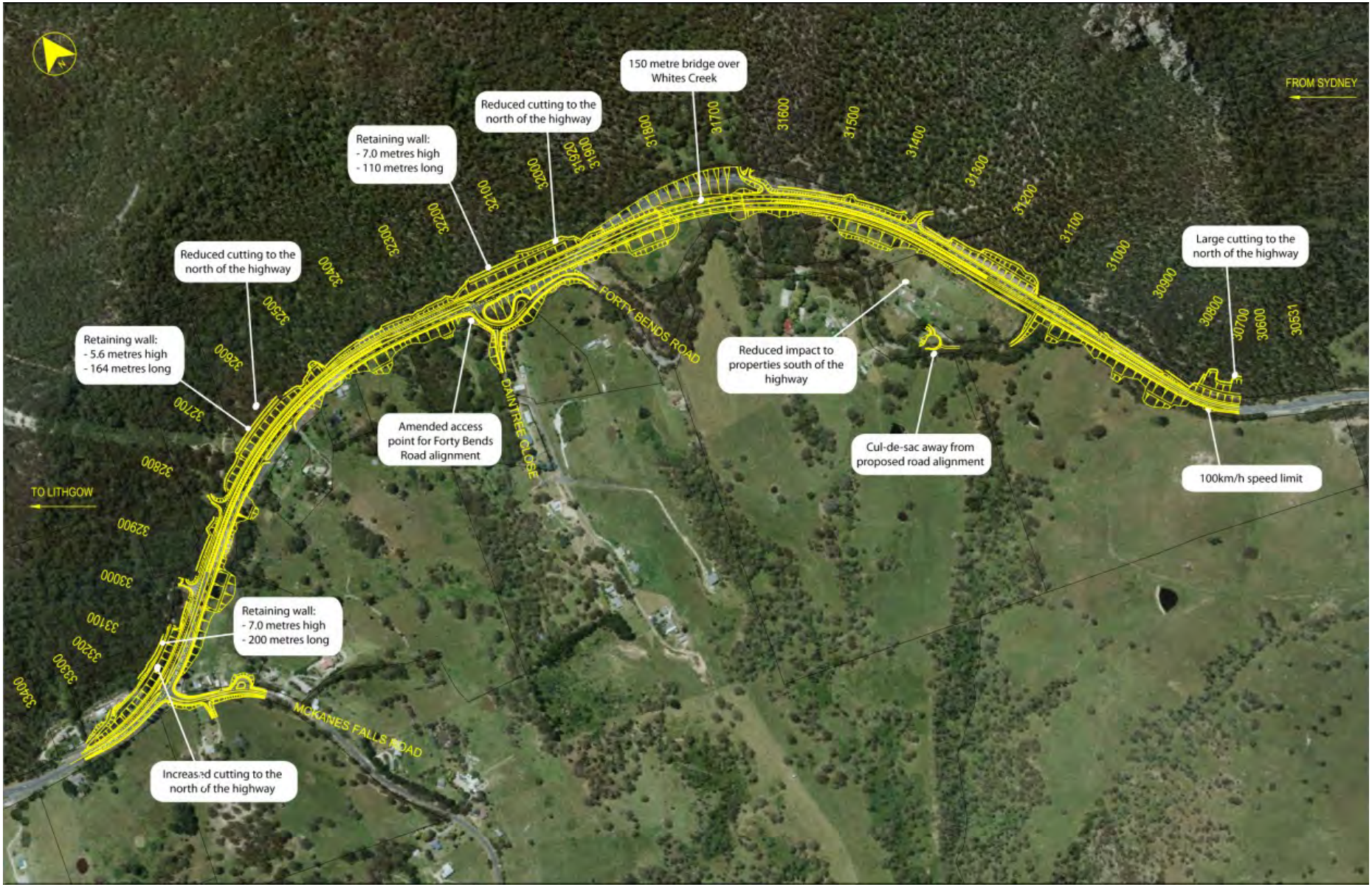


Figure 2-7: Highway alignment Option 6

Identification of sub-options for Whites Creek crossing

Whites Creek crosses the proposal site towards the eastern end of the proposal around Chainage 31700 (refer to **Figure 1-1**) At Whites Creek, the alignment traverses between Forty Bends Road and the existing Great Western Highway. Two sub-options were considered for the White's Creek crossing:

- Whites Creek crossing sub-option 1 – This option would comprise a fill embankment, similar to adjacent stretches of the proposal to span across Whites Creek. At the proposal road level, the embankment would be about 20 metres above existing ground at its highest point. Due to the natural sloping topography, the embankment would extend about 50 metres in width before meeting the ground level on the southern side. Option 2a would include a box culvert for Whites Creek and another box culvert for fauna passage. The embankment would also cover a portion of the existing Forty Bends Road, requiring it to be realigned slightly to the south of the existing alignment.
- Whites Creek crossing sub-option 2 – This option would comprise two bridges (one for each direction of traffic flow). The total length for each bridge would be about 150 metres over five spans and would be up to about 20 metres above the existing ground level.

These options are illustrated in **Figure 2-8** and **Figure 2-9** below.

In addition to the consideration of sub-options for an embankment and a bridge structure, three main bridge design options were considered as part of the design refinement process. The bridge design options that were considered included the following:

- A 150 metre bridge with five x 30 metre spans.
- A 128 metre bridge with four x 32 metre spans.
- A 130 metre bridge with five x 26 metre spans.

An analysis of the two main options considered for the Whites Creek crossing (the embankment and the bridge) is provided in Section 2.4.4 below.

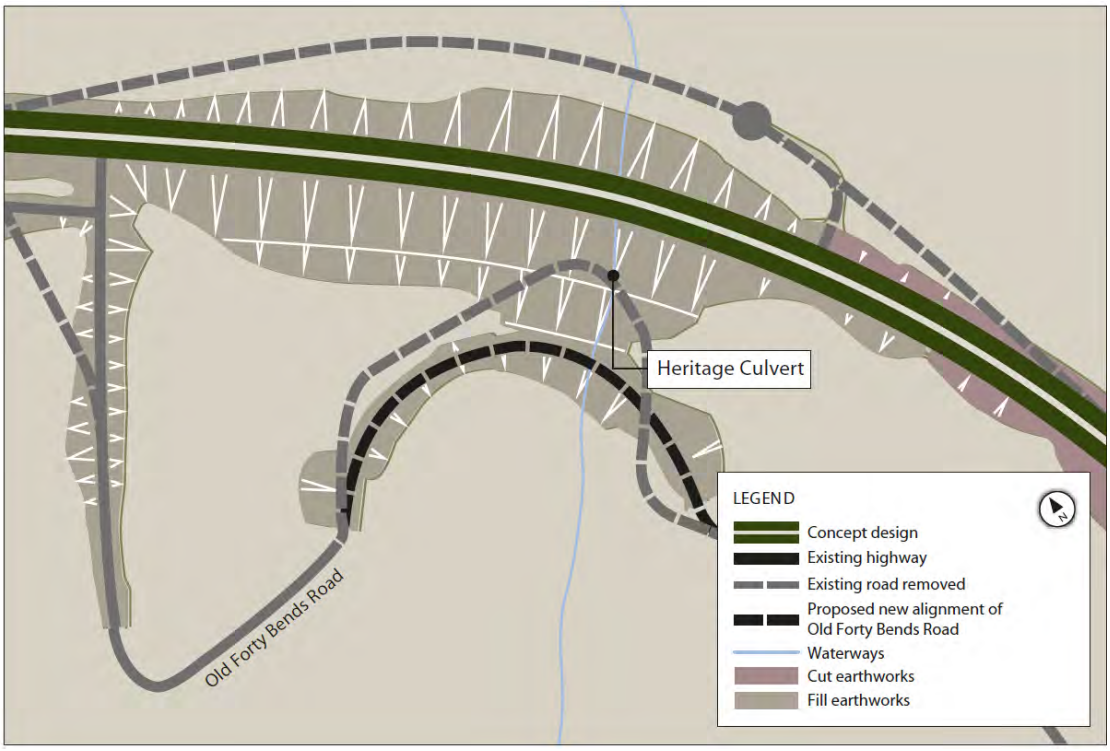


Figure 2-8: Whites Creek crossing sub-option 1

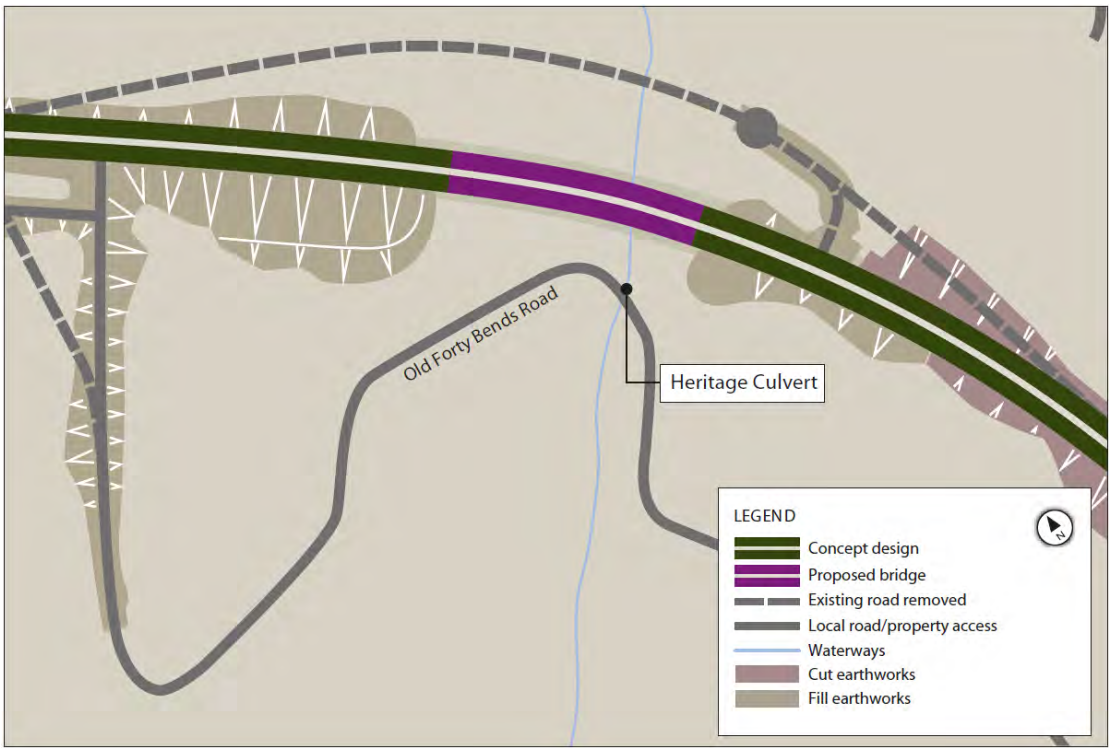


Figure 2-9: Whites Creek crossing sub-option 2

Identification of sub-options for black ice mitigation measures

Black ice formation has been identified as a hazard along the highway at Forty Bends. The formation of black ice is associated with specific meteorological conditions where cold airflow descends from Hassans Walls, known as katabatic drainage.

Three sub-options were considered for the mitigation of black ice:

- Black ice sub-option 1 – This option considered various amounts of vegetation clearance (including five metre, 10 metre and 15 metre clearances) on the whole of the northern side of the proposal alignment. The purpose of the clearing was to allow additional sunlight to reach the road surface, and reduce microclimate effects leading to black ice formation.
- Black ice sub-option 2 – This option considered the provision of a drainage swale on the high side of the highway, with a solid fence structure along the whole of the northern side of the proposal to help collect the cold air and direct it away from the road. This option could be combined with the provision of large drainage culverts under the proposal to allow cold air to pass through.
- Black ice sub-option 3 – This option considered the development of a black ice active maintenance program. This program would include the installation of one or two weather stations supported by a sensor network to monitor the local climate and active control measures such as electronic signage and the application of de-icing chemicals.

It should also be noted that the volume of cold airflow that is currently generated from Hassans Walls would require the implementation of ongoing maintenance measures throughout the life of the highway in Forty Bends, regardless of the proposed options outlined above. This option also includes measures to prevent cold air 'pooling' on the road surface such as wire rope barriers (instead of solid barriers) and road grading to facilitate air flow. This would be considered a 'do nothing' approach to the management of existing black ice conditions along the highway.

An analysis of the three main options considered for black ice mitigation is provided in Section 2.4.4 below.

2.4.4 Analysis of options

Each of the options was analysed against the proposal objectives and the criteria described above in Section 2.4.1. The outcomes of the analysis are described below.

Highway alignment option 1 – Base case

Option 1 would result in a lower design speed than all of the remaining options. This option would result in the loss of an existing residential property on the south side of the proposals' main alignment and require the largest amount of imported fill material. The increased earthworks required as part of this option would also result in significant biodiversity impacts as a result of the larger proposal site area.

This is inconsistent with the proposal objective of being sensitive to the natural environment. Two properties (near chainage 37200, refer to **Figure 1-1**) would also loose direct access to the Great Western Highway, requiring access to be gained by Forty Bends Road to the east.

Visually, this option would limit the use of high retaining walls on the northern side of the main proposal alignment limiting visual amenity impacts, however would require five substantial fill embankments to the south of the main alignment, impacting on the visual amenity for residences south of the existing highway.

The design would also result in the demolition of one existing private residence which is inconsistent with the MCA criterion that aims to minimise impacts to properties (refer to Section 2.4.2). In addition, the amount of fill material required to be imported would be substantial and the greatest fill deficit of all options considered (231,000 cubic metres), and as such, this option was not considered to be economically viable. This is inconsistent with the MCA criterion of providing an option that offers value for money. The estimated cost of this option would be the most expensive of all the considered options, with an estimated value of about $99 million.

For the reasons identified above, this Option 1 was not considered to be the preferred option.

Highway alignment option 2

Option 2 included further development of Option 1 to reduce the earthworks imbalance, however the earthworks would still be substantial (third largest deficit of all options). This option would result in the demolition of a listed heritage property on the southern side of the proposal and a second residential dwelling. This is inconsistent with the proposal objective of being sensitive to the natural environment and the MCA criteria of minimising impacts to properties.

As part of this option, the main highway alignment at Whites Creek would be moved slightly closer to Hassans Walls with the aim to reduce the amount of fill in this area. This would result in some improvement in noise levels over the previous option through the movement of the main highway alignment away from the existing residential receivers within the Forty Bends area. This would also result in an improvement with respect to minimising the impact on the natural environment in terms of fill required and resultant vegetation clearance and overall biodiversity impact. The engineering constraints of this option would be similar to those of the other alignment options proposed. The estimated cost of this option would be about $92 million, the third-most expensive of all the options considered.

Visually this option would result in some additional impact in comparison to Option 1 as it would require two retaining walls of increased height and length.

As the amount of fill material required for this option would still be substantial compared with the other options (third largest deficit of all options), would result in the loss of two residential properties, including a listed heritage building, and would represent the third-most expensive option, this option was not considered to be the preferred option.

Highway alignment option 3

Option 3 also considered a further development of Option 1 with the aim of achieving a more balanced earthworks level between the cut and fill volumes. In addition to the loss of two residential properties along the alignment (including the heritage cottage) as part of Option 2, this option would additionally require the full acquisition of a third property towards the eastern end of the design, which would be utilised as a borrow pit to supply fill material for the highway upgrade (assisting with meeting the earthworks balance requirement).

This is inconsistent with the MCA criterion of minimising environmental impacts and reducing impacts on properties and the community, however is more consistent with other identified MCA criterion such as minimising engineering constraints (ie by providing a balanced earthworks level) than the previous two options considered.

Due to the increased proposal site (largest proposal site of all option considered) required to create the proposed borrow pit, this option would result in significant biodiversity and visual impacts. One property, near chainage 32700 (refer to **Figure 1-1**) would also loose direct access to the highway, requiring access to be gained via Forty Bends Road to the east.

The highway east of Whites Creek was also lowered (to a maximum of six metres) and moved to the south to provide additional material and assist with the construction staging. This option would also represent the most cost effective of all the options with an estimated cost of about $80 million. This option would therefore meet the MCA criterion of providing a value for money proposal.

Given the significant property impact required as part of the borrow pit and the loss of three residential dwellings (including a listed heritage item), this option was not considered acceptable based on the substantial negative impacts to local properties and the community.

Highway alignment option 4

Option 4 was a refined version of Option 1, being similar in alignment (horizontally and vertically) to Option 1 but with a 100 kilometre per hour design speed. This option would result in significant cuts to the north of the proposals' main alignment and higher retaining walls than each of the other options considered. These design elements would have significant impacts to both biodiversity (resulting in the largest area of potential vegetation clearing, including an area close to an identified Purple Copper Butterfly habitat) and visual amenity (through the provision of the largest retaining wall heights of all options considered. This is inconsistent with the proposal objective and MCA criterion of minimising environmental impacts, in particular to biodiversity.

Similar to Option 1, Option 4 would result in the loss of one residential property, however, the listed heritage house would be retained. Three retaining walls would also be required, at a height of up to eight metres. This option would not be as compatible in meeting the established design criteria (such as minimising environmental impacts, property impacts and urban design impacts) when compared to the other alignment options identified.

This option would result in a reasonable earthworks balance with the need to import about 40,000 cubic metres of fill which is consistent with minimising engineering constraints. This option would also represent the second-most cost effective of all the options with an estimated cost of about $85 million. This option would therefore meet the MCA criterion of providing a value for money proposal.

Given the proposed loss of the residential dwelling and the increased size of the proposed retaining walls, this option was not considered to be acceptable.

Highway alignment option 5

Option 5 would provide a similar design outcome to Option 2. This option would result in a similarly large amount of fill to be imported (second largest fill deficit of all options of about 116,000 cubic metres) and would be the second most expensive option with an estimated cost of $93 million. Similar to Option 1 and Option 4, Option 5 would result in the loss of one residential property, however, the listed heritage house would be retained, providing an advantage for this option over Option 2 and Option 3.

Similarly to Option 4, this option would result in two moderate cuttings along the northern side of the proposals' main alignment, however the cuttings proposed as part of this option would be smaller in scale, reducing the overall impact of this option on biodiversity and reducing visual amenity impacts.

This option was considered to be unacceptable due to the high fill import requirement and high proposal cost.

Highway alignment option 6

Option 6 would be similar in nature to Option 5 requiring the same estimated amount of fill material and estimated cost, providing a reasonable compromise between the criteria of value for money and minimising environmental constraints.

The advantages of Option 6 over Option 5 include the retention of all properties within the proposal site (reducing impact to properties, the community and heritage), reduced proposal site (resulting in reduced biodiversity impacts) and slightly reduced retaining wall heights (resulting in advantages for this option over other identified options with respect to minimising urban design and visual amenity impacts).

This option is considered to be the preferred alignment for the proposal as it would represent the second-most cost effective of all the options with an estimated cost of about $85 million. This option would therefore meet the MCA criterion of providing a value for money proposal. This option would also reduce biodiversity, heritage and visual amenity impacts compared to the other considered options.

A summary of analysis of the six options is shown in **Table 2-2**.

Based on the analysis of all the options developed and assessed for the main alignment of the highway, Option 6 was determined as the preferred option and is described in more detail as the proposal for this REF in Chapter 3.

Table 2-2: Summary of options considered

Option	Design Speed	Fill requirement (m^3)	Cost ($m)	Residential Impact	Heritage impact
Option 1	90 km/h	- 231,000	$99	Demolition of one residence	Retention of a listed heritage house residence
Option 2	100 km/h	- 163,000	$92	Demolition of one residence	Demolition of one listed heritage house
Option 3	100 km/h	+ 4000 (excess)	$80	Demolition of two residences and the full acquisition of two properties	Demolition of one listed heritage house
Option 4	100 km/h	- 40,000	$85	Demolition of one residence	Retention of a listed heritage house
Option 5	100 km/h	- 166,000	$93	Demolition of one residence	Retention of a listed heritage house
Option 6	100 km/h	- 40,000	$85	No demolition of any residences	retention of a listed heritage house

Analysis of sub-options at Whites Creek crossing

In considering the alignment of the proposal, one of the main constraints was Whites Creek, which runs in a north-south direction from Hassans Walls to the north of the existing alignment south to flow into the Cox's River. As identified in Section 2.4.3, two main options were identified for the proposal to cross Whites Creek, being a fill embankment and a bridge structure. A MCA analysis was undertaken to assess the two options using the same criteria as used to assess the various highway alignments for the proposal.

Whites Creek crossing sub-option 1

The MCA process identified that the embankment option would result in a number of key negative impacts on proposal objectives and identified criteria. These include significant disadvantages regarding environmental impacts including hydrology, drainage, biodiversity and visual impacts over the option for the bridge. In addition, the embankment would cover a portion of the existing Forty Bends Road requiring it to be realigned slightly. The buried section of Forty Bends Road would include a heritage, convict built stone culvert and would therefore result in a substantial impact to non-Aboriginal heritage in this location.

An advantage of the embankment option would however be reduced costs with respect to maintenance in comparison to the bridge option.

Whites Creek crossing sub-option 2

Whites Creek sub-option 2 would have the advantage of allowing for improved fauna passage beneath the structure including provisions for the movement of arboreal fauna through the provision of rope bridges that would pass under the bridge structure. The development of a bridge at this location would also provide substantial advantages for providing opportunities for safe fauna movement across the highway.

Whites Creek sub-option 2 would also have the advantage of avoiding any direct impacts on Forty Bends Road (including the convict-built culvert). Additionally, property impacts and land acquisition requirements would be reduced as a result of the bridge option.

The bridge option would however be more prone to black ice formation in adverse weather conditions, (due to a smaller thermal mass than the embankment option) which would require an active black ice mitigation maintenance program during the cooler months (refer below for black ice sub-options considered). The additional black ice maintenance is not considered significant as black ice would still need to be addressed for the remainder of the proposal within Forty Bends.

Overall, Whites Creek sub-option 1 (embankment) would result in a significantly larger footprint that would impact Forty Bends Road and a heritage convict-built culvert over Whites Creek sub-option 2 (bridge). Whites Creek sub-option 2 would also have a reduced overall environmental impact including providing advantages for hydrology and drainage, biodiversity retention, fauna movement and minimising impacts to non-Aboriginal heritage (culvert).

Initial cost estimates also indicated a bridge structure (Whites Creek sub-option 2) would have a similar cost to an embankment (Whites Creek sub-option 1) with the embankment being slightly more expensive than the bridge option.

Given the advantages which the bridge would provide over an earth embankment for a similar cost, Whites Creek sub-option 2 is considered to be the preferred option for the crossing of Whites Creek.

Analysis of sub-options for black ice mitigation measures

To assess the potential options for mitigating black ice formation on the Great Western Highway at Forty Bends, RMS sought specialist technical advice on the adverse weather related risks and potential mitigation measures. A specialist report was prepared that provided suggested design refinements and mitigation measures for the proposal (ARRB Group, 2011). Mitigation measures that were considered included:

- Design refinements to drainage systems and barriers to promote and improve cold air flow under and away from the main carriageway.
- The optimised placement of weather monitoring systems.
- The provision of road user warning and information systems.
- A winter service (winter maintenance) regime for the Great Western Highway.

Black ice sub-option 1 considered the use of vegetation clearing (up to 15 metres) to maximise the ability of sunlight to reach the road surface. Shadow fall assessments for different time periods were undertaken with a vegetation clearance of 15 metres for each time of day. The results of the shadow fall assessment are shown in **Figure 2-10** to **Figure 2-12** below (note: the shadow fall assessment are based on Option 5, which provides an alignment that is generally consistent with the preferred proposal alignment).

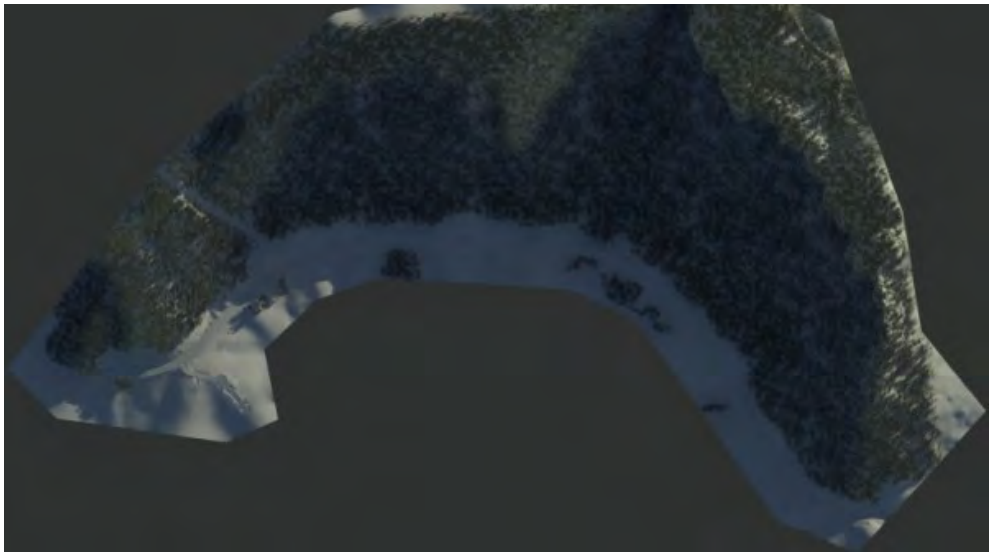


Figure 2-10: Study shadow diagram (preferred alignment) – 9.00am

Figure 2-11: Study shadow diagram (preferred alignment) – 12.00pm

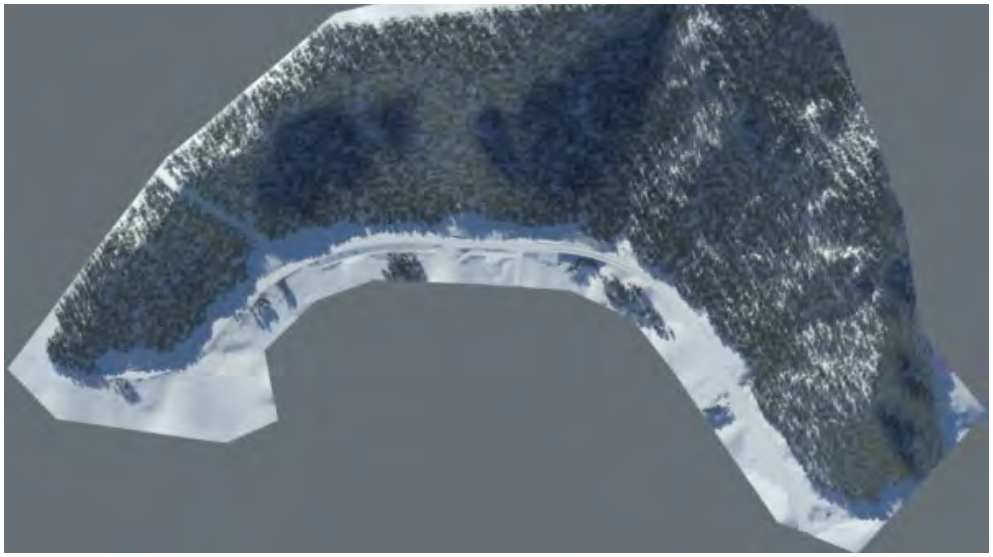


Figure 2-12: Study shadow diagram (preferred alignment) – 3.00pm

Following research into the application of this technique overseas, it was determined that there was limited technical or scientific information to demonstrate that the proposed clearing of vegetation would provide an effective black ice mitigation measure. This option was discounted as the preferred option due to the uncertainty of its effectiveness and the substantial environmental impact on biodiversity resulting from the proposed extensive vegetation clearing, including severance of fauna connectivity and impacts on an area of endangered ecological community (EEC) (Ribbon Gum Woodland) and habitat for a threatened fauna species (Purple Copper Butterfly), in addition to limited evidence of effectiveness.

Black ice sub-option 2 would be effective in reducing the occurrence of black ice on the highway. It was determined that it would be almost impossible to prevent cold air drainage reaching the road surface through design measures alone as the katabatic flows that could occur have the potential to be about 10 to 15 metres in depth. Therefore, measures such as enlarged channel drains and walls/fencing would be ineffective in re-directing flows away from the highway.

As such, this option was not considered feasible to meet the requirements for black ice mitigation.

Black ice sub-option 3 was considered to provide the most effective black ice mitigation measure. This option would result in a minimal impact to existing vegetation, resulting in a clearing of only about five metres which would not require additional clearing to what is required to construct the proposal. As a result, this option would also minimise impacts to identified sensitive sites including an area of EEC and threatened fauna species (Purple Copper Butterfly).

This option would also include measures to minimise 'pooling' of cold air including wire rope barriers (instead of solid barriers) and road grading to facilitate air flow. These measures would provide the advantage of providing the required safety design elements (meeting the proposal objectives), whilst minimising the restriction of cold air flows that can lead to the formation of black ice.

Given the advantages that the active maintenance program (Black ice sub-option 3) would provide over the other two options, this option was considered to be the preferred black ice mitigation option.

2.5 Preferred option

The preferred option for the upgrade of the Great Western Highway at Forty Bends (the subject of this REF) consists of a combination of the following design option elements.

- Highway alignment option 6 – Preferred alignment for the Great Western Highway at Forty Bends.
- Whites Creek crossing sub-option 2 – Whites Creek bridge.
- Black ice sub-option 3 – Black ice active maintenance program.

This combination of option elements for the proposal best achieves the project objectives and the supporting criteria by:

- Improving the geometry and highway alignment to remove a number of existing curves and, where possible, move the alignment further to the south away from Hassans Walls to improve traffic and freight efficiency, road safety and reduce the ability for black ice to form.
- Minimising significant direct impact on habitat for the endangered Purple Copper Butterfly the EEC identified towards the eastern end of the proposal (Ribbon Gum Grassy Woodland).
- Maintaining safe access to the highway for existing landowners along the proposal.
- Minimising impact to private property.
- Minimising impact to identified listed heritage items and curtilages.
- Providing a cost effective design option. Value for money is achieved by improved safety and minimised environmental and property impacts for reasonable cost.

2.6 Design refinements

As part of the Mount Victoria to Lithgow Concept Design display (refer to Chapter 5), feedback from the community was considered with respect to the design of the Forty Bends section of the overall concept design. Following assessment of the feedback received, an amendment to the location of the eastern cul-de-sac on Forty Bends Road was made.

The cul-de-sac would be relocated about 200 metres east of the original location to a new location just below the proposed alignment of the new highway. The primary reason for the movement of the cul-de-sac was as a result of additional land ownership information which was received, identifying the original location as private property, rather than road reserve as initially anticipated. The location of the new cul-de-sac is within the existing road reserve of Forty Bends Road.

3 Description of the proposal

3.1 The proposal

3.1.1 Overview of the proposal

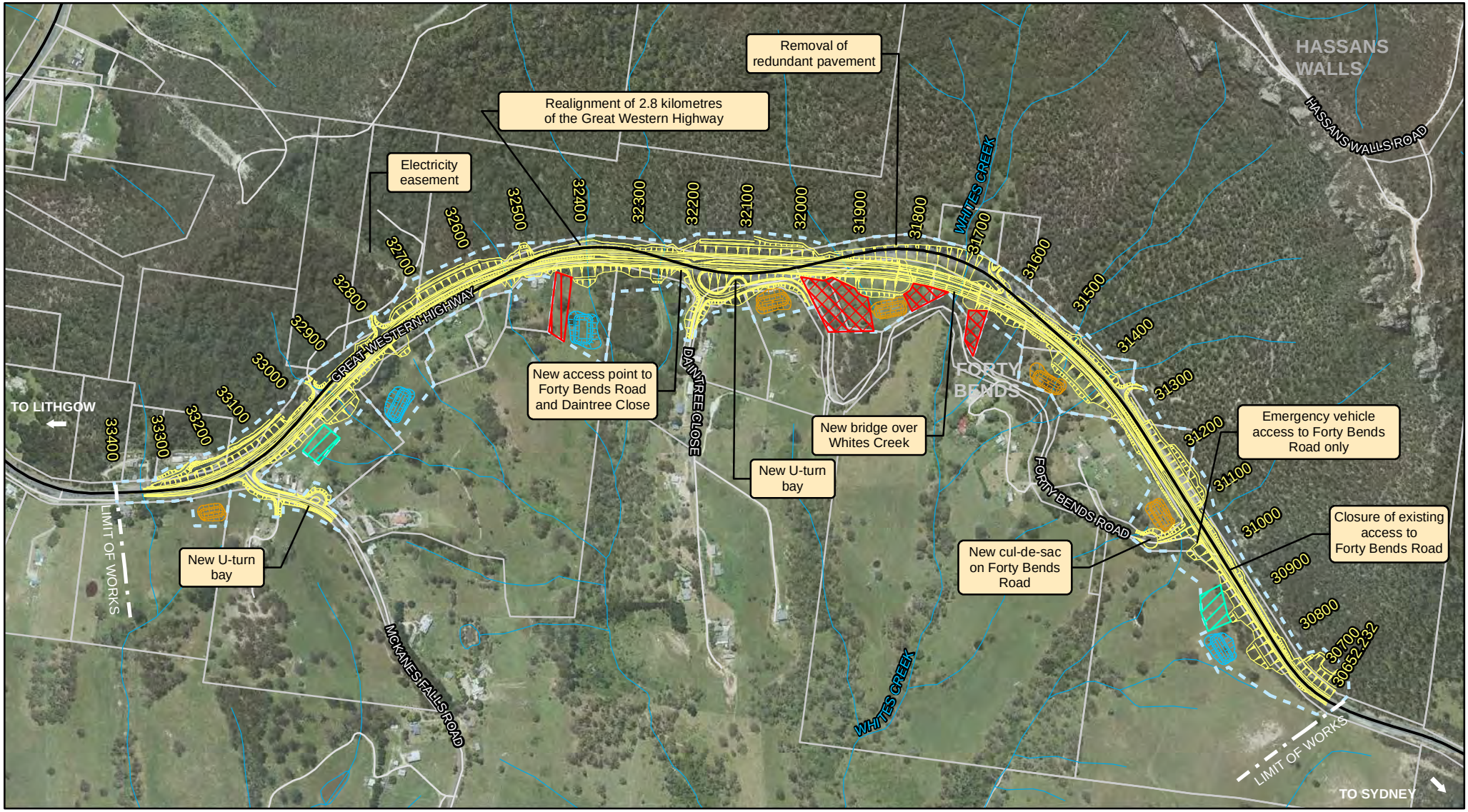
RMS is proposing to upgrade the Great Western Highway at Forty Bends, approximately 5.5 kilometres south of Lithgow. The proposal would include the realignment of about 2.8 kilometres of the Great Western Highway from a point about 470 metres east of the eastern end of Forty Bends Road to a point about 250 metres west of McKanes Falls Road (the proposal).

The proposal has been developed based on the concept design that has been prepared using the available information and current design standards and criteria for the Great Western Highway upgrade program. Some elements of the design may be further refined during detailed design. The key elements of the proposal include the following:

- Construction of a new road alignment consisting of generally three lanes with two lanes eastbound to the east of Whites Creek and two lanes westbound to the west of Whites Creek. Lane widths would be 3.5 metres with shoulder widths typically varying between 1.0 metres and 2.5 metres. The upgrade alignment would diverge up to 40 metres south of the existing Great Western Highway in the vicinity of Whites Creek.
- The design speed for the alignment would be 100 kilometres per hour east of McKanes Falls Road and 80 kilometres per hour west of McKanes Falls Road. The posted speed limit for the whole of the new highway alignment would be 80 kilometres per hour
- Widening of the existing alignment predominantly to the south of the Great Western Highway. The total proposal footprint of the widening works would vary from about 40 metres to 90 metres.
- A central median along the length of the proposal of varying widths, ranging up to 9.5 metres. Carriageways would be separated by a combination of vegetated, depressed and paved medians.
- Construction of new twin, five-span bridges, about 150 metres in length across Whites Creek. The new bridges would comprise four lanes, each 3.5 metres in width, with two lanes carrying traffic in each direction. The total width of the two bridges would be about 30 metres. Shoulders on the bridges would be between 2.5 and 3.25 metres (off-side) and 1.0 metres on the near side.
- Rehabilitation works along the existing alignment of Whites Creek following the removal of the redundant section of the existing Highway. This would include creating a rehabilitated, natural creek bed in this location linking the existing alignment of Whites Creek prior to passing under the new Whites Creek bridge.
- Upgrades to four existing local road intersections, including two intersections with Forty Bends Road, Daintree Close and McKanes Falls Road, to provide connection to the upgraded highway and property access points. Upgrades would include minor widening and u-turn facilities located along the western end of Forty Bends Road and about 150 metres south of the intersection of the Great Western Highway and McKanes Falls Road.
- New or improved access from the existing highway to nine properties along the length of the proposal. The proposal includes provision of new or reconstructed driveways to retain existing property access.

- Closure and relocation of two intersections of Forty Bends Road with the Great Western Highway. These include:
    - Closure of the existing intersection at the eastern end of Forty Bends Road to general traffic (except for emergency vehicles) and a new cul-de-sac constructed on Forty Bends Road.
    - Relocation of the existing intersection at the western end of Forty Bends Road to a point about 200 metres west of the existing intersection.
- Five major cuts 14 metres to 19 metres in height located on the northern side of the proposed alignment.
- Five major fill embankments 10 metres to 15 metres in height located predominantly on the southern side of the proposed alignment.
- Three retaining walls would be required at the following locations
    - Retaining wall 1 – between approximate chainages 32080 and 32190 (about 110 metres long and up to 7.0 metres high).
    - Retaining wall 2 – between approximate chainage 32560 and 32725 (about 165 metres long and up to 5.6 metres high).
    - Retaining wall 3 – between approximate chainage 33040 and 33240 (about 200 metres long and up to 7.0 metres high).
- Removal of about 300 metres of redundant Great Western Highway pavement from about 100 metres east of Whites Creek to about 200 metres west of Whites Creek, and associated culvert. This would include rehabilitation works to link this area to the existing alignment of Whites Creek.
- Construction of three temporary and five permanent construction basins in addition to temporary access tracks along the length of the proposal.
- Construction of nine new culverts along the length of the proposal to manage cross-drainage flows and six new culverts across access roads and service roads as part of the proposal. One existing culvert would be retained at the western end of the proposal. A total of 23 existing drainage culverts under the Great western Highway would be either decommissioned or removed.
- Measures to mitigate the formation of black ice, including the relocation of the road alignment to the south away from the Hassans Walls escarpment in key locations and an active maintenance program.
- A main compound site located east of the western end of Forty Bends Road, in addition to smaller stockpile areas along the length of the proposal during construction.
- A combination of wildlife crossing structures, which would include three fauna underpasses (box culverts), canopy rope bridges at Whites Creek and the western underpass and glider poles located at Whites Creek and near the western fauna underpass.
- Relocation and/or temporary diversion of existing underground utilities including water, powerlines and telephone cables.

Construction of the proposal would be staged so that continued use of the Great Western Highway would be maintained throughout the construction period (detailed further in Section 3.3). An overview of the proposal showing key features is shown in **Figure 3-1**. A detailed description of the concept design is included below and concept design plans have been included in **Appendix B.**



Transport Roads & Maritime Services

Figure 3-1 Forty Bends proposal

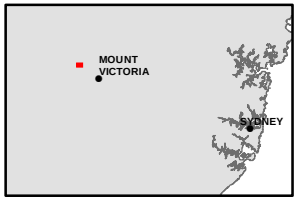
Mt Victoria to Lithgow: Great Western Highway Forty Bends upgrade

MV2L Alliance 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.

LEGEND

- 31900 Chainage
- Proposal
- Proposal site
- Existing highway
- Waterways
- Property boundary
- Permanent sedimentation basins
- Temporary sedimentation basins
- Compound site and stockpile locations
- Potential compound
- Potential stockpile
- Potential stockpile and compound

LOCALITY



GDA 94 | MGA 56

0 200

Metres

Aerial Photograph:AUSIMAGE/SKM 2011

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3.2 Design

This section provides a detailed description of the proposal. The concept design described would be further refined during the detailed design phase.

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*. Reference to a range of other design guides and policies were also considered during the development of the proposal including the following:

- *Austroads Guide to Road Design* (Austroads 2009) and RMS supplements to the Austroads Guide.
- *RMS Road Design Guid*e (RMS undated).
- *Great Western Highway Urban Design Framework – Blue Mountains – Lapstone to Katoomba* (RTA 2006).

Table 3-1 below summarises the adopted design criteria for the proposal.

Table 3-1: Design criteria

Requirement	Criteria
Highway alignment and cross sections	
Design speed	***East of McKanes Falls Road*** • Design Speed Horizontal 100km/hr • Design Speed Vertical 100km/hr • Posted Speed Limit 80km/hr ***West of McKanes Falls Road*** • Design Speed Horizontal 80km/hr • Design Speed Vertical 80km/hr • Posted Speed Limit 80km/hr
Grade	1.0 % minimum. 6.0 % maximum.
Cross section / lane width	Basic configuration of divided carriageways, providing between one and two travel lanes in each direction (depending on location along the proposal). Provision has been made for the potential upgrade of the concept design for a fourth lane when traffic volumes warrant it (subject to future approval). ***Lane and median configurations*** • Through lanes – 3.5 metres. • Auxiliary lanes – 3.5 metres. The carriageway would include a depressed centre median, with a width of 9.5 metres.
Safety barriers	Generally there will be no barrier within the median for the 3 lanes. Once the fourth lane is constructed (subject to separate approval), a wire rope barrier would required in the centre median west of Whites Creek.
Tie-ins	The tie-in would commence about 200 metres east of the eastern end of Forty Bends Road and conclude about 470 metres east of this location. The western tie-in would be about 250 metres west of McKanes Falls Road.

Requirement	Criteria
Property access	Property access would be available throughout the length of the proposal from the direction of travel.
Pavement	Preliminary pavement design comprises a composite, low maintenance pavement of spray seal wearing surface on a 200 millimetre concrete base and 300 millimetre selected material sub-base.
Drainage	• Eight construction sedimentation basins – Five permanent, three temporary (ie construction only). • Longitudinal drainage throughout the proposal. • Nine new culverts along the length of the main alignment of the proposal to manage cross-drainage flows. • Six new culverts across access roads and service roads. • One existing culverts would be retained at the western end of the proposal.
Stopping sight distance	Reaction Time: 2.0 seconds.
Shoulder width	Typically 2.5 metres nearside, 1.0 metres offside. Additional 0.5 metres to any roadside barriers.
Batters	Fill batter 2:1 Cut batter 2:1
Twin bridge structures over Whites Creek	
Length	150 metres.
Spans	Five spans (26 metres, 31 metres, 31 metres, 31 metres and 31 metres).
Structure spacing	100 millimetre gap between the inside raised medians of the two structures.
Design life	100 years.
Vertical clearance	Minimum vertical clearance to Whites Creek of about 12.5 metres to the estimated 100 year ARI flood level.
Lane width and shoulder width	***Westbound bridge carriageway*** • Two 3.5 metre traffic lanes, a • 3.25 metre nearside shoulder and 1.0 metre offside shoulder. ***Eastbound carriageway bridge*** • Two 3.5 metre traffic lanes • 2.5 metre nearside shoulder and 1.5 metre offside shoulder.

3.2.2 Engineering constraints

A series of engineering constraints have been identified for the design and construction of the proposal. The main issues and constraints associated with the proposal are:

- Existing natural features, including topography (steep terrain to the north (Hassans Walls) and undulating land to the south) and existing water courses/ drainage lines (specifically Whites Creek) and flood extents. With the upgraded highway designed in accordance with design criteria, large cuts and fills were required across the proposal.
- Tie-ins to the existing highway. The eastern and western extents are required to tie-in to existing curves forming constraints to the design speed at these locations.

- Formation of black ice. Black ice formation has been identified as a hazard along the highway at Forty Bends. Its formation is largely due to cold air flowing down from Hassans Walls. A black ice active maintenance program is proposed to address this issue. Further detail is provided in Section 3.2.5.
- Geotechnical issues and risks within the proposal area. There are geological risks and slope failure risks associated with this section of the Great Western Highway. The risks primarily include remobilisation of small to large boulders residing on steep slopes as a result of erosion and slump failures/debris flows. The potential for acid sulfate rock has also been identified.
- The presence of existing utilities infrastructure including electricity (underground and overhead transmission easement), telecommunications infrastructure and water services which may require adjustments.
- Property access requirements during road construction for the properties, generally to the south of the existing Great Western Highway. There are about 21 different property owners whose land would be affected during the construction phase.
- Existing road connections. There are three local roads in the vicinity of the existing highway of which vertical and horizontal alignments would need to be adjusted to tie-in with the chosen design of the new highway. These local roads are Forty Bends Road (two intersections), Daintree Close and McKanes Falls Road.
- Environmental constraints in particular:
    - Biodiversity – Constraints include areas within the proposal site identified as being potential habitat for the Purple Copper Butterfly, which is a threatened species and an area of Ribbon Gum Grassy Woodland, an threatened ecological community (TEC) listed on the TSC Act, towards the western end of the proposal site.
    - Non-Aboriginal heritage – There are five Local Environmental Plan (LEP) listed heritage items located in close proximity to the existing highway.
    - Aboriginal heritage – A number of potential aboriginal heritage sites and potential archaeological deposits (PADs) are located within the study area.
- Staging of the project. The proposal would be generally constructed on the same alignment as the existing highway for the majority of the section. This would pose staging challenges as traffic flows in both directions would be required to be maintained.

3.2.3 Great Western Highway realignment and widening

The proposal would comprise the construction of an upgrade of about 2.8 kilometres of the existing Great Western Highway. The proposal would generally comprise three lanes alternating between two lanes eastbound and two lanes westbound, with the change in lane configurations occurring near the crossing of Whites Creek.

The proposed highway alignment would follow the general alignment and grade of the existing highway, however it would be substantially straightened with construction predominantly occurring to the south of the existing alignment (away from the Hassans Walls escarpment).

The main point of divergence away from the alignment of the existing highway would be at the crossing of Whites Creek, where the proposed highway alignment would be located about 40 metres south of the existing highway alignment. At this point, new twin, dual lane, multi-span bridges, about 150 metres in length, would cross Whites Creek (refer to Section 3.2.4 for details).

The other main divergence of the proposed highway alignment would be about 600 metres east of McKanes Falls Road, where the proposed highway alignment would be about 30 metres north of the existing highway alignment. The refined alignment would allow for improved surface conditions which would reduce the formation of black ice in cold weather periods. The width of the proposal would vary from about 40 metres to 90 metres.

The realignment would be constructed to a 100 kilometre per hour design speed east of McKanes Falls Road and an 80 kilometres per hour design speed west of McKanes Falls Road. The posted speed limit of the proposal would be 80 kilometres per hour throughout. The alignment would have 3.5 metre wide lanes, with shoulders about 2.5 metres wide and a maximum grade of six per cent.

The upgraded highway would have a central median (both pavement and vegetated of varying widths up to 9.5 metres) and would involve upgrading all existing intersections west of Whites Creek and closure of the eastern intersection of the Great Western Highway and Forty Bends Road (due to safety concerns). These intersections would be located where the new highway alignment intersects with the new location for the western end of Forty Bends Road (about 200 metres to the west of the existing intersection) and with the existing McKanes Falls Road intersection. Both of these intersections would allow for all traffic movements.

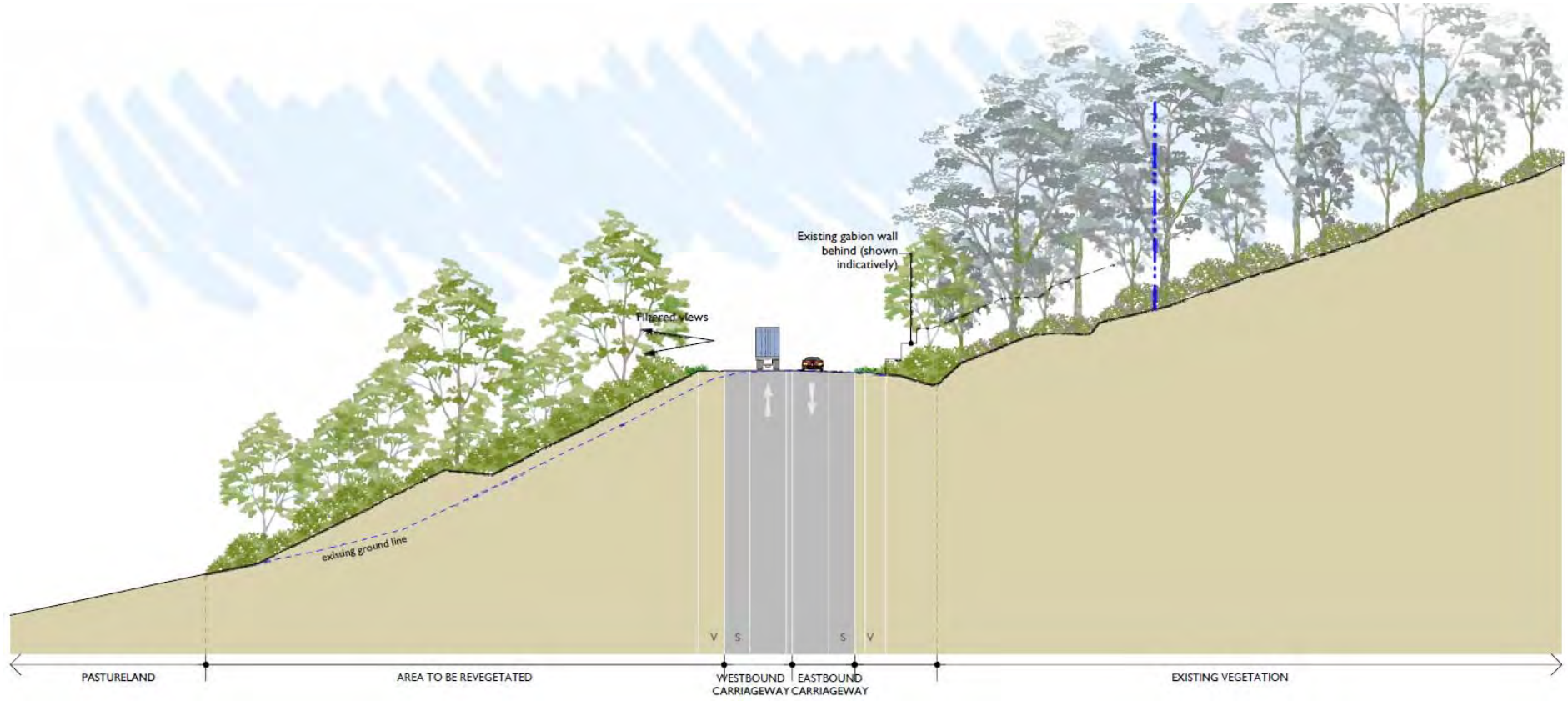
The remaining intersection (eastern end of Forty Bends Road) would be closed and a new intersection provided (about 100 metres to the west of the current intersection) that would be restricted to use by emergency vehicles only. Other associated works would include the provision of local road tie-ins (allowing for level changes between the existing and proposed highway alignments) and local traffic u-turn facilities along Daintree Close and McKanes Falls Road. A short service road would also be provided at the western end of the proposal to allow access to the existing residential properties at this location.

Three retaining walls, with maximum heights of between 5.6 metres and 7.0 metres, would be required where there is a need to minimise the impact on adjacent land.

The new alignment would include a new pavement and would typically consist of asphaltic concrete. The final pavement type and design would be subject to investigations during detailed design.

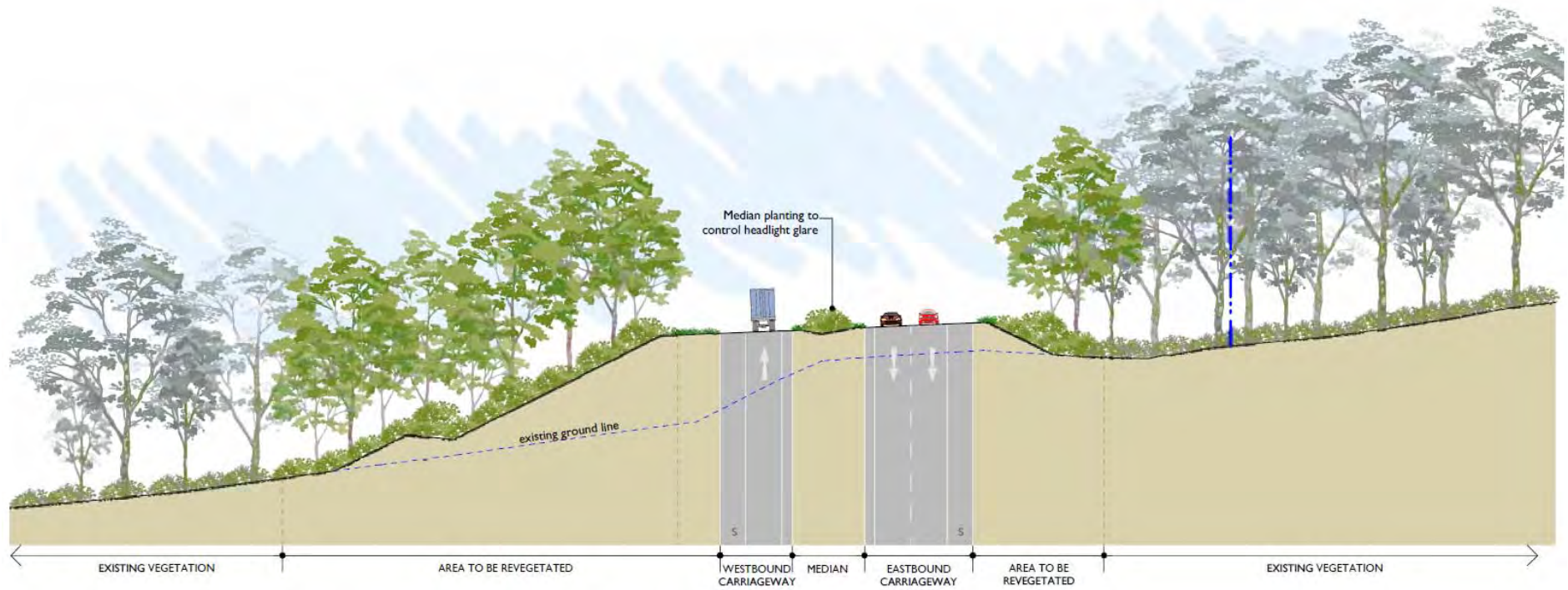
The proposal would involve the clearing or disturbance of about 7.39 hectares of existing remnant native vegetation in varying degrees of condition and about 15.27 hectares of cleared and highly modified habitats. Impacts to threatened ecological communities are limited to approximately 0.05 hectare of moderate condition vegetation (Ribbon Gum Grassy Woodland). Further details regarding the proposed vegetation loss from the proposal is discussed in Section 6.1.

Cross sections of the proposal are provided as Figure **3-2** to **Figure 3-6**. References to chainages refer to approximate locations to those shown on the concept design (refer to **Figure 3-1**).



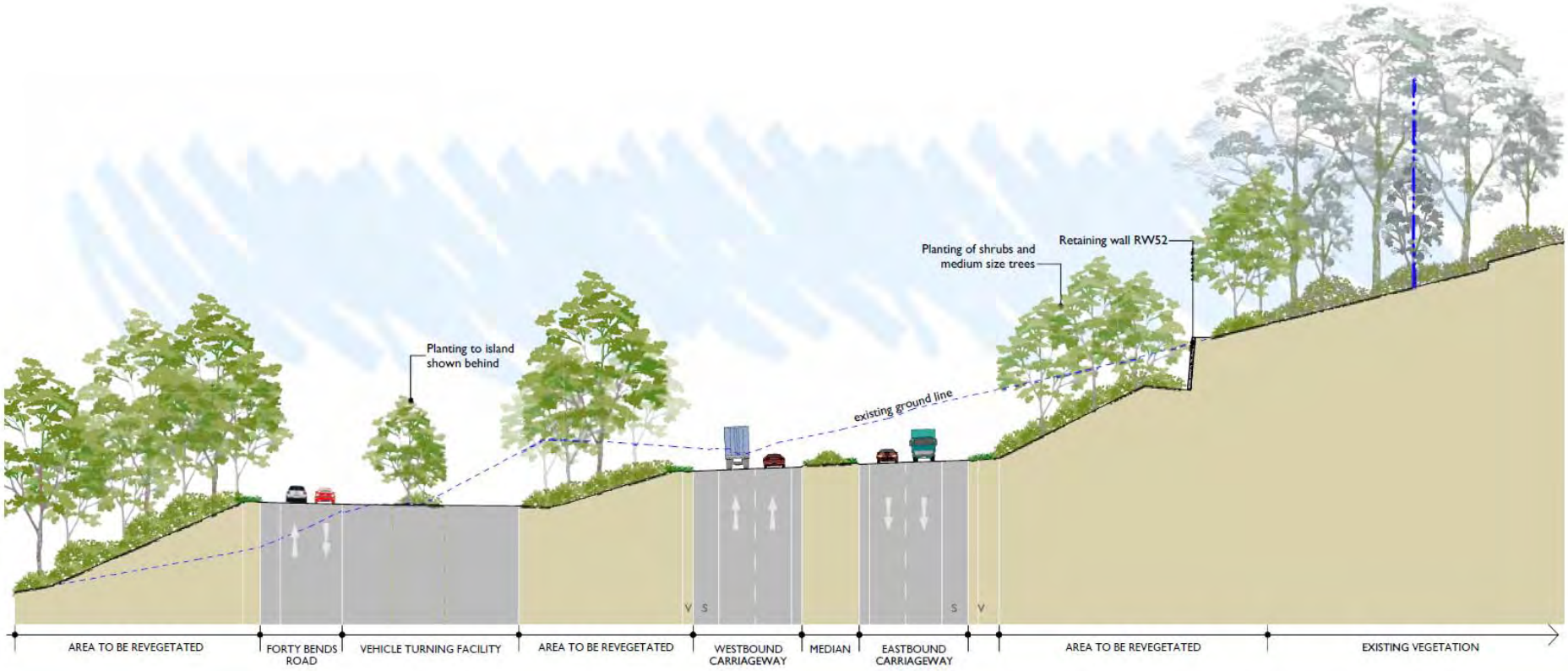
Source: Spackman Mossop Michaels, 2012 (Technical Paper 7)

Figure 3-2: Indicative cross section for the Great Western Highway looking west (Chainage 30800)



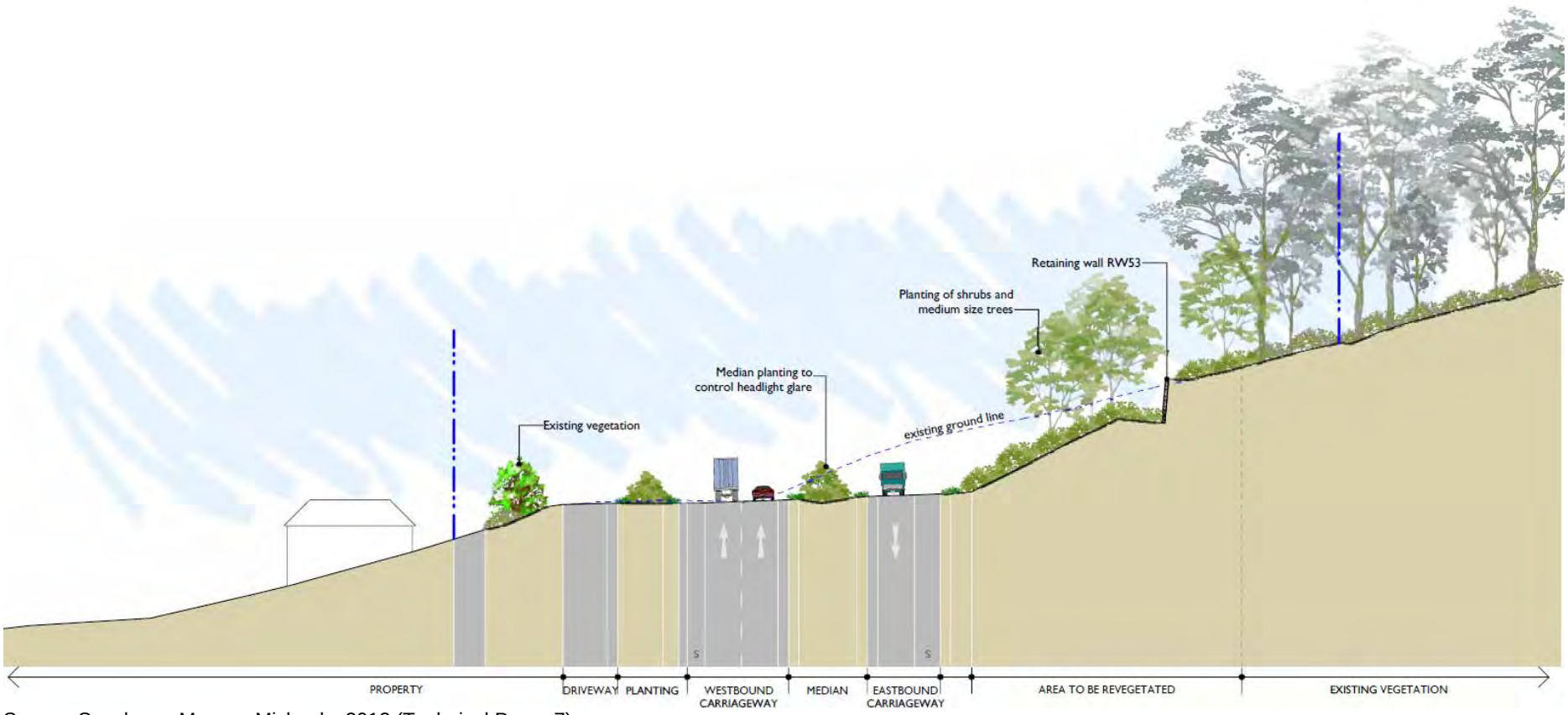
Source: Spackman Mossop Michaels, 2012 (Technical Paper 7)

Figure 3-3: Indicative cross section for the Great Western Highway looking west (Chainage 31400)



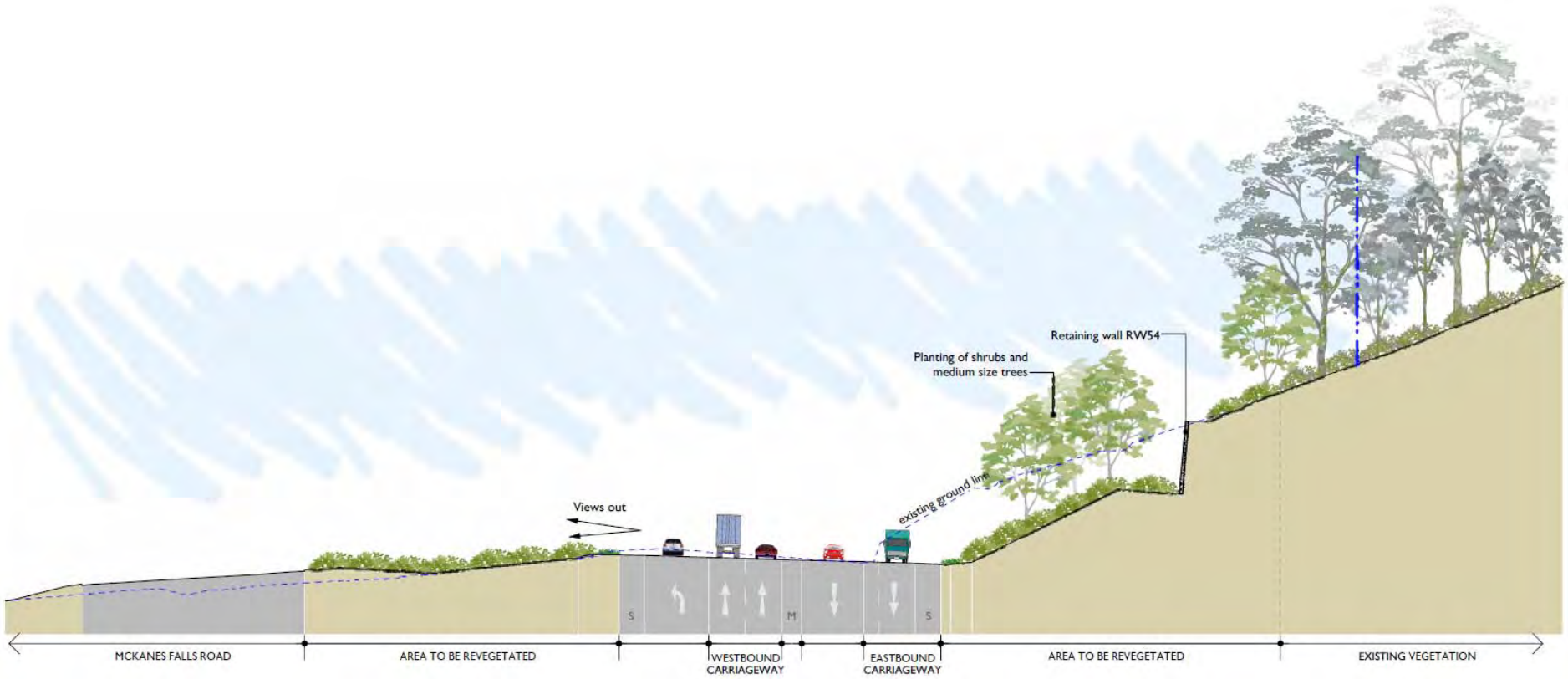
Source: Spackman Mossop Michaels, 2012 (Technical Paper 7)

Figure 3-4: Indicative cross section looking west showing the Great Western Highway and proposed turning circle on Forty Bends Road (Chainage 32100)



Source: Spackman Mossop Michaels, 2012 (Technical Paper 7)

Figure 3-5: Indicative cross section for the Great Western Highway (Chainage 32600)



Source: Spackman Mossop Michaels, 2012 (Technical Paper 7)

Figure 3-6: Indicative cross section for the Great Western Highway looking west (Chainage 33140)

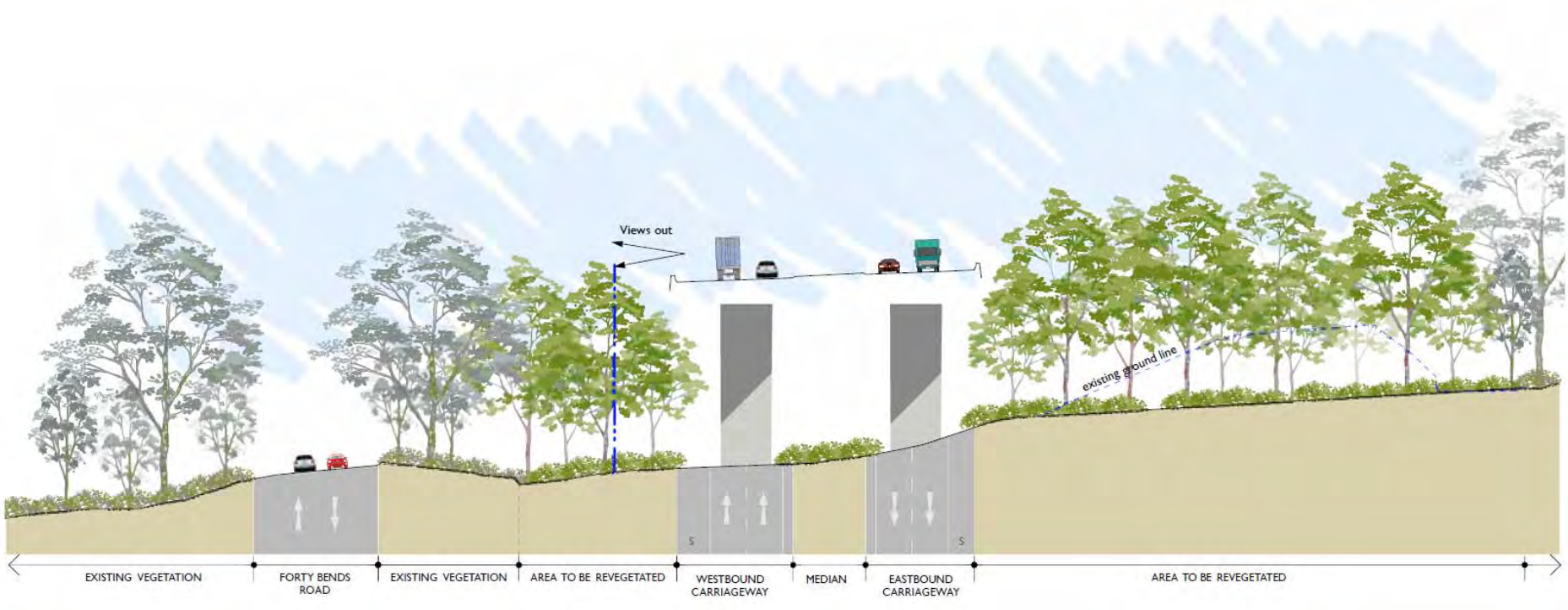
3.2.4 Bridge over Whites Creek

The Whites Creek bridge would be located approximately 1.3 kilometres east of the intersection of the Great Western Highway and McKanes Falls Road between approximate chainages 31650 and 31800. The new Whites Creek bridge would comprise a twin bridge structure of reinforced concrete construction (one structure eastbound and one structure westbound each comprising two lanes) and would have a length of 150 metres and a total width of 30 metres (both structures) and would be above the 1 in 100 year flood level. The bridge has been designed in accordance with relevant guidelines (as listed in Section 3.2.1).

The key features of the Whites Creek bridge would include:

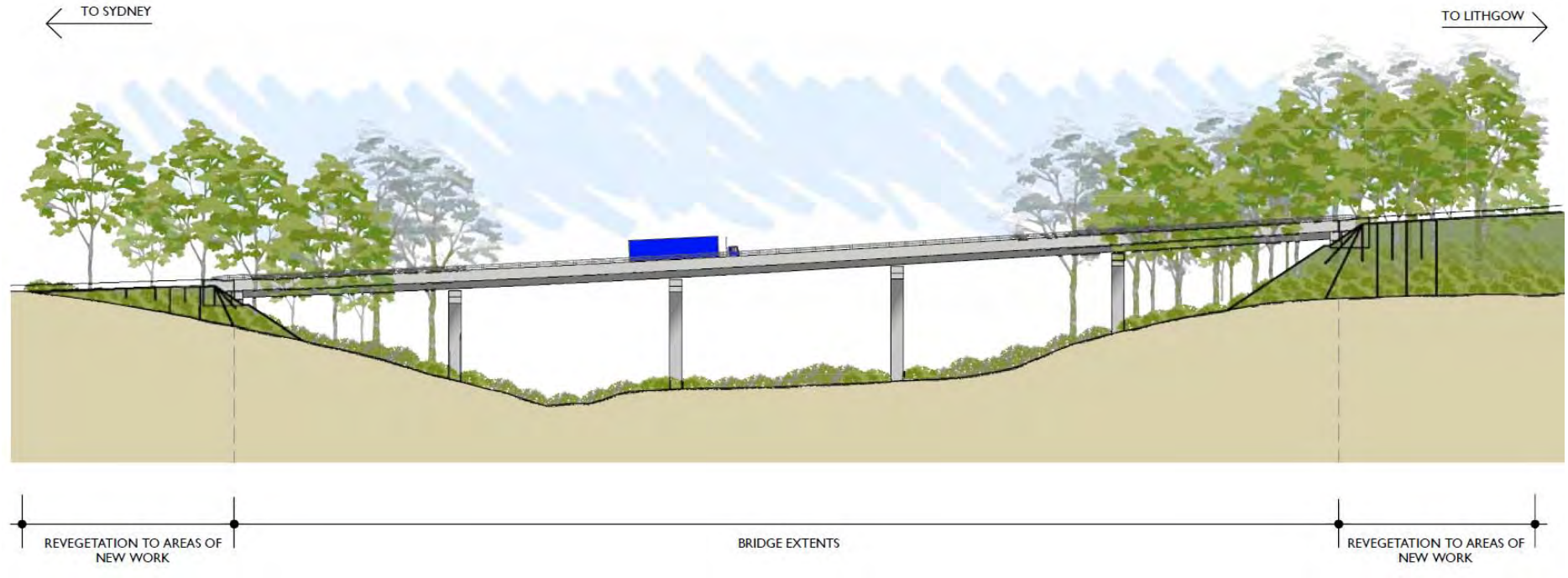
- A substructure consisting of five spans for each bridge (about 26 metres, 31 metres, 31 metres, 31 metres and 31 metres).
- Westbound carriageway with a 3.25 metre outside shoulder, which is required for adequate sight stopping distance (SSD), two 3.5 metres wide lanes and a 1.0 metre inside shoulder.
- Eastbound carriageway with a 2.5 metre outside shoulder, two 3.5 metres lanes and a 1.5 metre inside shoulder, which is required for adequate drainage width in the shoulder to avoid the need for scuppers (small open drains along the edge of the bridge structures).
- A medium performance level traffic barrier provided on the outside shoulder, and a 3.45 metre wide raised median on the inside shoulder. The barrier and median layout is mirrored on the eastbound carriageway.
- A 100 millimetre gap between the inside raised medians of the two bridge structures covered by a steel plate.
- Bridge superstructures consisting of seven 1500 millimetre deep 'super-T' girders with a nominal composite 200 millimetre cast-in-place reinforced concrete deck slab.
- A 75 millimetre thick asphaltic concrete surfacing underlain by a bituminous waterproofing membrane for the wearing surface on the bridge deck.
- Stabilisation treatment for the abutments in the form of stone pitching surfacing would be provided. The fill embankment height at the eastern abutment would be a maximum of about 7.0 metres and the fill embankment height at the western abutment would a maximum of about 7.5 metres.
- A substructure comprising four piers for each bridge supported on pile foundations. This would involve excavation of the Whites Creek banks and rehabilitation upon completion. Creek rehabilitation would comprise providing a natural creek bed through the use of suitable rocks and boulders in addition to any suitable plantings. The pier locations would be skewed at an angle of about 10 degrees to line up with the stream contours for pier foundations. The maximum pier height would be 16 metres.
- Four per cent one way cross fall (falling to the south).
- A minimum vertical clearance of 12.5 metres to the estimated 100 year Average Recurrence Interval (ARI) flood level of Whites Creek

An indicative cross section for the Whites Creek bridge is provided as **Figure 3-7** and an indicative elevation is provided as **Figure 3-8**.



Source: Spackman Mossop Michaels, 2012 (Technical Paper 7)

Figure 3-7: Indicative cross section of the Whites Creek bridge (Chainage 31700)



Source: Spackman Mossop Michaels, 2012 (Technical Paper 7)

Figure 3-8: Indicative elevation of the Whites Creek bridge, looking south

3.2.5 Other design features

Drainage

The proposal would require the construction of 9 new culverts along its length to manage cross-drainage flows from drainage lines to the north of the proposal. Two existing culverts would also be retained at the western end of the proposal. A number of the new pipe culvert structures may also require drop structures to ensure critical flow velocities are not exceeded. A total of 23 existing drainage culverts would be either decommissioned or removed as part of the proposal.

New culverts would generally consist of new single or double pipe culverts ranging in size between 450 millimetres and 1050 millimetres in diameter. Each culvert would range from between about 10 metres along the side roads/access roads metres to 80 metres along the main carriageway in length. Each of the culverts would typically drain to existing gullies located on the southern side of the highway.

One existing farm dam would be utilised as a permanent sedimentation basin towards the eastern end of the proposal about 200 metres east of the eastern abutment of the Whites Creek bridge. One existing farm dam would also be decommissioned due to the proposal.

The cross drainage infrastructure would be designed to ensure that the proposal is immune from flooding in the 100 year ARI flood event and that local roads achieve a 20 year ARI level.

Longitudinal drainage would be installed along the length of the proposal that would intercept and control surface water runoff that would be designed to be sufficient to manage 1 in 10 year ARI storm event and allow one lane trafficable in the 1 in 100 year ARI storm event. The longitudinal drainage would drain to the permanent basins located along the proposal.

Details of drainage culverts that are proposed as part of the proposal are provided in **Table 3-2** below.

Table 3-2: Proposed drainage culverts and locations

No.	Approximate chainage	Size
1	3080	750mm
2	31060	2 x 1050mm
3	31000	3.3m x 3.3m
3	31070	675mm
4	31470	2 x 1050mm
5	31600	750mm
6	31660	450mm
7	32250	2.4m x 2.4m
8	32250	Unknown
9	32380	1200mm
10	32540	750mm
11	32770	1200mm

No.	Approximate chainage	Size
12	32800	1050mm
13	33000	825mm
14	33000	1050mm
15	33250	600mm
16	33170	450mm

Cut and fill and retaining walls

There are a series of fill embankments and cuts required to construct the proposal due to the varying terrain and location of the proposal in relation to Hassans Walls. Batters for cuts and fills would be designed to minimise maintenance requirements and reduce urban design impacts.

Cut batters would typically be 2:1 (horizontal:vertical) and benches would be provided every seven metres respectively. Fill batters would also typically range between 2:1 (horizontal:vertical) and benches would typically be provided for every 10 metres in vertical height.

Cut and fill would be required along the length of the proposal. Significant cuts and fills would be required at the following locations (note chainages are shown on **Figure 3-1**).

- Chainage 30650 (eastbound) – Cutting of up to about 13 metres in height.
- Chainage 30800 (westbound) – Fill embankment up to about 18 metres in height.
- Chainage 30880 (westbound) – Fill embankment up to about 13 metres in height.
- Chainage 31020 (westbound) – Fill embankment up to about 14 metres in height.
- Chainage 31100–31280 (eastbound) – Cutting of up to about 12 metres in height.
- Chainage 31350–31500 (westbound) – Fill embankment up to about 12 metres in height.
- Chainage 31650–31950 (eastbound) – Wide fill embankment up to about 10 metres in height and up to about 50 metres in width at the widest point where the redundant paving would be removed near Whites Creek.
- Chainage 32080 and 32190 (eastbound) – retaining wall about 110 metres long and seven metres in height.
- Chainage 32400 (westbound) – Fill embankment up to about 15 metres in height.
- Chainage 32560 and 32725 (eastbound) – retaining wall about 165 metres long and 5.6 metres in height.
- Chainage 32790 (westbound) – Fill embankment up to about 13 metres in height.
- Chainage 32900–33000 (westbound) – Fill embankment up to about 18 metres in height.
- Chainage 33040 and 33240 (eastbound) – retaining wall about 200 metres long and seven metres high.

Fauna crossing structures and devices

A combination of wildlife crossing structures would be included within the proposal design to minimise impacts to existing wildlife corridors and allow for an improvement in the ability of fauna to safely move between each side of the highway.

The need for fauna crossings has been identified at three locations within the proposal site. These locations include proposed fauna culverts at the eastern end of Forty Bends Road and near Daintree Close and a third crossing, comprising a series of fauna rope bridges under the Whites Creek bridge structure. The fauna crossings would consist of reinforced concrete box culverts (between 2.4 metres by 2.4 metres and 3.3 metre by 3.3 metre) passing under the main alignment of the proposal. The culverts would act as dedicated fauna structures and separate drainage structures would be located within close proximity to the proposed fauna crossings. Fauna fencing would also be provided on the northern side of the alignment to assist with guiding fauna to the two fauna culvert passages.

Canopy rope bridges would also be provided across the alignment in the vicinity of Whites Creek and the proposed western underpass. The rope canopy bridges would be attached to the underside of the Whites Creek bridge structure to allow fauna passage in this location. These canopy bridges would consist of either a single rope or a mesh bridge that would cross the highway alignment. The rope bridges under the Whites Creek bridge would be positioned to allow for ongoing maintenance of the bridge to occur.

Glider poles would also be provided at three locations along the proposal to allow for the movement of gliders between the northern and southern sides of the alignment. The passage of various terrestrial and aquatic fauna across the Great Western Highway would also be available under the proposed Whites Creek. These structures would be installed to minimise impacts to existing wildlife corridors within the proposal site and allow improved, safer movement of fauna across the highway. Where possible, crossing structures would be installed prior to vegetation clearing to minimise disturbance to fauna.

The indicative locations for these structures are provided in **Figure 6-6**. Section 6.1 provides additional detail regarding the proposed fauna crossing structures and devices. The final location of the proposed fauna crossing locations and devices would be further refined during the detailed design stage.

Urban design

The key urban design objectives for the proposal are outlined in the urban design landscape character and visual impact assessment report prepared by Spackman Mossop Michaels (refer to Volume 3, Technical Paper 7). The urban design objectives which informed the design of the proposal included:

- Protect and enhance existing views, character, heritage and cultural values of the corridor.
- Provide a flowing road alignment that is responsive to, and integrated with the natural and built landscape.
- Develop a simple and unified palette of elements and details that are attractive, easily maintained and fits sensitively into the specific landscape character of this area.

A number of principles for each objective have also been identified and would be further considered for feasibility during the detailed design phase.

To meet the objectives identified for the proposal, an urban and landscape design concept plan has been prepared (refer to Section 7 of Technical Paper 7). The landscape and urban design concept plan provides an overall strategy that broadly describes the urban and landscape design approach to mitigating adverse visual and landscape impact from the proposed design. The main design elements of the landscape and urban design concept are as follows:

- Retain as many trees as possible along the route and enhance with additional tree planting to maintain a generally enclosed character, where this character currently exists.
- Retain open views across the rural landscape, where these are desirable, through the use of scattered tree plantings and low level groundcovers and native grasses.
- Maintain and enhance the creek crossing experience and riparian areas at Whites Creek to distinguish it along the road journey.
- Reduce the extent of cut and fill embankments, where road design constraints allow, by reducing median widths.
- Retain landmark regional views to Hassans Walls Reserve.
- Rehabilitate areas of existing disused roadway with native plant species.

These elements would be incorporated into the detailed design of the proposal and would be further developed and refined as part of a landscape plan to be implemented following construction.

Black ice active maintenance program

Design measures to allow for the free passage of katabatic flows have been provided as part of the design of the proposal. The design would include the relocation of the road alignment to the south away from the Hassans Walls escarpment in key locations, assisting with some reduced impacts of the black ice by allowing additional sunlight to reach the road surface for a longer period of time. Additional measures would include using wire rope barriers and grading of the road in order to allow the katabatic flows to pass freely across the road surface. These measures are designed to prevent the 'pooling' of cold air on the road surface. Other measures that would be undertaken would consist of the following:

- Clearance of vegetation up to five metres from the top or toe of batters.
- Formulation of an active black ice maintenance program. As part of the formulation of a maintenance program, a suitable de-icing chemical would be identified for use during identified black ice events.
- Installation of a weather station that would obtain local meteorological data and provide warnings to motorists and alert RMS maintenance crews as part of the active maintenance program.

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 as a result of factors such as identification and location of underground utilities and services, on-site conditions identified during pre-construction activities, ongoing refinement of the detailed design and community consultation including consideration of submissions received. The final contractor 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 approval 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

Conventional techniques that are typically employed on highway construction projects would be used during the construction of the proposal. The construction would generally involve the following general construction activities and sequencing shown in **Table 3-3**.

Table 3-3: Proposed construction phases and activities

Construction phase	Activities
Environmental Management System (EMS)	• EMS development. • Environmental management plans. • Statutory approvals and licensing.

Early works	• Land acquisition.
	• Relocation of farm dams/fencing.
	• Survey of construction site.
	• Notify residents of commencement of work.
	• Site establishment.
	  ▸ Site compounds.
	  ▸ Fencing of site boundaries and areas to be used for stockpile sites.
	• Fencing of sensitive environmental and heritage areas.
	• Installation of erosion and sediment control outside identified environmental constraint areas and temporary water control basins.

Construction phase	Activities
Service relocations	• Utility adjustment (electricity and telecommunications) as required.
Site preparation	• Seed collection prior to construction for rehabilitation works where practicable • 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. • Stripping and stockpiling of topsoil in stages. • Prepare surface using graders, dozers, scrapers and other equipment. • Establishment of access tracks. • Establishment of temporary and permanent crossovers. • Traffic barrier erection. • Temporary pavement widening.
Earthworks	• Excavation of cuttings. • Fill embankments. • Rock crushing (if required). • Placement of select materials. • Construct roadside cuts and fill batters. • Batter treatments. • Retaining walls
Whites Creek bridge	• Site preparation including installation of sediment controls to prevent slurry and excavated material from entering waterway. • Construction of abutments and piles. • Backfill behind abutments. • Place bridge girders using crane. • Construct deck and kerbs. • Complete road approaches for new half bridge. • Switch traffic.
Drainage	• Culverts. • Catch drains. • Drainage blankets. • Permanent water quality control basins.
Pavement	• Gravel base/sub-base layers and asphaltic concrete paving. • Apply asphaltic concrete pavement using pavers and rollers. • Removal of existing Great Western Highway redundant pavement and rehabilitation and naturalisation of Whites Creek where pavement is removed in this location.
Other works	• Property access. • Local roads. • Tie-ins.

Construction phase	Activities
Finishing works	• Noise mitigation measures. • Safety barriers and safety screens (if/where required). • Kerbs, gutters and verges • Street lighting. • Landscape and re-vegetate proposal site. • Install line marking, signs and guide posts. • Decommission temporary facilities; eg site compounds. • Site clean-up and disposal of all surplus waste materials.

Construction staging and program

As the proposal is predominantly on the same alignment as the existing highway, it is proposed that construction would be undertaken in three main stages. The indicative proposed stages are briefly described below. An indicative construction program showing the estimated timing of each construction stage is provided in **Figure 3-9**.

Stage 1 – Westbound carriageway, retaining walls and Whites Creek bridge

Following some preliminary structures works, the first stage would be to construct the westbound carriageway east of Whites Creek, and to construct the eastbound pavement in front of the two retaining walls, west of Whites Creek. The traffic during this stage is under existing conditions. Some temporary widening at these construction locations will also be required.

The Whites Creek bridge is located away from the existing highway and would be able to be constructed offline without affecting the existing traffic configuration.

Stage 2 – Westbound carriageway and Whites Creek

During the second stage the traffic would be reduced to a two-lane, two-way configuration (one lane in each direction) predominantly on the existing carriageway. This allows for the ultimate westbound carriageway to be constructed west of Whites Creek.

Stage 3 – Eastbound carriageway

The final stage would involve opening the new bridge to traffic and constructing the remaining eastbound sections while traffic occupies the completed westbound carriageway.

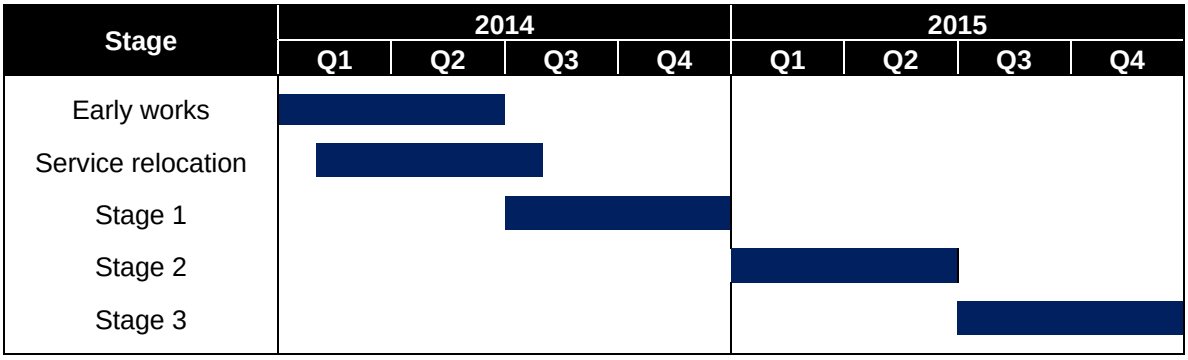


Figure 3-9: Indicative construction program

It should be noted that the dates identified are approximate, and that greater detail regarding the duration and staging of the proposal would be determined by the construction contractor as part of a detailed staging plan.

3.3.2 Construction hours and duration

Construction is anticipated to commence in the late 2013. It is estimated that the construction of the proposal is expected to take up to 24 months.

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 120 personnel per day across all construction locations. On either side of this peak period, daily workforce numbers would fluctuate between about 50 and 100 personnel across all construction sites along the proposal at any given time during the construction period. The final number of construction workers would be determined by the construction contractor following the detailed design of the proposal.

Construction would be undertaken during standard construction working hours in accordance with *the Interim Construction Noise Guideline (DECC, 2009)* as follows:

- Monday to Friday 7.00am to 6.00pm.
- Saturday 8.00am to 1.00pm.
- Sunday and public holidays No work.

In order to minimise disruption to daily traffic volumes and disturbance to surrounding land owners and businesses, it may be necessary to undertake periods of work outside of these hours, including night works. Work undertaken outside of standard working hours (if required) would be in accordance with the Office of Environment and Heritage (formerly DECCW) *Interim Construction Noise Guideline* (DECC 2009) and the RMS's *Environmental Noise Management Manual (RTA 2001): Practice Note vii – Road works outside normal working hours*.

Prior consultation would be given to the community of any works proposed to be undertaken outside standard construction hours.

3.3.3 Plant and equipment

A range of plant and equipment would be used during the construction of the proposal. It should be noted that additional equipment is likely to be utilised during the construction period. Additional equipment requirements would be determined during detailed design by the construction contractor.

An indicative list of plant and equipment that would typically be required is provided below.

- Asphalt pavers.
- Asphalt profiling machines.
- Back hoes.
- Bobcats.
- Bulldozers.
- Cherry pickers.
- Chipping machines.
- Compactors.
- Compressors.
- Compressed air machinery.
- Concrete pavers.
- Concrete saws.
- Concrete trucks.
- Concrete pumps.
- Concrete mixers.
- Cranes.
- Dewatering pumps.
- Drill/boring rigs.
- Dump trucks.
- Elevated work platform.
- Excavators.
- Front-end loaders.
- Generators.
- Graders.
- Hand tools.
- Hydraulic hammer.
- Hydraulic jacks.
- Lighting units.
- Line marker.
- Mobile cranes.
- Piling plant.
- Roadheaders.
- Rock breakers.
- Road rollers.
- Road sweepers.
- Scrapers.
- Vibratory rollers.
- Water carts.

3.3.4 Earthworks

Due to the topography of the local area, the proposal would require a series of cuts (generally to the north of the highway alignment into Hassans Walls) and fill embankment earthworks (generally to the south of the highway alignment) to allow for widening of existing fill embankments used to support the existing alignment of the highway).

The proposal has been designed to minimise excess spoil and/or the need to import large quantities of fill. Earthworks for the new road realignment would require about 134,000 cubic metres of excavation and about 206,000 cubic metres of fill. The current design would therefore produce a fill deficit of about 72,000 cubic metres (refer to Section 3.3.5 for details).

The proposal would be required to source additional earth fill material from off-site quarry sources to meet this deficit. This quantity and quality of the required material is readily available from established quarries in the local area (refer to Section 3.3.5).

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

3.3.5 Source and quantity of materials

The source and quality of materials required to construct the proposal would be finalised during detailed design through the development of a construction materials and resources plan. As discussed in Section 3.3.4, a large amount of the required fill material would be sourced from cut materials from within the proposal site. However about 72,000 cubic metres of additional material would be required to meet the requirements for fill embankments across the proposal.

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

It should be noted that the accuracy of fill required is subject to variations in bulking factors for excavated material, relative compaction achieved for placed material and volume of usable material once it has been excavated. This would be refined during detailed design.

The major resources requirements for the proposal are described below.

Quarry products

Select fill requirements for the proposal are:

- 70,000 to 100,000 cubic metres of road base.
- 3500 to 7000 cubic metres of drainage rock.

These materials would be sourced from local quarries and commercial suppliers in the local region of Lithgow wherever possible. Two quarries located in the vicinity of the proposal site have been identified that may be able to be utilised for sourcing required materials during construction. These quarries are:

- Austen Quarry (Hy-Tec) – located about 11 kilometres south of the intersection of the existing Great Western Highway and Jenolan Caves Road.
- Marrangaroo (Metromix) – located about seven kilometres west of Lithgow.

It is not considered that the materials that would be required are in short supply at this time. The location of each of the potential sources of quarry materials from the proposal site are shown on **Figure 3-10**.

Water requirements

Water would be required for the earthworks construction and for dust control within the proposal site. Water for the works would be sourced from authorised off-site sources, including recycled, re-used and farm-dam water or groundwater bores with appropriate licences (refer to Chapter 7). Water from the on-site construction basins would also be used for construction water. The volume of water required for construction is expected to be about 30 to 50 megalitres. The quantity and quality of the required construction water is readily available from existing sources in the local area that would be determined by the construction contractor.

Further detailed discussion regarding construction water requirements is provided in Section 6.5.

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Transport Roads & Maritime Services
NSW GOVERNMENT

Figure3-10 Potential quarry locations

Mt Victoria to Lithgow: Great Western Highway Forty Bends upgrade

LEGEND

- Routes to the quarries from the proposal site
- Existing highway
- Local roads
- Forty Bends locality

GDA 94 | MGA 56

0 2

Kilometres

Aerial Photograph:
1. High resoulotion imagery: SKM AUSIMAGE 2011
2. (c) 2010 Microsoft Corporation and its data suppliers

Concrete, reinforcement, asphalt and bitumen

Concrete would be required for bridge, retaining wall, drainage and pavement works. Due to the size and location of the proposal, it is considered that establishment of on-site concrete batching facilities would not be required. Supply of ready mix concrete to the proposal would be from established local sources.

As with earth fill materials, detailed quantities required for construction are currently unknown, however the proposal is anticipated to require the following estimated amount of concrete and steel:

- 11,000 cubic metres of concrete for bridges, retaining walls and culverts/pipes.
- 3500 tonnes of steel reinforcement.

Manufactured items, including pre-cast bridge components, and stormwater pipes and pits, would also be required for the proposal. These would be sourced from existing commercial providers. The amounts of materials required would be refined during the detailed design process.

Asphalt and bitumen would be used as part of the pavement works and tie-in of the proposal with the eastern and western extents of the proposal with the existing pavement (through activities that may include milling and resheeting to create consistent levels between existing and new pavement). It is anticipated that the following approximate material volumes would be required to construct the road surface:

- Lean mix concrete sub-base – 13,500 cubic metres.
- Dense graded asphalt – 11,000 cubic metres.
- Select material – 18,000 cubic metres.

Details of the material volumes for the road surface would be determined during detailed design. Due to the size and location of the proposal it is considered that establishment of on-site asphalt batching facilities would not be required. Supply of asphalt to the proposal would be from established local sources.

Surplus materials

Surplus material that is not able to be used on-site as part of the proposal would be reused or disposed of in the following order of priority:

- Transfer to other nearby RMS projects for immediate use.
- Transfer to an approved RMS temporary stockpile site for future use during projects or routine maintenance.
- Transfer to an RMS approved site for reuse on concurrent private/local government project (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 management of excess material would be detailed in a waste management plan (WMP) that would form part of the CEMP.

3.3.6 Traffic management and access

Vehicle movements

The construction of the proposal would result in a temporary increase in heavy vehicle movements along the Great Western Highway and nearby local roads. Construction traffic associated with the proposal at any construction site would generate a range of vehicle type movements including cars, light and heavy trucks and concrete trucks. Construction vehicle traffic would be greatest during the main earthworks and civil construction, and would comprise vehicles transporting equipment, materials and spoil and construction workers accessing the work sites.

Access to and from the site for construction vehicles would generally be from the Great Western Highway and Forty Bends Road. Some access may also occur along McKanes Falls Road. A number of heavy vehicles would be required on-site per day. The estimated vehicles movements for the site per day are provided in **Table 3-4**.

Table 3-4: Indicative construction traffic volumes

Type	Movements per day	Duration
Light vehicle	200 - 500	24 Months
Truck – external earth movement	50 - 130	16 Months
Truck – internal earth movement	50 - 130	16 Months
Water Truck	0 - 20	16 Months
Trucks - external pavement	50 - 130	16 Months
Concrete Trucks	10 - 100	16 Months
Delivery Trucks	0 - 10	24 Months

Construction workers would generally arrive by car. The main construction car park would be at the main site compound located at the western end of Forty Bends Road (refer to **Figure 3-1**). Limited car parking would be provided within the proposed road corridor, near nominated access gates, where this would not interfere with existing traffic on the Great Western Highway

During construction it would be necessary to move a large amount of on-site excavated materials from cuttings to fill areas. Where possible, tracks would be constructed within the proposal site and haulage and movements would be maintained within the work area zone and separate from the travelling public. There are however sections of the works where haulage across or along the Great Western Highway are required. Any haulage movement across or along the Great Western 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 of the proposal site, major material truck haulage routes would be required between the proposal site and the sourced material. Material being imported from the local quarries would use the Great Western Highway and access the work areas from established and designated access points. The indicative haulage routes are shown on **Figure 3-10**.

Traffic management, control and signage

Where possible, the proposed construction works would be programmed to minimise impact on traffic using the local and regional road network.

Standard traffic management measures would be employed to minimise short-term traffic impacts expected during construction. These measures would be identified in a traffic management plan (TMP) for the proposal and would be developed in accordance with the RMS's *Traffic Control at Works Sites Manual* (RTA 2010) and RMS *Specification G10 – Control of Traffic*.

The TMP would provide details of traffic management to be implemented during construction, to ensure that traffic flow along the Great Western Highway is maintained throughout construction. The TMP would be reviewed by RMS prior to 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 as part of the final staging plan for the proposal.

Road and lane closures

The traffic staging would be designed to ensure two-lane (one lane each way) traffic flow is maintained throughout the construction period. Some short-term work under traffic control or lane closure would be required for traffic switches, barriers work and asphalt overlay work. There are three intersections within the proposal site including the western end of Forty Bends Road and McKanes Falls Road. It is considered that traffic delays would be minimal during construction due to the reasonably low traffic volumes. Works would be staged so that construction at the actual intersections would be limited to the shortest possible duration.

Construction parking impacts would be managed through measures identified in the TMP that would form part of the CEMP. Further details regarding the potential traffic impacts during construction is provided in Section 6.7.

3.4 Ancillary facilities

3.4.1 Site compound facility and stockpile sites

Construction compound or stockpile areas of varying sizes would be required to construct the proposal. The potential compound and stockpile areas are identified on **Figure 3-1**. Five potential locations have been identified as potential compounds and/or stockpile sites within the proposal site.

The most suitable location for the main compound site has been identified as being just west of the proposed bridge at the western end of Forty Bends Road. This location is adjacent to the Whites Creek bridge and is central to the overall construction works. This site also has the advantage of having access off Forty Bends Road.

Stockpile sites would have the potential to occur anywhere within the proposal site. Stockpiles would be required to store materials, such as spoil, stripped topsoil, excavated rock and building materials. They would be constructed on relatively level ground and away from areas of ecological and heritage conservation value. Suitable sites for potential stockpile sites have also been identified at each end of the proposal on the southern side of the alignment.

The final location of the stockpile areas would be subject to the site location criteria set out in the RMS's *Stockpile Site Management Procedures* (RTA 2011). In addition, to minimise impacts from the construction compounds, the selection of the final construction compound locations would take into consideration the following site factors:

- Located on relatively level ground.
- Accessible for construction traffic and deliveries.
- Located in areas previously disturbed within the proposal site and that do not require the clearing of native vegetation.
- Located away from residential buildings or heritage items.
- Located in plain view of the public to deter theft and illegal dumping.
- Located close to key construction activities (eg bridge construction) to minimise transport of materials and equipment.
- Located within the area of potential impact to minimise impacts on private and public property.
- Located in areas not prone to flash flooding and more than 40 metres from a watercourse.
- Located outside the drip line of trees and on level ground wherever possible.

The final location of the compound and stockpile and storage sites would be determined during the detailed design phase. Once the contractor has a preferred location for the stockpile and storage areas, consultation with RMS' Senior Environmental Officer (Western) would be undertaken prior to any works in those locations to determine if any additional environmental assessment is required.

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.

Each site would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of the construction works, the temporary site compound, work area and stockpiles would be removed, the site cleared of all rubbish and materials and rehabilitated.

3.4.2 Water quality structures

Construction of the proposal has the potential to affect water quality through erosion of exposed or disturbed areas and subsequent sedimentation of watercourses. Temporary construction basins would be positioned throughout the proposal site to trap sediments and other pollutants from disturbed areas. Additional soil and water management measures would be developed and included as part of the CEMP.

The proposal would result in some changes to the local hydrology, with some modifications to the existing sub-catchments within the study area occurring due to the realignment and widening of the highway. To mitigate the impacts of any increased flows, to manage flows in the other sub-catchments and to mitigate potential impacts to water quality, permanent water quality measures are proposed including drains, culverts and detention basins to capture and direct stormwater. It is proposed that eight basins would be constructed during the construction of the highway. Of these basins, five would be retained as permanent basins to manage operational water quality of the new alignment. Construction and permanent basins are shown on **Figure 3-1**.

Preliminary investigations have been undertaken in accordance with the guidelines set out in the *Soils and Construction – Managing Urban Stormwater* Volume 1 (Landcom, 2004) and Volume 2D (DECC, 2008b) to determine the likely number, size and location for sedimentation control devices at the proposal site. The management of potential water quality impacts would be further developed during the detailed design process. The final number, location and sizing of these sedimentation basins would be determined during the detailed design phase of the upgrade.

3.5 Public utility adjustment

3.5.1 Existing services

Utility investigations to date include dial-before-you-dig (DBYD) enquiries in 2011 and 2012, visual inspections and ground survey to ascertain the location of existing utility services within the proposal site. Further detailed underground detection/survey would be undertaken during the detailed design stage. Investigations to date indicate there are no sewerage or gas mains within the proposal site that would be affected by the proposal.

The existing utilities and services that are within the proposal site and that may be affected by the proposal include the following:

- Telecommunications (Telstra).
- Electricity (Endeavour Energy).
- Water services (Sydney Water/Lithgow City Council).

These services are generally located towards the western end of the proposal site near the intersection of the existing Great Western Highway and McKanes Falls Road and are typically a combination of above-ground (power) and below-ground (water) utility services. Some minor augmentation of these services would be required as a result of the proposal within the proposal site to accommodate changes in level between the existing and proposed designs.

A Telstra fibre optic cable line has also been identified about 650 metres to the south of the proposal (at its closest point). This utility would not be affected by the proposal. In addition, to the above services, the proposal would cross beneath a 132 kilovolt overhead power line (near chainage 32700).

The proposal would not impact on the safe vertical clearance requirements to these power lines as the proposal would generally be at a similar level to the existing Great Western Highway. The current vertical clearance is about 15.4 metres (when measured at 10.00 am on a 20 degree temperature day).

3.6 Property acquisition

The current land ownership within and adjoining the proposal site is shown on **Figure 3-11**.

The proposal would require the full acquisition of three lots and partial acquisition of 14 private lots, four lots of Crown Land and one Department of Main Roads owned lot with an acquisition area of about 17.7 hectares. Some additional areas of land may also be required to be leased by RMS during the construction period for ancillary items such as temporary construction basins or construction compounds and stockpile sites.

The indicative property acquisition and property lease area requirements are identified in **Table 3-5** and shown on **Figure 3-12**. All property acquisitions would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, the *Roads Act 1993* and the RMS's *Land Acquisition Information Guide* (RMS, 2012b).

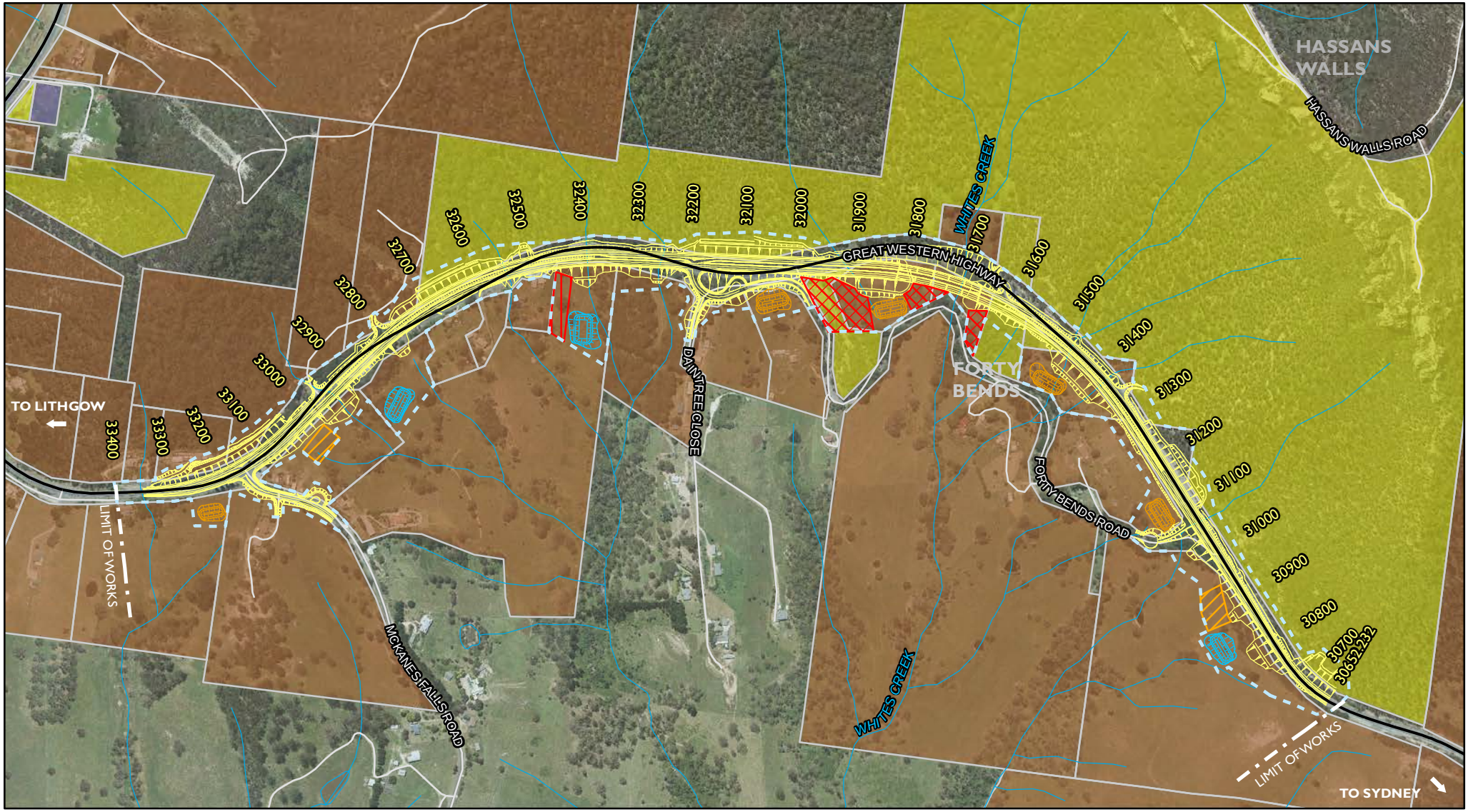
Areas that are leased by RMS during construction only would be returned to the landowner following the completion of works.

Acquisition of Crown Land would be undertaken in accordance with the *Crown Lands Act 1989*.

The RMS would commence the process of negotiating with affected landowners following determination of the proposal. The RMS would consult with directly affected property owners during the detailed design phase of the proposal. This process would be undertaken in accordance with the *RMS's Land Acquisition Information Guide, February 2012*.

Table 3-5: Indicative property acquisition and property lease required for the proposal

Lot/DP	Full/partial acquisition or lease	Ownership type	Indicative area (hectares)
Lot 31 DP 1127293	Partial/lease	Private	2.15
Lot 1 DP 514845	Partial	Private	0.90
Lot 93 DP 751650	Full	Private	1.30
Lot 7002 DP 1028421	Full	Crown Land	0.20
Lot 165 DP 1118256	Partial	Crown Land	0.13
Lot 2 DP 847851	Full	Private	0.74
Lot 1 DP 847851	Full	Private	1.89
Lot 7001 DP 1028421	Partial	Crown Land	0.44
Lot 11 DP 844595	Partial	Private	0.46
Lot 12 844595	Partial	Private	0.20
Lot 1 844595	Partial	Private	0.49
Lot 1 DP 211888	Partial/lease	Private	3.16
Lot 6 DP 806538	Partial	Private	0.06
Lot 1 DP 378232	Partial	Private	0.72
Lot 1 DP 508850	Partial	Private	0.25
Lot 1 DP 798073	Partial	Private	0.37
Lot 1 DP 999340	Partial	Private	0.25
Lot 129 DP 659053	Partial	Private	0.35
Lot 1 DP 845821	Partial	Private	0.37
Lot 7027 DP 1059095	Partial	Crown Land	3.1
Lot 2 DP446409	Full	Commissioner for Main Roads	0.17
TOTAL			**17.7**



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Transport Roads & Maritime Services

Figure 3-11 Land ownership

Mt Victoria to Lithgow: Great Western Highway Forty Bends upgrade

LEGEND

- 31300 Chainage
- Proposal
- Proposal site
- Existing highway
- Waterways
- Property boundary
- Permanent sedimentation basins
- Temporary sedimentation basins
- Compound site and stockpile locations
- Potential compound
- Potential stockpile
- Potential stockpile and compound

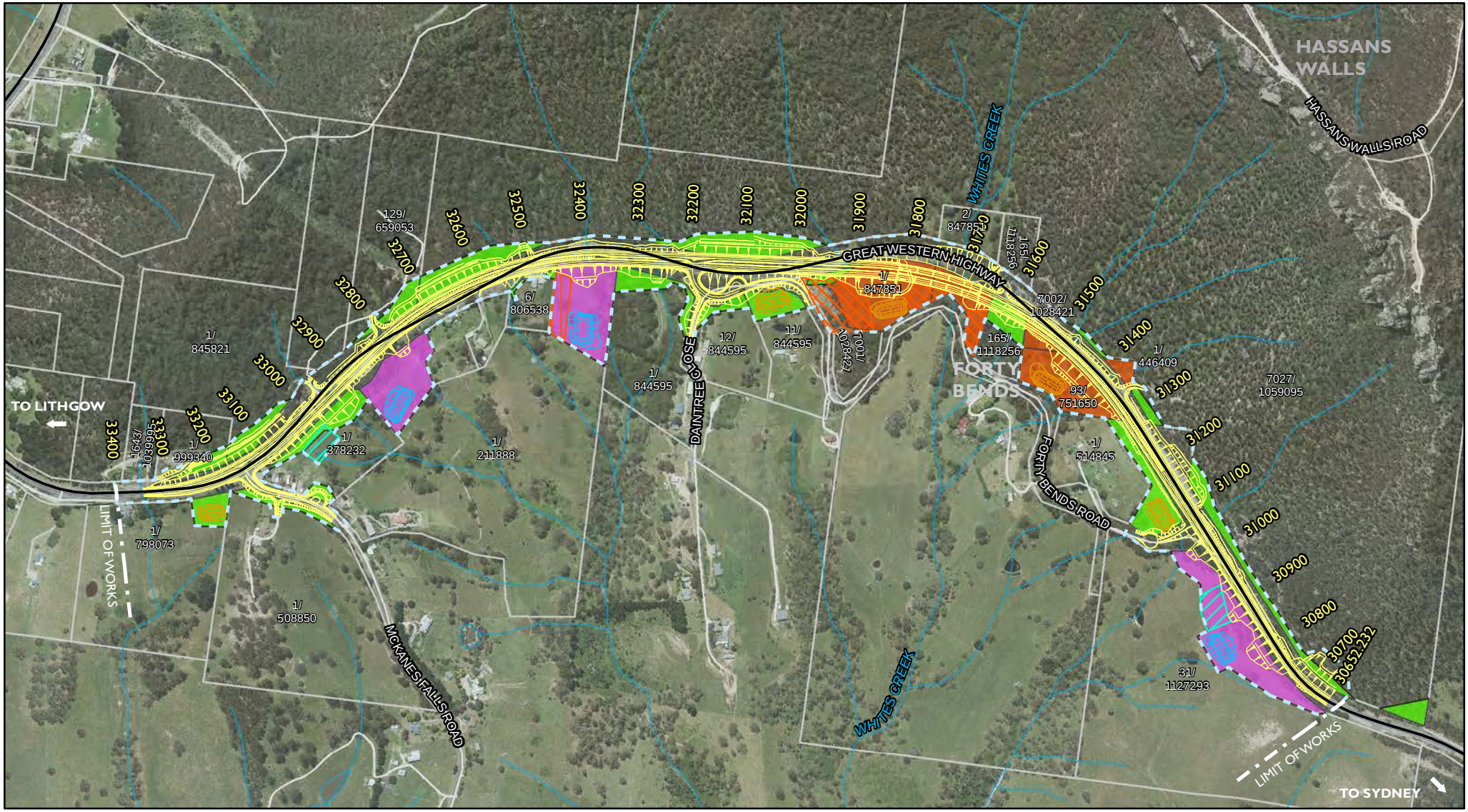
Land ownership

- Council
- Department of Lands (Crown)
- Freehold

GDA 94 | MGA 56

0 200 Metres

Aerial Photograph:AUSIMAGE/SKM 2011



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Transport Roads & Maritime Services

Figure 3-12 Proposed property acquisition

Mt Victoria to Lithgow: Great Western Highway Forty Bends upgrade

LEGEND

- 30300 Chainage
- Proposal
- Proposal site
- Existing highway
- Waterways
- Property boundary
- Permanent sedimentation basins
- Temporary sedimentation basins
- Compound site and stockpile locations
- Potential compound
- Potential stockpile
- Potential stockpile and compound

Acquisition

- Full
- Partial
- Partial/Lease

GDA 94 | MGA 56

0 200

Metres

Aerial Photograph:AUSIMAGE/SKM 2011

4 Statutory and planning framework

4.1 State Environmental Planning Policies

4.1.1 State Environmental Planning Policy (Infrastructure) 2007

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

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

As the proposal is for a road and is to be carried out on behalf of the RMS, it can be assessed under Part 5 of the EP&A Act. Development consent from 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 Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by Infrastructure SEPP (where applicable), is discussed in Chapter 5 of this REF.

4.1.2 State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of natural vegetation areas that provide habitat for koalas to ensure that permanent, free living areas are maintained over their present range. The policy applies to a number of LGAs across NSW, including the Greater Lithgow LGA.

The requirements of SEPP 44 do not apply to this proposal, as it is not subject to council consent. However, it is RMS practice to consider SEPP 44 criteria in its environmental impact assessment process. The assessment criteria consider whether the percentage cover of known feed trees, listed under Schedule 2 of SEPP 44 is greater or less than 15% of the total tree canopy.

There are three historical records of koalas in the locality (Atlas of NSW Wildlife OEH 2012), and suitable feed species are present in the study area. There is a small area of forest dominated by Ribbon Gum (*Eucalyptus viminalis*) towards the western end of the proposal site. This species is a known feed tree listed under SEPP 44. The proposal site also contains more extensive areas of marginal habitat which may provide some foraging opportunities such as the dominant tree species in the majority of vegetation in the study area which are Monkey Gum (*Eucalyptus cypellocarpa*) and Blaxland's Stringybark (*Eucalyptus blaxlandii*) which have been identified as providing secondary/supplementary food sources (DECC 2008b).

Given the limited extent of proposed vegetation clearing of preferred Koala habitat and mitigation measures proposed (refer to Chapter 6), koala habitats have been identified as having a high potential to occur within the proposal site. Further discussion of the potential impacts of the proposal on Koala habitat is provided in Section 6.1 of this REF.

4.1.3 State Environmental Planning Policy 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) was enacted to provide a state-wide 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 along the proposal. These include:

- Stockpiled materials (predominantly road construction materials with some evidence of other general waste materials) along the existing highway.
- The existing Great Western Highway.
- Regional agricultural land use within and surrounding the corridor area including the potential use of chemicals, storage and use of fuels, fill, stock dips and waste disposal practices.

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

4.1.4 State Environmental Planning Policy (Sydney Drinking Water Catchments) 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, inclusive of the Blue Mountains and the Illawarra. The area of these catchments extends from north of Lithgow to the Shoalhaven River north of Cooma, including the area in which the proposal is to be undertaken (refer to SEPP Sydney Drinking Water Catchment Map SDWC_006).

The proposal is located within the catchment of the Coxs River, and is within the boundary of the Warragamba Drinking Water Catchment. Consequently, 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 (Drinking Sydney Water Catchment) states as follows:

> '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.'

The proposal, once the proposed mitigation measures (refer to Chapter 6) have been implemented, would not have an adverse impact on the quality of water being discharged into the Coxs River sub-catchment. The mitigation measures for the proposal would also, in accordance with Clause 9 of the SEPP take into account the relevant SCA recommended practices and performance standards.

A qualitative Neutral or Beneficial Effect (NorBE) water quality assessment has been undertaken and is attached as Appendix G of Technical Paper 6 – Water Quality contained within Volume 3 of this REF.

4.2 Local Environmental Plans

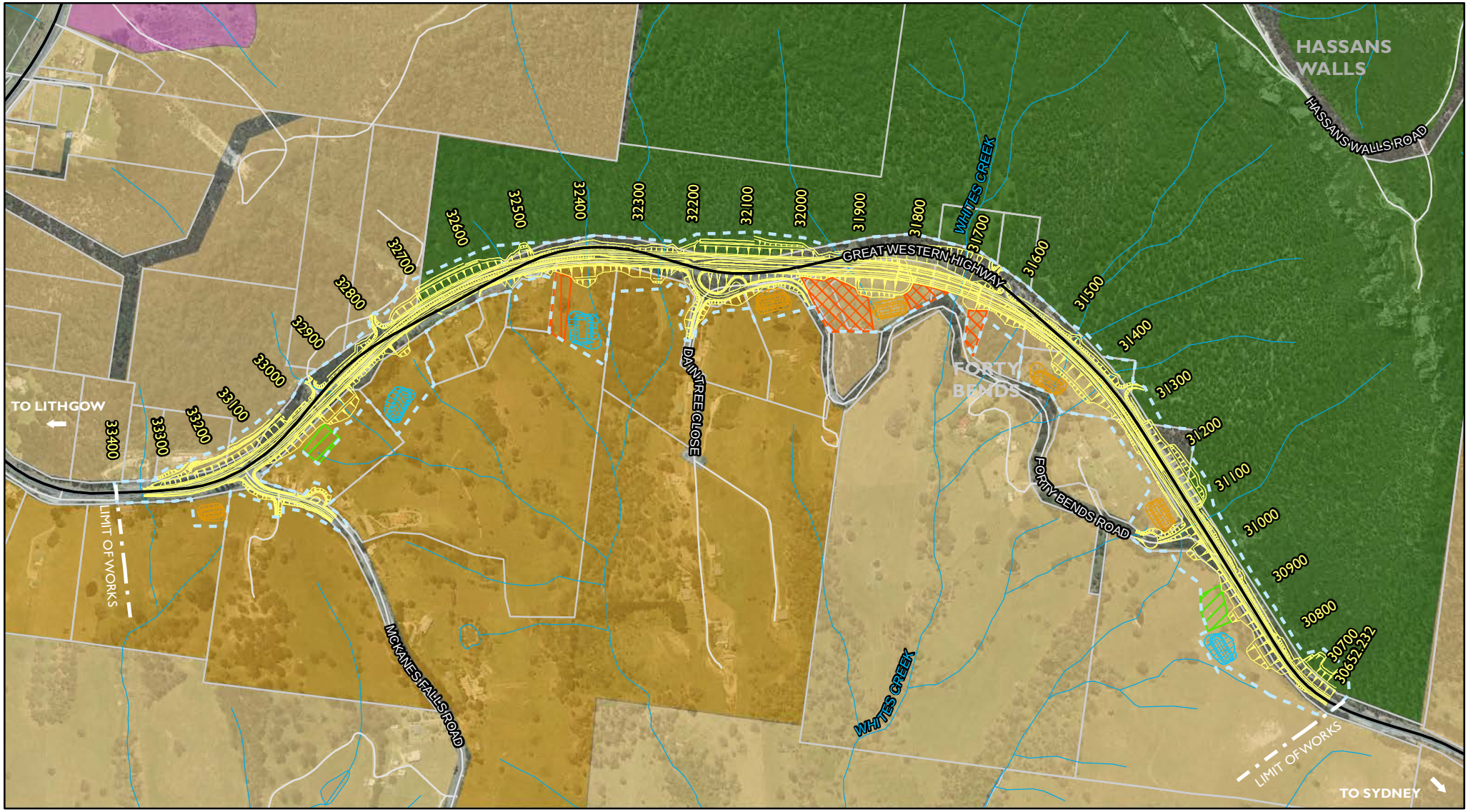
The proposal is located within the Lithgow City LGA. Consequently, the principal relevant local environmental planning instrument under the EP&A Act is the Lithgow City Local Environmental Plan 1994 (LEP 1994).

Under this LEP, the land use zonings that would be affected by the proposal would include:

- Zone No 1 (a)–Rural (General).
- Zone No 1 (c)–Rural (Small holdings).
- Zone No 6–Open space.

The existing road corridor is unzoned under the Lithgow City LEP 1994. The current zoning within the proposal site is provided on **Figure 4-1**.

A significant proportion of the proposal would be within the existing road corridor and would not substantially impact on other land uses within the proposal site. **Table 4-1** outlines the current zoning objectives for each of the impacts zones and the consistency of the proposal against these objectives.



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Transport Roads & Maritime Services

Figure 4-1 Zoning - Lithgow LEP

Mt Victoria to Lithgow: Great Western Highway Forty Bends upgrade

LEGEND

- 31300 Chainage
- Proposal
- Proposal site
- Existing highway
- Waterways
- Property boundary

Zoning - Lithgow LEP

- Zone 1a, RURAL (GENERAL)
- Zone 1c, RURAL (SMALL HOLDINGS)
- Zone 2a, RESIDENTIAL
- Zone 6, OPEN SPACE

- Permanent sedimentation basins
- Temporary sedimentation basins

Compound site and stockpile locations

- Potential compound
- Potential stockpile
- Potential stockpile and compound

GDA 94 | MGA 56

0 200

Metres

Aerial Photograph:AUSIMAGE/SKM 2011

Table 4-1: Relevant Lithgow City LEP 1994 zoning objectives

Zone	Objectives	Consistency of proposal against objectives and permissibility
Zone No 1 (a)–Rural (General)	*(a) protecting, enhancing and conserving:* *(i) rural land, in particular prime crop and pasture land, in a manner which sustains its efficient and effective agricultural production potential,* *(ii) soil, by controlling and locating development in accordance with soil capability,* *(iii) forests of existing and potential commercial value for timber production,* *(iv) valuable deposits of minerals, coal and extractive materials, by controlling the location of development for other purposes in order to ensure the efficient extraction of those deposits,* *(v) trees and other vegetation in environmentally sensitive areas, where the conservation of the vegetation is significant for scenic amenity or natural wildlife habitat or is likely to control land degradation,* *(vi) water resources for use in the public interest, preventing the pollution of water supply catchment and major water storages,* *(vii) localities of significance for nature conservation, including places with rare plants, wetlands and significant wildlife habitat, and* *(viii) items of heritage significance,* *(b) preventing the unjustified development of prime crop and pasture land for purposes other than agriculture,* *(c) facilitating farm adjustments,* *(d) minimising the cost to the community of:* *(i) fragmented and isolated development of rural land, and* *(ii) providing, extending and maintaining public amenities and services,* *(e) providing land for other non-agricultural purposes, in accordance with the need for that development, and* *(f) providing for the separation of conflicting land uses.*	The rural and scenic conservation of the area and visual impact of the proposal has been considered and mitigation provided. The alignment of the proposal generally follows the alignment of the existing highway and has considered the minimisation of fragmentation of rural land. The proposal is considered to be consistent against the objectives of this zone and would be permissible with development consent.

Zone	Objectives	Consistency of proposal against objectives and permissibility
Zone No 1 (c)–Rural (Small holdings)	*(a) to allow development of land for rural small holdings if the land is identified as suitable for that purpose,* *(b) to ensure that allotments created for rural small holdings are of an area and subject to arrangements that:* *(i) enable the provision of an adequate water supply,* *(ii) enable effective disposal of domestic waste,* *(iii) minimise the creation of traffic hazards,* *(iv) do not contribute to pollution of water supply catchments, and* *(v) do not impact unfavourably on water quality within the Nepean-Hawkesbury River System,* *(c) to ensure that development is carried out in a way that is sensitive to the environmental characteristics of the land,* *(d) to minimise the cost to the community of providing, extending and maintaining public amenities and services,* *(e) to ensure that rural small holdings development does not prejudice the interests of agricultural producers in the vicinity, and* *(f) to allow development for a range of purposes which are compatible with the environmental capabilities of the land and which are unlikely to adversely affect land or other development in the vicinity or create unscheduled demands for service infrastructure.*	The rural and scenic conservation of the area and visual impact of the proposal has been considered and mitigation provided. The proposal is considered to be compatible with the environmental capabilities of the existing road corridor and the surrounding land. The alignment of the proposal generally follows the alignment of the existing highway and has considered the minimisation of fragmentation of rural and rural small holding land. The proposal is considered to be consistent against the objectives of this zone and would be permissible with development consent.
Zone No 6–Open space	*(a) to identify land which is owned, controlled or managed by the Council, is proposed for open space or public recreational purposes or is privately owned and used for recreational purposes,* *(b) to maximise the value of community land and promote its multiple use to satisfy the diverse recreational needs of the community,* *(c) to enable development, including clubs, only if associated with, ancillary to, or supportive of recreational uses,* *(d) to offer opportunities for recreational pursuits within residential neighbourhoods,* *(e) to provide opportunities to enhance the total environment of Lithgow,* *(f) to retain significant features and ensure that the visual impact is not unnecessarily reduced,* *(g) to ensure that water quality is maintained in watercourses and wetlands, and* *(h) to maintain or enhance the ecological biodiversity of watercourses and wetlands.*	Only a small amount of this zone would be impacted by the proposal which consists of the Crown Land reserve to the north of the existing highway. The proposal is considered to be consistent against the objectives of this zone and would be permissible with development consent.

As the proposal is for a road and road infrastructure facilities and is to be carried out by RMS under the Infrastructure SEPP (refer to Section 4.1.1 above), development consent from council under the Lithgow City LEP 1994 is not required.

Lithgow City Council has also been consulted as part of the proposal, in particular regarding potential impacts of the proposal on locally listed heritage items within the proposal site. Details of the consultation with Lithgow City Council are provided in Chapter 5.

4.3 Other relevant legislation

4.3.1 National Parks and Wildlife Act 1974

The *National Parks & Wildlife Act 1974* (NP&W Act) provides for the control and management of all national parks, historic sites, nature reserves, reserves, wetlands and other state reserves. The NP&W Act outlines approval requirements for works in the vicinity of indigenous archaeological sites and provides for the protection of flora and fauna.

The Act also provides statutory protection for all Aboriginal 'objects' (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 90 of the Act, and for 'Aboriginal Places' (areas of cultural significance to the Aboriginal community) under Section 84. Aboriginal objects are afforded automatic statutory protection in NSW.

The proposal would impact on one Aboriginal site identified within the proposal site with cultural heritage value. An application for an Aboriginal heritage impact permit (AHIP) under Section 90 of the NPW Act would be made by RMS prior to commencement of construction works (refer to Sections 6.2 and Technical Paper 3 – Cultural Heritage Assessment Report contained within Volume 2 of this REF for a detailed assessment).

4.3.2 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to protect and preserve items of non-Aboriginal heritage significance. The Heritage 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 approval of development which may impact items of heritage significance.

A number of historic items (of local and State significance have been identified within proximity to the proposal (refer to Section 6.3 of this REF). No non-Aboriginal heritage items would be adversely affected in a direct manner by the proposal.

There is some limited possibility for finding unknown or buried remains of culverts between Forty Bends Road and Emoh. As a precaution a Section 140 approval under the Heritage Act would be obtained from the Office of Environment & Heritage (Heritage Branch) for this eventuality so as to reduce potential delays and manage risk. Further consultation with OEH Heritage branch would be undertaken prior to seeking this approval.

There is also some limited possibility for finding relics associated with water quality basins associated with two historic properties but outside the two identified heritage curtilages. These works would also be covered by a Section 140 approval.

4.3.3 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides protection for threatened species, populations and ecological communities and their habitat in NSW. If any of these could be impacted by the proposal, an Assessment of Significance that addresses the requirements of Section 5A of the EP&A Act must be completed to determine the significance of the impact.

One threatened ecological community (Ribbon Gum Grassy Woodland – *Eucalyptus viminalis*), three threatened fauna species (Purple Copper Butterfly (*Paralucia spinifera*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and Little Bent-wing Bat (*Miniopterus australis*) and no threatened flora species have been recorded in the vicinity of the proposal site.

The requirements of Section 5A of the EP&A Act to undertake significance assessments have been considered (refer to Appendix F of Technical Paper 1 – Biodiversity) and concluded that the proposal is unlikely to result in a significant impact on any threatened species, endangered population, endangered ecological community or critical habitat listed under the TSC Act. Therefore the impacts of the proposal would not trigger the need for a Species Impact Statement. Further discussion of the potential biodiversity impacts of the proposal are provided in Section 6.1.

4.3.4 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the protection of threatened fish and marine vegetation and is administered by the Department of Primary Industries. The FM Act, in conjunction with the TSC Act, aims to conserve, develop and share fishery resources and conserve marine species, habitats and diversity.

The proposed alignment would cross Whites Creek.

Waterway crossings have been designed where possible according to NSW Fisheries (part of NSW Department of Primary Industries – DPI) guidelines and in consultation with NSW Fisheries staff to ensure minimal impact on aquatic habitats and species protected under the Act.

The RMS would consult with NSW Fisheries to discuss the proposal and its constraints, and to assist in refining waterway crossing options during the detailed design phase of the proposal as part of the Infrastructure SEPP consultation (refer to Chapter 5 for greater details regarding this consultation).

4.3.5 Water Act 1912

The *Water Act 1912* (Water Act) provides for the granting of various licences and approvals, including water rights and works, flood control works and licensing for artesian wells and the extraction of water.

Licensing for water extraction from boreholes (if required) as part of the construction of the proposal would be required under Section 112 of the Water Act.

4.3.6 Crown Lands Act 1989

The *Crown Lands Act 1989* (CL Act) provides for the management, administration and use of Crown Land in NSW. Section 11 of the CL Act states that the principles of Crown Land management are:

> '(a) that environmental protection principles be observed in relation to the management and administration of Crown land,
> (b) that the natural resources of Crown land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible,
> (c) that public use and enjoyment of appropriate Crown land be encouraged,
> (d) that, where appropriate, multiple use of Crown land be encouraged,
> (e) that, where appropriate, Crown land should be used and managed in such a way that both the land and its resources are sustained in perpetuity, and
> (f) that Crown land be occupied, used, sold, leased, licensed or otherwise dealt with in the best interests of the State consistent with the above principles.'

Additionally, under Clause 34(1) the relevant Minister has the power to:

> **34 Powers of Minister in relation to Crown land**
>
> (1) 'in such manner and subject to such terms and conditions as the Minister determines:
>
> (a) sell, lease, exchange or otherwise dispose of or deal with Crown land, or
> (b) grant easements or rights-of-way over, or licences or permits in respect of, Crown land, on behalf of the Crown.'

As part of the proposal, some Crown Land would be directly impacted. In accordance with the CL Act, any works proposed to be carried out on Crown Land requires a permit from the Department of Primary Industries Crown Lands Division (DPI Crown Lands Division). Consultation would be undertaken with the DPI Crown Lands Division and consideration given to the principles of Crown Land management in accordance with Section 11, as outlined in **Table 4-2** below:

Table 4-2: Consistency of proposal against the principles of the Crown Land Act 1989

Clause	Consistency of proposal against the principles of the Crown Land Act 1989
(a) that environmental protection principles be observed in relation to the management and administration of Crown land	The proposed alignment of the Great Western Highway at Forty Bends would not impact the existing areas of Crown Land in relation to the management and administration of this land.
b) that the natural resources of Crown land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible	A range of mitigation measures are proposed to minimise impacts on the natural resources of Crown land including water, soil, flora, fauna and scenic quality .
(c) that public use and enjoyment of appropriate Crown land be encouraged	The existing Crown Land to the north of the Great Western Highway at Forty Bends is typically not currently used for public use. The realignment of the highway in this location is not anticipated to impact on the current use of this land.

Clause	Consistency of proposal against the principles of the Crown Land Act 1989
(d) that, where appropriate, multiple use of Crown land be encouraged	The existing Crown Land to the north of the Great Western Highway at Forty Bends is typically open forest on steep land. Limited multiple uses are currently available for the Crown Land proposed to be impacted by the proposal.
(e) that, where appropriate, Crown land should be used and managed in such a way that both the land and its resources are sustained in perpetuity	The proposal would allow for the remaining Crown Land to the north of the highway be used and managed in such a way that both the land and its resources are sustained in perpetuity.
(f) that Crown land be occupied, used, sold, leased, licensed or otherwise dealt with in the best interests of the State consistent with the above principles	A short term licence (under Clause 45) or an easement (under Part 4, Division 5) would need to be sought prior to construction officially been sought from the DPI Crown Lands Division under Clause 45 of the CL Act. Construction works for the proposal would not commence until receipt of this licence, which would include the concurrence of the Minister for Planning and Infrastructure. It is considered that given the small amount of land to be purchased, and the location of the land in relation to the existing Great Western Highway, that the sale of the land would be consistent with the stated principles.

4.4 Commonwealth legislation

4.4.1 Environment Protection and Biodiversity Conservation Act 1999

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

Based on the assessment proposal's impact on matters of national environmental significance and the environment of Commonwealth land, the RMS would submit a referral to SEWPAC to determine whether or not the proposal constitutes a controlled action due to potential impacts on number of threatened fauna species including the Purple Copper Butterfly, Koala, Spotted Tail Quoll, Grey Headed Flying Fox, Regent Honey Eater and the Swift Parrot (refer to Section 6.1).

If the proposal is determined to be a controlled action, the approval of the Australian Government Minister for the Environment is required. Impacts from the proposal on matters of NES are discussed further in Section 6.1 and **Appendix A**.

4.5 Confirmation of statutory position

All relevant statutory planning instruments have been examined for the proposal. It is concluded that Infrastructure SEPP operates to remove the development consent requirements, thereby permitting assessment of the proposal under Part 5 of the EP&A Act.

5 Stakeholder and community consultation

5.1 Consultation objectives and strategy

The consultation objectives included:

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

A community consultation and stakeholder engagement plan ('communications plan') was developed and implemented as part of the Mount Victoria to Lithgow upgrade development phase which guided community and stakeholder engagement as part of the proposal. The communications plan identifies key objectives and outcomes of consultation activities with the community, stakeholders and government agencies.

The proposal has incorporated consultation with directly and indirectly affected landowners, interested local and regional individuals as well as the wider community. Consultation has also included involvement of local interest groups and state government agencies, including:

- Aboriginal Land Councils and individuals (refer to Section 5.3).
- Federal, State and Local government agencies, authorities and representatives (refer to Section 5.4 and Section 5.5).
- Local community and local community groups (refer to Section 5.5).

5.2 Community involvement

Community consultation was undertaken for various stages throughout the project development of the proposal. The concept design for the Mount Victoria to Lithgow upgrade (inclusive of the Forty Bends section, subject of this REF) has been under development since the announcement of the proposed upgrade in October 2007 including the development of route corridor options between 2008 and 2009 and the announcement of the preferred route in May 2010. Various consultation activities have occurred as part of the overall upgrade of the Great Western Highway between Mount Victoria and Lithgow such as letterbox drops, advertisements, community meetings and display of various planning and design documentation. This consultation process has assisted in informing the development of the concept design for Forty Bends upgrade and the remaining sections of the highway between Mount Victoria and Lithgow.

These activities are described in more detail below.

5.2.1 Preferred route – Mount Victoria to Lithgow

In May 2010, the RMS announced the preferred route for the upgrade of the Great Western Highway between Mount Victoria and Lithgow. Property owners within the preferred route boundary and those no longer directly affected by the various routes under investigation were individually contacted via mail and phone. Over 10,000 community updates were distributed to the communities between Blackheath and Lithgow. Information was updated on the project website with emails advising of the update being sent to those registered on the email list. Advertisements were placed in the following publications, notifying of the display:

- Lithgow Mercury.
- Blue Mountains Gazette.
- SMH.
- Daily Telegraph.
- The Koori Mail.
- Oberon Review.
- The Land.
- National Indigenous Times.

Information about the preferred route was also put on public display at six venues. These venues included:

- Blue Mountains City Council.
- Katoomba Library.
- City of Lithgow Council.
- Lithgow Library.
- Oberon Council.
- Lithgow Motor Registry.

In June 2010, four staffed displays were held with residents and other stakeholders to outline the preferred route and the next steps in project development. Two staffed displays were held at Hartley and two at Mount Victoria.

In addition to issues raised during the displays of the preferred route, feedback was also received which was directly relevant to the Forty Bends area. The May 2010 route options submissions summary, which was published during the display of the preferred route, outlined a number of issues regarding the route options for Forty Bends. A majority of people who responded to the route options report noted a preference for a straightened alignment; however, there was also some support for the existing alignment and some opposition to both options.

The reasons given for preferring the straightened alignment were:

- Safety.
- Avoiding black ice.
- Minimising traffic disruption.

Concern was raised in one response that earthworks required to cross the gully of White Creek could potentially act as a dam.

The reasons given for preferring the current alignment were:

- Reduced impact on properties.
- Reduced impact on heritage items.
- Reduced damage to surrounding areas.

- Reduced impact on native vegetation.
- Reduced expense.
- Reduced earthworks requirement.

Alternative construction ideas were also suggested including:

- A road alignment that provided a straight line from south-east of Forty Bends Road, where the Great Western Highway intersects with the road design to just north-east of the McKanes Falls Road, Great Western Highway intersection.
- Minimum deviation from the current highway.
- A minor adjustment to the straightened alignment could avoid impact on Forty Bends Road, while assisting in the reduction of black ice.

Issues raised during this stage of the project were used to develop the concept design for Mount Victoria to Lithgow, including the Forty Bends upgrade.

As part of the design development process, in June 2011 RMS invited all affected landowners to meetings to discuss property access issues. Five owners in the Forty Bends area accepted the offer of a meeting. The meetings were attended by designers from RMS and the MV2L Alliance to ensure that all issues raised could be considered in the design development process.

5.2.2 Mount Victoria to Lithgow concept design

The concept design for the proposed Mount Victoria to Lithgow upgrade is currently on public display until 26 October 2012.

A community update was provided to the public in late July 2012 advising of the concept design display and key features of the concept design. Advertisements were placed in the Lithgow Mercury and the Blue Mountains Gazette, notifying of the display. Five public community meetings were held during August 2012 at locations in Mount Victoria, Hartley and Lithgow. These meetings were held to discuss various aspects of the concept design were discussed such as the overall concept alignment, the proposed service road, property impacts and access changes, impacts to the environment and timing of the upgrade. A visualisation of the concept design was also presented at each of the community meetings for the whole of the concept design alignment.

The relevant community feedback relating to the proposal is summarised and discussed in further detailed below and in **Table 5-1**.

A series of non-government and stakeholder consultations were also consulted during the design of the proposal. In particular, targeted consultation was initiated with affected landowners from the proposal in July 2012 following display of the concept design. These meetings sought to introduce the Alliance team, transfer local knowledge and information, and provide landowners with information about the environmental assessment process. The affected landowner meetings were also to seek comment on the design and discuss implications of the design as they relate to particular properties.

Community issues raised during the concept design display

Additionally, as described in Section 5.2.3 above, additional public five public community meetings were held in August 2012 to discuss various aspects of the overall concept design between Mount Victoria to Lithgow (including the Forty Bends section which constitutes the proposal described in this REF). Feedback from the community meetings on the concept design, including the Forty Bends section, was collected as part of the development of the proposal.

Table 5-1 provides a summary of the key community issues raised during the targeted affected landowner meetings and items raised regarding the Forty Bends section of the Great Western Highway Mount Victoria to Lithgow concept design during the public community meetings.

Table 5-1: Summary of key community issues raised during the Mount Victoria to Lithgow concept design display regarding Forty Bends

Issue category	Summary of key issues raised	Section(s) where addressed in REF
General design	• Type of road surface proposed to be used and potential impacts to noise	Section 3.3.5, Section 6.6.4 Technical Paper 5 – Noise and Vibration
	• Impact to existing utilities	Section 3.5
Project justification	• Consideration of only clearing 10 metres of vegetation on the north side of the proposal as being enough to impact on black ice mitigation.	Section 2.4.3 Section 3.2.5
	• Many accidents occur on the area between River Lett Hill and Forty Bends. What works are being undertaken in these areas?	Section 2.1.5
Access	• Access arrangements during construction.	Section 3.3.6
	• Access arrangements during operation.	Section 3.3.1 and Section 3.2.1
	• Concern regarding the closure of the eastern end of Forty Bends Road to traffic.	Section 3.2.3 Section 6.8.3
	• Need to retain existing access points to properties.	Section 3.3.1 and Section 3.2.1
Biodiversity	• Concern regarding the impact on remnant vegetation or environmentally sensitive land	Section 6.1 and Technical Paper 1 - Biodiversity
	• Concern regarding the extent of vegetation clearing proposed and the proposed use of cleared vegetation.	Section 6.1 and Technical Paper 1 - Biodiversity
	• Are locations for wildlife crossing points going to be provided?	Section 6.1 and Technical Paper 1 - Biodiversity
Noise and vibration	• Concern regarding the potential noise and vibration impacts associated with the proposal during construction and operation.	Section 6.4, Technical Paper 5 – Noise and Vibration

Issue category	Summary of key issues raised	Section(s) where addressed in REF
Traffic	• Concern that the proposal is only one lane west bound (for part) as this is a major freight route.	Section 6.8 and Technical Paper 8 – Traffic and Transport
	• Concern regarding potential traffic delays and reduced safety caused by construction of the proposal.	Section 3.3.6 and Section 6.7.4
	• There is a need to provide barriers along the length of the proposal.	Section 6.7.3
Drainage and water quality	• Potential additional drainage impacts associated with the proposal including impacts to existing farm dams and potential additional erosion impacts.	Section 6.5 and Technical Paper 6 – Water Quality
	• Run off of petrol/diesel/oil etc to run off the proposal into the proposed sedimentation basins.	Section 6.5 and Technical Paper 6 – Water Quality and Section 6.14
	• If existing dams are removed as part of the proposal, there would be overflows of water on other parts of the property.	Section 6.5 and Technical Paper 6 – Water Quality
Property impacts	• Decrease in property values as a result of the proposal.	Section 6.10
	• Sterilisation of land for future use.	Section 6.9
	• Close proximity of portions of the proposal with regard to existing buildings resulting in the potential to reduce visual amenity and increase noise levels.	Section 6.4, Section 6.7
Property acquisition	• Clarification of land acquisition process	Section 3.6
	• Potential to acquire the whole property rather than just a part of it.	Section 3.6
Safety improvements	• Concern that the alignment of Forty Bends cutting further into Hassans Walls would mean more black ice, not less.	Section 3.1.1 Section 3.2.5
	• Non-local traffic are unaware of the potential road conditions (black ice, fog, snow etc) and the quick variability in these conditions.	Section 3.2.5
	• Sight distances at McKanes Falls Road.	Section 6.8.3
Socio-economic	• Ability to construct a house on the property following construction of the proposal if the land size is reduced.	Section 6.8
	• Impact of the proposal on the existing (informal) school bus stop location(s) along the Great Western Highway.	Section 6.10
	• Loss of business for tow-truck drivers.	Section 6.10

Consultation with affected landowners would continue throughout detailed design and construction of the proposal.

5.3 Aboriginal community involvement

Comber Consultants undertook consultation with local Aboriginal heritage stakeholders in accordance with the RMS *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (RMS, 2011a) and *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010). The following activities have been undertaken as part of this consultation:

- Public advertising in regional and local newspapers to seek registration of interested Aboriginal parties (closing date April 2010). Aboriginal land councils and individuals were invited to register their interest for involvement in the assessment of Aboriginal archaeology and cultural heritage.
- Identification of potential knowledge holders in consultation with the Office of Environment and Heritage (April to May 2011).
- Issue of an invitation to registered parties to participate in the consultation process and attend three Aboriginal Focus Group (AFG) meetings.
- Participation of Aboriginal representatives as part of the ongoing field investigations.

Aboriginal Focus Group meetings

The AFG was formed to provide a forum to bring together 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 proposal ensuring appropriate care and control of Aboriginal artefacts identified during the Aboriginal heritage investigations and to provide for comment on all aspects of the Aboriginal heritage management.

Twenty nine Aboriginal stakeholders were registered for the proposal, including members from 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 Mittagr Aboriginal Group.
- Wargon and Bura Aboriginal Centre Inc.
- Wiradjuri Traditional Owners.
- Yarrawalk (a division of Tocomwall Pty Ltd).

The initial AFG meeting was held on 31 May 2011 at Katoomba to discuss the scope of works and the cultural heritage assessment process. Details of the upcoming archaeological field survey work were also discussed at this time. The meeting was attended by 15 stakeholders, archaeologists, RMS and Alliance representatives.

Following this, the RMS's Aboriginal Cultural and Heritage Advisor (ACHA) attended survey investigations on 28 March 2011 and 11 May 2011 with archaeologists and various Aboriginal stakeholders. This was to assist in the identification of any known or potential Aboriginal cultural heritage constraints (eg archaeological deposits) within or adjacent to the proposal site as part of initial geotechnical survey investigations for the Mount Victoria to Lithgow concept design. Additional archaeological field investigations were also undertaken between 14 June 2011 and 29 August 2011 as part of the overall corridor study investigations for the Mount Victoria to Lithgow concept design.

A second AFG meeting was held on 13 October 2011 attended by nineteen stakeholders to discuss the findings of the Aboriginal field investigations undertaken between June and August 2011 (refer to Section 6.2). The archaeological test excavation methodology was provided to all registered stakeholders for review and comment and discussed at this meeting. Comments made regarding the proposed archaeological test investigations during the meeting and comment period were incorporated into the finalised methodology. Three letters of support were provided by members of the AFG with respect to the recommendations outlined in the draft excavation methodology.

Following detailed site survey, archaeological test excavation and cultural heritage surveys of the proposal site, a draft Aboriginal Cultural Heritage Assessment Report (CHAR) was prepared for the proposal. The draft CHAR outlined the results of the site survey, test excavations and provided an assessment of impacts and proposed mitigation for archaeological sites and cultural places within the proposal site (refer to Section 6.2). The draft CHAR was provided to the Aboriginal stakeholders for review and comment in preparation for discussion at the third AFG

At the third AFG meeting, held on 23 July 2012. the results of the archaeological testing and draft CHAR were discussed. This meeting was attended by thirteen stakeholders. The Aboriginal stakeholders determined that the work undertaken as part of the ongoing Aboriginal investigations was appropriate and that the results and recommendations of the draft CHAR were suitable. Appropriate care and control of the Aboriginal artefacts identified was also agreed upon at this meeting. Two letters of support were provided by members of the AFG with respect to findings and recommendations presented within the draft CHAR. The final archaeological test excavations report and final Aboriginal CHAR are attached as Technical Papers 2 and 3 of this REF respectively.

The AFG group would continue to be consulted as the proposal progresses through detailed design.

5.4 Infrastructure SEPP consultation

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

Table 5-2 lists the clauses to be considered, a summary of whether these are relevant to the proposal and identification of any requirements for the Infrastructure SEPP consultation.

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

Clause	Response
Clause 13	
1(a) Substantial impact on stormwater management services provided by a council.	The proposal is anticipated to have some impact on the stormwater system provided by Lithgow City Council due to the changes in pavement extent and water catchments. Formal consultation with Lithgow City Council has been undertaken with regard to this item.
1(b) Likely to generate traffic to an extent that would strain the capacity of the road system in a local government area.	The proposal would temporarily result in increased traffic during construction largely relating to the cut and fill works for the construction of the new road alignment. This impact has the potential to temporarily impact the existing operation of the Great Western Highway during this period. However, in the long-term, the proposal would improve the capacity of the road by improving the existing design and providing additional capacity for current and future traffic volumes. Formal consultation with Lithgow City Council is not required under this clause.
1(c) Involves connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council.	The proposal would not substantially impact on the capacity of a sewerage system provided by Lithgow City Council or the connection into such a system. Formal consultation with Lithgow City Council is not required under this clause.
1(d) Involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council.	Water would be required during construction for the management of dust. The source of this water would be determined during the detailed design phase of the proposal. Formal consultation with Lithgow City Council is not required on this item at this stage.
1(e) Involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential.	The proposal would not involve the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic. Formal consultation with Lithgow City Council is not required under this clause.
1(f) Involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the Roads Act 1993 (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath).	The proposal would not involve any substantial excavation of an existing footpath managed by Lithgow City Council. Some impact from excavation of roadways managed by Council (Forty Bends Road, Daintree Lane and McKanes Falls Road) would be involved as part of the proposal. Formal consultation with Lithgow City Council has been undertaken with regard to the potential impact on council managed roadways.

Clause	Response
Clause 14	
Is likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area.	The proposal is located within close proximity to a series of heritage items under the LEP and draft *Land Use Strategy*. The proposal has been identified as having the potential to have a moderate impact on one draft local heritage item (Daintree Cottage) and the potential for relics to be identified on the properties known as Emoh and Cottage 1960116 (refer to Section 6.3). Formal consultation with Lithgow City Council has been undertaken with regard to this clause.
Clause 15	
Development that is to be carried out on flood liable land that may be carried out without consent and that would change flood patterns other than to a minor extent.	The proposal would not involve development in an area that is considered to constitute flood liable land. Formal consultation with Lithgow City Council is not required under this clause.
Clause 16	
Clause 16 of the Infrastructure SEPP states that a consent authority must not carry out any of the following development without giving written notice to the specified authority and taken their responses into consideration:	
(a) development adjacent to land reserved under the National Parks and Wildlife Act 1974 (Office of Environment and Heritage)	The proposal site is not located adjacent to land reserved under the *National Parks and Wildlife Act 1974*.
(b) development adjacent to a marine park declared under the Marine Parks Act 1997 (Marine Parks Authority)	The proposal site is not located adjacent to a marine park declared under the *Marine Parks Act 1997.*
(c) development adjacent to an aquatic reserve declared under the Fisheries Management Act 1994 (Office of Environment and Heritage)	The proposal site is not located adjacent to an aquatic reserve declared under the *Fisheries Management Act 1994.*
(d) development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998 (Sydney Harbour Foreshore Authority)	The proposal site is not located foreshore area within the meaning of the *Sydney Harbour Foreshore Authority Act 1998.*
(e) development comprising a fixed or floating structure in or over navigable waters (Maritime Authority of NSW)	The proposal is not development that would comprise a fixed or floating structure in or over navigable waters.
(f) development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act) (NSW Rural Fire Service)	The proposal is not development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land.

Consultation with Lithgow City Council has been undertaken under the requirements of the ISEPP, with respect to Clauses 13(1)(a), 13(1)(f) and Clause 14.

A letter was sent to Lithgow City Council on 20 August 2012 providing information on the proposal and seeking comment. As at the time of preparing the REF, no comments had been received from Lithgow City Council under the Infrastructure SEPP regarding the proposal.

5.5 Government agency and stakeholder involvement

Issues raised by agencies and stakeholders have been considered and addressed throughout the REF's preparation. The issues raised (refer to **Table 5-3**) have informed the specialist studies for the proposal and have been considered and addressed in this REF.

5.5.1 Government authorities and agency consultation

Consultation with government authorities and agencies has been undertaken throughout proposal development through regular correspondence and their involvement in one-on-one meetings and briefings.

Consultation with government authorities and agencies was conducted to help identify key environmental issues and opportunities as part of the concept design in addition to discussing potential management options for environmental issues and assessment requirements. Correspondence and meetings were held with Office of Environment and Heritage (OEH) (Heritage Branch) (14 July 2011) and Sydney Catchment Authority (SCA) (2 May 2012).

In May 2012, a number of government authorities and agencies were contacted by letter to provide details of the proposal and provided an opportunity to comment. The agencies and stakeholders contacted were:

- Environmental Protection Agency.
- NSW Department of Primary Industries (Agriculture).
- NSW Department of Primary Industries (Crown Lands Division).
- NSW Department of Primary Industries (Fisheries).
- NSW Department of Primary Industries (Office of Water).
- Office of Environment and Heritage (Parks and Wildlife).
- Office of Environment and Heritage (Heritage Branch).
- Sydney Catchment Authority.

In addition to the above, the following agencies were notified of the display of the Mount Victoria to Lithgow concept design, including the Forty Bends section, and invited to provide comment.

- Department of Human Services.
- Hawkesbury Nepean Catchment Authority.
- NSW Fire Brigades.
- Rural Fire Service.
- NSW Police.
- Blue Mountains City Council.
- Lithgow City Council.
- RailCorp.
- Department of Sustainability, Environment, Water, Population and Communities.

The issues raised in the submissions received by the above-mentioned government agencies, and where issues are addressed in the REF, are provided in **Table 5-3**. Copies of the responses received from each agency or stakeholder (and meeting minutes where meetings were held) as part of the consultation process are in **Appendix B** of this REF.

Table 5-3: Summary of government authorities and agencies stakeholder issues raised

Issue category	Issues raised	Section(s) where addressed in REF
Office of Environment and Heritage (Heritage Branch)		
Non-Aboriginal heritage	The extent of the proposal is to be determined along the Forty Bends Road near to where it joins the upgraded highway.	Chapter 3
Non-Aboriginal heritage	OEH (Heritage Branch) expressed interest in the current work being undertaken in relation to historic road routes within the local area such as Lockyers Road.	Section 6.3 Technical Paper 4 – Non-Aboriginal Heritage.
Non-Aboriginal heritage	Given the significant heritage located in and around the proposed works, the Heritage Branch recommends that a Statement of Heritage Impact (SoHI) is undertaken for this work.	Section 6.3 Technical Paper 4 – Non-Aboriginal Heritage.
Non-Aboriginal heritage	Where impacts to heritage are unavoidable, the Heritage Council expects that the necessary Approvals are obtained (including the Heritage Council, where appropriate) prior to works commencing.	Section 6.3 Technical Paper 4 – Non-Aboriginal Heritage. Section 7.3

Issue category	Issues raised	Section(s) where addressed in REF
Non-Aboriginal heritage	Suitable mitigation measures should be put in place to ensure that any heritage to be impacted is robustly recorded prior to any impacts, which includes measures to 'make good' any impacts to items which may be outside the area of impact.	Section 6.3 Technical Paper 4 – Non-Aboriginal Heritage.
Sydney Catchment Authority		
Water Quality	Management and maintenance of sedimentation basins.	Section 6.5 Technical Paper 6 – Water Quality.
Water Quality	Rationalisation of sedimentation basins. SCA raised the issue that in practice, it would potentially be more effective if more basins were provided during operation with smaller catchments.	Section 6.5 and Technical Paper 6 – Water Quality
Drainage	The opportunity for rehabilitation of Whites Creek where appropriate.	Section 3.1.1 Section 3.2.4
Consultation	It was determined that the NSW Office of Water would be consulted in regards to Whites Creek (Water Management Act 2000).	Section 5.5.1. A letter was sent to NOW as part of the consultation process for the proposal.
Department of Primary Industries (Office of Water)		
Project description	The REF should include details on the following: • Details of the project description. • Design specifications of the bridge, culverts and the permanent and temporary basins. • Groundwater assessment. • Surface water assessment. • Safeguard measures to mitigate impacts and contingency plans for remediation and rehabilitation.	Chapter 3 Section 6.1.5 Section 6.5 Section 6.13 Technical Paper 1 – Biodiversity Technical Paper 6 – Water Quality
Department of Primary Industries (Trade and Investment)		
Rural land impact	Consideration of the relevant agricultural issues when assessing the proposal as set out in the Departments' Guideline: *Infrastructure Proposals for Rural Lands*.	Section 6.9, Section 6.10
Lithgow City Council		
Road design	Lithgow City Council would like to see an improvement in the concept design with the entire length of the road to be dual lanes in both directions.	Section 2.1

5.6 Ongoing or future consultation

5.6.1 Display of the proposal

This REF will be placed on public display and community comments invited. The proposal will be on public display from 8 October 2012 to 26 October 2012. The community would be kept informed of any further changes to the proposal resulting from the submissions report and any future consultation process.

Internet

Details of the proposal (including all proposal documents) would be provided on the Mount Victoria to Lithgow webpage to allow members of the community to find more information about the proposal, exhibition period and how to make a submission. (http://www.rta.nsw. gov.au/road projects/index.html).

Public display

During the display period, static display locations would be established which would include a copy of the REF documentation, details of the proposal's design and community updates. Public displays would be located at the following locations (open during working hours):

- Blue Mountains Council office – 2-6 Civic Place, Katoomba.
- Katoomba library – Town Centre Arcade, Katoomba Street, Katoomba.
- Lithgow City Council office – 180 Mort Street, Lithgow.
- Lithgow Library – 157 Main Street, Lithgow.
- RMS Motor Registry Lithgow – Shop 51, Valley Plaza, Corner of Lithgow and Bent Streets, Lithgow.

A staffed display would also be held as part of the public display period. This would provide an opportunity for the community to look at the proposal in more detail. Members of the proposal team would be available to discuss any matters the community and stakeholders may have regarding the proposal at the following location.

- 10.00 am to 2.00 pm, Wednesday 17 October 2012, Bowen Inn Motel, 5 Col Drewe Drive, Lithgow.

Promotion of the REF display

To promote the REF display, a community update would be distributed to local residents, government agencies and councils, and other relevant stakeholders. Advertisements would also be placed in local newspapers to announce the REF's display and the dates of the staffed displays. The advertisements would provide details of the display and would invite property owners and members of the community to write submissions in response to the REF. Letters would be sent to all property owners directly affected by the proposal.

At the conclusion of the public display period of the REF, submissions received by RMS will be compiled for consideration. After reviewing all submissions, RMS will prepare a submissions report that documents the submissions and RMS's response to them. The submissions report will be publicly available on the RMS website and letters sent to respondents to advise them of the submissions report.

In the event that design changes are required in response to submissions, these would be documented in the report and any new impacts assessed. In the event that these design changes are substantial, the community would be informed.

The RMS will continue to work closely with the community through all stages of the proposal. Future consultation stages for the ongoing development of the proposal are described below.

- Consultation with community stakeholders to assist in managing impacts during construction.
- Follow-up meetings to discuss access arrangements with directly affected landholders.
- Ongoing updates throughout the planning phase and construction period to the immediately affected community as well as travelling public.
- Ongoing meetings with Lithgow City Council, government agencies, utility providers, adjacent landowners and community stakeholders as required.
- Ongoing updates as required on the proposal website.

Ongoing consultation would be undertaken in accordance with the RMS *Community Participation and Communications: A resource manual for staff* (RTA, 2010b).