Intersection Upgrade, Great Western Highway and Ross Street, Glenbrook
Review of Environmental Factors
October 2017
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Prepared by Hills Environmental

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Executive summary

The proposal

NSW Roads and Maritime Services (Roads and Maritime) proposes to upgrade the intersection of the Great Western Highway and Ross Street, Glenbrook (the proposal). Key features of the proposal include:

- New traffic lights at the Ross Street intersection that allow for all vehicle turning movements to and from the Great Western Highway and signalised pedestrian crossings on all approaches to the intersection
- Changing the configuration of the Hare Street / Mann Street intersection to close access for general traffic between Mann Street and the Great Western Highway while maintaining access for emergency vehicles
- Extending the two right turn bays on the Great Western Highway between Hare Street and Ross Street
- Providing new road signs, line marking and footpath connections to suit the revised road configuration
- Installing a new water main on the northern side of the Great Western Highway
- Installing intelligent transport systems (ITS) conduits
- Adjusting the stormwater drainage infrastructure to suit the revised road configuration
- Trimming trees on the southern side of the Great Western Highway to achieve minimum vertical and horizontal clearances from the new edge line
- Installing and relocating directional road signs as required.

Need for the proposal

In March 2015, the Australian and NSW governments announced $5 million to upgrade the intersection of the Great Western Highway and Ross Street, Glenbrook as part of the Western Sydney Infrastructure Plan. This investment recognises the need to manage congestion and improve road safety at this location.

Proposal objectives

The objectives of the proposal are to:

1. Achieve acceptable Level of Service (LoS) at both intersections over a 10-year period
2. Provide an enhanced primary gateway to and from Glenbrook Village Centre and the Blue Mountains
3. Improve road safety and access along the Great Western Highway
4. Provide additional intersection capacity to accommodate future traffic volume increases
5. Minimise adverse impacts on the environment and the community.

Options considered

Blue Mountains City Council undertook the initial proposal development in consultation with Roads and Maritime. In late 2015, Blue Mountains City Council placed four proposal options on public display and community comments were invited. The four options initially considered for the proposal were:

- Option 1 – new traffic lights at the Great Western Highway / Ross Street intersection and full closure of access to the Great Western Highway from Mann Street, Hare Street (south), and Wascoe Street
• Option 2 – new traffic lights at the Great Western Highway / Ross Street intersection and left-turn only from the Great Western Highway to Hare Street (south) and left only access to Wascoe Street from Hare Street (south)
• Option 3 – new traffic lights at the Great Western Highway / Ross Street intersection and left-turn only from the Great Western Highway to Hare Street (south), left only access to Wascoe Street from Hare Street (south) and left-turn access from Wascoe Street to the Great Western Highway
• Option 4 – do nothing. No change to the Ross Street and Great Western Highway intersection and no change to access from Mann Street, Hare Street, and Wascoe Street.

Option 1 received the most support from community submissions. While there was some community support for Option 4 (do nothing option), it does not meet the proposal objectives or address the identified need. It therefore, would only be preferred where the costs and environmental impacts of proceeding outweighed the identified benefits. The do nothing option was discarded as this was not the case.

• Option 3a – After considering community preferences by Blue Mountains City Council – and noting Council’s preference for increased access from Wascoe Street / Hare Street / Mann Street onto the Great Western Highway – Option 3 was refined (referred to as Option 3a). This option included installing a centre barrier on Wascoe Street to prevent through movement from Mann Street to Hare Street (south) and Great Western Highway
• Option 3b – During a subsequent Value Management Workshop conducted with Blue Mountains City Council and Roads and Maritime, a revised option (Option 3b) was developed to address both design and cost requirements for the proposal. Option 3b includes traffic lights at the Great Western Highway / Ross Street intersection. It also includes the Option 3a configuration at the Great Western Highway / Hare Street / Mann Street / Wascoe Street intersections, but reduced other elements of the design
• Option 5 – After further review as part of the detailed design process, a new option (Option 5 - Figure 1-2) was developed. Option 5 is a variation of Option 1 and includes restricting traffic access to and from the Great Western Highway at Hare Street (south) to address safety issues while maintaining access for emergency vehicles. Option 5 delivers better traffic efficiency and road safety outcomes which would be achieved with the closure of Hare Street (south) to general traffic (while maintaining access for emergency vehicles). In addition, it also maximises use of existing pavements on the southern side of the Great Western Highway to reduce the impact on trees and utility services on the northern side of Great Western Highway.

Statutory and planning framework

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

The proposal is subject to assessment under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). In accordance with Section 111 of the EP&A Act, this Review of Environmental Factors (REF) examines and takes into the account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposal. This REF also considers Clause 228 of the Environmental Planning and Assessment Regulation 2000 and matters of national environmental significance under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Community and stakeholder consultation

Consultation has been carried out with the community and a range of government and non-government stakeholders as part of the proposal.

Community and stakeholder consultation has been underway since late 2015. In October 2015, Blue Mountains City Council sought community feedback on four options for the proposal.
Feedback was accepted until December 2015 and all comments received during the consultation period were considered and investigated as part of the proposal’s preferred option development.

Roads and Maritime has since revised the preferred proposal identified by Blue Mountains City Council and has consulted with Council during the project development.

An ISEPP consultation letter was sent to Blue Mountains City Council on 13 February 2017 and a response was received on 24 February 2017 advising that Council would provide further input during the public display of the REF.

A further letter was sent to Blue Mountains City Council on 26 July 2017 advising of the decision to select Option 5 (rather than Option 3b) as the preferred option. By letter dated 8 August 2017, Blue Mountains City Council responded advising that they do not support Option 5. Roads and Maritime will continue to consult with Council on the development of the proposal.

Roads and Maritime has developed a Community and Stakeholder Engagement Plan for the proposal. The plan identifies key objectives and the desired consultation outcomes. It focuses on consultation with relevant government agencies, stakeholders and the community affected by the proposal. The plan’s overall objectives are to:

- Provide stakeholders with clear, relevant, timely and accurate information about the proposal, proposed changes and impacts
- Identify local issues to ensure the proposal aligns with community needs
- Inform and consult affected and interested stakeholder groups.

Information about the project has been communicated on the project website, project updates, and notifications.

Roads and Maritime will seek feedback about the proposal from the community and key stakeholders during the public display of this REF document. Given that the proposal is near a State Heritage Register listed item, the Office of Environment and Heritage has been contacted about the proposal and will be consulted during the public display period.

Roads and Maritime will collate all submissions received during the consultation period and acknowledgement letters and emails will be sent to each respondent. The details of submission authors will be retained and authors will be updated when project information is released.

After considering community comments, Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary. The community and key stakeholders will be kept informed about the REF determination.

Environmental impacts

The main potential construction impacts associated with the proposal would be:

- Construction noise that may exceed noise management levels at the nearest residences, mainly when work needs to occur during evening (exceedances of up to 8 dB(A) predicted) and night-time (exceedances of up to 28 dB(A) predicted) periods. Construction noise may also exceed sleep disturbance criteria by up to 28 dB(A). Roads and Maritime would require construction contractors to use noise management measures as set out in the Roads and Maritime Environment Noise management standards and guidelines. Noisy construction would be managed under these guidelines to reduce impacts on the community.
- Construction vibration that could be noticeable at locations nearest the work and which could affect adjacent buildings, including the State Heritage Register listed Glenbrook Railway Residence. Trial vibration measurements have been proposed to establish site-specific safe working distances to prevent impact on the Glenbrook Railway Residence
- A low to moderate potential to encounter locally significant archaeological remains during excavation (an exception notification under section 139 of the Heritage Act 1977 would be lodged with the Office of Environment and Heritage prior to the start of works)
- Construction related ground disturbance and the potential for erosion and sedimentation
• Potential for contaminated soils to be encountered during construction, particularly near the service station at the Ross Street intersection
• Potential for localised delays to road users and pedestrians associated with minor diversions around construction sites
• Localised air quality impacts associated with dust and emissions from mobile plant
• Loss of some informal heavy vehicle parking on the northern side of the Great Western Highway.

The main potential operational impacts associated with the proposal would be:

• Potential small increases in travel time for some road users associated with the proposed intersection changes, and travel time savings for other road users
• Low level visual impacts associated with the new structures and potential impacts on the visual environment of the State Heritage Register listed Glenbrook Railway Residence

The safeguards and mitigation measures identified in this REF would help minimise the expected adverse impacts.

Justification and conclusion

The proposal is subject to assessment under Part 5 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

The proposal as described in the REF best meets the project objectives but would still result in some short-term construction impacts including noise and general disturbance to road users and nearby residential properties. These impacts would be mitigated or minimised by implementing the mitigation measures described in this REF.

The environmental impacts of the proposal are not likely to be significant and therefore it is not necessary for an Environmental Impact Statement to be prepared, and approval sought from the Minister for Planning under Part 5.1 of the EP&A Act. The proposal is unlikely to significantly affect threatened species, populations or ecological communities or their habitats and therefore a Species Impact Statement is not required. The proposal is also unlikely to affect Commonwealth land or have an impact on any matters of national environmental significance.

On balance, the benefits derived from proceeding with the proposal are considered to outweigh the potential impacts. It is therefore considered justified.

Display of the Review of Environmental Factors

This Review of Environmental Factors is on display for comment between Monday, 16 October and Sunday, 12 November 2017. You can access the documents in the following ways:

Internet


Display

A printed copy of the documents will be available for viewing at:

• Blaxland Library
  33 Hope St, Blaxland
• Glenbrook Visitor Information Centre
  Lot 7050 Hamment Place, Glenbrook
How can I make a submission?

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

- Email: wsip@rms.nsw.gov.au
- Mail: Western Sydney Infrastructure Plan, PO Box 973 Parramatta CBD NSW 2124

Submissions must be received by 5pm on Sunday, 12 November 2017.

Privacy information

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

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

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

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

The information will be held by Roads and Maritime’s Parramatta office.

What happens next?

Following the submissions period, Roads and Maritime will collate submissions. Acknowledgement letters and emails will be sent to each respondent. Submission author’s details will be retained and authors will be advised when project information is released.

After considering community comments, Roads and Maritime will determine whether the proposal should proceed as proposed or whether alterations are necessary. The community and key stakeholders will be kept informed about the REF determination.

If the proposal goes ahead, Roads and Maritime will proceed with the final design and tenders will be called for construction of the project.

If you have any queries, please contact the Roads and Maritime project team on:

- Phone: 1800 703 457 (toll free)
- Email: wsip@rms.nsw.gov.au
- Mail: Western Sydney Infrastructure Plan, PO Box 973 Parramatta CBD NSW 2124
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1 Introduction

1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) proposes to upgrade the intersection of Great Western Highway and Ross Street, Glenbrook (the proposal). The proposal is needed to improve road safety and ease congestion.

Key features of the proposal include:

- New traffic lights at the Ross Street intersection that allow for all vehicle turning movements to and from the Great Western Highway and signalised pedestrian crossings on all approaches to the intersection
- Changing the configuration of the Hare Street / Mann Street intersection to close access for general traffic between Mann Street and the Great Western Highway while maintaining access for emergency vehicles
- Extending the two right turn bays on the Great Western Highway between Hare Street and Ross Street
- Providing new road signs, line marking and footpath connections to suit the revised road configuration
- Installing a new water main on the northern side of the Great Western Highway
- Installing intelligent transport systems (ITS) conduits
- Adjusting the stormwater drainage infrastructure to suit the revised road configuration
- Trimming trees on the southern side of the Great Western Highway to achieve minimum vertical and horizontal clearances from the new edge line
- Installing and relocating directional road signs as required.

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Chapter 3 describes the proposal in more detail.
Figure 1-1 Location of the proposal
Figure 1-2 Overview of the proposal
1.2 Purpose of the report

This REF has been prepared by Hills Environmental on behalf of Roads and Maritime, Western Sydney Project Office. For the purposes of this work, Roads and Maritime is the proponent and the determining authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

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

The description of the proposed work and associated environmental impacts have been undertaken in context of Clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Department of Urban Affairs and Planning, 1995), the Threatened Species Conservation Act 1995 (TSC Act), the Fisheries Management Act 1994 (FM Act), and the Australian Government’s Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). In doing so, the REF helps to fulfil the requirements of Section 111 of the EP&A Act, that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

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

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an Environmental Impact Statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act.
- The strategic assessment approval granted by the Federal Government under the EPBC Act in September 2015, with respect to the impacts of Roads and Maritime’s road activities on nationally listed threatened species, populations, ecological communities and migratory species.

The findings of the REF would be considered when assessing:

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

In March 2015, the Australian and NSW governments announced $5 million to upgrade the intersection of Great Western Highway and Ross Street at Glenbrook, as part of the Western Sydney Infrastructure Plan. This investment recognises the need to manage congestion and improve road safety at this location.

The proposal aims to address the following specific issues at the Ross Street and Hare Street intersections on the Great Western Highway:

- Current inefficient operation of the Great Western Highway / Hare Street intersection due to insufficient queuing space on Hare Street (south) between the Great Western Highway and Wascoe Street. This affects vehicles turning both into and from Hare Street (south), a situation which was exacerbated by the previous banning of right-turns from Ross Street to the Great Western Highway, for safety reasons
- Limited alternatives for drivers seeking to travel eastbound on the Great Western Highway from the southern side of Glenbrook. Alternatives currently include taking indirect routes to access the traffic lights at Coughlan Street (about 1.3 kilometres to the west) or the seagull intersection at Mount Street (about 1.2 kilometres to the east)
- Safety issues which arise when drivers become frustrated with delays in accessing the Great Western Highway from Hare Street (south). This results in drivers taking risks, making illegal turning movements and/or becoming involved in disputes with other drivers
- Queuing back across Wascoe Street which affects both through traffic on Wascoe Street and all traffic seeking to access the Great Western Highway from Hare Street (south)
- Unsafe crossing of the Great Western Highway by pedestrians near Ross Street due to the lack of crossing signals near Ross Street and the additional walking distance to the Hare Street traffic lights. It is also noted that there is a pedestrian pathway link from the northern side of the Great Western Highway near Ross Street to Moore Street that likely encourages crossing at this location.

Safety is the chief issue driving the need for this proposal. From July 2009 to June 2014, there were 13 crashes at the Great Western Highway / Hare Street intersection, of which five resulted in injuries. Six crashes were also reported at the Great Western Highway / Ross Street intersection in the same reporting period, of which four resulted in injuries.

2.2 Existing road and infrastructure

At the subject location, the Great Western Highway is a four lane road (two lanes in each direction divided primarily by a central concrete median) with a posted speed limit of 80 kilometres per hour. Data from the nearest permanent traffic counter (M4 Motorway, west of Mulgoa Road, Jamisontown) indicates that Annual Average Daily Traffic (AADT) volumes increased from 46,770 vehicles per day in 1996 to 54,600 vehicles per day in 2012. This is the equivalent to a growth in traffic of 16.74 per cent over the 16-year period.

The Ross Street and Hare Street intersections on the Great Western Highway are about 200 metres apart. Ross Street is a non-signalised T-junction with prohibited right-turn movements out of Ross Street while the Hare Street intersection is currently a signalised cross junction permitting all traffic movements.

Traffic counts at the two intersections were conducted in mid-2015 during the AM and PM peak periods. Figure 2-1 shows the results, which confirm a high demand for right turns from Hare Street (south) to the Great Western Highway (eastbound) in both the AM and PM peak periods.
Other infrastructure on the Great Western Highway includes signage, light poles, a bus stop with shelter and seating, and a built drainage channel which runs parallel to the Great Western Highway on the northern side. Adjacent land uses include Glenbrook Park, Glenbrook Oval, Glenbrook.
Skatepark, Glenbrook Panthers Bowling Club, Glenbrook Visitor Information Centre, Glenbrook Native Plant Reserve and Nursery, Lower Mountains Anglican Parish, a service station and commercial retail uses. Residential uses are set further back from the Great Western Highway on both the southern and northern sides and Glenbrook Public School is located on Woodville Street, about 200 metres to the southeast of the proposal site. Figure 2-2 illustrates the proposal site.

![Image of the proposal site](image1)

**Figure 2-2 Images of the proposal site**

### 2.3 Proposal objectives

The objectives of the proposal are to:

1. Achieve acceptable Level of Service (LoS) at both intersections over a 10-year period
2. Provide an enhanced primary gateway to and from Glenbrook Village Centre and the Blue Mountains
3. Improve road safety and access along the Great Western Highway
4. Provide additional intersection capacity to accommodate future traffic volume increases
5. Minimise adverse impacts on the environment and the community.

### 2.4 Alternatives and options considered

#### 2.4.1 Methodology for selection of preferred option

The initial option evaluation process for the proposal was managed by Blue Mountains City Council and involved seven main stages:

- Development of options to address the identified need
- Traffic modelling
- Presentation of options to the community and stakeholders for comment
- Preparation of a submissions report as part of a review of community / stakeholder comment and preferences
- Briefing of Blue Mountains City Council elected representatives and consideration of comments
- Identification of a preliminary preferred option
- Value Management Workshop attended by Blue Mountains City Council and Roads and Maritime to refine the preliminary preferred option and confirm the preferred option
- Further refinement as part of the detailed design process.
2.4.2 Identified options

Four options were initially considered for the proposal, including:

- Option 1 – new traffic lights at the Great Western Highway / Ross Street intersection and full closure of access to the Great Western Highway from Mann Street, Hare Street (south), and Wascoe Street
- Option 2 – new traffic lights at the Great Western Highway / Ross Street intersection and left-turn only from the Great Western Highway to Hare Street (south) and left only access to Wascoe Street from Hare Street (south)
- Option 3 – new traffic lights at the Great Western Highway / Ross Street intersection and left-turn only from the Great Western Highway to Hare Street (south), left only access to Wascoe Street from Hare Street (south) and left-turn access from Wascoe Street to the Great Western Highway
- Option 4 – do nothing. No change to the Ross Street and Great Western Highway intersection and no change to access from Mann Street, Hare Street, and Wascoe Street.

Options 1, 2 and 3 are shown by Figure 2-3, Figure 2-4 and Figure 2-5 respectively.

The four proposal options were placed on public display by Blue Mountains City Council in late 2015 and community comments were invited.

Refined options were subsequently developed as part of the option evaluation process and following community and stakeholder consultation. These refined options are described in Section 2.4.3.
Figure 2-3 Option 1

New traffic lights at the Ross Street and Great Western Highway intersection.

Full closure of access to the Great Western Highway from Hare Street on the south side of the highway.
Figure 2-4 Option 2

NEW TRAFFIC LIGHTS AT THE ROSS STREET AND GREAT WESTERN HIGHWAY INTERSECTION.
LEFT TURN ONLY FROM THE GREAT WESTERN HIGHWAY WESTBOUND TO HARE STREET.
Figure 2-5 Option 3

Intersection upgrade, Great Western Highway and Ross Street, Glenbrook
Review of Environmental Factors

OPTION 3
NEW TRAFFIC LIGHTS AT THE ROSS STREET AND GREAT WESTERN HIGHWAY INTERSECTION.

LEFT TURN ONLY FROM THE GREAT WESTERN HIGHWAY WESTBOUND TO HARE STREET AND LEFT ONLY ACCESS TO WASCOE STREET FROM HARE STREET.

LEFT TURN FROM WASCOE STREET TO HARE STREET THEN LEFT ONTO THE GREAT WESTERN HIGHWAY WESTBOUND.
2.4.3 Analysis of options

Community preferences

There were 111 individual submissions received during the community consultation period with most favouring Option 1. Submissions also included a petition with 42 signatures that favoured Option 4 (do nothing). Figure 2-6 shows the distribution of community support across the options.

![Figure 2-6 Distribution of support for proposal options](image)

The main reason identified by respondents for supporting Option 1 was the need for improved safety, both for pedestrians and motorists. A Submissions Report, which further reviews the community response to the options, is at Appendix C.

Do nothing option

While there was some community support for the do nothing option, it does not meet the proposal objectives or address the identified need and would therefore only be preferred in circumstances where the costs and environmental impacts of proceeding were assessed as outweighing the identified benefits. This was not the case and the do nothing option was discarded.

Traffic modelling of options

Traffic modelling of Options 1, 2 and 3 was conducted for the AM and PM peak periods to identify how well the Hare Street and Ross Street intersections would perform with the changes proposed and whether each option would meet the first proposal objective of providing an acceptable LoS. The traffic modelling report is included in Appendix D and summarised below.

The modelling results indicated that all options performed similarly at both the Hare Street and Ross Street intersections (using 2015 traffic volumes), with a LoS A and average vehicle delay of about 11-13 seconds per vehicle in both peak hours. The relatively good intersection performance is due in part to the lack of pedestrian activity across the Great Western Highway, as well as overall level of capacity available at both intersections.

The modelling (which is based on 2015 traffic volumes) shows that both intersections have spare capacity and could accommodate future traffic volume increases.

Option 3 – which permits left-in and left-out to and from Hare Street (southern section), results in slightly shorter queue lengths in the left lane of Ross Street, when compared to Options 1 and 2.

Blue Mountains City Council evaluation

The outcomes of the community consultation and the community preference for Option 1 (full closure of access to the Great Western Highway from Hare Street (south) were presented to the
Councillors at a briefing session on 22 March 2016. Following debate, the Councillor’s determined that their preferred option should include increased access from Wasco Street / Hare Street / Mann Street onto the Great Western Highway (Option 3). Of specific note was access for the NSW Fire and Rescue station located about 330 metres west on Wascoe Street.

Following consideration of the views expressed by Councillors, Option 3 was refined (and referred to as Option 3a). This option included:

- Installation of a centre barrier on Wascoe Street to prevent:
  - Right-turns from Wascoe Street to the Great Western Highway
  - Right-turns from Mann Street to Wascoe Street
  - Straight ahead and left-turns to the Great Western Highway from Mann Street
- Left-turns only from Mann Street to Wascoe Street.

**Value Management Workshop**

A Value Management Workshop was held on 15 April 2016 to review Option 3a to examine opportunities to revise scope and cost to align with the available funding of $5 million.

The Value Management Workshop resulted in a revised option (Option 3b) which met both design and cost requirements. Option 3b includes new traffic lights at the Great Western Highway / Ross Street intersection and the Option 3a configuration at the Great Western Highway / Hare Street / Mann Street / Wascoe Street intersections but reduces other elements of the design such as the extent of kerb on the northern side of highway, treatments at the Ross Street / Wascoe Street intersection and landscaping. Option 3b also uses more of the existing road pavements on the southern side of the Great Western Highway, reducing the extent of road widening on the northern side of the Great Western Highway.

**Refinement as part of the detailed design process**

As part of the detailed design process, the operation of the Great Western Highway / Hare Street intersection was considered further as was the need to minimise impacts on public utilities and trees on the northern side of the Great Western Highway. It was determined that better traffic efficiency and road safety outcomes could be achieved with the closure of Hare Street (south) to general traffic (while maintaining access for emergency vehicles). Further, it was decided that the alignment should be shifted slightly to the south to make better use of existing pavements to avoid impacts on trees to the north and minimise impacts on a water main and power infrastructure in that location. This resulted in a new option, which is a variation on Option 1, referred to as Option 5.

**2.5 Preferred option**

Option 5 is the preferred option and includes:

- New traffic lights at the Ross Street intersection that allow for all vehicle turning movements to and from the Great Western Highway and signalised pedestrian crossings on all approaches to the intersection
- Changing the configuration of the Hare Street / Mann Street intersection to close access for general traffic between Mann Street and the Great Western Highway while maintaining access for emergency vehicles
- Extending the two right turn bays on the Great Western Highway between Hare Street and Ross Street
- Providing new road signs, line marking and footpath connections to suit the revised road configuration
- Installing a new water main on the northern side of the Great Western Highway
- Installing intelligent transport systems (ITS) conduits
- Adjusting the stormwater drainage infrastructure to suit the revised road configuration
- Trimming trees on the southern side of the Great Western Highway to achieve minimum vertical and horizontal clearances from the new edge line
• Installing and relocating directional road signs as required.

Option 5 best addresses the proposal objectives by balancing the need for access between the Great Western Highway and Glenbrook with the need to address identified safety and traffic efficiency issues. It can also be delivered with relatively minor environmental and community impacts (refer to Chapter 6).

The proposal is based on the preferred option and is described further in Chapter 3.

The principles of ecologically sustainable development encourage the integration of present and future economic, social development and environmental considerations into the decision-making process for all developments. The development of the proposal is consistent with these principles as demonstrated by the proposal objectives which include economic, social and environmental considerations, and the alignment of the preferred option with those objectives.
3 Description of the proposal

3.1 The proposal

Roads and Maritime proposes to upgrade the intersection of the Great Western Highway and Ross Street at Glenbrook. Key features of the proposal include:

- New traffic lights at the Ross Street intersection that allow for all vehicle turning movements to and from the Great Western Highway and signalised pedestrian crossings on all approaches to the intersection
- Changing the configuration of the Hare Street / Mann Street intersection to close access for general traffic between Mann Street and the Great Western Highway while maintaining access for emergency vehicles
- Extending the two right turn bays on the Great Western Highway between Hare Street and Ross Street
- Providing new road signs, line marking and footpath connections to suit the revised road configuration
- Installing a new water main on the northern side of the Great Western Highway
- Installing intelligent transport systems (ITS) conduits
- Adjusting the stormwater drainage infrastructure to suit the revised road configuration
- Trimming trees on the southern side of the Great Western Highway to achieve minimum vertical and horizontal clearances from the new edge line
- Installing and relocating directional road signs as required.

The proposed new set of traffic lights at Ross Street would be co-ordinated with the existing traffic lights at Hare Street by the Sydney Coordinated Adaptive Traffic System (SCATS). Traffic signal coordination via SCATS improves traffic flow and ensures minimum overall stops and delays for road users.

The key features of the proposal are shown by Figure 1-2 and the cross sections of the proposal are included in Section 3.2.3 and the design drawings are included in Appendix B.

The project construction boundary is shown by Figure 3-1 and incorporates an area of about 1.7 hectares, extending over an east-west distance of about 420 metres. The width of the proposal construction boundary ranges between about 15 metres and 110 metres (including ancillary facility sites). It has been assumed that construction work would occur anywhere within the proposal construction boundary; although all trees are to be retained. Some pruning of trees may be required to achieve suitable sight distances and/or vehicle clearances.
Figure 3-1 Proposed construction boundary
3.2 Design

3.2.1 Design criteria

The concept design for the proposal was prepared in accordance with a design management system certified under AS/NZS ISO 9001:2008 Quality Management Systems. Other design guides and policies considered during the development of the proposal included:

- *Austroads Guide to Road Design* (Austroads, 2009a)
- *Austroads Road Safety Audit Manual* (Austroads, 2009b)
- *Delineation* (Roads and Traffic Authority, 2008)

The adopted design criteria are summarised in Table 3-1.

**Table 3-1 Proposal design criteria**

<table>
<thead>
<tr>
<th>Element</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posted speed</td>
<td>Retain at 80 km/h</td>
</tr>
<tr>
<td>Design speed</td>
<td>90 km/h</td>
</tr>
<tr>
<td>Grade</td>
<td>Retain existing grades</td>
</tr>
<tr>
<td>Horizontal alignment</td>
<td>Minimum radii R550</td>
</tr>
<tr>
<td>Lane widths</td>
<td>Minimum 3.0 m</td>
</tr>
<tr>
<td>Design vehicles</td>
<td>Great Western Highway / Ross Street</td>
</tr>
<tr>
<td></td>
<td>12.5 m single unit truck / bus for all turning movements</td>
</tr>
<tr>
<td></td>
<td>Great Western Highway and Hare Street</td>
</tr>
<tr>
<td></td>
<td>8.8 m service vehicle for left-in / left-out movements for the Great Western Highway and Hare Street south</td>
</tr>
<tr>
<td></td>
<td>12 m rigid bus / SU truck for left-out / right out movements for the Great Western Highway and Hare Street north</td>
</tr>
<tr>
<td></td>
<td>12 m rigid bus / SU truck for right-in for the Great Western Highway and Hare Street north</td>
</tr>
<tr>
<td>Central median</td>
<td>Variable width</td>
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<tr>
<td></td>
<td>100 mm reinforced concrete</td>
</tr>
<tr>
<td></td>
<td>100 mm recycled granular material</td>
</tr>
<tr>
<td>Stopping sight distance</td>
<td>103 m for cars. This allows for a reaction time of 1.5 seconds at 90 km/h design speed</td>
</tr>
<tr>
<td>New pavement</td>
<td>Asphaltic concrete (two options – see Appendix C)</td>
</tr>
<tr>
<td></td>
<td>7 mm spray seal</td>
</tr>
<tr>
<td></td>
<td>300 mm select material</td>
</tr>
<tr>
<td></td>
<td>300 mm controlled subgrade</td>
</tr>
</tbody>
</table>
### 3.2.2 Engineering constraints

The proposal has the following identified constraints:

- Existing road boundaries along the Great Western Highway and local road network
- Requirement to maintain through traffic during construction
- Condition of existing pavements and subgrade
- Existing utilities including the presence of a 200 millimetre diameter cast iron cement lined (CICL) water main positioned beneath the eastbound lanes of the great Western Highway generally between Hare Street and Ross Street
- Existing roadside trees
- Adjacent State Heritage Register listed item, located on the south-western corner of the Great Western Highway / Ross Street intersection.

### 3.2.3 Cross sections

The typical cross section for the proposal is shown in Figure 3-2 to Figure 3-4 and includes:

- Great Western Highway – 3.6 metre wide through lanes, a variable raised concrete median, some on-road provision for cyclists and new footpath connections
- Ross Street – 5.6 metre wide southbound through lane and 3.3 metre wide northbound turning lanes with new footpath connections.

![Figure 3-2 Typical cross section – Great Western Highway at the Hare Street intersection](image)
3.2.4 Drainage

The drainage design includes extensions of and adjustments to existing pit and pipe infrastructure. Work would include:

- Reconstruction and conversion of existing drainage pits in the Great Western Highway median, between Hare Street and Ross Street
- Construction of new drainage pits in the Great Western Highway median, with pipe connections to the existing drainage system
• Conversion of three existing pits to junction boxes at the Ross Street intersection, with new connections as required
• Construction of new drainage pits (four in total) on the northern and southern sides of the Great Western Highway at the Ross Street intersection
• Installation of a trench drain along the northern side of the Great Western Highway at the Ross Street intersection.

3.3 Construction activities

3.3.1 Work methodology

Site establishment activities and early work would include:
• Establishing the site compound (refer to Section 3.4) and erecting worksite fencing where required
• Implementing traffic management measures
• Installing environmental controls, including tree protection measures
• Relocation of light poles (where specified).

Drainage work would include:
• Reconstruct / covert existing pits
• Excavate for new pits and pipe connections
• Compact subgrade
• Place and compact bedding material
• Place pipe
• Place headwalls, where required
• Fill and compact material around the pipe
• Place erosion protection at new pipe outlets where required.

Water main relocation work would include:
• Excavate for new water main
• Compact subgrade
• Place and compact bedding material
• Place new water main pipe
• Connect new water main
• Testing and disinfection of the new water main using ozone or chlorine (as specified by Sydney Water)
• Grout fill redundant section of water main pipe and retain in place
• Fill and compact material around the new water main
• Protect new water main from damage during construction of pavement work, where required.

Pavement work would include:
• Preparation of new lane surfaces by grading and milling machine
• Lay gravel base / sub-base layers for new pavements (where required)
• Apply asphaltic concrete pavement using pavers and rollers
• Repair existing pavements where required
• Construct footpath connections.

Final work would include:
• Install line markings, signs and guide posts
• Decommission temporary facilities (such as site compounds)
• Clean up the site and dispose of all surplus waste materials
• Removal of construction traffic management and opening of the proposal to traffic.
3.3.2 Construction hours and duration

Subject to approval, construction is anticipated to commence in early-2018 and take about six months to complete, weather permitting.

Construction work would be carried out during standard hours where possible:

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

To minimise disruption to traffic and to reduce the duration of construction, a substantial amount of work would need to be carried out outside these hours at night. This includes the relocating existing utilities and services and some pavement work. For work required outside standard hours, reasonable and feasible work practices to minimise noise nuisance (nominally set at 5 dBA above background noise levels) would be planned and implemented through a construction noise management plan. This would include notifying potentially affected residents and businesses. For further details refer to Section 6.1 of this REF.

3.3.3 Plant and equipment

Plant and equipment to be used for construction would be confirmed during the construction planning process, but an indicative list of equipment expected to be used on site during construction of the proposal includes:

- Asphalt pavers
- Asphalt profiling machines
- Generators
- Lighting units
- Back hoes
- Hydraulic hammers
- Hand tools
- Line marking equipment
- Concrete saws
- Vibratory rollers
- Mobile cranes
- Concrete trucks and pumps
- Trucks and light utilities.

3.3.4 Earthworks

Most construction work would be confined to existing road pavements and, therefore, earthworks would be generally confined to placement of subgrade material for small sections of new pavements and excavation for signage, traffic light and light pole footings.

3.3.5 Source and quantity of materials

The proposal would require moderate quantities of materials, primarily manufactured steel, concrete and select materials. The quantities of material required would not result in a regional or local supply shortage and none are likely to be in short supply in the foreseeable future. Materials would be sourced from local commercial suppliers where available.

Non-renewable resources such as petroleum fuels would not be used in large quantities.

3.3.6 Traffic management and access

Access to the proposal site would be directly from the Great Western Highway.
Some temporary lane closures and minor temporary pedestrian diversions may be required. These would occur in accordance with a Traffic Management Plan and, where necessary, a Road Occupancy Licence.

Where possible, the proposed construction work would be programmed to minimise impact on traffic using the Great Western Highway and the local road network. Access for bus passengers to the bus stop on the northern side of the Great Western Highway, east of Hare Street, would be maintained during construction.

Standard traffic management measures would be employed to minimise the 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 Roads and Maritime *Traffic Control at Works Sites Manual* (Roads and Traffic Authority, 2010) and Roads and Maritime Specification G10 – Control of Traffic. Traffic management measures may include:

- Modification of lane widths to facilitate the safe entry, exit and movement of plant and materials and to allow for construction staging of work
- Placement of separation barriers to protect traffic from the worksites
- Reduced speed zones (where approved).

During all stages of construction, access to businesses and other private property would be maintained. Pedestrian and cyclist routes would be managed daily to suit construction activities.

Restrictions on informal heavy vehicle parking on the northern side of the Great Western Highway would be needed due to the presence of the proposed site compound (refer to Section 3.4) and temporary impacts on sight lines for vehicles re-entering the traffic stream from this area.

The existing bus stops (277325 (eastbound) and 277352 (westbound)) and bus routes (690P and 691) would remain operational for the majority of the construction phase prior to closure of Hare Street (south). Temporary relocation for bus stop 277352 may be required when works occur on the southern side of Great Western Highway, however, temporary bus stops would be provided. Roads and Maritime will consult with the bus operator during delivery stage to minimise disturbance and impacts to existing bus operation.

Consultation with bus service operators and Transport for NSW would be ongoing for implementation of the closure of Hare Street (south) (which would affect routes 690P and 691. The date of implementation would be provided to the operator at least three months in advance of the closure to enable review / consultation / planning and roll out of the re-route of services to use Ross Street.

### 3.4 Ancillary facilities

A construction compound would be established on the northern side of the Great Western Highway between Hare Street and Ross Street (refer to Figure 3-6). The compound would be used for the following:

- Site office
- Worker amenities
- Equipment and materials storage
- Temporary stockpiling.
3.5 Public utility adjustment

Several public utility adjustments and new work would be implemented in consultation with the relevant asset owner and would include:

- Four new communications (and associated electrical) pits on the northern side of the Great Western Highway
- Installation of ITS conduit on the northern side of the Great Western Highway
- Underbores for new ITS conduits beneath Hare Street and beneath the Great Western Highway, immediately east of the Ross Street intersection
- Installation of ITS equipment housing on the southeast corner of the Ross Street intersection
- Partial relocation of 200 millimetre cast iron cement lined water main positioned on the northern side of the Great Western Highway near the Ross Street intersection. This would involve the placement of a new water main over a distance of about 80 metres, while the existing redundant length of water main would be retained in place and grout filled as required.

3.6 Property acquisition

Property acquisition is not required for the proposal.

Lots 7053, 7054 and 7055, DP 1080609, which are adjacent to the proposed works, are subject to an Aboriginal Land Claim under the NSW Aboriginal Land Rights Act 1983 (ALR Act) (Appendix K). It has been confirmed that the proposed works, including the proposed compound, would not encroach on Lots 7053, 7054 or 7055.
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 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. Relevantly, the definition of road infrastructure facilities provided by Clause 93 of the ISEPP includes associated public transport facilities for roads used to convey passengers by means of regular bus services.

As the proposal is for a road and road infrastructure facilities and is to be carried out by Roads and Maritime Services, it can be assessed under Part 5 of the Environmental Planning and Assessment Act 1979. Development consent from council is not required. Note that relocation of commercial advertising at bus shelters does not form part of the proposal and where this is required it would be subject to a separate assessment and approval process.

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 or State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (Major Development) 2005.

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

4.1.2 Sydney Regional Environmental Plan No.20 - Hawkesbury-Nepean River (No 2—1997)

Sydney Regional Environmental Plan No. 20 – Hawkesbury-Nepean River (No 2 – 1997) (SREP 20) is a deemed State Environmental Planning Policy.

SREP 20 aims to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context. It adopts a twofold approach to achieving that aim: (1) the setting of the general planning considerations, specific planning policies and recommended strategies; and (2) the imposition of specific development controls. The proposal is located on land identified on the SREP 20 Map.

Clauses 5 and 6 of SREP 20 set out general planning considerations and specific planning policies and recommended strategies respectively. Clause 4 requires that those considerations, policies and recommended strategies be taken into consideration by consent authorities and by public authorities proposing to undertake development that does not require consent. SREP 20 planning matters are considered further in Appendix L.

4.2 Local Environmental Plans

The proposal is located within the Blue Mountains local government area. Land use and development within this area is primarily regulated by the Blue Mountains Local Environmental Plan 2015 (Blue Mountains LEP).

The proposal site is zoned as follows under the Blue Mountains LEP:

- R2 Low Density Residential
- IN1 General Industrial
• RE1 Public Recreation
• SP2 Infrastructure (Classified Road).

Development for the purposes of roads is permitted with development consent in all the above zones. The ISEPP removes these consent requirements (see Section 4.1.1).

The proposal is aligned with the first objective of the SP2 zone which is to provide for infrastructure and related uses. As the proposal is confined to the existing public road corridor, it would not affect the realisation of objectives for adjacent residential, industrial and public recreation uses.

4.3 Other relevant legislation

4.3.1 Protection of the Environment Operations Act 1997

Section 120 of the Protection of the Environment Operations Act 1997 (POEO Act) prohibits the pollution of waters. Water quality is addressed in Section 6.7.

Air pollution-related Sections 124 to 126 (Chapter 5, Part 5.4., Division 1) of the POEO Act require activities to be conducted in a proper and efficient manner, while Section 128 (Chapter 5, Part 5.4., Division 1) of the POEO Act requires that all necessary practicable means are used to prevent or minimise air pollution. Air quality is addressed in Section 6.8.

Pollution of land and waste is covered by Part 5.6 of the POEO Act. The Act defines ‘waste’ for regulatory purposes and establishes management and licensing requirements for waste.

It defines offences relating to waste and sets penalties. The POEO Act also establishes the ability to set various waste management requirements via the Protection of the Environment Operations (Waste) Regulation 2014. Waste is addressed in Section 6.11 while contamination is considered in Section 6.7.

Part 3.2 of the POEO Act requires an Environmental Protection Licence for scheduled development work and the carrying out of scheduled activities. The proposal does not trigger these requirements.

4.3.2 Heritage Act 1977

Section 57 of the Heritage Act 1977 regulates development affecting items on the State Heritage Register or which are the subject of an interim heritage order. While the proposal would be adjacent to the State Heritage Register listed Glenbrook Railway Residence (Item 00713), the proposal would not have any physical impact on this item and would have only a minor impact on its setting (refer to Section 6.3).

An excavation permit is required to disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed. A permit is also required to disturb or excavate any land on which the person has discovered or exposed a relic. Section 139(4) of the Heritage Act 1977 makes provision for the issuing of an exception in certain prescribed circumstances. Where items are defined as a ‘work’ rather than a ‘relic’, such as early road fabric, kerbing or tram tracks, no excavation permit or exception is required. Roads and Maritime proposes to confirm with the Office of Environment and Heritage the application of an exception in relation to potential impacts on subsurface relics that may be present near the Great Western Highway / Ross Street intersection (refer to Section 6.3).

4.3.3 National Parks and Wildlife Act 1979

The harming or desecrating of Aboriginal objects or places is an offence under Section 86 of the National Parks and Wildlife Act 1979 (NPW Act). Under Section 90, an Aboriginal heritage impact permit may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons. Aboriginal objects and/or places are not expected to be affected by the proposal (refer to Section 6.6).
4.3.4 **Roads Act 1993**

Section 138 of the *Roads Act 1993* requires consent from the relevant roads authority for the erection of a structure, or the carrying out of work in, on or over a public road, or the digging up or disturbance of the surface of a road.

Approval under Section 138 would not be required for the proposal. In relation to classified roads, Roads and Maritime may exercise the functions of the roads authority. Further, under clause 5(1) in Schedule 2 of the *Roads Act 1993*, public authorities do not require consent for work on unclassified roads.

4.3.5 **NSW Aboriginal Land Rights Act 1983**

The ALR Act establishes 122 Local Aboriginal Land Councils and the NSW Aboriginal Land Council with statutory responsibility for representing the interests of Aboriginal people, including claiming and managing land on behalf of Aboriginal people within their statutory boundary.

Under the ALR Act, a Local Aboriginal Land Council, or the New South Wales Aboriginal Land Council on behalf of a Local Aboriginal Land Council, may make claims over Crown Land that is not needed for an essential public purpose or legally used and/or occupied.

Section 42B of the ALR Act provides that land vested in a Land Council shall not be appropriated or resumed except by an Act of Parliament. Only a special Act of Parliament can authorise a compulsory acquisition.

As noted above in Section 3.6, Lots 7053, 7054 and 7055, DP 1080609, which are adjacent to the proposed works, are subject to an Aboriginal Land Claim under the ALR Act. The proposed works, including the proposed compound, do not encroach on Lots 7053, 7054 or 7055.

4.3.6 **Threatened Species Conservation Act 1995**

The *Threatened Species Conservation Act 1995* (TSC Act) is directed at conserving threatened species, populations and ecological communities of animals and plants.

Certain species of animals or plants are identified as endangered species, populations or communities or vulnerable species under the Act. Areas of land comprising the habitats of listed endangered species may also be declared critical habitat under the Act.

By operation of associated EP&A Act provisions, activities that are likely to have a significant impact on listed threatened species, populations, endangered ecological communities or their habitats must be the subject of a Species Impact Statement and require concurrence from Chief Executive of the Office of Environment and Heritage.

As outlined in Section 4.3.7, the TSC Act was repealed on 25 August 2017, following the commencement of the *Biodiversity Conservation Act 2016* (BC Act). Notwithstanding, this proposal has been assessed in accordance with the TSC Act by virtue of the transitional provisions of the BC Act (discussed further in Section 4.3.7).

4.3.7 **Biodiversity Conservation Act 2016**

The BC Act and its supporting regulations commenced on 25 August 2017. The BC Act repeals the TSC Act along with other natural resource management legislation. The BC Act sets out the assessment framework for threatened species and ecological communities for activities subject to assessment under Part 5 of the EP&A Act (amongst other types of development).

Under the Biodiversity Conservation (Savings and Transitional) Regulation 2017, all Roads and Maritime EP&A Act Part 5 assessments that have commenced can continue under the previous legislative framework and guidelines, provided that the environmental assessment began before 25 August 2017 and provided the assessment will be determined before 25 February 2019.

The transitional provisions of the BC Act apply to the proposal. For this reason, the proposal has been assessed in accordance with the TSC Act.
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 (Environmental assessment) of the REF.

A referral is not required for proposed road actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015. Potential impacts to these biodiversity matters are also considered as part of Chapter 6 and in Appendix A.

The assessment of potential proposal impacts found that it would be unlikely to cause a significant impact on matters of national environmental significance or the environment of Commonwealth land. A referral to the Australian Department of the Environment and Energy is not required.

4.5 Confirmation of statutory position

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

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

The assessment of potential proposal impacts found that it would be unlikely to cause a significant impact on matters of national environmental significance or the environment of Commonwealth land. A referral to the Australian Department of the Environment and Energy is not required.
5 Stakeholder and community consultation

5.1 Community involvement strategy

Roads and Maritime has developed a Community Consultation and Stakeholder Engagement Plan for the proposal. The plan identifies key objectives and the desired consultation outcomes. It focuses on consultation with relevant Government agencies, stakeholders and the community affected by the proposal. The plan’s overall objectives are to:

- Provide stakeholders with clear, relevant, timely and accurate information about the proposal, proposed changes and impacts
- Identify local issues to ensure the proposal aligns with community needs
- Inform and consult affected and interested stakeholder groups.

A mix of communication channels will be used to communicate with the community and stakeholders throughout the proposal’s development.

5.2 Community involvement

To date, consultation has primarily been with Blue Mountains City Council and the community, including their input into the option selection process. Community preferences expressed during the option selection process are briefly reviewed in Section 2.4.3 while a Submissions Report, which further reviews the community response to the options, is included in Appendix C.

The Community Consultation and Stakeholder Engagement Plan notes that the REF will be displayed publicly and that submissions will be invited. All issues raised during the public display period will be considered and responded to in the Submissions Report.

The REF will be displayed on the Roads and Maritime website. A community update will be letterbox dropped to residents and businesses, and additional stakeholders will receive the community update with a covering email / letter.

During the public display period, potentially affected residents, businesses and other nearby stakeholders will be visited by project team staff to discuss the proposal and address their issues of concern. Project team staff will also schedule and meet with potentially affected residents and other stakeholders as requested.

5.3 Aboriginal community involvement

The proposal has been considered against the requirements of the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime Services, 2011). This procedure is generally consistent with the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Department of Environment, Climate Change and Water, 2010). An outline of the procedure is presented in Table 5-1.

Table 5-1 Procedure for Aboriginal Cultural Heritage Consultation and Investigation

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Initial Roads and Maritime assessment. Desktop assessment to determine whether a Roads and Maritime proposal is likely to harm Aboriginal cultural heritage, and whether further assessment or investigation is required.</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Desktop assessment and site survey. Further assessment and a survey with specific Aboriginal stakeholders and an archaeologist to assess whether a project would impact Aboriginal cultural heritage.</td>
</tr>
<tr>
<td>Stage</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Formal consultation and preparation of cultural heritage assessment report. Aboriginal parties must be involved in the preparation of these reports in accordance with legislative requirements and the <em>Aboriginal cultural heritage consultation requirements for proponents 2010</em> (Department of Environment, Climate Change and Water, 2010).</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Implement project mitigation measures. Undertake salvage and/or project implementation in accordance with an Aboriginal Heritage Impact Permit (AHIP) and/or a Part 5.1/Part 4 approval or Part 5 determination obtained under the EP&amp;A Act.</td>
</tr>
</tbody>
</table>

Aboriginal cultural heritage impacts are not expected as a result of the proposal (see Section 6.4). An Aboriginal Heritage Information Management System (AHIMS) search was conducted on 20 February 2017 and identified eight registered sites in the wider locality. The nearest registered site is 45-5-3216 (habitation structure and potential archaeological deposit) located about 650 metres to the north-east of the proposal site.

The Roads and Maritime Aboriginal Cultural Heritage Adviser for Sydney Region has considered the proposal and has advised there is no requirement to proceed to Stage 2 of the Roads and Maritime PACHCI. A Stage 1 clearance letter was obtained. (see Appendix H).

As noted in Section 3.6, Lots 7053, 7054 and 7055, DP 1080609, which are adjacent to the proposed works, are subject to an Aboriginal Land Claim under the ALR Act. The proposed works, including the proposed compound, do not encroach on Lots 7053, 7054 or 7055.

### 5.4 ISEPP consultation

Part 2 Division 1 of the ISEPP outlines particular circumstances where consultation with councils and other public authorities is required. The consultation requirements under clauses 13 to 16 of the Infrastructure SEPP have been reviewed and while Blue Mountains City Council has been involved in the development of the proposal, it is still considered that formal consultation is required under ISEPP clause 13(1)(f). ISEPP consultation requirements are reviewed in Appendix D.

An ISEPP consultation letter was sent to Blue Mountains City Council on 13 February 2017 and a response was received on 24 February 2017 advised that Council currently had no further comments but would provide further input during the public display of the REF. A further letter was sent to Blue Mountains City Council on 26 July 2017 advising of the decision to select Option 5 (rather than Option 3b) as the preferred option.

By letter dated 8 August 2017, Blue Mountains City Council responded advising of its objection to Option 5. Roads and Maritime has subsequently responded to Council advising that Roads and Maritime will proceed with display of the REF for the Option 5 proposal along with reasons for the decision.

### 5.5 Government agency and stakeholder involvement

Blue Mountains City Council has been closely involved in the development of the proposal and the selection of the preferred option (refer to Chapter 2 (Need and options considered)). Consultation has also occurred with council under the provisions of the ISEPP.

Consultation has also occurred with Sydney Water regarding the proposed new water main installation and with Endeavour Energy regarding street lighting adjustments.

Further consultation with key stakeholders, including Blue Mountains City Council and the Office of Environment and Heritage, will occur during the public display of the REF.
5.6 Ongoing or future consultation

As noted in Section 5.2, the REF will be publicly displayed and submissions will be invited. All submissions will be reviewed and issues raised will be considered and responded to in a subsequent submissions report, which will be made publicly available.

Nearby residents and businesses will be notified prior to the commencement of any construction, if the proposal is approved. This would reference working hours and expected impacts. Contact details of the work supervisor would be made available to residences via community letters to allow construction phase issues to be raised and addressed in a timely manner.
This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in the guidelines *Is an EIS required?* (Department of Urban Affairs and Planning, 1995) and *Roads and Related Facilities – EIS Guideline* (Department of Urban Affairs and Planning, 1996) as required under Clause 228(1)(b) of the Environmental Planning and Assessment Regulation 2000. The factors specified in Clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A. Site-specific safeguards are provided to ameliorate the identified potential impacts.

### 6.1 Traffic and transport

#### 6.1.1 Existing environment

The Great Western Highway and the Blue Mountains Railway line are key transport routes within the locality and provide access to the central west of NSW. The Blue Mountains Railway line runs in a generally north-south direction south of the Great Western Highway. The Great Western Highway crosses over the Blue Mountains Railway line at Blaxland.

Key features of the Great Western Highway at the proposal site (Figure 1-1) and existing issues at the Ross Street and Hare Street intersections are discussed in Section 2.2.

**Public transport**

The Blue Mountain Railway line and Glenbrook Railway Station is located about 200 metres to the south of the proposal site.

The local area is also serviced by buses which are operated by Blue Mountains Transit. Route 690P operates daily between Penrith and Springwood via Glenbrook, Blaxland, Warrimoo and Valley Heights. This route passes through Glenbrook on the local road network before joining the Great Western Highway at Hare Street (south). Route 691 operates daily between Penrith and Mount Riverview via Blaxland. This route uses the section of the Great Western Highway within the proposal site as well as Ross Street and Hare Street (south).

There are two bus stops within the proposal site. Bus stop 277325 (eastbound) services route 690P (Springwood to Penrith) and route 691 (Penrith to Mount Riverview via Blaxland) and includes a concrete pad, shelter, seat and signage attached to the adjacent light pole. Bus stop 277352 (westbound) also services route 690P and route 691 and includes a seat and bus zone signage. Figure 6-1 shows the location of bus stops within and near the proposal site. Both bus routes 690P and 691 use Ross Street, the Great Western Highway and Hare Street (north).
Figure 6-1 Location of bus stops within and near the proposal site

Note: At various times of the day, the bus route may divert or have a different stop sequence.

Safety

As noted in Section 2.1, for the five-year period between July 2009 and June 2014 there were 13 crashes at the Great Western Highway / Hare Street intersection, of which five resulted in injuries. Ten of the 13 crashes reported at this location involved rear end crashes.

There were also six crashes at the Great Western Highway / Ross Street intersection over the same period, of which four resulted in injuries.

Pedestrian and cyclist facilities

There are generally no formalised pedestrian and cyclist facilities along the Great Western Highway at the proposal site – with the exception of a narrow concrete footpath on the southern side of the Great Western Highway between Ross Street and the Caltex service station. Signalised pedestrian crossings are provided on all approaches to the Hare Street intersection, which is used by people accessing the skate park, Glenbrook Oval and the Glenbrook Panthers Bowling Club.

There are no pedestrian crossings provided at the Ross Street intersection; however, there is a strong pedestrian desire line between the southern side of the Great Western Highway near Ross.
Street (with demand generated by the Glenbrook town centre) and the pathway which extends north along the eastern side of Glenbrook Oval before connecting to Moore Street.

Sealed shoulders on the northern and southern sides of the Great Western Highway currently have sufficient width to accommodate cyclists – although no designated cycle lanes are provided.

**On street parking**

There are no formalised parking provisions along the northern side of the Great Western Highway, although parking is not restricted and the area is frequently used as an informal rest area largely by heavy vehicles.

About four restricted (one hour) parking spaces are located along the southern side of the Great Western Highway, adjacent to and west of the Caltex service station. Parking is not permitted on those parts of Hare Street and Ross Street within the proposal site. There are, however, a substantial number of restricted (two hour) parking spaces on both sides of Wascoe Street.

### 6.1.2 Potential impacts

#### Construction

Details of the proposed construction activities, including methodology and work hours, are detailed in Section 3.3. Through traffic would be maintained on the Great Western Highway during construction; however, several general short-term traffic and transport impacts may occur to a varying degree. These include:

- Some temporary increases in travel times for vehicles due to speed limit restrictions around areas where construction activities need to be completed under traffic
- Short-term delays associated with construction traffic entering and exiting the construction site under traffic control
- Changes to the safe operating profile of the road network given the addition of construction traffic, including heavy vehicles, as well as temporary traffic controls
- Possible delays to bus journeys due to temporary traffic control measures. It is expected that buses would be affected in a similar way to general traffic and it is noted that the bus stop on the northern side of the Great Western Highway, east of Hare Street, can remain in use during construction
- Potential for minor and temporary relocation of bus stops within the proposal site
- Minor detours for pedestrians
- Minor kerbside parking changes
- Reduction in the area available for use as an informal rest area on the northern side of the Great Western Highway.

Safeguards and mitigation measures have been proposed to address the construction related impacts identified above (refer to Section 6.1.3).

Construction activities would require a range of plant and equipment including light and heavy vehicles. The number of construction vehicle trips generated by the proposal would be small relative to highway traffic and is not expected to affect network performance.

Roads and Maritime has consulted with the bus service operator (ie Blue Mountains Transit) who has provided a list of the affected services. The existing bus stops and bus routes would remain operational for the majority of the construction phase prior to closure of Hare Street (south). Temporary relocation for bus stop 277352 may be required when works are required on the southern side of Great Western Highway, however, temporary bus stops would be provided. Roads and Maritime would consult with the bus operator during delivery stage to minimise disturbance and impacts to existing bus operation.
Operation

Intersection performance

Traffic modelling for the proposal (using 2015 traffic volumes) indicates that both the Hare Street and Ross Street intersections would operate at Level of Service\(^1\) (LoS) A in the AM and PM peak periods and would have average vehicle delays in the order of 10-12 seconds per vehicle.

Based on predicted 2025 traffic volumes (assuming an increase of 10.5 per cent), traffic modelling for the proposal indicates that both intersections would retain a satisfactory to good operation with a peak period Level of Service A/B operation with average vehicle delays in the order of 10-20 seconds per vehicle at the individual intersections.

Access

The proposal involves restricting movements (except for emergency vehicles) between the Great Western Highway and Hare Street (south).

These changes mean that traffic on the Great Western Highway and Hare Street (north) seeking to access Mann Street and Wascoe Street would need to use the new traffic lights at Ross Street instead of the Hare Street intersection, which is about 150 metres east of Hare Street. This may represent a minor increase in travel time for some road users.

Safety

The proposal would address several identified safety issues at the Hare Street and Ross Street intersections as described in Section 2.1, including the difficulties associated with turning right from Hare Street (south). It would also improve pedestrian safety by providing an additional safe crossing location at Ross Street.

Public transport

Consultation with bus service operators and Transport for NSW will be ongoing for implementation of the closure of Hare Street (south). The date of implementation would be provided to the operator at least three months in advance of the closure to enable review / consultation / planning and roll out of the re-route of services to Ross Street.

Pedestrians and cyclists

The proposal would deliver improved facilities for pedestrians including footpath connections to signalised crossing locations. The provision of a pedestrian crossing at the proposed new traffic lights at Ross Street would better link Glenbrook shops and cinema with the residential areas to the north of the Great Western Highway.

The proposal also includes some on-road provision for cyclists in the form of variable width sealed shoulders on the Great Western Highway and provision of an on-road cycle lane on the northern side of the Great Western Highway at the Ross Street intersection (refer to Figure 3-3 in Chapter 3 (Description of the proposal)).

Parking

The proposal would not result in the loss of any formalised on-street parking; although, following construction, there would be a minimal reduction in the area available for use as an informal rest area on the northern side of the Great Western Highway between Ross Street and Hare Street.

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\(^1\) Level of Service is a qualitative assessment of the effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to manoeuvre. There are six levels of service with A indicating the best performance and F indicating the worst performance.
6.1.3 Traffic Management Plan

A Traffic Management Plan (TMP) has been prepared to address the impact of restricted access at the intersection of Great Western Highway and Hare Street (south), which forms part of the project scope. This TMP is included as Appendix J in this report.

6.1.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic and Transport</td>
<td>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual (Roads and Traffic Authority, 2010) and QA Specification G10 Control of Traffic. The TMP will include: • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms</td>
<td>Contractor</td>
<td>Detailed design / Pre-construction</td>
<td>Core standard safeguard TT1 Section 4.8 of QA G36 Environment Protection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bus stop</th>
<th>Bus stop signage and other</th>
<th>Roads and</th>
<th>Detailed</th>
<th>Additional</th>
</tr>
</thead>
</table>

Intersection upgrade, Great Western Highway and Ross Street, Glenbrook
Review of Environmental Factors 37
### 6.2 Noise and vibration

A Noise and Vibration Assessment was conducted for the proposal by Pacific Environment (refer to Appendix F). The following sections summarise the main findings of that assessment.

#### 6.2.1 Existing environment

The proposal is in an urban area which includes residential, commercial and recreational land uses. The nearest residential receiver is located on Wascoe Street about 30 metres from the proposal site. The location of noise sensitive receivers and noise catchment areas (NCA) adopted for the purposes of this assessment are shown in Figure 6-2. An NCA is a logical grouping of receivers affected by the same works and includes receivers where noise levels have the potential to increase.
For the purposes of this assessment, ambient noise levels were measured at one location representative of the nearest noise sensitive receiver. Table 6-1 gives the location and the measured results.

### Table 6-1 Unattended noise measurement results – ambient noise levels

<table>
<thead>
<tr>
<th>Location</th>
<th>Existing Background Noise Levels (RBL) – dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Wascoe Road, Glenbrook²</td>
<td>Day¹</td>
</tr>
<tr>
<td>Receiver NCA2-1 on Figure 6-2.</td>
<td>52</td>
</tr>
</tbody>
</table>

1. Day (7 am to 6 pm Monday to Saturdays and 8 am to 6 pm Sundays and Public Holidays), Evening (6 pm to 10 pm Monday to Sunday). Night (10 pm to 7 am Monday to Saturdays and 10 pm to 8 am Sundays and Public Holidays).

2. Free field monitoring location (the area more than three metres from a reflective surface and which is not affected by it)

Attended noise measurements were also taken to help characterise the noise environment of the area. These measurements indicated that noise environment is dominated by road traffic noise from the Great Western Highway with an occasional local traffic influence.
6.2.2 Criteria and assessment approach

Construction noise

Noise management goals for construction are given in the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009).

For residential receivers, the guideline provides that construction noise should not exceed the background noise levels by more than 10 dB(A) during standard hours, and by more than 5 dB(A) out-of-hours (that is, for night-time work). The level of 75 dB(A) is identified as the point above which there may be a strong community reaction to construction noise.

The project specific construction noise management levels for residential receivers have been set based on the background noise levels presented in Section 6.2.1 and are listed in Table 6-2.

*Table 6-2 Project specific construction noise management levels – residential receivers*

<table>
<thead>
<tr>
<th>Standard hours²</th>
<th>Out-of-hours Day³</th>
<th>Out-of-hours Evening⁴</th>
<th>Out-of-hours Night⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>62 dB(A)</td>
<td>57 dB(A)</td>
<td>54 dB(A)</td>
<td>42 dB(A)</td>
</tr>
</tbody>
</table>

1. Daytime construction noise criteria calculated as \( L_{A\text{eq},15\text{min}} = RBL + 10 \text{ dB} \); evening and night-time construction noise criteria calculated as \( L_{A\text{eq},15\text{min}} = RBL + 5 \text{ dB} \)
2. Standard hours: Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm
3. Out-of-hours daytime: Saturday 1 pm to 6 pm, Saturday, 7 am to 6 pm, Sunday
4. Out-of-hours evening: Monday to Sunday 6 pm to 10 pm
5. Out-of-hours night-time: Monday to Saturday 10 pm to 7 am, Sunday and Public Holidays 10 pm to 8 am.

The *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009) provides the following noise management goals for other non-residential noise sensitive receivers:

- Active recreation areas (such as parks): external \( L_{A\text{eq}, 15\text{min}} \) 65 dB(A) (when in use)
- Industrial premises: \( L_{A\text{eq}, 15\text{min}} \) 75 dB(A) (external)
- Offices, retail outlets: \( L_{A\text{eq}, 15\text{min}} \) 70 dB(A) (external)
- Places of worship \( L_{A\text{eq}, 15\text{min}} \) 45 dB(A) (internal) (when in use)
- Classrooms at schools \( L_{A\text{eq}, 15\text{min}} \) 45 dB(A) (internal) (when in use).

There are several noise sensitive commercial receivers located near the proposal site, including restaurants, an art studio and a cafe. As recommended in the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009), these were assessed using the recommended maximum internal noise levels from Australian Standard (AS) 2107:2000 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*. These values have been converted to external noise levels based on typical transmission losses for internal to external. It was assumed that these buildings would be configured such that windows could remain closed, resulting in an attenuation of approximately 20 dB. The resulting external construction noise management levels are:

- Art / craft studio: \( L_{A\text{eq}, 15\text{min}} \) 65 dB(A) (external)
- Restaurant / café: \( L_{A\text{eq}, 15\text{min}} \) 70 dB(A) (external).

Maximum noise levels from night-time construction noise are assessed according to the sleep disturbance screening criteria in the *NSW Road Noise Policy* (Department of Environment, Climate Change and Water, 2011). The notes recommend a sleep disturbance screening criteria of \( RBL + 15 \text{ dB(A)} \). The criteria for residential receivers is therefore \( L_{A\text{max}} \) 52 dB(A).

Construction vibration

The publication *Assessing Vibration: a technical guideline* (Department of Environment and Conservation, 2006) sets out human comfort criteria for continuous, impulsive and intermittent vibration. Where vibration is intermittent, as would be the case with the proposal, the vibration dose values in Table 6-3 are applicable.
Table 6-3 Acceptable vibration dose values for intermittent vibration

<table>
<thead>
<tr>
<th>Location</th>
<th>Daytime (1) – m/s^{1.75}</th>
<th>Night-time (1) – m/s^{1.75}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preferred</td>
<td>Maximum</td>
</tr>
<tr>
<td>Critical areas (2)</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>Residences</td>
<td>0.20</td>
<td>0.40</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>0.40</td>
<td>0.80</td>
</tr>
<tr>
<td>Workshops</td>
<td>0.80</td>
<td>1.60</td>
</tr>
</tbody>
</table>

1. Daytime is 7 am to 10 pm and night-time is 10 pm to 7 am.
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source: BS 6472-1992 Guide to evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz) (British Standards Institution, 1992)

In relation to potential building damage, German Standard DIN 4150-3-1999 Structural Vibration – Part 3 Effects of vibration on structures sets guide values to minimise risk of cosmetic damage to residential and industrial buildings.

Table 6-4 Guideline Vibration Values for Short Term Vibration on Structures (mm/s)

<table>
<thead>
<tr>
<th>Building type</th>
<th>Guideline values for velocity (mm/s)</th>
<th>1 to 10 Hz</th>
<th>10 to 50 Hz</th>
<th>50 to 100 Hz</th>
<th>Vibration at horizontal plane of highest floor at all frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial and Industrial Building</td>
<td></td>
<td>20</td>
<td>20-40</td>
<td>40-50</td>
<td>40</td>
</tr>
<tr>
<td>Dwellings and buildings of similar occupancy or design</td>
<td></td>
<td>5</td>
<td>5-15</td>
<td>15-20</td>
<td>15</td>
</tr>
<tr>
<td>Structures that, because of their particular sensitivity to vibration cannot be classified under lines 1 and 2 and are of great intrinsic value</td>
<td></td>
<td>3</td>
<td>3-8</td>
<td>8-10</td>
<td>8</td>
</tr>
</tbody>
</table>

1. Daytime is 7 am to 10 pm and night-time is 10 pm to 7 am.
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.
Operational road traffic noise

The *NSW Road Noise Policy* (NSW Department of Environment, Climate Change and Water, 2011) sets out road traffic noise criteria for residential land uses. These criteria are listed in Table 6-5.

**Table 6-5 NSW Road Noise Policy residential land use criteria**

<table>
<thead>
<tr>
<th>Road type</th>
<th>Type of project/land use</th>
<th>Assessment criteria - dBA</th>
</tr>
</thead>
</table>
| Freeway / arterial / sub-arterial road | Existing residences affected by noise from redevelopment of existing freeway / arterial / sub-arterial roads
Existing residences affected by additional traffic on existing freeways / arterial / sub-arterial roads generated by land use developments | Day (7 am to 10 pm): 60 dB(A) $L_{Aeq}$ 15 hour
Night (10 pm to 7 am): 55 dB(A) $L_{Aeq}$ 9 hour |

"Redevelopments" are defined as work where it is proposed to increase traffic-carrying capacity, increase the number of heavy vehicles by more than 50 per cent (eg from 10 per cent heavy vehicles to 15 per cent heavy vehicles) or change the road alignment through design or engineering changes.

The upgrade is not intended to increase the traffic carrying capacity or shift the alignment significantly closer to sensitive noise receivers. As a result, the upgrade is not considered a redevelopment or new project as defined within the *Noise Criteria Guideline* (Roads and Maritime Services, 2015) for the purpose of this assessment, and has been assessed as a minor work. The *Noise Criteria Guideline* provides a practical approach to applying the *NSW Road Noise Policy* and addresses specific situations relevant to Roads and Maritime road projects.

Section 6.6 of the *Noise Criteria Guideline* states that the existing road criteria may be applied where minor work increases noise levels by more than 2.0 dB(A) relative to existing noise levels at the worst affected receiver. Where the total noise level for the ‘build’ year exceeds the criterion and there is an increase of more than 2.0 dB(A) (ie 2.1 dB(A)), relative to the ‘no-build’ year, then the receiver qualifies for consideration of noise mitigation.

Criteria for other non-residential noise sensitive land uses are listed below in Table 6-6.

**Table 6-6 NSW Road Noise Policy criteria for non-residential land uses**

<table>
<thead>
<tr>
<th>Land use</th>
<th>Assessment criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>School classroom</td>
<td>$L_{Aeq, (1 hour)}$ 40 dB(A) (external) when in use</td>
</tr>
<tr>
<td>Places of worship</td>
<td>$L_{Aeq, (1 hour)}$ 40 dB(A) (internal)</td>
</tr>
<tr>
<td>Open space (active)</td>
<td>$L_{Aeq, (15 hour)}$ 60 dB(A) (external) when in use</td>
</tr>
<tr>
<td>Open space (passive)</td>
<td>$L_{Aeq, (15 hour)}$ 55 dB(A) (external) when in use</td>
</tr>
<tr>
<td>Aged care facilities</td>
<td>Adopt residential criteria</td>
</tr>
</tbody>
</table>

In relation to sleep disturbance, the *NSW Road Noise Policy* (NSW Department of Environment, Climate Change and Water, 2011) notes that:

- Maximum internal noise levels below 50 dB(A) to 55 dB(A) are unlikely to cause awakening reactions
• One or two events per night, with maximum internal noise levels of 65 dB(A) to 70 dB(A), are not likely to affect health and wellbeing significantly.

The *Environmental Noise Management Manual* (Roads and Traffic Authority, 2001) suggests that the assessment of sleep disturbance should include an examination of ‘maximum noise events’. A ‘maximum noise event’ is defined as any single event where the $L_{A_{\text{max}}}$ external noise level exceeds 65 dB(A) and the $L_{A_{\text{max}}}$ noise level exceeds the $L_{A_{\text{eq}}}$ noise level by more than 15 dB(A).

**Audio tactile pedestrian beepers**

Criteria for the assessment of pedestrian beepers are derived from the NSW *Industrial Noise Policy* (Environment Protection Authority, 2000). Table 6-7 shows applicable intrusiveness and amenity criteria (including a 5 dB(A) adjustment for annoying characteristics).

**Table 6-7 NSW Industrial Noise Policy criteria**

<table>
<thead>
<tr>
<th>Period</th>
<th>Descriptor</th>
<th>Intrusiveness criteria dB(A)</th>
<th>Amenity criteria dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>$L_{A_{eq}}$ 15 min</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>Evening</td>
<td>$L_{A_{eq}}$ 15 min</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Night</td>
<td>$L_{A_{eq}}$ 15 min</td>
<td>34</td>
<td>40</td>
</tr>
</tbody>
</table>

1. Includes 5 dB(A) adjustment for annoying characteristics of the subject noise.

### 6.2.3 Potential impacts

**Construction noise**

Table 6-8 presents a summary of the relevant construction scenarios with the potential to generate impact on the nearest residential receivers. Sound power levels were sourced from AS 2436 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites* and the United Kingdom Department for Environment, *Food and Rural Affairs Noise Database for Prediction of Noise on Construction and Open Sites*. Plant and equipment may be used in isolation or simultaneously.

**Table 6-8 Construction scenarios and plant**

<table>
<thead>
<tr>
<th>ID</th>
<th>Scenario</th>
<th>Equipment</th>
<th>Overall Sound Power Level, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earthworks</td>
<td>Road truck, front end loader, grader, vibratory roller, excavator, water cart and generator</td>
<td>116</td>
</tr>
<tr>
<td>2</td>
<td>Paving</td>
<td>Road truck, front end loader, grader, vibratory rollers, excavator, and water cart, bobcat and generator</td>
<td>118</td>
</tr>
<tr>
<td>3</td>
<td>Line marking</td>
<td>Line marking equipment, compressor, trucks and generator</td>
<td>113</td>
</tr>
</tbody>
</table>

A summary of the calculated construction noise level ranges for each NCA are presented in Table 6-9 for residential receive and Table 6-10 for non-residential receivers. These values assume maximum simultaneous operation of plant at the representative working locations.

Based on the calculations, it is considered that construction noise levels would impact on residential sensitive receivers when work is at its closest point; however, noise levels would generally be within noise management levels when work moves away from the receiver. During standard hours exceedances of noise management levels are not expected. During out-of-hours daytime work exceedances of up to 5 dB(A) are predicted, during out-of-hours evening work...
exceedances of up 8 dB(A) are predicted, while during out-of-hours night-time work exceedances of up to 20 dB(A) are expected.

Noise levels are predicted to remain below noise management levels at commercial receivers and the community centre (including cinema and performing arts theatre) for all construction scenarios. An exceedance of up to 4 dB(A) is predicted for The Glenbrook Centre (campus of Springwood High School) on Ross Street.

Table 6-9 Predicted typical construction noise level ranges – Residential receivers

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise Management Levels</th>
<th>Predicted construction noise level – dB(A) (by scenario)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Hours</td>
<td>OOH D</td>
</tr>
<tr>
<td>NCA 1</td>
<td>62</td>
<td>57</td>
</tr>
<tr>
<td>NCA 2</td>
<td>48 – 52</td>
<td>48 – 48</td>
</tr>
<tr>
<td>NCA 3</td>
<td>46 – 52</td>
<td>46 – 53</td>
</tr>
<tr>
<td>NCA 4</td>
<td>41 – 46</td>
<td>41 – 42</td>
</tr>
</tbody>
</table>

1. OOH D: Out-of-hours daytime – Saturday 1 pm to 6 pm, Sunday 7 am to 6 pm
2. OOH E: Out-of-hours evening – Monday to Sunday 6 pm to 10 pm
3. OOH N: Out-of-hours night-time – Monday to Saturday 10 pm to 7 am, Sunday and Public Holidays 10 pm to 8 am.

Table 6-10 Predicted typical construction noise level ranges – Non-residential receivers

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise Management Levels</th>
<th>Land use</th>
<th>Predicted construction noise level – dB(A) (by scenario)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>NCA2-02</td>
<td>70</td>
<td>Commercial</td>
<td>60 – 62</td>
</tr>
<tr>
<td>NCA2-03</td>
<td>65</td>
<td>Place of worship(^2)</td>
<td>57 – 62</td>
</tr>
<tr>
<td>NCA2-10</td>
<td>70</td>
<td>Commercial</td>
<td>58 – 60</td>
</tr>
<tr>
<td>NCA2-11</td>
<td>70</td>
<td>Commercial</td>
<td>49 – 76</td>
</tr>
<tr>
<td>NCA2-13</td>
<td>55</td>
<td>Education(^3)</td>
<td>51 – 59</td>
</tr>
<tr>
<td>NCA2-11</td>
<td>70</td>
<td>Active recreation</td>
<td>49 – 59</td>
</tr>
<tr>
<td>NCA4-01</td>
<td>65</td>
<td>Community centre(^2)</td>
<td>47 – 60</td>
</tr>
<tr>
<td>NCA4-02</td>
<td>70</td>
<td>Active recreation</td>
<td>47 – 57</td>
</tr>
<tr>
<td>NCA4-03</td>
<td>70</td>
<td>Commercial</td>
<td>45 – 54</td>
</tr>
<tr>
<td>NCA3-01</td>
<td>70</td>
<td>Active recreation</td>
<td>50 – 69</td>
</tr>
<tr>
<td>NCA3-02</td>
<td>70</td>
<td>Active recreation</td>
<td>59 – 66</td>
</tr>
<tr>
<td>NCA3-03</td>
<td>70</td>
<td>Active recreation</td>
<td>54 – 59</td>
</tr>
<tr>
<td>NCA4-04</td>
<td>70</td>
<td>Active recreation</td>
<td>51 – 65</td>
</tr>
</tbody>
</table>

1. Applicable during periods of use
2. External criteria based on 20 dB correction for external to internal noting close proximity to the Great Western Highway
3. External criteria based on 10 dB correction for external to internal.

Predicted noise levels associated with the proposed construction compound, located on the northern side of the Great Western Highway east of Hare Street, are listed in Table 6-11.
Predictions assumed an overall sound power level of 115 dB(A) with the use of a truck, front end loader, grader, vibratory roller, excavator, water cart and generator. The results show that compliance with noise management levels would be achieved for all NCAs during standard hours. Exceedances of noise management levels by up to 4 dB(A) are predicted for out-of-hours daytime work, by up to 7 dB(A) for out-of-hours evening work and by up to 19 dB(A) for out-of-hours night-time work.

Table 6-11 Predicted typical construction noise level ranges – construction compound

<table>
<thead>
<tr>
<th>NCA</th>
<th>Noise Management Levels</th>
<th>Predicted construction noise level – dB(A)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Hours</td>
<td>OOH D</td>
</tr>
<tr>
<td>NCA 1</td>
<td>62</td>
<td>57</td>
</tr>
<tr>
<td>NCA 2</td>
<td>62</td>
<td>57</td>
</tr>
<tr>
<td>NCA 3</td>
<td>62</td>
<td>57</td>
</tr>
</tbody>
</table>

¹ Assumes operation of road truck, front end loader, grader, vibratory roller, excavator, water cart and generator

Sleep disturbance impacts may occur due to any work occurring between 10 pm and 7 am. Maximum noise levels would generally be associated with impact noise or construction plant / truck air brake release. The results presented in Table 6-12 indicate that noise levels during night-time period have the potential to exceed criteria at the nearest receivers if effective management practices are not implemented.

Table 6-12 Predicted sleep disturbance noise level ranges

<table>
<thead>
<tr>
<th>Location</th>
<th>Sleep Disturbance Criteria, dB(A)</th>
<th>Predicted construction noise level – dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCA 1</td>
<td>52</td>
<td>57 – 67</td>
</tr>
<tr>
<td>NCA 2</td>
<td>52</td>
<td>57 – 80</td>
</tr>
<tr>
<td>NCA 3</td>
<td>52</td>
<td>51 – 77</td>
</tr>
<tr>
<td>NCA 4</td>
<td>52</td>
<td>50 – 64</td>
</tr>
</tbody>
</table>

Construction vibration

Construction vibration would generally be associated with the use of heavy machinery and vibratory equipment such as jackhammers and vibratory rollers.

The Construction Noise and Vibration Guideline (Roads and Maritime Services, 2016) provides recommended safe working distances for a range of construction activities. These are presented in Table 6-13 and provide for minimum safe working distances to prevent cosmetic damage and human response to vibration.

Table 6-13 Minimum safe working distances for vibration intensive plant

<table>
<thead>
<tr>
<th>Plant Item</th>
<th>Rating / description</th>
<th>Safe working distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibratory roller</td>
<td>&lt; 50 kN (Typically 1-2 tonnes)</td>
<td>5 m</td>
</tr>
<tr>
<td></td>
<td>&lt; 100 kN (Typically 2-4 tonnes)</td>
<td>6 m</td>
</tr>
<tr>
<td>Plant Item</td>
<td>Rating / description</td>
<td>Safe working distance</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cosmetic Damage</td>
</tr>
<tr>
<td>Small Hydraulic Hammer</td>
<td>&lt; 200 kN (Typically 4-6 tonnes)</td>
<td>12 m</td>
</tr>
<tr>
<td></td>
<td>300 kN (Typically 7-13 tonnes)</td>
<td>15 m</td>
</tr>
<tr>
<td></td>
<td>&gt; 300 kN (Typically 13-18 tonnes)</td>
<td>20 m</td>
</tr>
<tr>
<td></td>
<td>&gt; 300 kN (&gt; 18 tonnes)</td>
<td>25 m</td>
</tr>
<tr>
<td>Medium Hydraulic Hammer</td>
<td>(300 kg – 5 to 12t excavator)</td>
<td>2 m</td>
</tr>
<tr>
<td>Large Hydraulic Hammer</td>
<td>(900 kg – 12 to 18t excavator)</td>
<td>7 m</td>
</tr>
<tr>
<td></td>
<td>(1600 kg – 18 to 34t excavator)</td>
<td>22 m</td>
</tr>
<tr>
<td>Vibratory Pile Driver</td>
<td>Sheet piles</td>
<td>2 m to 20 m</td>
</tr>
<tr>
<td>Pile Boring</td>
<td>≤ 800 mm</td>
<td>2 m (nominal)</td>
</tr>
<tr>
<td>Jackhammer</td>
<td>Hand held</td>
<td>1 m (nominal)</td>
</tr>
</tbody>
</table>

Construction plant would be selected to ensure minimum safe working distances are compliant with both in relation to cosmetic damage and human response to vibration. Given the proximity of the sandstone structures associated with the State Heritage Register listed Glenbrook Railway Residence (Item 00713) (which are positioned at a distance of about five metres from the construction boundary), trial vibration measurements have been proposed to establish site-specific safe working distances for this item (refer to Section 6.2.4).

**Operational noise**

**Operational road traffic noise**

Relative changes in operational traffic noise levels were calculated based on the traffic volumes and classifications recorded for Wascoe Street and the Great Western Highway, and the separation distance between the existing and proposed road alignments, and the nearest noise sensitive receivers. Existing traffic noise contributions were predicted for daytime and night-time periods based on distances to the alignments, posted speed limits and measured heavy vehicle classifications. Taking into account the distance from Wascoe Street and the Great Western Highway to the external façade of receivers NCA1-01, NCA1-07 and NCA2-01, results for the existing alignment are presented in Table 6-14.

**Table 6-14 Predicted operational road traffic noise changes**

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Distance to receiver (m)$^1$</th>
<th>Existing Contribution Difference, dB$^2$</th>
<th>Future change in traffic noise, dB$^3$</th>
</tr>
</thead>
</table>

Intersection upgrade, Great Western Highway and Ross Street, Glenbrook
Review of Environmental Factors
The results indicate that noise levels are controlled by the contribution from the Great Western Highway by 11-14 dB during the daytime and 15-18 dB during the night-time. As a result, minor changes in traffic flows on Wascoe Street due to closure of the Hare Street (south) access are not expected to result in a change to receiver noise levels.

The proposed realignment of the westbound lanes of the Great Western Highway by up to four metres closer to residential receivers in Wascoe Street is predicted to result in less than 1 dB change in noise levels. This is below the 2.0 dB(A) increase criteria for minor works discussed in section 6.2.2.

No significant change (>1 dB) in maximum noise level events due to the proposal is expected.

**Audio tactile pedestrian beepers**

The audio-tactile pedestrian push button devices are designed to produce an audio signal with a built-in volume control. This control automatically moderates the button volume correlating with the surrounding ambient noise level, thereby ensuring that impacts on the surrounding receivers are appropriately regulated.

The upgraded intersection at Ross Street would involve the installation of new pedestrian crossings, including audio-tactile push buttons. These systems generally have two operational modes, being standby and walking signals, which generally comprise periodic tones and beeper tones depending on functionality. Due to the distance between the intersection and nearest residential receivers (over 150 metres), impacts are not expected. The change in beeper noise levels would be less than 1 dB at the nearest residences.

Impacts on the Glenbrook Visitors Centre (and associated Cinema and theatre) are also not expected given a setback of about 30 metres and the automatic volume controls for the beepers as described above.

### 6.2.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction noise and vibration</td>
<td>A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Core standard safeguard NV1 Section 4.6 of QA G36</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>----------</td>
<td>---------------------------------</td>
</tr>
</tbody>
</table>
| Construction noise and vibration | All sensitive receivers (e.g., schools, local residents) likely to be affected will be notified at least five days prior to commencement of any work associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:  
- The project  
- The construction period and construction hours  
- Contact information for project management staff  
- Complaint and incident reporting  
- How to obtain further information. | Contractor | Pre-construction | Core standard safeguard NV2 |
| Construction vibration         | Building condition surveys will be carried out for the State Heritage Register listed Glenbrook Railway Residence and any building or structure identified as having the potential to be affected by vibration impacts during construction work. | Contractor | Pre-construction | Additional measure |
### Impact

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction vibration</td>
<td>Trial vibration measurements will be carried out to establish safe working distances in relation to the State Heritage Register listed Glenbrook Railway Residence.</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Additional measure</td>
</tr>
</tbody>
</table>

### 6.3 Non-Aboriginal heritage

A Statement of Heritage Impact was prepared by Artefact to address impacts on the State Heritage Register listed Glenbrook Railway Residence and nearby locally significant heritage items (refer to Appendix G). The following sections summarise the main findings of that assessment but also consider potential impacts on nearby locally significant heritage items.

#### 6.3.1 Existing environment

**Listed heritage items**

A search of the NSW State Heritage Inventory was conducted for the suburb of Glenbrook on 19 February 2017. It returned 50 records. A similar search of the Australian Heritage Database returned 10 records. The Blue Mountains LEP and Roads and Maritime Heritage Conservation Register were also searched with no additional items identified. There are no heritage items within the proposal construction boundary.

The Blue Mountains World Heritage Area is located, at its nearest point, about 500 metres to the south-west of the proposal site.

Table 6-15 lists heritage items near the proposal site while Figure 6-4 shows the location of these items.

**Table 6-15 Heritage items adjacent to the proposal**

<table>
<thead>
<tr>
<th>ID</th>
<th>Item</th>
<th>Location</th>
<th>Listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>00713</td>
<td>Glenbrook Railway Residence</td>
<td>78 Great Western Highway</td>
<td>State Heritage Register</td>
</tr>
<tr>
<td>G007</td>
<td>Blaxland, Wentworth and Lawson Memorial</td>
<td>Railway Street</td>
<td>Blue Mountains LEP</td>
</tr>
<tr>
<td>G010</td>
<td>Former Station-Master's House</td>
<td>78 Great Western Highway</td>
<td>Blue Mountains LEP Part State Heritage Register</td>
</tr>
<tr>
<td>G015</td>
<td>Glenbrook Primary School</td>
<td>10 Park Street, Glenbrook</td>
<td>Blue Mountains LEP</td>
</tr>
<tr>
<td>G019</td>
<td>Glenbrook Native Plant Reserve</td>
<td>41 Great Western Highway</td>
<td>Blue Mountains LEP</td>
</tr>
<tr>
<td>G020</td>
<td>Original Glenbrook Railway</td>
<td>Railway Street</td>
<td>Blue Mountains LEP</td>
</tr>
<tr>
<td>ID</td>
<td>Item</td>
<td>Location</td>
<td>Listing</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td></td>
<td>Sign and Monument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G046</td>
<td>House</td>
<td>6 Wascoe Street</td>
<td>Blue Mountains LEP</td>
</tr>
<tr>
<td>G047</td>
<td>Glenbrook Park</td>
<td>20–28 and 30 Park Street and 2 Ross Street</td>
<td>Blue Mountains LEP</td>
</tr>
<tr>
<td>G049</td>
<td>Horse trough</td>
<td>2 Ross Street</td>
<td>Blue Mountains LEP</td>
</tr>
</tbody>
</table>

As Figure 6-4 shows, the nearest heritage item to the proposal site is the State Heritage Register listed Glenbrook Railway Residence (which is positioned immediately adjacent to the construction boundary on the south-western corner of Ross Street and the Great Western Highway). The statement of significance for this item notes:

*Stone railway cottages of this style are rare. No other comparable station-masters' house survives in the mountains, although there are six gatekeepers’ stone cottages of a quite different Gothic style (two of them with surviving stone privies). The interior of the residence is in surprisingly good order and is sympathetically used as a store for the garage shop. Now stripped back to the bare stone, the cottage presents a strikingly attractive address to the Great Western Highway.*

Figure 6-3 shows the Glenbrook railway residence.

*Figure 6-3 Glenbrook Railway Residence*

The locally significant ‘Glenbrook Park’ is also positioned immediately adjacent to the proposed construction boundary where it runs along the southern side of the Great Western Highway to the west of Ross Street. The statement of significance for this item notes:

*For over a century the park has been a strong focal point for cultural and active life in the village and its hinterland. It is significant for having housed the original public school (1892 to 1903), the two successive Schools of Arts since 1909 and various sporting facilities (later supplemented by Glenbrook Oval). As the location of the present Information Centre and the Community Theatre (the former School of Arts), it continues to have cultural value.*

*There is some archaeological significance in the north-east triangle where on the flat area among the surviving and regrowth bush the first school and the first School of Arts were erected. The ditch on the northern perimeter is almost certainly the original drainage channel between the reserve and the railway and has significance.*
Aesthetically, Glenbrook Park is a representative municipal park. It provides important green space and recreational facilities close to the village centre, although the open public area of the main park has been eroded both in quality and in extent by car-parking and by additional buildings.

The locally significant ‘Horse trough’ is also positioned immediately adjacent to the proposed construction boundary, where it runs along the eastern side of Ross Street. The statement of significance for this item notes:

Socially significant. Evocative of an earlier mode of transport prior to the rise and dominance of motor vehicles. Also evidence of early philanthropy and the development of animal protection societies during the early twentieth century.
Figure 6-4 Heritage items near the proposal site
Archaeological potential and significance

Non-Aboriginal archaeological potential is defined as the potential of a site to contain historical archaeological relics, as classified under the *Heritage Act 1977*. Non-Aboriginal archaeological potential is assessed by identifying former land uses and associated features through historical research, and evaluating whether subsequent actions (either natural or human) may have impacted on evidence for these former land uses. Table 6-16 summarises the findings for the proposal in relation to archaeological potential and significance.

*Table 6-16 Non-Aboriginal archaeological potential and significance*

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
<th>Modern disturbance</th>
<th>Archaeological potential</th>
<th>Archaeological significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Glenbrook Railway Station</td>
<td>Site of the first Glenbrook Railway Station, established in circa 1876 and demolished in circa 1902. The building was a timber framed construction and was used as a private residence. It is occupied the southern side of the railway line</td>
<td>Moderate to high</td>
<td>Low</td>
<td>Local or state depending on the nature of any remains</td>
</tr>
<tr>
<td>Second Glenbrook Railway Station and Platform</td>
<td>Site of the second Glenbrook Railway Station, established in 1902 and abandoned in 1913. The building and platform were constructed using brick, and likely sat on cement or brick footings / foundations. Likely occupied the southern part of the current Great Western Highway corridor.</td>
<td>Moderate to high</td>
<td>Low-moderate</td>
<td>Local</td>
</tr>
<tr>
<td>Railway infrastructure</td>
<td>Railway infrastructure including rails, sleepers, ballast, signals and power lines associated with the Main Western Railway which occupied southern part of the current Great Western Highway corridor within the project area between 1867 and 1913.</td>
<td>Moderate to high</td>
<td>Low</td>
<td>Local</td>
</tr>
<tr>
<td>Water tanks</td>
<td>Water tanks that occupied land along the northern side of the railway line between 1867 to at least 1884. It is likely that these</td>
<td>Moderate to high</td>
<td>Low</td>
<td>Local</td>
</tr>
</tbody>
</table>
### 6.3.2 Potential impacts

**Glenfield Railway Residence**

**Physical impacts**

The proposal would involve ground excavation in a cleared area of land adjacent to the northeast boundary of the Glenbrook Railway Residence. Proposed work in this location would involve realignment and reconstruction of footpaths and kerbing, installation of traffic signals and some drainage work. This work has been positioned outside the heritage curtilage of the Glenbrook Railway Residence, and therefore the proposal would not directly impact this heritage item.

Construction work would occur immediately adjacent to the hedgerow that delineates the eastern edge of the heritage curtilage of the Glenbrook Railway Residence and would be within 25 metres of the Glenbrook Railway Residence buildings, creating the potential for vibration impacts. As noted in Section 6.2.3 and Section 6.2.4 of this REF, trial vibration measurements have been proposed to establish site-specific safe working distances for this item.

**Visual impacts**

The proposal would involve installation of visually prominent elements adjacent to the heritage curtilage of the Glenbrook Railway Residence, in particular the new traffic signals at the intersection of the Great Western Highway and Ross Street. These elements would increase the visual clutter on the edge of the road, and would change views to and from the Glenbrook Railway Residence, including views south from the adjacent Glenbrook Oval and the northern side of the Great Western Highway.

It is noted, however, that the historic setting of the Glenbrook Railway Residence has been substantially diminished over time. The item’s setting and associations were significantly impacted following the deviation of the Lapstone Zig Zag Railway line in 1913 and subsequent completion of the Great Western Highway in 1926. Amalgamation of the cottage as part of a garage, and later construction of the adjacent Caltex service centre, further obscured the visual setting and character of the Glenbrook Railway Residence.
**Archaeological impacts**

There is low and low to moderate potential for locally significant archaeological remains associated with the use of former railway station buildings and platform and associated railway infrastructure to be located within the proposal site.

Services upgrades, drainage adjustments, pavement works and the placement of new signs and traffic light signals would occur at the Great Western Highway / Ross Street intersection, in areas of low to moderate archaeological potential. This includes the location of the Stationmaster’s Cottage Outbuilding and Second Glenbrook Railway Station and Platform. With the exception of some drainage works and some sign footings, excavation would be generally shallow (about 0.6 metres deep) and the potential for impacts on archaeological remains below the road pavement is therefore considered to be low. Notwithstanding, Roads and Maritime proposes to confirm with the Office of Environment and Heritage (via an exception notification) the application of an exception in relation to potential impacts on subsurface relics that may be present near the Great Western Highway / Ross Street intersection.

**Local heritage items**

The proposal would have no direct impacts on locally significant heritage items or associated curtilages. The proposal would introduce some new visual elements, such as the traffic lights at Ross Street, but these are consistent with the character of the Great Western Highway corridor at this location and would not adversely affect the setting of adjacent locally significant heritage items. In general, there would be a visual improvement along most sections of the Great Western Highway within the proposal site, due to the upgrade of road shoulders, kerbs, footpaths. Table 6-17 provides an assessment of potential impacts on locally significant heritage items near the proposal site.

*Table 6-17 Potential impacts on locally significant heritage items*

<table>
<thead>
<tr>
<th>Item name</th>
<th>Physical impact</th>
<th>Visual impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blaxland, Wentworth and Lawson Memorial</strong></td>
<td>The proposal does not involve any works that directly affect the physical fabric of the Blaxland, Wentworth and Lawson Memorial. The proposal site is located about 35 metres to the south west of the heritage item. Vibration impacts are therefore not anticipated. The proposal would result in a neutral physical impact to the Blaxland, Wentworth and Lawson Memorial.</td>
<td>The proposal site is located near the Blaxland, Wentworth and Lawson Memorial, and there are direct sightlines between the two. No new signage or visually prominent features would be installed in the immediate vicinity of the heritage item, and therefore views to the memorial from the surrounding area and for motorists travelling along the Great Western Highway would not be obstructed. The proposal would result in negligible visual impacts to the Blaxland, Wentworth and Lawson Memorial.</td>
</tr>
<tr>
<td><strong>Glenbrook Native Plant Reserve</strong></td>
<td>The proposal does not involve any works that directly affect the physical fabric of the Glenbrook Native Plant Reserve. The proposal site is located about 20 metres from the southern boundary of the item’s heritage curtilage. Given the nature of this heritage item as a landscape heritage item, potential</td>
<td>The proposal site is located in the vicinity of the Glenbrook Native Plant Reserve and there are direct sightlines between the two. No new signage or visually prominent features would be installed in the immediate vicinity of the heritage item, and therefore views to the reserve from the surrounding area and for motorists</td>
</tr>
<tr>
<td>Item name</td>
<td>Physical impact</td>
<td>Visual impact</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Original Glenbrook Railway Sign and Monument</td>
<td>The proposal does not involve any works that directly affect the physical fabric of the Original Glenbrook Railway Sign and Monument. The proposal site is located about 20 metres to the south west of the heritage item. Vibration impacts are therefore possible without appropriate mitigation. The proposal has the potential to result in a minor physical impact to the Original Glenbrook Railway Sign and Monument.</td>
<td>The proposal site is located in the vicinity of the Original Glenbrook Railway Sign and Monument and there are direct sightlines between the two. No new signage or visually prominent features would be installed in the immediate vicinity of the heritage item, and therefore views to the monument from the surrounding area and for motorists travelling along the Great Western Highway would not be obstructed. The proposal would result in negligible visual impacts to the Original Glenbrook Railway Sign and Monument.</td>
</tr>
<tr>
<td>Glenbrook Primary School</td>
<td>The proposal does not involve any works that directly affect the physical fabric of Glenbrook Primary School. The project site is located approximately 15 metres from the north east corner of the item’s heritage curtilage, although the closest built structure within this item is located some 40 metres from the works area. Vibration impacts are therefore not anticipated. The proposal would result in a negligible physical impact to Glenbrook Primary School.</td>
<td>The proposal site is located in the vicinity of Glenbrook Primary School and there are direct sightlines between the two. No new signage or visually prominent features would be installed in the immediate vicinity of the heritage item. The proposed installation of new traffic signals at the intersection of Ross Street and the Great Western Highway would be located about 70 metres to the north of the item’s heritage curtilage, and would not result in any visual impact to the Glenbrook Primary School. Views to the school from Ross Street and Wascoe Street, and also views out from the heritage item, therefore, would not be obstructed by the proposal. The proposal would result in negligible visual impacts to Glenbrook Primary School.</td>
</tr>
<tr>
<td>Glenbrook Park</td>
<td>The proposal does not involve any works that directly affect the physical fabric of the heritage item.</td>
<td>The proposal site is located in the vicinity of Glenbrook Park and there are direct sightlines between the two. No new signage or visually prominent features would be installed in the immediate vicinity of the heritage item. The proposed installation of new traffic signals at the intersection of Ross Street and the Great Western Highway would be located about 70 metres to the north of the item’s heritage curtilage, and would not result in any visual impact to the Glenbrook Primary School. Views to the school from Ross Street and Wascoe Street, and also views out from the heritage item, therefore, would not be obstructed by the proposal. The proposal would result in negligible visual impacts to Glenbrook Primary School.</td>
</tr>
<tr>
<td>Item name</td>
<td>Physical impact</td>
<td>Visual impact</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>fabric of Glenbrook Park.</td>
<td>The proposal site is located adjacent to the northwest boundary of the item’s heritage curtilage, and is within 25 metres of the nearest building on the site, Glenbrook Cinema. Vibration impacts are therefore possible without appropriate mitigation.</td>
<td>The proposal would result in the installation of several road signs along the northern and western boundary of the item’s heritage curtilage. This includes installation of ‘No Stopping’ signs on the kerb along the southern side of the Great Western Highway and ‘No Stopping’ and ‘Bus Zone’ signs on the eastern kerb of Ross Street. Although these signs are near Glenbrook Park, their form and scale would not have a moderate or major impact, as they are relatively small in scale. Visual interference would therefore be minimal. The proposal would result in minor visual impacts to Glenbrook Park.</td>
</tr>
<tr>
<td>Horse Trough</td>
<td>The proposal does not involve any works that directly affect the physical fabric of the Horse Trough. The proposal site is located immediately north of the heritage item. Vibration range impacts are therefore anticipated. The proposal would result in the construction and consolidation of footpaths to the north of the Horse Trough. While this would potentially enhance public engagement and connectivity with heritage item, there is a risk of inadvertent impact/damage during works if the item is not appropriately managed and protected for the proposed project’s duration. The proposal has the potential to result in a minor physical impact to the Horse Trough.</td>
<td>The proposal site is located in the immediate vicinity of the Horse Trough, and there are direct sightlines between the two. The proposal would result in the installation of several road signs near the heritage item. This includes installation of ‘No Stopping’, ‘Bus Zone’ and ‘School Zone’ signs on the eastern kerb of Ross Street. Although these signs are near the Horse Trough, their form and scale would not have a moderate or major impact, as they are relatively small in scale. Visual interference would therefore be minimal. The proposal would result in a minor visual impact to Horse Trough.</td>
</tr>
<tr>
<td>House (6 Wascoe Street)</td>
<td>The proposal does not involve any works that directly affect the physical fabric of the House at 6 Wascoe Street. The proposal site is located adjacent to the northern boundary of the item’s heritage curtilage, although it is noted that works would be more than 25 metres away from the house on the site. Vibration range impacts are</td>
<td>The proposal site is located in the vicinity of the House at 6 Wascoe Street, and there is a direct sightline between the two. The proposal would result in the removal of several ‘Stop’ signs, and also installation of several road signs near the heritage item. This includes installation of a ‘Bus Zone’ sign and ‘No Stopping’ sign on the southern</td>
</tr>
<tr>
<td>Item name</td>
<td>Physical impact</td>
<td>Visual impact</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>therefore not anticipated. The proposal would result in a neutral physical impact to the House at 6 Wascoe Street.</td>
<td>kerb of Wascoe Street. Although these signs are near the House at 6 Wascoe Street, their form and scale would not have a moderate or major impact, as they are relatively small in scale. Visual interference would therefore be minimal. The proposal would result in a negligible visual impact to the House at 6 Wascoe Street.</td>
</tr>
</tbody>
</table>

### 6.3.3 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unexpected finds</td>
<td>The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime Services, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard H2 Section 4.10 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Inadvertent impacts on known heritage items and unexpected impacts on heritage values</td>
<td>Non-Aboriginal heritage awareness training will be provided for workers prior to commencement of construction work to communicate potential heritage items that may be impacted during work, and the procedure required to be carried out in the event of discovery of historical heritage materials, features or deposits.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Inadvertent impacts on known heritage items</td>
<td>A Temporary Protection Plan (TPP) will be prepared and implemented to ensure heritage fabric is protected from construction work. The TPP will specify the measures (for example high visibility fencing) that will be used to delineate significant areas and prevent impacts.</td>
<td>Contractor</td>
<td>Pre-construction Construction</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>-----------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Impacts on archaeological resources</td>
<td>A work method statement will be prepared by a suitably qualified archaeologist, detailing proposed archaeological monitoring for works on the southern side of the Great Western Highway near Ross Street that involve excavation to a depth greater than 600 millimetres.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>Additional Measure</td>
</tr>
<tr>
<td>Impacts on archaeological resources</td>
<td>Roads and Maritime will confirm with the Office of Environment and Heritage the application of an exception (via a notification under Section 139(4) of the <em>Heritage Act 1977</em>) in relation to potential impacts on subsurface relics that may be present near the Great Western Highway / Ross Street intersection.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>Additional Measure</td>
</tr>
</tbody>
</table>

* Safeguards which address construction vibration are included in Section 6.2.4

### 6.4 Aboriginal heritage

#### 6.4.1 Existing environment

An Aboriginal Heritage Information Management System (AHIMS) search was carried out on 20 February 2017, which identified eight registered sites in the wider locality. The nearest registered site is 45-5-3216 (habitation structure and potential archaeological deposit) located about 650 metres to the north-east of the proposal site. There are no declared Aboriginal places near the proposal site.

The subject site has been heavily disturbed by road construction and the installation of underground utilities. This reduces archaeological potential.

As noted above in Section 3.6, Lots 7053, 7054 and 7055, DP 1080609, which are adjacent to the proposed works, are subject to an Aboriginal Land Claim under the ALR Act. The proposed works, including the proposed compound, do not encroach on Lots 7053, 7054 or 7055.

#### 6.4.2 Potential impacts

Aboriginal cultural heritage impacts are not expected as a result of the proposal. The Roads and Maritime Aboriginal Cultural Heritage Advisor for Sydney Region has provided the following advice in relation to the proposal (refer to Appendix H):

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate any known Aboriginal objects or places in the immediate study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage’s Due diligence Code of Practice for the Protection of Aboriginal objects in NSW and the Roads and Maritime Services' procedure.
• The Aboriginal cultural heritage potential of the study area appears to be severely reduced due to past disturbance.

There would be no encroachment of construction works onto adjacent land (Lots 7053, 7054 and 7055, DP 1080609) that is the subject of a land claim under the ALR Act.

### 6.4.3 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unexpected finds</td>
<td>The <em>Standard Management Procedure - Unexpected Heritage Items</em> (Roads and Maritime Services, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard AH2 Section 4.9 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Impacts on the land the subject of an Aboriginal Land Claim</td>
<td>There is to be no encroachment of construction works onto land that is the subject of an Aboriginal Land Claim under the <em>Aboriginal Land Rights Act 1983</em> (Lots 7053, 7054 and 7055, DP 1080609).</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional Measure</td>
</tr>
</tbody>
</table>

### 6.5 Visual amenity

#### 6.5.1 Assessment approach

Landscape character and visual assessment is considered in accordance with the *Guidelines for landscape character and visual impact assessment* (Roads and Maritime Services, 2013).

The guidelines establish an assessment process by reference to the sensitivity of the area and magnitude of the proposal in that area. Sensitivity refers to how sensitive the character of the setting is to the proposed change while magnitude refers to the level of intrusion of the proposal within the existing landscape due to factors such as scale and extent of earthworks required to implement the proposal. Figure 6-5 illustrates this process.
Figure 6-5 Landscape Character / Visual impact grading matrix

Landscape character

Landscape character assessment sums up an area’s sense of place including all built, natural and cultural aspects, covering towns, countryside and all shades between (Roads and Maritime Services, 2013). The assessment involves identifying landscape character sensitivity and potential impacts attributable to the proposal under consideration.

Visual impact

The visual impact assessment of the proposal involves the assessment of the visibility of the proposal, the identification of key existing view points and their sensitivity followed by the assessment of their visual impact.

6.5.2 Existing environment

Landscape character

The proposal site occurs in an urban context with landscape character sensitivity assessed as moderate. Table 6-18 identifies six landscape character zones and considers landscape character sensitivity of each zone.

The proposal site is not identified as a protected area on the Blue Mountains LEP Scenic and Landscape Values Map.
Table 6-18 Landscape character sensitivity

<table>
<thead>
<tr>
<th>ID</th>
<th>Location</th>
<th>Sensitivity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCZ1</td>
<td>Highway corridor</td>
<td>Moderate</td>
<td>Rating recognises tree lining of the Great Western Highway and numerous heritage items.</td>
</tr>
<tr>
<td>LCZ2</td>
<td>Glenbrook Oval</td>
<td>Moderate</td>
<td>Rating recognises open space character of this area and adjacent heritage items.</td>
</tr>
<tr>
<td>LCZ3</td>
<td>Service station site</td>
<td>Moderate</td>
<td>While an industrial site, the presence of a State Heritage Register listed item warrants a moderate rating.</td>
</tr>
<tr>
<td>LCZ4</td>
<td>Glenbrook Park (including Visitor Centre)</td>
<td>Moderate</td>
<td>Rating recognises open space character of this area and its heritage listing.</td>
</tr>
<tr>
<td>LCZ5</td>
<td>Commercial / retail (Wascoe Street mixed use, Panthers site)</td>
<td>Moderate</td>
<td>Rating recognises the presence of heritage items.</td>
</tr>
<tr>
<td>LCZ6</td>
<td>Residential (Wascoe Street, Mann Street)</td>
<td>Moderate</td>
<td>Rating recognises the residential character of this area and the presence of heritage items.</td>
</tr>
</tbody>
</table>

**Views**

The visual amenity of the site is largely established by landscape character values and there are no identified scenic views to or from the proposal site. Views are available from the elevated areas to the north; however, intervening buildings and vegetation mean that the proposal site is either not visible from this area or is otherwise not a dominant foreground feature.

The curved horizontal alignment of the Great Western Highway through Glenbrook means that there are no resulting vistas of significant length.

**Street trees**

There are several planted Pin Oak (*Quercus palustris*) trees along the Great Western Highway verges and these represent an important streetscape feature. They are also recognised by the *Blue Mountains City Council Street Tree Masterplan* (Blue Mountains City Council, 2012).

The *Blue Mountains City Council Street Tree Masterplan* includes the following strategies for the Glenbrook:

- Great Western Highway (out of village centre) – Protect, restore and/or consolidate indigenous bushland character between Kidman and Hare Streets, and between Hill Street and the eastern local government boundary at Lapstone. Wascoe and Railway Streets provide important backdrop canopy to Great Western Highway and should be protected and managed accordingly
- Hare Street (north) – An important entry to the northern residential parts of the town. Consolidate Visually Significant Streetscape with further street planting where capability allows
- Village Centre – Maintain village scale in tree selection. Keep open view lines for traffic, within the village, and to Glenbrook Park
- Village Centre – Extend Pin Oaks as frontage to Glenbrook Oval between Hare and Hill Streets. Along with the open space of the park, they are an important landmark to the town from the Great Western Highway
- Repeat existing worthy themes such as Crepe Myrtle in Mann Street and Weeping Crimson Bottlebrush in Euroka Road.

Table 6-19 identifies trees within and near the proposal site. Figure 6-6 shows the location of these trees.

**Table 6-19 Street trees within and near the proposal site**

<table>
<thead>
<tr>
<th>ID</th>
<th>Common name</th>
<th>Scientific name</th>
<th>Retention value</th>
<th>DBH² (mm)</th>
<th>TPZ³ (m)</th>
<th>SRZ⁴ (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>150</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>2</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>200</td>
<td>2.4</td>
<td>1.7</td>
</tr>
<tr>
<td>3</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>250</td>
<td>3.0</td>
<td>1.9</td>
</tr>
<tr>
<td>4</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>300</td>
<td>3.6</td>
<td>2.0</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td><em>Eucalyptus sp.</em></td>
<td>Medium</td>
<td>200</td>
<td>2.4</td>
<td>1.7</td>
</tr>
<tr>
<td>6</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>150</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td><em>Melaleuca sp.</em></td>
<td>Low</td>
<td>100</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>8</td>
<td>Removed</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>300</td>
<td>3.6</td>
<td>2.0</td>
</tr>
<tr>
<td>10</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>400</td>
<td>4.8</td>
<td>2.3</td>
</tr>
<tr>
<td>11</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>400</td>
<td>4.8</td>
<td>2.3</td>
</tr>
<tr>
<td>12</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>400</td>
<td>4.8</td>
<td>2.3</td>
</tr>
<tr>
<td>13</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>500</td>
<td>6.0</td>
<td>2.5</td>
</tr>
<tr>
<td>14</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>500</td>
<td>6.0</td>
<td>2.5</td>
</tr>
<tr>
<td>15</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>400</td>
<td>4.8</td>
<td>2.3</td>
</tr>
<tr>
<td>16</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>400</td>
<td>4.8</td>
<td>2.3</td>
</tr>
<tr>
<td>17</td>
<td>Pin Oak</td>
<td><em>Quercus palustris</em></td>
<td>Medium</td>
<td>150</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>18</td>
<td>Deodar Cedar</td>
<td><em>Cedrus deodara</em></td>
<td>Medium</td>
<td>500</td>
<td>6.0</td>
<td>2.5</td>
</tr>
<tr>
<td>ID</td>
<td>Common name</td>
<td>Scientific name</td>
<td>Retention value</td>
<td>DBH² (mm)</td>
<td>TPZ³ (m)</td>
<td>SRZ⁴ (m)</td>
</tr>
<tr>
<td>----</td>
<td>----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>19</td>
<td>English Oak</td>
<td><em>Quercus robur</em></td>
<td>Medium</td>
<td>550</td>
<td>6.6</td>
<td>2.6</td>
</tr>
<tr>
<td>20</td>
<td>English Oak</td>
<td><em>Quercus robur</em></td>
<td>Medium</td>
<td>500</td>
<td>6.0</td>
<td>2.5</td>
</tr>
<tr>
<td>21</td>
<td>Flooded Gum</td>
<td><em>Eucalyptus grandis</em></td>
<td>Medium</td>
<td>300</td>
<td>3.6</td>
<td>2.0</td>
</tr>
</tbody>
</table>

1. The tree retention assessment was conducted in accordance with the Institute of Australian Consulting Arborists *Significance of a Tree, Assessment Rating System*.
2. Diameter at breast height
3. Tree Protection Zone – The TPZ is the optimal combination of crown and root area (as defined by AS 4970-2009) that requires protection during the construction process so that the tree can remain viable.
4. Structural Root Zone – The SRZ is the area of the root system (as defined by AS 4970-2009) used for stability, mechanical support and anchorage of the tree.

Further details on the characteristics of potentially affected trees are included in the Arboricultural Impact Assessment (Appendix I).
Figure 6-6 Potentially affected street trees
6.5.3 Potential impacts

Construction

Visual impacts

Visual impacts during construction would be associated with presence of work vehicles and the construction site itself. These impacts would be minor and short-term. During evening and night-time work periods the construction site lighting would be used and this has some potential to result in light spill to adjacent properties.

Impacts on street trees

The Arboricultural Impact Assessment (Appendix I) considered the potential for construction work to encroach the Tree Protection Zone (TPZ) of each tree, calculated in accordance with AS4970-2009 Protection of trees on development sites. The findings of the Arboricultural Impact Assessment were as follows:

- Tree 1, 2, 3, 4, 5, 6, 7 were identified outside the footprint of the proposed work. No impacts to these subject trees are expected and these trees can be successfully retained.
- Tree 9, 12, 13, 14, 15, 16, 17 would be subject to a minor encroachment (less than 10 per cent) of the TPZ. Minor encroachments are considered acceptable and these trees can be retained.
- Tree 10, 11, 18, 19, 20, 21 would be subject to a major encroachment (less than 20 per cent) of the TPZ. With the implementation of mitigation measures for all work undertaken within the TPZ, it is expected that these can be successfully retained.

While no trees would be removed as part of the proposal, trimming of the under-canopy of Tree 13, 14, 15, 16 and 19 would be required to achieve a minimum 5.3 metre vertical clearance and minimum 0.6 metre horizontal clearance from the new edge line on the southern side of the Great Western Highway.

Operation

The proposal would introduce new features into the streetscape including new pavements, signage and traffic signals. However, these features would have minimal visual prominence, would be consistent with the character of the Great Western Highway environment and would not significantly affect any views. As noted in Section 6.3.2, new road-related infrastructure would result in some increase to the visual clutter on the edge of the road, and would change views to and from the State Heritage Register listed Glenbrook Railway Residence, including views south from the adjacent Glenbrook Oval and the northern side of the Great Western Highway.

The proposal would also not affect the implementation of the strategies for Glenbrook set out in the Blue Mountains City Council Street Tree Masterplan (Blue Mountains City Council, 2012).

Table 6-20 evaluates the potential landscape character and visual amenity impacts of the proposal once work is complete.

**Table 6-20 Landscape character and visual amenity impacts**

<table>
<thead>
<tr>
<th>ID</th>
<th>Location</th>
<th>Impact</th>
<th>Comment</th>
</tr>
</thead>
</table>
| LCZ1 | Highway corridor | Moderate-Low | Magnitude: Low  
New signage and other elements consistent with existing streetscape. |
| LCZ2 | Glenbrook Oval   | Negligible | Magnitude: Negligible  
No direct impacts. Changes in adjacent highway corridor generally consistent with existing |
<table>
<thead>
<tr>
<th>ID</th>
<th>Location</th>
<th>Impact</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>streetscape.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| LCZ3 | Service station site (including State Heritage Register listed Glenbrook Railway Residence)        | Moderate-Low | Magnitude: Low
No direct impacts. Changes in adjacent highway corridor generally consistent with existing streetscape. |
| LCZ4 | Glenbrook Park (including Visitor Centre)                                                           | Negligible   | Magnitude: Negligible
No direct impacts. Changes in adjacent highway corridor generally consistent with existing streetscape. |
| LCZ5 | Commercial / retail (Wascoe Street mixed use, Panthers site)                                       | Negligible   | Magnitude: Negligible
No direct impacts. Changes in adjacent highway corridor and on Wascoe Street / Hare Street (south) generally consistent with existing streetscape. |
| LCZ6 | Residential (Wascoe Street, Mann Street)                                                           | Negligible   | Magnitude: Negligible
No direct impacts. Changes in adjacent highway corridor and on Wascoe Street / Hare Street (south) generally consistent with existing streetscape. |

### 6.5.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction stage visual impacts</td>
<td>The work site will be left tidy at the end of each working day.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Impact on Street trees</td>
<td>No trees are to be removed.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Impact on Street trees</td>
<td>Establishment of Tree Protection Zones and tree protection measures consistent with AS4970-2009 <em>Protection of Trees on Development Sites</em> will be implemented for all trees within or immediately adjacent to the construction footprint.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>----------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Impact on Street trees</td>
<td>Pruning of Tree 13, 14, 15, 16 and 19 is to occur consistent with AS4373-2007 Pruning of Amenity Trees.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Impact on Street trees</td>
<td>Any excavation within Tree Protection Zones or pruning of trees is to occur under the supervision of an AQF5 qualified arborist.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Construction lighting impacts</td>
<td>Construction lighting will be oriented to as to minimise the potential for light spill to adjacent areas.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional measure</td>
</tr>
</tbody>
</table>

6.6 Socio-economic

6.6.1 Existing environment

Community profile

Key demographic, social and economic information derived from the 2016 Census (Australian Bureau of Statistics, 2016) for the suburb Glenbrook is outlined below in Table 6-21.

Table 6-21 Key social and demographic information

<table>
<thead>
<tr>
<th>Category</th>
<th>Census data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>5,051</td>
</tr>
<tr>
<td>Median age</td>
<td>43</td>
</tr>
<tr>
<td>Household occupancy</td>
<td>2.8</td>
</tr>
<tr>
<td>Employment (2011 data)</td>
<td>2,689 in labour force (59.2 per cent employed full time, 32.8 per cent employed part-time and 3.0 per cent were unemployed)</td>
</tr>
<tr>
<td>Travel to work (2011 data)</td>
<td>Top responses – Car as driver 58.7 per cent, Train 10.1 per cent and Car Passenger 4.4 per cent</td>
</tr>
<tr>
<td>Education</td>
<td>31.9 per cent attending an educational institution</td>
</tr>
<tr>
<td>Median weekly household income</td>
<td>$2,094</td>
</tr>
<tr>
<td>Motor vehicles per dwelling</td>
<td>2</td>
</tr>
</tbody>
</table>

Relevant to the current proposal, it is noted that the use of the car (58.7 per cent) is slightly above the NSW average (57.6 per cent).

Key social infrastructure

There is a range of social infrastructure located near the proposal site. This includes:

- Glenbrook Public School (Woodville Street and Park Street)
- Glenbrook Rotary Markets (Ross Street) (operates first Saturday of each month)
- Glenbrook Visitor Information Centre (Great Western Highway)
- BaptistCare Merindal Hamlet (King Street)
- Dentist and doctor (Within the Glenbrook Town Centre)
- Glenbrook Oval and skate park
- Glenbrook Panthers Bowling Club (Hare Street)
- Blue Mountains Creative Arts Centre (corner of Hare Street and Moore Street).

**Economic profile and businesses**

A snapshot of the economic profile for the Blue Mountains local government area is provided in Table 6-14.

*Table 6-22 Economic profile for Blue Mountains*

<table>
<thead>
<tr>
<th>LGA</th>
<th>Gross Regional Product</th>
<th>Jobs</th>
<th>Businesses</th>
<th>Largest industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Mountains</td>
<td>$2.24 billion</td>
<td>20,785</td>
<td>5,163</td>
<td>Health Care and Social Assistance</td>
</tr>
</tbody>
</table>

Source: (National Economics, 2015).

The nearest businesses to the proposal site are:
- Wascoe Street (Café, gift shop, real estate business, painted panorama attraction)
- Caltex Service Station (Great Western Highway)
- Glenbrook Cinema
- Various businesses in the Glenbrook town centre (Ross Street, south of Park Street)
- Glenbrook Panthers Bowling Club (Hare Street).

### 6.6.2 Potential impacts

#### Amenity impacts during construction

Issues such as air quality, dust, noise, vibration, visual amenity and traffic delays have the potential to affect the local community and road users during construction of the proposal.

These issues have been outlined and assessed in other sections of this report, as follows:

- Traffic and transport (refer to Section 6.1)
- Noise and vibration (refer Section 6.2)
- Visual impacts (refer Section 6.5)
- Air quality (refer Section 6.8)

General amenity impacts would be temporary and potentially occur during construction of the proposal as a result of the following:

- Increases in noise due to the operation of plant and equipment
- Potential dust mobilisation due to vegetation removal, pavement work and minor excavation
- Increase in construction traffic due to the delivery of plant, materials and construction personnel
- Traffic management arrangements and associated minor delays for traffic.

#### Accessibility

During construction, access to adjacent properties would be maintained and bus services are expected to still operate servicing established stops along the route. The proposal involves no permanent changes to property accesses.

As noted in Section 6.1.2, for some vehicle movements (such as access to Hare Street (north) and a right-turn onto the Great Western Highway to travel east) the new traffic lights at Ross Street would need to be used instead of the Hare Street intersection. This may represent a minor increase in travel time for some road users.
The proposal would improve access between the Glenbrook town centre and the residential areas north of the Great Western Highway through the provision of pedestrian crossing facilities at the Ross Street intersection.

Community wellbeing and safety

The proposal would improve safety of both the local community and travelling public (refer to Section 6.1.2) through the provision of signalised pedestrian crossings at the Ross Street intersection and more traffic arrangements at the Mann Street / Hare Street intersection which reduce the risk of vehicle conflicts. This represents a social benefit.

Business impacts

During construction, visibility of and access to local businesses would be maintained. These businesses may benefit from additional custom from construction personnel. There may be some short-term business impacts associated with more limited space available during construction at the informal rest area on the northern side of the Great Western Highway, between Hare Street and Ross Street. This may discourage people to stop in Glenbrook.

Once complete, the proposal would provide more direct access to local businesses within the Glenbrook Town centre (for both motorists and pedestrians).

Property impacts

Property acquisition is not required for the proposal. As noted above in Section 3.6, Lots 7053, 7054 and 7055, DP 1080609, which are adjacent to the proposed works, are subject to an Aboriginal Land Claim under the ALR Act. It has been confirmed that the proposed works, including the proposed compound, would not encroach on Lots 7053, 7054 or 7055.

6.6.3 Safeguards and mitigation

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-economic impacts</td>
<td>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints.</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Core standard safeguard SE1</td>
</tr>
</tbody>
</table>

6.7 Soils and water

6.7.1 Existing environment

Geology and soils

The underlying geology of the proposal site is described as medium to very course grained quartz sandstone, minor laminated mudstone and siltstone lenses (Clark & Jones, 1991).
Most the proposal site is mapped as being within the Gymea Soil Landscape. This is an erosional landscape (meaning it has been sculpted by erosive action of running water) and has topsoils with low erodibility and subsoils with moderate or high erodibility (Bannerman & Hazelton, 1990).

A small section of the proposal site, on Hare Street north of the Great Western Highway, is within the Falconbridge Soil Landscape. This is a residual landscape (meaning it was formed from in situ weathering of parent materials) and has topsoils with low or very low erodibility and subsoils with moderate erodibility (Bannerman & Hazelton, 1990).

Acid sulfate soil occurs predominantly on coastal lowlands, with elevations generally below five metres and is therefore not expected at the proposal site. The proposal site is not identified as having acid sulfate soil potential by NSW acid sulfate soils risk mapping.

Contamination

A review of the list of NSW Contaminated Sites notified to the Environment Protection Authority was carried out on 15 September 2017 identified one contaminated site within the suburb of Glenbrook (Caltex Service Station, 78 Great Western Highway).

This service station is located immediately adjacent to the proposal site. The contamination at the site (which is likely to be associated with underground fuel storage) is being assessed by the NSW Environment Protection Authority to determine whether regulation is required.

A search of the Environment Protection Authority contaminated land record of notices (15 September 2017) returned no records for the suburb of Glenbrook.

Contamination (such as heavy metals, benzene, toluene, ethylbenzene xylene and polycyclic aromatic hydrocarbons) could be present at proposal site associated with the degradation of road surfaces (asphalt in surface soils), road runoff impacted sediments within drainage lines next to the road and exhaust depositions, although the contamination is unlikely to be present in elevated concentrations.

Testing for coal tar within the proposal site conducted in May 2017 found it not to be present.

Catchments, watercourses and groundwater

The proposal is within the Hawkesbury-Nepean Catchment. The majority of stormwater runoff from the proposal site enters an open concrete lined drainage channel located immediately to the north of the proposal site. This unnamed watercourse joins Knapsack Gully to the east of the proposal site and flows into the Nepean River via Jamison Creek at Emu Plains.

That part of the proposal site near the Wascoe Street / Hare Street / Mann Street intersection drains to the south via the constructed stormwater drainage system before entering unnamed tributaries of Glenbrook Creek, Glenbrook Creek and the Nepean River at Leonay.

The proposal site is not within or immediately adjacent to the Sydney Drinking Water Catchment as defined by State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011.

Stormwater from the urban catchment is generally not treated (except for gross pollutants). Common urban stormwater pollutants would include gross pollutant and litter, sediments and suspended solids, nutrients, toxic organics, heavy metals and hydrocarbons.

Groundwater is not expected to be present close to the surface within the proposal site. The nearest groundwater bores are located near the proposal site on Mann Street. The logs for these bores indicate the first water bearing zones are at a depth of 40 metres (GW108221) and 28 metres (GW0064537).

Flooding

Most of the proposal site is not flood affected. However, the Lapstone, South Glenbrook and South Blaxland Floodplain Risk Management Study and Plan (Jacobs SKM, 2015) indicates that Wascoe Street is flood affected, including that part of the proposal site at the Wascoe Street / Hare Street / Mann Street intersection. The study indicates flood depths at this location of up to 0.5 metres in the
one per cent annual exceedance probability (AEP) flood event and up to one metre in the probable maximum flood.

6.7.2 Potential impacts

Construction

Construction of the proposal has the potential to cause soil erosion and loss of topsoil. The highest risk of erosion and sedimentation would be associated with disturbance of the ground surface during site preparation, earthworks, excavation and other construction activities.

Unmitigated potential impacts associated with sedimentation of eroded material include:

- Increased sedimentation and elevated turbidity levels of nearby creeks from exposed soil during site disturbance and movement of construction vehicles, particularly following rainfall events
- Increased sedimentation of downstream watercourses, which reduces light penetration, smotheres aquatic life, alters fluvial geomorphology and affects the ecosystems of downstream sensitive waterways and drinking water bodies
- Increased levels of nutrients, metals and other pollutants, transported via sediment to downstream watercourses.

A specific water quality risk is the potential for sediment laden or otherwise contaminated runoff to enter the concrete drainage channel to the north of the proposal site. This conveys flows to Knapsack Gully and then the Nepean River via Jamison Creek at Emu Plains. These watercourses traverse sensitive areas including areas of the NSW and Commonwealth listed Sydney Turpentine-Ironbark Forest.

There is also some potential for contaminated soil to be disturbed and this could disperse contaminated materials into the receiving environments, result in the release of contaminated stormwater runoff from the site and/or expose construction personnel and/or the public to these contaminants if appropriate controls are not put in place.

During construction, there would also be potential for spills / leaks of contaminating materials which could result in contamination of soil and/or water.

No groundwater extraction would be required for construction of the proposal and it is unlikely the water table would be intercepted during excavation.

Operation

While there would be some increase in impervious surfaces associated with the proposal, significant changes in flow volumes / velocities in receiving watercourses are not expected.

During operation, contamination impacts would generally be associated with contaminated run-off, which may arise from normal vehicle operation (tyre wear, minor leaks of lubricants and fuels), maintenance practices, or a spill or accident. These risks would be similar to the existing situation although the risk of accidents may be reduced with the proposed safety improvements.

6.7.3 Safeguards and mitigation measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion, sedimentation and pollution</td>
<td>A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Core standard safeguard SW1 Section 2.1 of QA G38</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>water pollution and describe how these risks will be addressed during construction.</td>
<td></td>
<td></td>
<td></td>
<td>Soil and Water Management</td>
</tr>
<tr>
<td>Erosion, sedimentation and pollution</td>
<td>A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the Soil and Water Management Plan</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Core standard safeguard SW2 Section 2.2 of QA G38 Soil and Water Management</td>
</tr>
<tr>
<td>Contamination</td>
<td>A Phase 2 contamination investigation, including intrusive investigations, will be conducted in accordance with the <em>Guideline for the Management of Contamination</em> (Roads and Maritime Services, 2013) to determine whether contamination from the service station site has migrated into the road reserve and the proposal site.</td>
<td>Roads and Maritime</td>
<td>Detailed Design</td>
<td>Additional measure</td>
</tr>
<tr>
<td>Contamination</td>
<td>If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard C2 Section 4.2 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Spills</td>
<td>A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <em>Code</em></td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard C3 Section 4.3</td>
</tr>
</tbody>
</table>
### Impact

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>of Practice for Water Management (Roads and Traffic Authority, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).</td>
<td></td>
<td></td>
<td></td>
<td>of QA G36 Environment Protection</td>
</tr>
</tbody>
</table>

### 6.8 Air quality

#### 6.8.1 Existing environment

Local air quality within the study area is likely to be relatively good due the large tracts of natural vegetation in the broader locality and the lack of pollutant sources. The main influence on air quality at the proposal site is road traffic.

The proposal site is in the Sydney Region and part of broader Greater Sydney, Newcastle and Wollongong Airshed. A National Pollution Inventory (2014/15 data) search indicates that local air quality is influenced by diffuse source emissions.

Diffuse sources include motor vehicles, lawn mowing, recreational boating, domestic/commercial solvents and fuel burning (including from domestic wood fires / heaters). The most commonly reported diffuse air emissions are:

- Total Volatile Organic Compounds
- Toluene (methylbenzene)
- Benzene
- Xylenes (individual or mixed isomers)
- n-Hexane

#### 6.8.2 Potential impacts

**Construction**

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with road construction. The total amount of dust generated would depend on the silt and moisture content of the soil, the types of activities being carried out, the size of exposed areas, and the frequency of water spraying and the speed of machinery.

Primary sources of emissions of airborne particulate matter associated with the construction of the proposal would include:

- Excavation by backhoes and/or excavators
- Movement of soil and fill by trucks
- Wind erosion from unsealed surfaces and stockpiles
- Vehicle (exhaust) emissions
- Dust generated by the wheels of construction vehicles travelling along unsealed areas.
There is potential for dust to cause nuisance impacts if activities are located close to sensitive receptors, such as residences. Sensitive receptors would be potentially impacted by increased dust levels. The magnitude of dust impacts would depend on the extent of soil disturbance at the particular location, the duration of activities and the local meteorology at the time, particularly the wind speed and direction.

As most work would be confined to existing pavements potential dust impacts are likely to be minor and manageable through the implementation of standard safeguards.

**Operation**

Air quality impacts during operation would mainly be from motor vehicle emissions, fuel combustion, fluid evaporation, brake and tyre wear, and re-suspended road dust. No increase in traffic volumes is anticipated as a result of the proposal hence air quality impacts as a result of operation of the proposal are not predicted.

### 6.8.3 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Air quality    | An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:  
• Potential sources of air pollution  
• Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines  
• Mitigation and suppression measures to be implemented  
• Methods to manage work during strong winds or other adverse weather conditions  
• A progressive rehabilitation strategy for exposed surfaces. | Contractor     | Pre-construction | Core standard safeguard AQ1  
Section 4.4 of QA G36 Environment Protection |

### 6.9 Biodiversity

#### 6.9.1 Existing environment

**Vegetation communities and flora**

The proposal site is highly urbanised and does not contain remnant native vegetation.

Several threatened flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the *NSW Threatened Species Conservation Act 1995* (TSC Act) have been previously recorded within the broader area. The proposal site does not represent suitable habitat for these species and they are therefore not expected to be present.
Fauna

Several threatened fauna species listed under the EPBC Act and/or the TSC Act have been previously recorded within the broader area. The proposal site does not represent suitable habitat for these species and they are therefore not expected to be present.

6.9.2 Potential impacts

The proposal does not involve the removal of trees and would not affect habitat for native flora or fauna, including threatened species. Biodiversity impacts are therefore not expected.

While several threatened birds and flying mammal species (ie Grey-headed Flying-fox and insectivorous bats) have been previously recorded within the broader area and may fly over / forage within the area investigated on occasion, none would be solely reliant upon the resources present such that the proposal would have a significant impact on the local or regional viability of these species, their populations or habitats.

6.9.3 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unexpected threatened species impact</td>
<td>• An unexpected threatened species find procedure is to be developed for the proposal in accordance with the Biodiversity Guidelines (Roads and Traffic Authority, 2011)</td>
<td>Contractor</td>
<td>Pre-construction Construction</td>
<td>Additional measure</td>
</tr>
</tbody>
</table>

6.10 Hazards and risks

6.10.1 Potential impacts

Hazards and risks associated with the construction of the proposal would potentially include:

- Undertaking work within or next to a major arterial and regional road (Great Western Highway)
- Carrying out work within the vicinity of existing services and utilities (eg power lines and gas mains)
- The use and storage of hazardous materials
- The use of heavy machinery
- Unexpected excavation of contaminated land
- Sparks and/or hot works causing bushfire, particularly during dry, hot periods
- Working in a constrained corridor and risks associated with pedestrians moving through the corridor to access bus services
- Unauthorised access to the construction work site and/or compound.

Construction hazards and risks are considered to be manageable through the application of standard mitigation measures, which would be developed by the construction contractor prior to construction.

Hazards or risks associated with the operation of the proposal would be limited to the potential for changed motorist and pedestrian behaviour associated intersection changes and new crossing locations. Overall the proposal is expected to improve safety and reduce operational hazards.
6.10.2 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazards and risks</td>
<td>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to: • Details of hazards and risks associated with the activity • Measures to be implemented during construction to minimise these risks • Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials • A monitoring program to assess performance in managing the identified risks • Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications.</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Core standard safeguard HAZ1</td>
</tr>
</tbody>
</table>

6.11 Waste minimisation and management

Roads and Maritime is committed to ensuring the responsible management of unavoidable waste and promotes the reuse of such waste in accordance with the resource management hierarchy principles outlined in the Waste Avoidance and Resource Recovery Act 2001. These resource management hierarchy principles, in order of priority are:

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

By adopting the above principles, Roads and Maritime aims to efficiently reduce resource use, reduce costs, and reduce environmental harm in accordance with the principles of ecologically sustainable development (refer Section 8.2).
The proposal is expected to generate small quantities of waste materials. The following waste streams have been identified:

- Concrete washout
- Asphalt and concrete
- Roadside materials (fencing, guide posts, guard rails etc)
- Paper and office waste from the site compound
- General waste (lunch packaging, portable toilets etc)
- Chemicals and oils
- Wastewater from wash down and bunded areas.
- Vegetated waste from tree trimming

Given the limited scope of the proposal, quantities of waste generated would be relatively small and could be appropriately managed in accordance with the resource management hierarchy principles outlined above.

### 6.11.1 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction waste management</td>
<td>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</td>
<td>Contractor</td>
<td>Pre-Construction</td>
<td>Core standard safeguard W1</td>
</tr>
<tr>
<td></td>
<td>• Measures to avoid and minimise waste associated with the project</td>
<td></td>
<td></td>
<td>Section 4.2 of QA G36 Environment</td>
</tr>
<tr>
<td></td>
<td>• Classification of wastes and management options (re-use, recycle, stockpile, disposal)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Procedures for storage, transport and disposal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Monitoring, record keeping and reporting.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction waste management</td>
<td>All wastes will be disposed of legally in accordance with their classification under the Waste Classification Guidelines Part 1:</td>
<td>Contractor</td>
<td>Pre-Construction</td>
<td>Additional measure</td>
</tr>
</tbody>
</table>
6.12 Cumulative impacts

Cumulative impacts have the potential to arise from the interaction of individual elements within the proposal as well as interaction with other projects that may be occurring or planned within the locality or the broader region. Clause 228(2) of the Environmental Planning and Assessment Regulation 2000 requires that potential cumulative impacts be considered during the environmental impact assessment process.

Construction traffic volumes associated with the proposal would be relatively small. Impacts from the interaction with construction traffic from other development projects are therefore not expected. Water quality in receiving watercourses is another area where cumulative effects are possible. The main potential water quality impacts associated with the proposal would be during construction and measures have been proposed to address these impacts.

Minimising impacts attributable to the proposal is the best way to address any potential cumulative effects and various measures have been proposed in throughout this chapter.

6.12.1 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction phase cumulative impacts</td>
<td>- The CEMP will be revised to consider potential cumulative impacts from surrounding development activities as they become known. This will include a process to review and update mitigation measures as new work begins or complaints are received.</td>
<td>Contractor</td>
<td>Pre-Construction</td>
<td>Additional measure</td>
</tr>
</tbody>
</table>
7 Environmental management

7.1 Environmental management

A number of safeguards and management measures have been identified in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these management measures will be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe safeguards and management measures identified. This plan will provide a framework for establishing how these measures will be implemented and who will be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the responsible Roads and Maritime Environment Officer, prior to the commencement of any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP will be developed in accordance with Roads and Maritime contract specifications including QA Specification G36 – Environmental Protection (Management System) and QA Specification G10 - Traffic Management.

7.2 Summary of safeguards and management measures

Environmental safeguards outlined in this document will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards will minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.
### Table 7-1 Summary of site specific environmental safeguards

<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
</table>
| GEN1| General - minimise environmental impacts during construction           | A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following:  
• Any requirements associated with statutory approvals  
• Details of how the project will implement the identified safeguards outlined in the REF  
• Issue-specific environmental management plans  
• Roles and responsibilities  
• Communication requirements  
• Induction and training requirements  
• Procedures for monitoring and evaluating environmental performance, and for corrective action  
• Reporting requirements and record-keeping  
• Procedures for emergency and incident management  
• Procedures for audit and review.  
The endorsed CEMP will be implemented during the undertaking of the activity. | Contractor / Roads and Maritime | Pre-construction / detailed design |
| GEN2| General - notification                                                 | All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity. | Contractor / Roads and Maritime | Pre-construction |
| GEN3| General – environmental awareness                                      | All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings. | Contractor / Roads and Maritime | Pre-construction / detailed design |
| U1  | Utilities                                                              | Prior to the commencement of work:  
• The location of existing utilities and relocation details will be confirmed | Contractor | Pre-construction |
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
</table>
| TT1 | Traffic and Transport | Following consultation with the affected utility owners  
- If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be undertaken.  
- A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime *Traffic Control at Work Sites Manual* (Roads and Traffic Authority, 2010) and QA Specification G10 Control of Traffic. The TMP will include:  
  - Confirmation of haulage routes  
  - Measures to maintain access to local roads and properties  
  - Site specific traffic control measures (including signage) to manage and regulate traffic movement  
  - Measures to maintain pedestrian and cyclist access  
  - Requirements and methods to consult and inform the local community of impacts on the local road network  
  - Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads.  
  - A response plan for any construction traffic incident  
  - Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic  
  - Monitoring, review and amendment mechanisms. | Contractor    | Detailed design / Pre-construction |
<p>| TT2 | Bus stop legibility | Bus stop signage and other infrastructure will comply with applicable Transport for NSW requirements and standards. | Roads and Maritime | Detailed design             |
| TT3 | Access to bus stops during | Bus operators will be consulted regarding any impacts on routes and the provision of access to bus stops for services 690P and 691. | Roads and Maritime | Pre-construction            |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
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<tbody>
<tr>
<td></td>
<td>construction</td>
<td></td>
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<tr>
<td>TT4</td>
<td>Loss of informal rest area</td>
<td>Road Freight NSW will be notified of the limitations on access to the informal rest area on the northern side of the Great Western Highway during construction.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
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<tr>
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<tr>
<td>NV1</td>
<td>Construction noise and vibration</td>
<td>A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify:</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td></td>
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<td>• All potential noise and vibration generating activities associated with the activity</td>
<td></td>
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<td></td>
<td></td>
<td>• Feasible and reasonable mitigation measures to be implemented</td>
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<td></td>
<td></td>
<td>• A monitoring program to assess performance against relevant noise and vibration criteria</td>
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<td></td>
<td></td>
<td>• Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures</td>
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<td></td>
<td></td>
<td>• Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NV2</td>
<td>Construction noise and vibration</td>
<td>All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five days prior to commencement of any work associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The project</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• The construction period and construction hours</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Contact information for project management staff</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Complaint and incident reporting</td>
<td></td>
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<td></td>
<td></td>
<td>• How to obtain further information.</td>
<td></td>
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<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
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</tr>
<tr>
<td>NV3</td>
<td>Construction vibration</td>
<td>Building condition surveys will be carried out for the State Heritage Register listed Glenbrook Railway Residence and any building or structure identified as having the potential to be affected by vibration impacts during construction work.</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>NV4</td>
<td>Construction vibration</td>
<td>Trial vibration measurements will be carried out to establish safe working distances in relation to the State Heritage Register listed Glenbrook Railway Residence.</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>H1</td>
<td>Unexpected finds</td>
<td>The <em>Standard Management Procedure - Unexpected Heritage Items</em> (Roads and Maritime Services, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>H2</td>
<td>Inadvertent impacts on known heritage items and unexpected impacts on heritage values</td>
<td>Non-Aboriginal heritage awareness training will be provided for workers prior to commencement of construction work to communicate potential heritage items that may be impacted during work, and the procedure required to be carried out in the event of discovery of historical heritage materials, features or deposits.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>H3</td>
<td>Inadvertent impacts on known heritage items</td>
<td>A Temporary Protection Plan (TPP) will be prepared and implemented to ensure heritage fabric is protected from construction work. The TPP will specify the measures (for example high visibility fencing) that will be used to delineate significant areas and prevent impacts.</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>H4</td>
<td>Impacts on archaeological</td>
<td>A work method statement will be prepared by a suitably qualified archaeologist, detailing proposed archaeological monitoring for works on the intersection upgrade, Great Western Highway and Ross Street, Glenbrook.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
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<tr>
<td></td>
<td>resources</td>
<td>southern side of the Great Western Highway near Ross Street that involve excavation to a depth greater than 600 millimetres.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H5</td>
<td>Impacts on archaeological resources</td>
<td>Roads and Maritime will confirm with the Office of Environment and Heritage the application of an exception (via a notification under Section 139(4) of the Heritage Act 1977) in relation to potential impacts on subsurface relics that may be present near the Great Western Highway / Ross Street intersection.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>AH1</td>
<td>Unexpected finds</td>
<td>The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime Services, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
</tr>
<tr>
<td>AH2</td>
<td>Impacts on the land the subject of an Aboriginal Land Claim</td>
<td>There is to be no encroachment of construction works onto land that is the subject of an Aboriginal Land Claim under the Aboriginal Land Rights Act 1983 (Lots 7053, 7054 and 7055, DP 1080609).</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>VA1</td>
<td>Construction stage visual impacts</td>
<td>The work site will be left tidy at the end of each working day.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>VA2</td>
<td>Impact on street trees</td>
<td>No trees are to be removed.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>VA3</td>
<td>Impact on street</td>
<td>Establishment of Tree Protection Zones and tree protection measures consistent with AS4970-2009 Protection of Trees on Development Sites will</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
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</tr>
<tr>
<td></td>
<td>trees</td>
<td>be implemented for all trees within or immediately adjacent to the construction footprint.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VA4</td>
<td>Impact on street trees</td>
<td>Pruning of Tree 13, 14, 15, 16 and 19 is to occur consistent with AS4373-2007 Pruning of Amenity Trees.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>VA5</td>
<td>Impact on street trees</td>
<td>Any excavation within Tree Protection Zones or pruning of trees is to occur under the supervision of an AQF5 qualified arborist.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>VA6</td>
<td>Construction lighting impacts</td>
<td>Construction lighting will be oriented to as to minimise the potential for light spill to adjacent areas.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td>SE1</td>
<td>Socio-economic impacts</td>
<td>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): * Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions * Contact name and number for complaints.</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>SW1</td>
<td>Erosion, sedimentation and pollution</td>
<td>A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>SW2</td>
<td>Erosion, sedimentation and pollution</td>
<td>A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the Soil and Water Management Plan</td>
<td>Contractor</td>
<td>Pre-construction</td>
</tr>
<tr>
<td>SW3</td>
<td>Contamination</td>
<td>A Phase 2 contamination investigation, including intrusive investigations, will be conducted in accordance with the Guideline for the Management of</td>
<td>Roads and Maritime</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
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<td></td>
<td><em>Contamination</em> (Roads and Maritime Services, 2013) to determine whether contamination from the service station site has migrated into the road reserve and the proposal site.</td>
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<tr>
<td></td>
<td>SW4</td>
<td>Contamination If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
<tr>
<td></td>
<td>SW5</td>
<td>Spills A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <em>Code of Practice for Water Management</em> (Roads and Traffic Authority, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).</td>
<td>Contractor</td>
<td>Construction</td>
</tr>
</tbody>
</table>
|     | AQ1        | Air quality An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:  
  • Potential sources of air pollution  
  • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines  
  • Mitigation and suppression measures to be implemented  
  • Methods to manage work during strong winds or other adverse weather conditions  
  • A progressive rehabilitation strategy for exposed surfaces. | Contractor       | Pre-construction |
|     | B1         | Unexpected An unexpected threatened species find procedure is to be developed for the                                                                                                                                       | Contractor       | Pre-construction |

Intersection upgrade, Great Western Highway and Ross Street, Glenbrook
Review of Environmental Factors
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>threatened species impact</td>
<td>proposal in accordance with the Biodiversity Guidelines (Roads and Traffic Authority, 2011)</td>
<td></td>
<td>Construction</td>
</tr>
</tbody>
</table>
| HAZ1| Hazards and risks           | A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:  
  - Details of hazards and risks associated with the activity  
  - Measures to be implemented during construction to minimise these risks  
  - Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials  
  - A monitoring program to assess performance in managing the identified risks  
  - Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations.  
  The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications. | Contractor     | Pre-construction |
| W1  | Construction waste management | A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:  
  - Measures to avoid and minimise waste associated with the project  
  - Classification of wastes and management options (re-use, recycle, stockpile, disposal)  
  - Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions  
  - Procedures for storage, transport and disposal  
  - Monitoring, record keeping and reporting.  
  The WMP will be prepared taking into account the Environmental Procedure - | Contractor     | Pre-Construction |
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>W2</td>
<td>Construction waste management</td>
<td>All wastes will be disposed of legally in accordance with their classification under the <em>Waste Classification Guidelines Part 1: Classifying Waste</em> (Department of Environment, Climate Change and Water, 2009)</td>
<td>Contractor</td>
<td>Pre-Construction</td>
</tr>
<tr>
<td>CI1</td>
<td>Construction phase cumulative impacts</td>
<td>The CEMP will be revised to consider potential cumulative impacts from surrounding development activities as they become known. This will include a process to review and update mitigation measures as new work begins or complaints are received.</td>
<td>Contractor</td>
<td>Pre-Construction</td>
</tr>
</tbody>
</table>
7.3 Licensing and approvals

Where required, an applicable road occupancy licence would be in place prior to the commencement of work.

Roads and Maritime proposes to confirm with the Office of Environment and Heritage the application of an exception (via a notification under Section 139(4) of the *Heritage Act 1977*) in relation to potential impacts on subsurface relics that may be present near the Great Western Highway / Ross Street intersection.

No other specific licencing/approval requirements have been identified.
8 Conclusion

8.1 Justification

The proposal forms part of the *Western Sydney Infrastructure Plan* and aims to address safety and traffic efficiency issues at the Hare Street and Ross Street intersections with the Great Western Highway in Glenbrook. Specifically, the proposal would:

- Address safety issues with access to the southern leg of the Great Western Highway / Hare Street intersection and the making of right-turns at that intersection
- Provide improved access to the Glenbrook town centre
- Provide improved crossing opportunities for pedestrians and discourage unsafe crossing of the Great Western Highway by pedestrians near Ross Street

While there would be some environmental impacts as a consequence of the proposal, they have been avoided or minimised wherever possible through design and site-specific safeguards summarised in Chapter 7.

The benefits of the proposal are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal.

8.2 Objects of the EP&A Act

A consideration of the proposal in the context of the objects of the EP&A Act is presented in Table 8-1 below.

*Table 8-1 Objects of the EP&A Act review*

<table>
<thead>
<tr>
<th>Object</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.</td>
<td>The proposal would improve safety. Social and economic impacts are assessed in Section 6.6. The assessment includes management measures to avoid and/or minimise impacts.</td>
</tr>
<tr>
<td>5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.</td>
<td>Not relevant to the proposal.</td>
</tr>
<tr>
<td>5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.</td>
<td>Not relevant to the proposal.</td>
</tr>
<tr>
<td>5(a)(iv) To encourage the provision of land for public purposes.</td>
<td>The proposal represents the improvement of a public asset.</td>
</tr>
<tr>
<td>5(a)(v) To encourage the provision and co-ordination of community services and facilities.</td>
<td>Not relevant to the proposal.</td>
</tr>
</tbody>
</table>
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.

The proposal would not affect native animals and plants. It would not have a significant impact on threatened species, populations and ecological communities, and their habitats.

5(a)(vii) To encourage ecologically sustainable development.

Ecologically sustainable development is considered in Sections 8.2.1 – 8.2.4 below.

5(a)(viii) To encourage the provision and maintenance of affordable housing.

Not relevant to the proposal.

5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.

Not relevant to the proposal.

5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.

Refer to Chapter 5.

<table>
<thead>
<tr>
<th>Object</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>5(a)(vi)</td>
<td>The proposal would not affect native animals and plants. It would not have a significant impact on threatened species, populations and ecological communities, and their habitats.</td>
</tr>
<tr>
<td>5(a)(vii)</td>
<td>Ecologically sustainable development is considered in Sections 8.2.1 – 8.2.4 below.</td>
</tr>
<tr>
<td>5(a)(viii)</td>
<td>Not relevant to the proposal.</td>
</tr>
<tr>
<td>5(b)</td>
<td>Not relevant to the proposal.</td>
</tr>
<tr>
<td>5(c)</td>
<td>Refer to Chapter 5.</td>
</tr>
</tbody>
</table>

8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been a consideration throughout the development of the proposal.

The EP&A Act recognises that ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are considered in the context of the proposal below.

8.2.2 Precautionary principle

The precautionary principle deals with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

The threat of serious or irreversible environmental damage is one of the essential preconditions to the engagement of the precautionary principle. In this case, there is no threat of serious or irreversible environmental damage.

8.2.3 Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The impacts of the proposal have been identified as short term and manageable. Improved reliability of bus services would be experienced over a longer period.

8.2.4 Conservation of biological diversity and ecological integrity

The twin principles of biodiversity conservation and ecological integrity have been a consideration during the design and assessment process with a view to identifying, avoiding, minimising and mitigating impacts.
The proposal would have negligible biodiversity impacts.

8.2.5 Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by a project, including air, water, land and living things. While it is often difficult to place a reliable monetary value on the residual, environmental and social effects of the project, the value placed on environmental resources within and around the corridor is evident in the extent of environmental investigations, planning and design of impact mitigation measures to prevent adverse environmental impacts.

8.3 Conclusion

The proposed upgrade of the intersection of Great Western Highway and Ross Street, Glenbrook, is subject to assessment under Part 5 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. This has included consideration of impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some including construction noise and general disturbance. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve safety. On balance the proposal is considered justified and the following conclusions are made.

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required. The proposal is also unlikely to affect Commonwealth land or have an impact on any matters of national environmental significance.
This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Stuart Hill
Environmental Planner
Hills Environmental
Date: 27 September 2017

I have examined this review of environmental factors and the certification by Stuart Hill (Hills Environmental) and accept the review of environmental factors on behalf of Roads and Maritime Services.

Steven Lyras
Project Manager
Roads and Maritime Services, Sydney Region
Date: 09 October 2017
References


Blue Mountains City Council, 2012. *Blue Mountains City Council Street Tree Masterplan*, s.l.: s.n.


### Terms and acronyms used in this REF

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>AEP</td>
<td>Annual exceedance probability</td>
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<tr>
<td>CEMP</td>
<td>Construction environmental management plan</td>
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<td>EIA</td>
<td>Environmental impact assessment</td>
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<td>EP&amp;A Act</td>
<td><em>Environmental Planning and Assessment Act 1979 (NSW).</em> Provides the legislative framework for land use planning and development assessment in NSW</td>
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<td>EPBC Act</td>
<td><em>Environment Protection and Biodiversity Conservation Act 1999</em></td>
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<td>ESD</td>
<td>Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased</td>
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<tr>
<td>FM Act</td>
<td><em>Fisheries Management Act 1994 (NSW)</em></td>
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<td>Heritage Act</td>
<td><em>Heritage Act 1977 (NSW)</em></td>
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<tr>
<td>ISEPP</td>
<td>State Environmental Planning Policy (Infrastructure) 2007</td>
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<td>NCA</td>
<td>Noise catchment area</td>
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<td>NES</td>
<td>Matters of national environmental significance under the Commonwealth <em>Environment Protection and Biodiversity Conservation Act 1999.</em></td>
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<td>NPW Act</td>
<td><em>National Parks and Wildlife Act 1974 (NSW)</em></td>
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<td>SEPP 14</td>
<td><em>State Environmental Planning Policy No.14 – Coastal Wetlands</em></td>
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<tr>
<td>TSC Act</td>
<td><em>Threatened Species Conservation Act 1995 (NSW)</em></td>
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<tr>
<td>QA Specifications</td>
<td>Specifications developed by Roads and Maritime Services for use with roadworks and bridgeworks contracts let by Roads and Maritime Services</td>
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